HIGHLIGHTING THE PRIVATE SECTOR RESPONSE TO ACCELERATING THE SUSTAINABLE OCEAN AGE:

INSIGHTS INTO PRIORITISING THE NEXT 500 INNOVATIVE BLUE ECONOMY ENTREPRENEUR IDEAS AND SOLUTIONS FROM 2021



Jack Dyer PhD; December 2020.

CEO Blue Economy Future.

Linked In Blue Economy Future SA,

[jadyer2020@gmail.com](mailto:jadyer2020@gmail.com)**;**

[jad@blueeconomyfuture.org.za](mailto:jad@blueeconomyfuture.org.za)**;**

[www.blueeconomyfuture.org.za](http://www.blueeconomyfuture.org.za)

Blue Economy Future is a specialised maritime economics and climate change consultancy service based in South Africa.

Our approach is to empower human potential through active, inclusive, stakeholder and results-driven research that strives to be practical, with meaningful, engaged outcomes. We focus on awareness raising, climate change, identifying blue, green and circular economy opportunities and finance, training and entrepreneurship possibilities through all stages of a project; including monitoring and evaluation.

Blue Economy Future extends beyond consulting and project management services to facilitating entrepreneurship and courses, devising curriculums and manuals; policy advice, implementation, supporting fund-raising, facilitation and awareness of news, events, initiatives and opportunities. It has established a significant global network and series of partnerships.

Our sustainable, climate change, green and blue economy experience extends to legislation, policies, socioeconomic, events and latest technological/knowledge updates with work experience in a variety of ocean/blue economy areas. These include ocean governance, illegal and unregulated fishing, undersea exploration; marine protected areas; marine renewable energy; ocean governance and sovereignty/maritime law; ocean pollution reduction and the circular economy; climate change; ports and small harbours; cruise and marine tourism; biotechnology entrepreneurship; education; drones; ship repair; blue economy strategies, maritime logistics and blue economy finance.

Blue Economy Future follows an approach based on sustainability, inclusivity, optimizing potential and integration. The need to balance the economic, social, and environmental dimensions of sustainable development in relation to oceans, land and ecosystems is a key component of the transition towards a climate-proofed future, to climate resilient livelihoods, communities, ecosystems and to a circular economy, zero-waste future. It is an approach that aims to ensure long term optimal survival, maximizing the technological innovations of the Fourth Industrial Revolution, harnessing individual and collective human ingenuity, sustainable finance and creativity for greater local and global prosperity.

Recent project examples include Durban’s Blue Oceans Economic Strategic Framework, advising on current global and South African ship repair markets and a socioeconomic valuation of the sector, risks and opportunities of the Benguela Current Region for the Benguela Current Convention (Namibia, Angola and South Africa). Others include monitoring and evaluating the Durban Oceans Champs/Durban-Bremen Marine Environment Education Network and advising on the implications of the 4th Industrial Revolution for maritime education and training.

**Disclaimer**

The following document represents the vision and perspective of the companies or individuals concerned. All intellectual copyright in composing this list under the 1968 Copyright Act, remains with this author and Blue Economy Future, who exert the moral, legal and physical right of authorship over this paper. All information is consistent with that available at the time of compilation and the author is not personally liable for any issues from information made available from third party sources, including financial loss from investments or other such consequences. Appropriate direct contact and Due Diligence should be undertaken for any of the businesses cited. Permission to cite/utilise any of the intellectual property including texts, ideas, figures and information, whether in part or in whole may be offered only through contacting the author via [jad@blueeconomyfuture.org.za](mailto:jad@blueeconomyfuture.org.za); [Jack.Dyer@utas.edu.au](mailto:Jack.Dyer@utas.edu.au). Or via his website [www.blueeconomyfuture.org.za](http://www.blueeconomyfuture.org.za) or Linked In, Jack Dyer, Blue Economy Future SA.

Contents

[BACKGROUND TO THIS RESEARCH. 20](#_Toc62880279)

[Generic Useful Sources including Funders, Accelerators and Source of Mentors/Innovation 22](#_Toc62880280)

[Investors That Have Shown an Interest In the Blue Economy. 23](#_Toc62880281)

[1. AQUACULTURE 25](#_Toc62880282)

[12 Tides Seaweed Co (Ocean Friendly Kelp Snacks, Aquaculture and Derivative Products) 25](#_Toc62880283)

[Akua (Ocean Farmed Kelp Aquaculture and Products) 25](#_Toc62880284)

[Akualogix (Urban Vertical Aquafarm Solutions) 25](#_Toc62880285)

[Aqua Connect (AI Centred Shrimp and Fish Aquaculture Solutions) 26](#_Toc62880286)

[Ace Aquatec (Aquaculture Technology/Sealice Removal Solutions) 26](#_Toc62880287)

[Adriatic Algae Biotech 26](#_Toc62880288)

[Micro Algae-based Products Development 27](#_Toc62880289)

[Algaeba (Aquaculture Technology Solution) 27](#_Toc62880290)

[Algae 4 Future (Various Algae Based Projects, Technology and Solutions) 27](#_Toc62880291)

[Algae Floating Systems (Algae Based CCS Systems, Cultivation Systems, Bio-oil and other Products) 28](#_Toc62880292)

[Air Jet Global (Biocell and Clean Ocean Yarn//Textile Based Technology/Products) 28](#_Toc62880293)

[Algi-Sys (Omega 3 EPA Oil and Related Health Products) 29](#_Toc62880294)

[Alune (Aquaculture Investment Source) 29](#_Toc62880295)

[ANB Sensors’ pH Calibration Free Sensor Solutions 29](#_Toc62880296)

[Aqua Nurch (Nature Dots - Improving Aquaculture Solution) 30](#_Toc62880297)

[Atlantic Sea Farms (Kelp Aquaculture) 31](#_Toc62880298)

[Biofishency (Aquaculture Filtration Technology Solutions) 31](#_Toc62880299)

[Bio-Feyn (Enhanced Aquaculture Fish Feed) 31](#_Toc62880300)

[Blue Aqua International (Various Miscellaneous Aquaculture Products and Solutions) 32](#_Toc62880301)

[Blue Evolution Aquaculture (Aquaculture Technology) 32](#_Toc62880302)

[Blue Lion Lab (AI Tech for Aquaculture Diseases/Organisms) 32](#_Toc62880303)

[Blue Nalu (Cell Based Aquaculture Products) 33](#_Toc62880304)

[Cage-Eye (Aquaculture Behaviour Monitoring Analysis) 33](#_Toc62880305)

[Calysta (Cell Based Protein Substitute for Fishmeal) 34](#_Toc62880306)

[Cascadia Seaweed (Seaweed Aquaculture Farm) 34](#_Toc62880307)

[Catchatrade (Integrated Online Seafood Marketplace China, Indonesia, India and Vietnam) 34](#_Toc62880308)

[C-Combinator (Sustainable Blue Carbon Seaweed Based Biomaterials and Other Products) 35](#_Toc62880309)

[C-Feed (Aquaculture Feed) 36](#_Toc62880310)

[Chicoa Fish Farm 37](#_Toc62880311)

[Dynaspace (Information Analytics For Shrimp Farmers) 37](#_Toc62880312)

[Ecto (Digital Aquaculture Biology Solutions) 38](#_Toc62880313)

[eFishery (Smart Fish Feeder Device for Aquaculture) 38](#_Toc62880314)

[Energaia (Sustainable Algae/Spirulina Aquaculture Products) 39](#_Toc62880315)

[Exci-Plex (Aquaculture/Fishery Mycotoxin Detection Strategies) 39](#_Toc62880316)

[Fishency Innovation (Automatic Sealice Solution For Fisheries and Aquaculture) 40](#_Toc62880317)

[Geneti-Rate Fish (Aquaculture Genetic Analysis) 40](#_Toc62880318)

[Glass Eels (UK Eel Sustainable Fisheries) 40](#_Toc62880319)

[Green Wave (Regenerative Ocean Aquaculture) 41](#_Toc62880320)

[Impact-9 (Sustainable Aquaculture) 41](#_Toc62880321)

[Indian Ocean Trepang (Sea Cucumber Aquaculture) 42](#_Toc62880322)

[Jala Improving Shrimp Production Using Data-driven Farming 42](#_Toc62880323)

[Kuehnle (Aquafeed and other Marine Biotechnology Products) 43](#_Toc62880324)

[Matorka (Arctic Char Aquaculture) 44](#_Toc62880325)

[MLK Waste Management: Recirculating Aquaculture Systems (RAS) + Aquaponics 44](#_Toc62880326)

[Molofeed (Aquaculture Larval Feed Answers) 45](#_Toc62880327)

[Nutrex Hawaii (Spirulina Aquaculture in Hawaii and Health Products) 45](#_Toc62880328)

[Ocean Basis (Aquaculture, Cosmetics and Other Related Ocean/Biotechnology Products) 46](#_Toc62880329)

[Ocean Harvest Technologies (Sustainable Animal/Fish Feed and Other Aquaculture Products) 48](#_Toc62880330)

[Olooson (Sustainable Sturgeon Fish and Caviar Aquaculture) 48](#_Toc62880331)

[Planktovie (Nutrient and Other Solutions for Aquariums/Aquaculture) 48](#_Toc62880332)

[Proteon Pharmaceuticals (Marine Aquaculture Bacteriophage Solutions) 49](#_Toc62880333)

[Protix (Aquaculture and Other Feed Solutions -Insect Based) 49](#_Toc62880334)

[Pura Bioglitter (Seaweed Based Biodegradable Glitter Products) 50](#_Toc62880335)

[Seaentia (Portugal based aquaculture) 51](#_Toc62880336)

[Sea Nest (Automatic Fish Cleaning Station/Recirculating Aquaculture System Solutions -Noras Watertech 51](#_Toc62880337)

[Shiok Meats (Cell Based Meat/Seafood) 52](#_Toc62880338)

[Spira Inc (Algae/Spirulina Based Dyes/Products) 52](#_Toc62880339)

[Swedish Algae Factory (Algae Based Materials, Skin Care and other Aquaculture Products) 52](#_Toc62880340)

[Triton Algae Innovations (Vegan/Algae Based Meat Substitute Products) 53](#_Toc62880341)

[UMITRON (Automatic Fish Counting/Measurement Solution for Aquaculture) 53](#_Toc62880342)

[XpertSea (Aquaculture AI Solutions) 54](#_Toc62880343)

[2. AQUACULTURE/MARINE BIOTECHNOLOGY 54](#_Toc62880344)

[Alga Bloom International (Algae Compact Bioreactors For Spirulina, Inoculum, Biofertilizer and Other Products) 54](#_Toc62880345)

[Alga Plus (Sustainable Macroalgae Aquaculture) 55](#_Toc62880346)

[Aquaai Norway (Optimised Aquaculture Data Platform) 55](#_Toc62880347)

[Aquatic Livelihoods (Precision Aquaculture Solutions Using Sensor Data and AI) 55](#_Toc62880348)

[Biomar (Aquaculture Feed) 56](#_Toc62880349)

[Bioprocess Algae (Commercial Scale Algae Bioreactors) 56](#_Toc62880350)

[Bluegrove (Integrated Aquaculture Cyber/Biophysical Solutions including Echofeeding) 57](#_Toc62880351)

[Cellana (Algae Based Products) 58](#_Toc62880352)

[ECOPEMER (Bivalve Mollusc Seed Aquaculture under company Acuinuga) 59](#_Toc62880353)

[Finless Foods (Marine Cell Based Protein) 61](#_Toc62880354)

[Fish Coin (Blockchain Based Fish Traceability and Data Ecosystem) 61](#_Toc62880355)

[Flex Base (Solar Powered Floating Fish Farm) 61](#_Toc62880356)

[Green Ocean Farming (UK Seaweed Aquaculture Farming) 62](#_Toc62880357)

[Hortimare (Seaweed Aquaculture and Seedlings) 62](#_Toc62880358)

[Inclita Seaweed Solutions 63](#_Toc62880359)

[Innomar (Live Fish Catch, Fisheries and Aquaculture Technology such as Sub Bottom Profilers) 63](#_Toc62880360)

[Innova-Sea (Aquaculture Data, Products and Technology Services) 65](#_Toc62880361)

[i-Wi Life (Algae Based Aquaculture Products) 65](#_Toc62880362)

[Kelp Blue (Kelp Aquaculture) 66](#_Toc62880363)

[Kona Bay Shrimp Genetics 68](#_Toc62880364)

[Lagosta (Spiny Lobster Aquaculture and Regenerative Marine Biotechnology/Conservation) 69](#_Toc62880365)

[Manolin Inc (Aquaculture Data Solution) 69](#_Toc62880366)

[Open Blue Fish Farms (Sustainable Cobia Aquaculture) 70](#_Toc62880367)

[Organic Illemba (Urban Aquaculture for Catfish) 71](#_Toc62880368)

[Ocean Era (Mariculture and Technology Systems) 71](#_Toc62880369)

[Origin by Ocean (Sustainable Blue Carbon Derived Aquaculture/Marine Biotechnology Products) 73](#_Toc62880370)

[Oyster Common (Virtual AI Powered Seafood Marketplace) 73](#_Toc62880371)

[Pan Gaea Feed (Aquaculture Feed) 74](#_Toc62880372)

[Planctonid Atlantic (Aquaculture/Coastal Eutrophication Solution) 74](#_Toc62880373)

[Plant based Seafood Company 76](#_Toc62880374)

[Pond Naturals/Pond Tech (Algae Bioreactor and Linked Technology) 76](#_Toc62880375)

[Poseidon AI (AI Sensor Technology for Aquaculture) 77](#_Toc62880376)

[Renewable Algae Energy (Algae Based Products) 78](#_Toc62880377)

[Seafarming Systems 78](#_Toc62880378)

[Sea Warden (Aquaculture Remote Monitoring Methods) 79](#_Toc62880379)

[Seaweed Solutions (Aquaculture and Biomass Related Products) 79](#_Toc62880380)

[Seagrass Tech (Carbon Capture/Biomass Solutions) 80](#_Toc62880381)

[Smart Oysters (Aquaculture Farm Operations Platform) 81](#_Toc62880382)

[The Fish Farm (South Africa patented micro-fish farms) 81](#_Toc62880383)

[Urchinomics (Sea Urchin Aquaculture and Kelp Forest Restoration). 82](#_Toc62880384)

[3. BIOFOULING: 83](#_Toc62880385)

[Biofouling Solutions -Australia 83](#_Toc62880386)

[Biofouling Management Solutions Platform 83](#_Toc62880387)

[Bio Pass (Blockchain Based Biosecurity Management Platform) 83](#_Toc62880388)

[Clean Sub-Sea/ The Envirocart: 83](#_Toc62880389)

[Fleet Cleaner (Vessel Biofouling Cleaning Robots) 84](#_Toc62880390)

[\_\_\_\_\_\_\_\_\_\_ Graphite Innovation and Technologies (Marine Biofouling, Noise and Emission Reducing Coating) 84](#_Toc62880391)

[Harsonic (Sustainable Antifouling Solutions) 85](#_Toc62880392)

[Hull-Skater (Jotun (Biofouling Cleaning Robot/Marine Coatings) 85](#_Toc62880393)

[i-Tech AB (Marine Anti-biofouling agent Selektope). 86](#_Toc62880394)

[Sonihull (Ultrasonic Anti-Biofouling Solutions) 88](#_Toc62880395)

[Symbytech (Underwater Hull Cleaning Drone) 89](#_Toc62880396)

[4. BIOTECHNOLOGY 89](#_Toc62880397)

[Aker Biomarine (Aquaculture Biotechnology, Krill and other Health/Nutrition Products) 89](#_Toc62880398)

[Algae-C (Algae Biosynthetics and Derivative Products) 90](#_Toc62880399)

[Alga Energy (Microalgae Biotechnology) 90](#_Toc62880400)

[Algae-Pro 91](#_Toc62880401)

[Algi-Knit (Kelp Based Textiles) 91](#_Toc62880402)

[Algix 92](#_Toc62880403)

[Algalife (Algae Based Sustainable Textiles/Biomaterials) 92](#_Toc62880404)

[Aqua Biotechnology ASA (Cosmetics, Skincare, Dermatology From Algae/Other Products) 93](#_Toc62880405)

[Aquammodate/Water Purification 94](#_Toc62880406)

[Aquatic Biologicals (Aquaculture Pathogen Biobank, Vaccines and Phage Therapy/Medicine Solutions) 94](#_Toc62880407)

[Atlantic Sapphire (Bluehouse System for Salmon/Other Species) 95](#_Toc62880408)

[Biotech Marine (SEPPIC -Marine Biotechnology Products) 95](#_Toc62880409)

[Bluevert (Algae Based Cosmetics) 96](#_Toc62880410)

[Buggy Power (Mini Algae Closed Photoreactor Systems) 96](#_Toc62880411)

[Celtosome™, culture of dedifferentiated cells from marine plants 97](#_Toc62880412)

[Cuan Tec (Antibacterial, Plastic-Free Film and Packaging) 98](#_Toc62880413)

[Cyanotech (Health Based Products Through Hawaii Algae Aquaculture) 98](#_Toc62880414)

[Hydro Neo (Smart Shrimp Farming Management Systems) 99](#_Toc62880415)

[Innovakeme (Wind Powered Aquaculture Farm) 100](#_Toc62880416)

[Inseco (Insect Based Fishmeal Feed Solution) 100](#_Toc62880417)

[Knip-Bio (Aquaculture Fishmeal Alternatives) 101](#_Toc62880418)

[Kverdi (CO2 Aqua Feed, Reverse Plastics & Other Circular/Blue Economy Biotech Innovations) 102](#_Toc62880419)

[Marina-Tex (Algae/Biodegradable Organic Packaging) 102](#_Toc62880420)

[MicroSynbiotiX (Oral Vaccination: Disease Management for Aquaculture) 103](#_Toc62880421)

[Neomerys (Algae Biotechnology, Biofuels and Direct Osmosis) 103](#_Toc62880422)

[Norskin Materials AS (Sustainable Ocean Alternative to Leather) 103](#_Toc62880423)

[Notpla (Alternative Seaweed/Plant Packaging) 104](#_Toc62880424)

[Observe Technologies (AI Data Analysis for Aquaculture) 104](#_Toc62880425)

[Oceanium (Sustainable Seaweed Packaging Answers) 105](#_Toc62880426)

[Ocean Rainforest 105](#_Toc62880427)

[Oceanwell (Cosmetics) 106](#_Toc62880428)

[PharmaMar (Marine Biotechnology Focusing On Oncology) 107](#_Toc62880429)

[Provectus Algae (Algae platform for designer compound expression) 107](#_Toc62880430)

[Recirculating Farms Coalition 108](#_Toc62880431)

[SBIOTECH (Aquaculture Probiotic Solutions) 109](#_Toc62880432)

[Scot Bio (Spirulina Based Blue Dye, Protein, Reagents &other Blue Biotechnology Products) 109](#_Toc62880433)

[Sea-6 Energy (Sustainable Algae Based Food, Feed and Fuel) 111](#_Toc62880434)

[Sea-Qual Initiative (Recycle Plastic into Textiles Initiative) 111](#_Toc62880435)

[Sea Run Holdings (Salmon Aquaculture Based Therapeutics and Reagents) 112](#_Toc62880436)

[Stellar Technologies (Sustainable Aquaculture Based Proteins and Other Immunology/Marine Biotech Solutions) 113](#_Toc62880437)

[SuSeWi (Algal Biomass Biotechnology) 114](#_Toc62880438)

[Symbrosia (Methane Reducing Seaweed Cattle Feeding Solutions) 114](#_Toc62880439)

[ViAqua Therapeutics 115](#_Toc62880440)

[Viva Maris GMBH 115](#_Toc62880441)

[Yemoja Limited (Micro-Algae Based Products) 116](#_Toc62880442)

[Ynsect (Insect Based Aquaculture Feed) 116](#_Toc62880443)

[5. DRONES, ROBOTICS, MARITIME SAFETY, SECURITY 117](#_Toc62880444)

[Aqua-Botix (Portable USV For Monitoring, Research, Defence and Surveillance) 117](#_Toc62880445)

[Aqua Smart (Inspection and Surveying Drones) 117](#_Toc62880446)

[Autonomous Marine Systems (Autonomous Wind/Solar Powered Ocean Observation Robot/System for Marine Surveys) 118](#_Toc62880447)

[Blue Atlas Robotics (AUV’s) 118](#_Toc62880448)

[Blue Eye Robotics (Marine Drones Operated From a Smartphone) 119](#_Toc62880449)

[Cydome (Maritime Cybersecurity Solutions and Innovations) 119](#_Toc62880450)

[Dive Technologies (AUV’s) 120](#_Toc62880451)

[ECA Group (AUV’s to 6000 metres deep) 120](#_Toc62880452)

[Eco Drone (Renewable Energy Powered Drones) 121](#_Toc62880453)

[Ellipsis Earth (Drone Monitoring Solutions for Monitoring Material Pollution) 121](#_Toc62880454)

[F Drones (Autonomous Drones for Shore to Ship and Ship to Shore Deliveries) 122](#_Toc62880455)

[Fu-Vex Drones 122](#_Toc62880456)

[Halona WEC Mobile AUV Docking Station (Wave Energy Powered) 123](#_Toc62880457)

[Green Sea Systems (Commercial Open Architecture Source for Unmanned Marine Robotics) 123](#_Toc62880458)

[Hydroswarm (AUV’s and Related Technology) 124](#_Toc62880459)

[Kraken Robotics (AUV’s, Sensors, Software and Related Goods/Services) 125](#_Toc62880460)

[Maritime Robotics (AUV’s) 126](#_Toc62880461)

[Marauder Robotics (AUV Platform, AUV Applications and Sea Urchin Resolving Robots) 126](#_Toc62880462)

[Nido Robotics (Underwater Robots) 127](#_Toc62880463)

[Ocean Aero (Ocean Drones) 127](#_Toc62880464)

[Ocean Infinity (AUV Marine Robotics) 128](#_Toc62880465)

[Ocean Sensor Network and Trident Drone (Sofarocean Company) 128](#_Toc62880466)

[(Ocean Server Technology) 129](#_Toc62880467)

[Open Ocean Robotics (Autonomous Energy/Ocean Data Based Vessels) 130](#_Toc62880468)

[Recon Robotics (Anti-Piracy, Surveillance and Maritime Security Micro Robot Reconnaissance Solutions) 131](#_Toc62880469)

[Saildrone 131](#_Toc62880470)

[Sea Proven (Drones for Sea Rescue and Other Applications) 131](#_Toc62880471)

[Sea Trac (Solar Powered Autonomous Drones) 131](#_Toc62880472)

[Shoreline (Maritime and Cybersecurity Insurance) 132](#_Toc62880473)

[Unseen Labs (Maritime Surveillance Solutions) 132](#_Toc62880474)

[6. LNG AND OTHER MARINE FUEL SOLUTIONS 133](#_Toc62880475)

[Algae Production Systems (Base for Biodiesel and Organic Fertiliser) 133](#_Toc62880476)

[Culture Biosystems (Marine Fuel, Culture Feeds and Nutraceuticals) 134](#_Toc62880477)

[CWP Renewables (Hydrogen Fuel and Renewable Energy/Desalination) 134](#_Toc62880478)

[DNV GL (LNG Fuel Provider and LNG Powered Containership Pilot Project) 135](#_Toc62880479)

[Farwind (Zero Emission Fuel Production via Offshore Wind Energy) 137](#_Toc62880480)

[Genifuels (Aquatic Biomass and Other Emissions Reducing Fuel Solutions) 137](#_Toc62880481)

[Hy-Sil Labs (Hydrogen Carrier Storage, Transport and Utilisation Solutions) 138](#_Toc62880482)

[Iberola (Hydrogen and Renewable Energy) 139](#_Toc62880483)

[Jalvasub Engineering (Hydrogen/PEM Fuel Cells and Drone Solutions) 141](#_Toc62880484)

[Manta Biofuel (Algae Based Biofuel) 142](#_Toc62880485)

[Nauticor (LNG Marine Fuel Provider) 142](#_Toc62880486)

[Phycobloom (Marine Biofuel) 142](#_Toc62880487)

[Plast2Oil (Converting Plastic Waste into Marine Fuel) 143](#_Toc62880488)

[Pro-Bunkers LNG 143](#_Toc62880489)

[Snam Hydrogen 144](#_Toc62880490)

[Titan LNG (Fuel Provider Solutions) 146](#_Toc62880491)

[Tre-Soil Biofuels (Waste Plastic to Hydrogen Ocean Retriever) 146](#_Toc62880492)

[Wartsila LNGPac (Marine Integrated LNG Bunkering, Fuel and Technology Solutions) 147](#_Toc62880493)

[7. ECOSYSTEM RESTORATION INCLUDING COASTAL EROSION, CORAL REHABILITATION ETC 147](#_Toc62880494)

[Beyond Coral Foundation (Coral Planting Robot CHARM) 147](#_Toc62880495)

[Biorock/Global Coral Reef Alliance 147](#_Toc62880496)

[Blue-Bot (Bajan Digital Creations Inc –AI Assistant to Create Marine Reef Ecosystem Monitoring Data) 150](#_Toc62880497)

[Bio Yarn (Recycled Coastal and Marine Textile Solutions) 151](#_Toc62880498)

[Blue Mater (Environmental Remediation Using Cork Floating Islands) 152](#_Toc62880499)

[Carbon Kapture (Offsetting Climate Change Via Kelp 153](#_Toc62880500)

[Coral Gardeners (Coral Reef Restoration) 153](#_Toc62880501)

[Coral Guardian 154](#_Toc62880502)

[Coral Lok 154](#_Toc62880503)

[Coral Reef Arks 155](#_Toc62880504)

[Coral Reef Arks Strategic Plan 156](#_Toc62880505)

[Coral Maker (Coral Replanting Robot Solutions) 156](#_Toc62880506)

[Coral Restoration Foundation 157](#_Toc62880507)

[Coral Vita 157](#_Toc62880508)

[Dalula Marine SL (Seagrass Restoration) 157](#_Toc62880509)

[Eco Cubes (Eco-friendly Artificial Reef Blocks By ARC Marine) 158](#_Toc62880510)

[Equilbrio Marino 158](#_Toc62880511)

[GEA@275 Oceanic Carbon Capture (Possible Marine Snow Solution to Climate Change) 159](#_Toc62880512)

[Girlfriend Collective (Female Activewear/Clothing From Recycled Plastic Bottles/Fishnets) 160](#_Toc62880513)

[Global Coralition (Integrated Coral Reef and Eco-Sustainable/Blue Carbon Solutions) 161](#_Toc62880514)

[Intelli-Reefs (Coral Reef Life Repair, Restoration and Support) 161](#_Toc62880515)

[Loliware (Seaweed Based Substitutes to Straws and Other Single Based Plastics) 162](#_Toc62880516)

[Naecoware (Ocean Recycled Plastic Bottles, Coral Planting and Other Products) 162](#_Toc62880517)

[NORI (Blockchain Based Global Voluntary Carbon Removal Marketplace) 162](#_Toc62880518)

[Oceaneos (Ocean Seeding, Fertilisation and Nutrient Enrichment Technology) 163](#_Toc62880519)

[Ocean Foresters (Ocean Macroalgal Afforestation) 163](#_Toc62880520)

[Ocean Habitats (Artificial Reefs) 163](#_Toc62880521)

[Ocean Nourishment (Ocean Nourishment or Negative Emission Technology) 164](#_Toc62880522)

[Ocean Rescue Alliance (Ecosystem Restoration) 165](#_Toc62880523)

[Plant a Million Corals 165](#_Toc62880524)

[The Eureka Mistake 166](#_Toc62880525)

[Pro-Co Reef (Ecotourism and Coral Reef Restoration). 166](#_Toc62880526)

[The Eureka Mistake 167](#_Toc62880527)

[Project Vesta (Coastal Enhanced Weathering for CO2 Removal) 167](#_Toc62880528)

[Reef Ball Foundation 167](#_Toc62880529)

[Reef Builders 168](#_Toc62880530)

[Reef Cells 168](#_Toc62880531)

[Reef Cubes (ARC Marine -UK). 169](#_Toc62880532)

[Reef Worlds 169](#_Toc62880533)

[Reef Design Lab (3D Printed Coral Reef Based Structures) 170](#_Toc62880534)

[Reefy (Restoring Coral Reefs) 170](#_Toc62880535)

[ReShore Living Breakwaters 172](#_Toc62880536)

[Remora Robotics (Waterway Cleaning Drone) 172](#_Toc62880537)

[Seaweed Biofilter 173](#_Toc62880538)

[Sea Forester (Restoring Sea Forests) 173](#_Toc62880539)

[Sea Trees 174](#_Toc62880540)

[Shorelock LLC (Coastal Erosion) 175](#_Toc62880541)

[Smart Reef 175](#_Toc62880542)

[Subcon (Artificial Reef Solutions) 175](#_Toc62880543)

[Sustainable Oceans International 176](#_Toc62880544)

[Sustainable Now (Algae Based Biotechnology that Captures CO2) 176](#_Toc62880545)

[8. ILLEGAL FISHERIES, BYCATCH WASTE, MARINE CONSERVATION AND OCEAN GOVERNANCE 176](#_Toc62880546)

[Abalobi 176](#_Toc62880547)

[Atlan Space (AI Ocean Drones) 177](#_Toc62880548)

[Blue Ocean Gear (IoT Connected Smart Buoys to Monitor Fishing Equipment) 177](#_Toc62880549)

[FAME (Fish Catch Documentation and Traceability) 178](#_Toc62880550)

[Fish Face (Marine Fisheries/Aquaculture Facial Recognition and Analysis Technology) 179](#_Toc62880551)

[OLSPS (Electronic Logbook Solutions) 180](#_Toc62880552)

[Ol-Trace (Seafood Traceability Solution) 181](#_Toc62880553)

[PISCES Safety Net Technologies (Reduce Bycatch/Improve Fishery Yields) 181](#_Toc62880554)

[Sedna (Seafood Traceability Systems) 182](#_Toc62880555)

[Shark Safe Barrier 183](#_Toc62880556)

[Smart-Catch (Reduce Fisheries Bycatch Waste) 184](#_Toc62880557)

[TEDEPAD: Technological Device for Avoiding Parasitic Discarding at Sea (Marexi Technologies) 184](#_Toc62880558)

[This-Fish (Seafood Traceability Software) 185](#_Toc62880559)

[Trademodo (Online Canadian Ethical Seafood Supply Chain Marketplace and Data Solution) 185](#_Toc62880560)

[TraSeable Solutions (Seafood Traceability Software) 186](#_Toc62880561)

[Verifik8 (Integrated Aquaculture Data Analytics Platform). 186](#_Toc62880562)

[9. MARITIME EDUCATION AND TRAINING/GENERAL VR AND SIMULATION TECH 187](#_Toc62880563)

[Artemis Technologies (Maritime Simulators/Zero Emission Vessels) 187](#_Toc62880564)

[Kongsberg Digital (Cloud Based Maritime Radar and Other Training/Simulator Solutions) 188](#_Toc62880565)

[Tapiit Maritime (Online Database for Maritime Training Solutions) 188](#_Toc62880566)

[VINCI VR 189](#_Toc62880567)

[Wärtsilä Voyage (Marine Simulators) 189](#_Toc62880568)

[10. MARINE POLLUTION INCLUDING OIL SPILLS, PLASTIC, GHOST FISHING GEAR AND THE CIRCULAR ECONOMY 190](#_Toc62880569)

[4Oceans (Recycled Beach Plastic Bracelets, Beachwear and Other Sustainable Apparel) 190](#_Toc62880570)

[Algae-Sys (Algae Powered Wastewater Treatment Systems) 190](#_Toc62880571)

[Ambercycle (Covert Ocean Plastics into Textile Fabrics) 190](#_Toc62880572)

[Biosolvit (Bio Blue Natural Absorber) 191](#_Toc62880573)

[Biodegradable Plastic from Sweet Potatoes 191](#_Toc62880574)

[BitEgreen Market Venture (Circular Economy & Waste Recycling Gamification Solution) 192](#_Toc62880575)

[Blue Eco Line (River Cleaner -Marine Pollution Solution) 192](#_Toc62880576)

[Blue Phin (Floating Waste Collecting Robot) 193](#_Toc62880577)

[Bureo (Recycled Fishing Gear and Debris Solutions) 193](#_Toc62880578)

[Clean Up Data (Mobile App Solution to Report Volunteer Clean Up Data) 193](#_Toc62880579)

[Clear Blue Sea; FRED - Our Floating Robot for Eliminating Debris 194](#_Toc62880580)

[Coastruction (Eco-Friendly Carbon Reducing Concrete Construction Via 3D Printing) 194](#_Toc62880581)

[Collect Nets (Ghost Fishing Gear Solutions) 195](#_Toc62880582)

[Cruz Foam (Recyclable Foam Products) 196](#_Toc62880583)

[Dot Ocean NV (Autonomous, Renewable Energy Powered Unmanned Vessels for Ocean Waste) 196](#_Toc62880584)

[Eco Spears (For PCB and Dioxin Contaminant Removal Solutions) 197](#_Toc62880585)

[EEL (Pyro-E) (Hydrodynamic Energy Harvester) 198](#_Toc62880586)

[End Ocean Plastic (Sri Lanka) 198](#_Toc62880587)

[Enaleia (Incentives for Fishing Communities to Collect Ocean Waste Recycled into Clothing) 199](#_Toc62880588)

[Enviro-Buggy (Waste Collecting Beach Buggy -Sea The Bigger Picture) 200](#_Toc62880589)

[Fishy Filaments (Recycling Fishing Nets into Engineering Filament Via 3D Printing) 200](#_Toc62880590)

[Flipflopi (Eco-Sustainable Sailing Dhows/Boats from Recycled Plastic and Flipflops) 200](#_Toc62880591)

[Foru Solution Floating Oil Recovery Unit (Oil Spill Response Solutions) 201](#_Toc62880592)

[\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 201](#_Toc62880593)

[\_Gjenge Makers Limited (Recycled Plastic/Waste into Bricks/Construction Materials) 201](#_Toc62880594)

[Got Bag (Backpacks Out of Ocean Plastic Waste) 202](#_Toc62880595)

[Great Bubble Barrier 202](#_Toc62880596)

[Hoola One Technologies (Plastic Pollution Removal Device Solutions) 203](#_Toc62880597)

[Ichthion (Ocean and River Waste Collection Technology Innovation) 204](#_Toc62880598)

[Integrated Ocean Tracking Solutions (Oil Spill/Marine Pollution Solutions) 205](#_Toc62880599)

[IRIS SRL (Floating Waterway and Marine Litter Vessel Solutions) 205](#_Toc62880600)

[Jospa Tug Ocean Plastics Harvester 206](#_Toc62880601)

[Madiba and Nature Ecoboat (Recycling Plastic into Boats) 207](#_Toc62880602)

[Matter Captures (Plastic Microfibre and Pollution Solutions) 207](#_Toc62880603)

[Mobius (Create Biodegradable Material, Biofuel & Renewable Chemicals from Lignin/Waste) 207](#_Toc62880604)

[Mr Trash Wheel 208](#_Toc62880605)

[Numix Materials (Removing Metal Contamination from Waterways via Water Treatment Processes) 209](#_Toc62880606)

[Nu Oceans (Recycled Sandals and Footwear from Ocean Plastic/Waste) 209](#_Toc62880607)

[Ocean Bottle (Reusable Plastic Based Products) 209](#_Toc62880608)

[Ocean Bound Plastic Certifications 210](#_Toc62880609)

[Ocean Cleaner Technology (Catamaran Ocean Waste Cleaning Solutions) 211](#_Toc62880610)

[Ocean Clean Up 212](#_Toc62880611)

[Ocean Currency International (Recycled Plastic Products, Vessels & Reward “Currency”/Other Initiatives for Marine Plastic Pollution & the Circular Economy) 213](#_Toc62880612)

[Ocean Eye (Payment Platform for Marine Protected Areas Compensated for Ecosystem Services) 214](#_Toc62880613)

[Ocean-I (Designer Recycled Ocean Plastic Furniture and Cigarette Butt Collection) 214](#_Toc62880614)

[Ocean Shapers (Gamification Platform for Ocean Waste Reduction) 214](#_Toc62880615)

[ORBITAL EOS (Marine Oil Pollution Tracking Solutions from Space) 215](#_Toc62880616)

[Parley for the Oceans (Recycled Textiles, Apparel and Supporting Ocean Plastic Cleanups) 216](#_Toc62880617)

[Pharem (Enzyme Based Micropollutant and Wastewater Treatment Solutions) 216](#_Toc62880618)

[River Cleaning (System to Intercept River Waste). 217](#_Toc62880619)

[Sulapac (Straws, Packaging and Other Alternatives to Ocean Plastic Products) 217](#_Toc62880620)

[The Beach Co-op (Data and Related Solutions to Ocean Plastic and Other Solutions) 218](#_Toc62880621)

[The Litterboom Project 219](#_Toc62880622)

[Net Your Problem (Recycle Ghost and Other Fishing Gear) 219](#_Toc62880623)

[Plastic to Bricks (Nigeria/West Africa) 220](#_Toc62880624)

[Purency (Automated Microplastic Analysis Solutions) 221](#_Toc62880625)

[Sea Bin Project (Collecting Marine Waste Innovation) 221](#_Toc62880626)

[The Sea Cleaners (Solutions to Removing Marine Pollution) 221](#_Toc62880627)

[Shore Buddies (Toys Made From Recycled Waste)/$1 For the Ocean (Business/Social Philanthropy Network). 222](#_Toc62880628)

[Slick Sleuth (Oil Spill Sensor Awareness and Alert System)/InterOcean Systems 222](#_Toc62880629)

[TIDE Ocean Material (For Recycled Jackets, Furniture, Electronic Products and Other Goods) 224](#_Toc62880630)

[TIPA (Compostable Packaging) 224](#_Toc62880631)

[Toraphene (Biodegradable Compostable Plastic Packaging) 225](#_Toc62880632)

[United By Blue (Sustainable Textiles, Clothing Apparel Combined with Ocean Pollution Removal) 226](#_Toc62880633)

[Waste Shark/Ran Marine Technology (ASV Marine Waste Solutions) 226](#_Toc62880634)

[11. MARINE RENEWABLE ENERGY 227](#_Toc62880635)

[Accumulated Ocean Energy Inc 228](#_Toc62880636)

[Anaconda 229](#_Toc62880637)

[Andritz Hydro/Tidal current turbines 230](#_Toc62880638)

[Akuo Energy (Offshore Wind Energy Solutions) 231](#_Toc62880639)

[Aquanet Power (Offshore Wave Power and Desalination Solutions) 232](#_Toc62880640)

[Archimedes Wave Swing 232](#_Toc62880641)

[Biogas Made from Fish waste -Brian Lee Chandler Barbados) 233](#_Toc62880642)

[Blue-Newables (Offshore Wind and Solar Project and Technology Solutions) 233](#_Toc62880643)

[Blue Power Synergy (Marine Renewable Energy Power, Storage and Desalination Unit Solutions) 234](#_Toc62880644)

[Cal Wave Power Technologies 235](#_Toc62880645)

[Carnegie Clean Energy /CETO II 235](#_Toc62880646)

[Cor Power Ocean (Wave Energy) 236](#_Toc62880647)

[C Power (Wave Energy) 237](#_Toc62880648)

[Crestwing (Wave Energy Power and Hydrogen Producing Solution) 237](#_Toc62880649)

[Eco Wave Power 238](#_Toc62880650)

[Envision Energy (Wind Turbines) 238](#_Toc62880651)

[Esteyco SA (Alternative Offshore Wind Maintenance Tech Solutions Without Jackup Vessels) 239](#_Toc62880652)

[Evolve (Produce Hydrogen from Tap Water) 239](#_Toc62880653)

[Gi-Kinetic Energy (Turbine Technology) 240](#_Toc62880654)

[Global OTEC Resources (Ocean Thermal Energy Power) 240](#_Toc62880655)

[Helio-Rec (Floating Solar Energy) 241](#_Toc62880656)

[Ingine (Wave Energy) 242](#_Toc62880657)

[LIFETAG D (Energy Harvesting Battery) 242](#_Toc62880658)

[Magallanes Renovables (Tidal Energy) 243](#_Toc62880659)

[Mean Sea Level (Wave Energy Converter Technology) 243](#_Toc62880660)

[MHI Vestas Offshore Wind 244](#_Toc62880661)

[Minas Energy (Tidal, Offshore Wind) 244](#_Toc62880662)

[Minesto (Tidal Stream and Ocean Current Energy Technology) 245](#_Toc62880663)

[Mocean Energy Blue Star Wave Energy Converter (Wave Energy) 247](#_Toc62880664)

[NEMOS (Wave Energy Converter) 247](#_Toc62880665)

[NEREUS (Wave Energy Conversion Single Point Absorber) 248](#_Toc62880666)

[Noordzee Wind (First Netherlands Offshore Wind Farms) 249](#_Toc62880667)

[Nova Innovations Limited 249](#_Toc62880668)

[Ocean Based Perpetual Energy 250](#_Toc62880669)

[Ocean Energy (Wave Energy) 251](#_Toc62880670)

[Ocean Grazer (Ocean Renewable Energy Battery and Other Solutions) 252](#_Toc62880671)

[Ocean Motion Energy (AI Controlled Wave Energy Converter) 252](#_Toc62880672)

[Orbital Marine Power 253](#_Toc62880673)

[Ocean Power Technologies 253](#_Toc62880674)

[Ocean Renewable Power Company (Tidal Energy) 254](#_Toc62880675)

[ORSTED Offshore Wind 254](#_Toc62880676)

[Ocean Thermal Energy Corporation 255](#_Toc62880677)

[Penguin (Company Wello-Oy) 255](#_Toc62880678)

[Planetary Hydrogen (Produce Hydrogen via water Electrolysis) 256](#_Toc62880679)

[Principle Power (Offshore Wind) 256](#_Toc62880680)

[QED (Sub Hub or Submersible Tidal Energy Platform Solutions or Interreg Tiger) 257](#_Toc62880681)

[Renewable Ocean Energy Inc 258](#_Toc62880682)

[Seabased (Wave Energy Power) 258](#_Toc62880683)

[Sea Turns (Wave Energy Converter) 258](#_Toc62880684)

[Seawind Ocean Technology 259](#_Toc62880685)

[SIMEC Atlantis Energy 260](#_Toc62880686)

[Simply Blue Energy 261](#_Toc62880687)

[Sinn Power (Wave Power) 262](#_Toc62880688)

[Solar Duck (Clean Offshore Solar Energy Solutions) 262](#_Toc62880689)

[Solar Marine Energy (Floating Solar Power Energy Solutions) 263](#_Toc62880690)

[Tidal Lagoon Power (Tidal Energy) 263](#_Toc62880691)

[US Wind Inc. 264](#_Toc62880692)

[Verdant Power (Tidal Energy Power) 265](#_Toc62880693)

[Wav EC 265](#_Toc62880694)

[Wave Piston (Wave Powered Energy and Desalination Solutions) 266](#_Toc62880695)

[Wave Swell Energy 266](#_Toc62880696)

[Weptos (Wave Energy Converter) 266](#_Toc62880697)

[Wunder Hexicon (Floating Offshore Wind Solutions) 267](#_Toc62880698)

[X1: Wind 267](#_Toc62880699)

[12 OCEAN OXYGENATION SOLUTIONS 268](#_Toc62880700)

[Messer’s FARMOX (For Aquaculture) 268](#_Toc62880701)

[Ocean Based Climate Solutions (Wave Energy Powered Oxygenation and Upwelling) 269](#_Toc62880702)

[13. OTHER OCEAN/BLUE ECONOMY TECHNOLOGY AND INNOVATIVE SOLUTIONS INCLUDING MARITIME COMMUNICATION 269](#_Toc62880703)

[Arviem (End to End Online Supply Chain and Cargo Monitoring Platform Solutions) 269](#_Toc62880704)

[Blue Link Ocean (Virginia Tech/Maritime Communications) 270](#_Toc62880705)

[Beach Necessities (Striving for Sustainable Beach Related Products Online Marketplace) 271](#_Toc62880706)

[Blue Tribe (Software Aiming to Improve Prediction of Floods and Natural Disasters for Coastal Management) 271](#_Toc62880707)

[Equiseas (Pre IPO Ocean/Blue Economy Stock Exchange) 272](#_Toc62880708)

[Fortuna Cools/Coconut Coolers 272](#_Toc62880709)

[Live Wire (Wave Energy to Power Ocean Observations) 272](#_Toc62880710)

[Mission Unlimited UUV Station 273](#_Toc62880711)

[Ocean Sonics (Digital Hydrophone and Maritime Communication Solutions) 273](#_Toc62880712)

[Searoutes (Optimising Greener Searoutes/Discover Searoutes) 273](#_Toc62880713)

[SINAY –Maritime Data Solution 274](#_Toc62880714)

[Wave Sub/Wind Sub. 274](#_Toc62880715)

[14. PORTS/LOGISTICS 275](#_Toc62880716)

[Cargo-X (Blockchain Linked Bill of Lading) 275](#_Toc62880717)

[C-Log (Blockchain Maritime Platform for Secure Stakeholder Integration and Data Exchange) 275](#_Toc62880718)

[ECOncrete™ (Sustainable Port/other Eco-friendly Concrete) 275](#_Toc62880719)

[Nautix (Maritime Ship to Shore Collaborator and Communication Interface Solutions) 276](#_Toc62880720)

[NAVIER (Sensor Communication on Ocean Assets) 276](#_Toc62880721)

[Secur-Space (Online Trucking/Logistics Parking and Storage Solutions On Demand Marketplace) 277](#_Toc62880722)

[Trade Lens (Blockchain Based Digital Solution). 277](#_Toc62880723)

[15: SEASTEADING /ARTIFICIAL AND ALTERNATIVE FLOATING/UNDERWATER HABITATS) 278](#_Toc62880724)

[Ocean Builders (Seapod Homes, Seasteading Communities and Floating Cruise Ship for Entrepreneurs) 278](#_Toc62880725)

[Sea Stem (Self-Contained Autonomous Mobile Sea Surface Habitat) 278](#_Toc62880726)

[Ventive Floathouse (Ventive Sea Tech) 279](#_Toc62880727)

[16 SHIPBUILDING, MAINTENANCE AND REPAIR 279](#_Toc62880728)

[Action Tracker Solutions (Fault Detection/Risk Management and Maintenance Solutions) 280](#_Toc62880729)

[Closelink \*Online Cloud/Digital Marketplace Solution for Marine Lubricants) 281](#_Toc62880730)

[Demogate (Online Ship Recycling Solution Marketplace) 281](#_Toc62880731)

[io-Currents (Risk Management Predictive Analytics, Fuel Optimisation and Long Term Reliability Maintenance -Marine Insights Platform) 281](#_Toc62880732)

[Main Deck (Drydocking Project Software Solutions) 282](#_Toc62880733)

[Pinovo AS (Zero Emission Vessel Sandblasting Solutions) 282](#_Toc62880734)

[Sea Drone Pro (Automated Ship Hull Inspections) 283](#_Toc62880735)

[Ship Support (Online Ship Supply and Electronic Commerce Marketplace) 283](#_Toc62880736)

[Techno-Carbon (Carbon Fibre Stone (Sustainable, Carbon Dioxide Reducing Vessel/Other Material) 283](#_Toc62880737)

[Tugdock (Modular Floating Dry Dock) 284](#_Toc62880738)

[X-Ship (Shipbuilding, Repair and Vessel Performance Software and Data Analytic Tools) 285](#_Toc62880739)

[17. SHIPPING/TRANSPORT 285](#_Toc62880740)

[Air Seas (Kite Based Wind Energy Powered Propulsion Systems) 285](#_Toc62880741)

[Andritz Hydro 286](#_Toc62880742)

[Blu-Energy Revolution (Hydrogen Energy Battery, Storage & Systems for Vessels) 287](#_Toc62880743)

[Blue Technology (Sustainable Maritime Transport (Zero Emission Ships and Solutions) 287](#_Toc62880744)

[Bound4Blue (Innovative Vessel Propulsion Via Foldable Wingsails) 288](#_Toc62880745)

[Boundary Layer Technologies (Hydrofoil Container Ships 3x Faster) 289](#_Toc62880746)

[Bunker Metric 289](#_Toc62880747)

[Bunker Trace 290](#_Toc62880748)

[Can-Scan (Automated Shipping Container Inspection Service) 290](#_Toc62880749)

[Cloud Fleet Manager (Hanseaticsoft) (Seafarer/Shipping Management and Resource Solutions) 290](#_Toc62880750)

[Cubex Global (Digital Marketplace for Sea Freight) 291](#_Toc62880751)

[Dolprop Fluke Tech (Vessel Sustainable and Silent Marine Propulsion System) 291](#_Toc62880752)

[Eco Marine Power (Solar/Wind Power Propulsion, Fuel Optimisation, Batteries, Data Logging) 292](#_Toc62880753)

[Ecomar Propulsion (Zero Emission Marine Propulsion Systems) 294](#_Toc62880754)

[Econowind (Autonomous Wind-Assisted Vessel Propulsion Units) 294](#_Toc62880755)

[EMH Systems Limited (Marine Environment Regulation Compliance Hub Solutions) 295](#_Toc62880756)

[Ever-Tracker (Integrated Supply Chain Solution) 295](#_Toc62880757)

[eYard (AI Software to Improve Container Terminal Operation Inefficiency) 296](#_Toc62880758)

[Flex Port (Online Customs Brokerage and Freight Forwarder Dashboard Solution) 296](#_Toc62880759)

[Flow Water Technologies (Carbon Neutral Water Ballast System) 297](#_Toc62880760)

[Flux Marine (Low Emission, Silent, Low Maintenance Electric Vessel Outboard Motor) 297](#_Toc62880761)

[FreightBro 298](#_Toc62880762)

[Fuel Save Marine (Integrated Marine Fuel Saving Solution) 298](#_Toc62880763)

[Futureproof Shipping (Integrated Zero Emission Carbon Service, Project Developer & Zero Emission Tonnage Provider). 299](#_Toc62880764)

[Golden Gate Zero Emission Marine (Marine Fuel Cell Technology) including the Water Go Round Vessel 300](#_Toc62880765)

[Green Steam (Enhanced Vessel Efficiency and Performance Monitoring) 300](#_Toc62880766)

[Hefring Marine (Digital Co-Pilot and Fleet Management Solution) 301](#_Toc62880767)

[i4Sea (Ocean and Climate Predictive Platform for Forecasting Risks to Vessels) 302](#_Toc62880768)

[Inno-Tractor (DiLLaS IoT Distributed Ledger for Logistics & Supply Chain management) Blockchain Service Platform) 303](#_Toc62880769)

[Marine Construction Technologies (Underwater Noise Reducing Pile Driving Construction) 303](#_Toc62880770)

[KNL Networks Maritime Connectivity and Internet of Things/ Data Solutions) 304](#_Toc62880771)

[MVXchange (Online African Integrated Logistics/Shipping Platform Solution) 304](#_Toc62880772)

[Mariquant (Maritime Data Analytics Platform Solutions including Port Congestion and ETA Monitoring) 305](#_Toc62880773)

[Maritime Digital (Fuel Optimisation, Vessel Performance Management and Route Planner) 306](#_Toc62880774)

[Mayflower Autonomous Ship (Renewable Energy Powered) 307](#_Toc62880775)

[Mercado (Integrated Digital Supply Chain Management Platform Solution) 307](#_Toc62880776)

[Metis Marine (Maritime Virtual Assistant chatbot & other Maritime Data Solutions) 308](#_Toc62880777)

[Nautilus Labs (Fleet Dashboard) 309](#_Toc62880778)

[Nav-Alt (Solar and Electric Boats) 310](#_Toc62880779)

[Nedstack (Marine and Port Related Fuel Cell, Emission Reducing Technology Solutions) 310](#_Toc62880780)

[Norse Power (Auxiliary Wind Propulsion Sail Systems) 311](#_Toc62880781)

[Optimiz (Cargo Claim Recovery Solution Platform for Cargo Underwriters and Shipping) 312](#_Toc62880782)

[Power Cell (Hydrogen Fuel Cell Zero Emission Power Sources 312](#_Toc62880783)

[Open Tug (Digital Brokerage Platform for Marine Assets) 313](#_Toc62880784)

[ORCA AI (AI Based Vessel Collision Avoidance/Safety System) 313](#_Toc62880785)

[Port-Xchange (Optimising Port Call Software/Platform) 314](#_Toc62880786)

[Protea Marine Emissions Solutions 314](#_Toc62880787)

[Quay Chain App (A Platform to Automate Bunkering in the Marine Industry Sector) 314](#_Toc62880788)

[Sea Bubbles (Hovering Electric Water Taxis) 316](#_Toc62880789)

[Shone (Digital Co-Pilot Solution) 316](#_Toc62880790)

[SPBES (Energy Storage for Electric and Hybrid Powered Vessels) 317](#_Toc62880791)

[Swiftly.com (Africa Online Shipping Marketplace) 318](#_Toc62880792)

[TEQPLAY (Shipping Applications Platform) 318](#_Toc62880793)

[TOTE INC (LNG Fuel Powered Containerships) 319](#_Toc62880794)

[Vessel Bot (Vessel Fleet Decision Support System, Digital Charterer Marketplace) 320](#_Toc62880795)

[Vessel Performance Solutions 321](#_Toc62880796)

[Vessel Insight (Vessel Data to Cloud and Performance Solution 322](#_Toc62880797)

[Xeneta (Ocean and Air Freight Price Benchmarking and Market Intelligence Platform) 322](#_Toc62880798)

[XOcean (USV Vessels as Ocean Data Solutions) 323](#_Toc62880799)

[Zeabuz (ZERO EMISSION AUTONOMOUS URBAN & COASTAL MOBILITY FERRIES) 323](#_Toc62880800)

[Z Ships (Zero Fuel Zero Emissions, 100% Renewable Energy Ships) 324](#_Toc62880801)

[18. TOURISM 324](#_Toc62880802)

[Envjoy (AI and VR Sustainable Coastal and Marine, COVID Free Tourism) 324](#_Toc62880803)

[Notilo Plus (Personal Marine, Coastal, Dive, Tourism and Other Drones) 325](#_Toc62880804)

[Peace Boat Eco-Ship (Most Sustainable Cruise Ship -Marine Tourism/Shipping Solution) 326](#_Toc62880805)

[Trilobis (Hydrogen Powered Yacht With Underwater Observation Dome) Company Semi-Sub Generation 327](#_Toc62880806)

[19. UNDERWATER/OCEAN OBSERVATION TECHNOLOGY AND EXPLORATION 327](#_Toc62880807)

[ANB Sensors’ pH Calibration Free Sensor Solutions 328](#_Toc62880808)

[Automar (Ocean Buoy -Waveco) 329](#_Toc62880809)

[Bedrock Ocean Exploration (Seafloor Data Platform and Solutions) 330](#_Toc62880810)

[Curious and Energetic Buoys 330](#_Toc62880811)

[Eelume (Self Propelled Robotic Arms) 330](#_Toc62880812)

[Green Power For Persistent Ocean Observation Buoys/Sensors (Blueprint Subsea) 331](#_Toc62880813)

[Hydro-Surv (USV’s for Hydrographic/Environmental/Geophysical Surveys) 331](#_Toc62880814)

[Mobile Observing Observation Network 331](#_Toc62880815)

[OCG Data Ocergy (Zero Emission Ocean Monitoring Buoy) 332](#_Toc62880816)

[Paralenz (Underwater Dive Camera) 332](#_Toc62880817)

[P.A.Zolutions (Wave Powered Buoy Strips) 332](#_Toc62880818)

[Pulse of the Oceans (Underwater Backscatter -Maritime Communications) 333](#_Toc62880819)

[Project Blu-Eyes(High tech Buoy Solution for Marine Protected Areas) 333](#_Toc62880820)

[Rev Ocean (Ocean Research Expedition Vessel and Research) 334](#_Toc62880821)

[REV Ocean Strategy (Private Research Vessel Exploration/Tourism) 334](#_Toc62880822)

[RIB WEC (Wave Energy Powered Breakwater to Shelter/Power UUV’s). 334](#_Toc62880823)

[Sea Machines Robotics (Vessel Sensors, Situational Awareness, Navigation Control and Related Solutions) 334](#_Toc62880824)

[Sea-Net 335](#_Toc62880825)

[Super Radio AS (5G Maritime Communications Solutions) 336](#_Toc62880826)

[Virtual-Dive 336](#_Toc62880827)

[Sea Cras (Earth Satellite Data Analytics) 338](#_Toc62880828)

[Teledyne Caris (Cloud Computing Marine Hydrography Solution) 338](#_Toc62880829)

[Wave Powered Oceanographic Gliders 339](#_Toc62880830)

[The Sea Opportunities (Renewable Energy Powered Underwater Technology Solutions) 339](#_Toc62880831)

[20. WATER SECURITY/WATER QUALITY/DESALINATION 340](#_Toc62880832)

[Desolenator 340](#_Toc62880833)

[Graphene Water Technologies (Membrane Tech to Reduce Water Loss from Desalination) 340](#_Toc62880834)

[H20K Innovations 340](#_Toc62880835)

[Impact Free Water 341](#_Toc62880836)

[Ocean Oasis (Wave Powered Desalination Solutions) 341](#_Toc62880837)

[Resolute Marine Energy (Wave Powered Desalination Solutions) 342](#_Toc62880838)

[21. UNDERWATER NOISE AND ACOUSTIC SOLUTIONS 342](#_Toc62880839)

[Quiet Oceans 342](#_Toc62880840)

[Sub-Acoustic Tech 343](#_Toc62880841)

# BACKGROUND TO THIS RESEARCH.

More and more stakeholders are currently in pursuit of the ocean/blue economy as one of the great salvations of humanity and many of the problems we face. From events such as the World Ocean Council’s Sustainable Ocean Summit, the Economist’s World Ocean Summit, the postponed UN Ocean Conference of 2020, Our Ocean Conference 2020 to initiatives such as the High Level Panel for a Sustainable Ocean Economy; the declarations of investors and financiers to the UNEP Sustainable Economy Finance Principles and others, a new wave of opportunities and prospects exists for those willing to embrace innovations. Unprecedented in our history, are those with ideas and potential; from the WEF Uplink initiative to many startup funders and entrepreneur accelerators such as Katapult Ocean, Washington Maritime Blue, Ocean Innovation Africa and others detailed in this summary report to investment platforms such as Investable Oceans. The first Blue Economy etf was launched by BNP Paribus. More and more innovations are promised from the newly proclaimed UN Decade of Ocean Science 2021-2030 and other initiatives. Previous research of mine has mapped global blue economy finance flows and ocean/blue economy initiatives pursued by governments, the private sector and others.

But to radically upscale progress in the blue oceans economy; this project targets the private sector. Who are the innovators in problems from aquaculture to biofouling to blue biotechnology to ocean renewable energy, plastic and other pollution; the circular economy; ports and shipping, marine ecosystem restoration including coral reefs, drones, illegal and unregulated fisheries, safety, maritime education and training, undersea exploration, logistics and others… even seasteading, sustainable marine tourism and others -even reversing many effects of climate change, food insecurity, poor health, environment, issues of security and ocean governance etc? This project aims to provide insights into the next potentially 500 ocean change makers; to illuminate many of the pioneers; innovative blue economy entrepreneur, ideas and solutions. This aims to not only publicise and advertise the individuals and companies, with ideas -or fully commercialisable solutions; but to help them to receive the resources and indispensable support necessary. It aims to connect and pitch ideas to investors and businesses/financial sector direct. It aims to connect entrepreneurs with accelerators -from ideas through to markets. Funders and the financial/start-up sector and mentors can more swiftly reach a return on investment It aims to assist stakeholders to find competitors and complementary products. Customers can them find solutions, depending on their needs. Ultimately externality benefits and spill-over multiplier impacts can be radically upscaled; to prioritise the right solutions.

Blue Economy Future is open to consulting and partnerships; marketing the right solutions and otherwise assisting all core stakeholders whom might benefit from supporting, investing and disseminating its research. It even envisions needing support for its pioneering concept of the Blue Economy Bazaar, the planet’s answer to a blue Amazon or sustainable commerce online marketplace for the blue/ocean/circular economy, with many of these answers and others out there, connected in a truly sustainable global marketplace and source of private sector information and solutions. The global blue economy has been estimated by the World Bank and others as reaching millions of jobs and over US $24 trillion. Upscaling these and other solutions, can provide a rapid, sure fire and prompt response to doing so to truly transform the blue economy. As others become more aware of the opportunities that exist and changes; many of these radical and ingenious people have provided; these can inspire others with hope and the opportunity that they too can contribute with their own ideas, support via crowd-funding, as a market for sustainable solutions; as providers of publicity, stakeholders and others.

As global climate change, current society, livelihoods pandemics and economies jeopardise not only business as usual but our, our ecosystem and planet’s very existence; stakeholders are becoming more proactive and conscious - from policymakers at the 2015 Paris Climate Change Agreement to private sector commercial and investor initiatives, such as Climate Action 100+ and the Global Investors Group Coalition on Climate Change. Still others are committed to the concept of the blue economy and harnessing the oceans to provide more sustainable radical solutions towards preserving our cultural, ecological, socioeconomic and general heritage.

This research’s contribution is not offering theoretical perspectives on this – these can be found in previous works and documents on the Blue Economy Future’s website. This piece of research aims more to provide a resource and database of those companies and organisations who are now actively engaged in coming up with solutions and innovations around the Blue Economy. It is aimed at those involved with Investing in, financing and supporting these initiatives, to provide them with a precis of 500 of the most interesting and promising ventures worldwide.

It has been undertaken in the time of Covid 19 as a desk top study, through extensive searches and sifting through available information. It hence should be viewed as a directory, or synopsis, of present activities. This directory does not contain any commentary as to the value, validity, accuracy or worthiness of these activities and initiatives. The Author does not offer any endorsement of any of the ventures listed, and accepts no responsibility for any of the information cited herein. It is hoped it will be useful to those involved in Blue Economy initiatives or financing.

# Generic Useful Sources including Funders, Accelerators and Source of Mentors/Innovation

As explained in the introduction to accelerate the blue, circular and climate resilient economy at all stages; it is essential not only to identify the planet changing, private sector innovations for 500 pioneers, whether from startup phase to fully established companies; it is pivotal to provide access to the resources and support necessary to upscale their innovations. This also seeks to inspire and guide not only those consulting this directory but any new innovator seeking a direction forward to obtain funding, mentoring, investment, marketing, accelerator or other support. It also provides a way of being able to spot the trends and developments; the planet changers that can shape the next wave of promising opportunities, including their stages of development; to recruit beyond the immediate 500 trend-setters and blazers immediately within the scope and focus of this directory. Many of the following represent connections that have expressed interest in developing this sector; encountered through one’s one professional Linked In network/other associations and relationships; worth publicising for their commitment to this sustainable future. These sources are seeking solutions to many of Earth’s problems; as categorised in this directory for the initial 500 or so entities contained in the following pages.

Please refer to website [www.blueeconomyfuture.org.za](http://www.blueeconomyfuture.org.za) for links, funders and sources.

* AIX Labs
* Amplifier
* Angel Labs
* Angel List
* Aqua Spark -focus on aquaculture based start ups
* Blue Action Lab
* Blue Institute’s Blue Incubator (US)
* Blue Invest Readiness Programme (EU)
* Blue World Perspective -claims 1400 promising start up to support.
* Blue Tech
* Blue X -Australia
* BOLD -Blue Oceans Leading Drives
* Canada Ocean Supercluster
* Centre for Ocean Ventures and Entrepreneurship COVE (Canada)
* Emergent Oceans
* EU Maritime Forum
* For Sea Invest
* Forum Oceano (Portugal)
* Fynd Ocean Ventures
* Genesis -Ocean Start Up
* Hatch-aquaculture
* Investable Oceans -an entire subscriber investment platform
* Katapult Ocean
* Maritime Alliance
* Marine Startups.Com
* NOAH Blue Fund
* Ocean Exchange
* Ocean Hub Africa (Africa Based organisations)
* Ocean Impact Organisation
* Ocean Opportunity Lab
* Ocean Programs.Com
* Ocean Start Up Project -Canada’s Ocean Cluster
* Ocean Ventures Alliance
* Optima X -Shipping related start ups
* Port XL
* Sea Ahead -Blue Swell Incubator
* Seastainable Ventures (US)
* Sky Ocean Ventures
* Start Up Wharf
* Stealth Start Up.
* Sustainable Ocean Alliance Accelerator
* Tech Stars (Focusing On Asia)
* The Maritime Alliance
* The Ocean Startup Project (Canada)
* Uplink-World Economic Forum
* Washington Maritime Blue (USA)
* World Ocean Council Global Innovation Incubation Network

## Investors That Have Shown an Interest In the Blue Economy.

For more information please check one’s previous Research on Mapping Progress towards Blue Economy Development.

* UNEPFI listed companies
* Althelia Ecosphere
* African Development Bank
* Asian Development Bank
* Aviva Investors
* AXA
* Bank of America (Indirectly)
* Bloomberg Philanthropies’ Vibrant Oceans Initiative
* Blue Finance
* Blue Horizon Ventures
* Blue Oceans Partners
* Boston Common Asset Management
* BNP Paribus -first global blue economy etf
* European Bank for Reconstruction and Development
* European Investment Bank
* Generation Investment Management
* Greenbacker’s Investment Capital
* HSBC
* Impact Vista
* Mana Impact Partners (Southeast Asia)
* Marine Capital
* Mar-Terra Era-Net Co Fund.
* Mirova
* NOAH Regen
* Ocean 14 Capital
* Peakview Strategy
* Portugal Ventures
* Posaidon Capital
* Pure Ocean Fund
* Re Gen Future Capital
* Rockefeller Capital Management
* Seaworthy Collective
* Seed and Click
* World Bank

## 1. AQUACULTURE

### 12 Tides Seaweed Co (Ocean Friendly Kelp Snacks, Aquaculture and Derivative Products)

Activities: Creating Ocean-Positive Food, Regenerative Ocean Farming; Kelp Forest Restoration.

Partner with regenerative ocean farmers, to do their part to remove carbon from our oceans, improving water quality while providing a habitat for biodiverse marine life.

Kelp is a zero-input crop which absorbs carbon from the ocean, reversing acidification and supporting biodiversity. Kelp farming requires no pesticides, no fertilizers, no arable land, and no fresh water. It produces tasty nutrient-rich food that Is rich in vitamins and minerals and has an umami-packed flavour.

They support coastal communities through sourcing kelp directly from small-scale ocean farmers in North America.

They support ocean restoration projects around the world, including SeaTrees initiative to restore kelp forests along the California coast through donating part of their turnover revenue or ‘1% for the Planet’.

Contact: <https://12tides.com/pages/our-impact>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Akua (Ocean Farmed Kelp Aquaculture and Products)

Activities: AKUA is a food company, working to scale ocean farmed kelp, which is a zero-input crop that grows without the need of fresh water, fertilizer, feed, or dry land... The question they seek to answer is that of sourcing sustainable food security from the ocean. So, how do we nourish a growing global population, but do so in a way that minimizes our carbon footprint? Regenerative ocean-farming has the potential to nourish a growing population, in a way that minimizes our carbon footprint. But until this year, a consumer market for ocean-farmed kelp did not exist outside of localized, high-end restaurant sales. And so, working together with the ocean farming industry, AKUA was created to manufacture scalable food products made from ocean-farmed kelp - starting with their first product Kelp Jerky - while building a brand that raises awareness for sustainable food, ocean health, and climate change. Kelp Jerky was recognized by Time Magazine as an Invention of the Year for Sustainability 2019 and by Fast Company as a World Changing Idea in 2020.

Contact: https://www.linkedin.com/in/courtneyboydmyers/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Akualogix (Urban Vertical Aquafarm Solutions)

Activities: Akualogix uses advanced technologies and sustainable practices in urban, vertical aquafarms to produce fresh shrimp, fish, and umibudo. They take a systems approach to innovate every aspect of the process. The result is an innovative aquaculture platform that uses no chemicals, antibiotics, fishmeal, or soy. Instead, they create a balanced ecosystem where their shrimp, fish, and algae grow together. They claim to be the world's first vertical farming solution for aquaculture, bringing fresh seafood to urban markets. The Co-Founder and CEO develops technologies across the Akualogix platform covering biological, mechanical and digital systems, and manages day to day operations working from their Research and Technology Development facility in Singapore.

Achievements include:

* “Developed the world's first vertical farming system for aquaculture.’
* Created a novel sensor array for assessing feeding behaviour and water quality conditions using deep learning algorithms
* Designed and prototyped an organics capture device
* Set up the Research and Technology Development facility in Singapore
* Preparing to file two patents”

Contact: https://akualogix.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Aqua Connect (AI Centred Shrimp and Fish Aquaculture Solutions)

Activities: Raj is the co-founder and CEO of Aqua Connect, Pioneer deep learning/AI startup, that works with shrimp and Fish aquaculture farmers to improve their farm productivity. Around 1 million rural farmers and coastal communities depend on shrimp & fish aquaculture, where traditional farming practices prevents them in achieving production efficiency and diseases prediction. His team built Farm MOJO, an AI-driven advisory solution that helps farmers improve productivity, predict disease and ultimately achieve higher farm income (up to 10%).

Contact: https://aquaconnect.in/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ace Aquatec (Aquaculture Technology/Sealice Removal Solutions)

Activities: Ace Aquatec is a company based in Dundee, Scotland, that is focusing on developing and selling technologies that increase responsible marine practices. They produce a range of award winning innovative rental systems for the aquaculture industry. These include humane electrical stunning systems for commercial fish farms; acoustic and electrical deterrent systems for mitigating predation on farmed fish; underwater biomass systems for measuring fish weights; and sealice removal and destruction systems. Their first product used precision transducer technology to develop an acoustic predator deterrent that was effective over the long term without harming animal hearing; a combination incumbent technologies couldn’t achieve. They then spent several years perfecting a way of using electricity to render fish unconscious while still in water before slaughter. The next technology they saw potential in was time-of-flight 3D cameras to measure the biomass of thousands of fish.

Contact; <https://aceaquatec.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Adriatic Algae Biotech

Activities: Adriatic Algae Biotech Ltd. Company is combining expertise in biotechnology, science and business to develop and validate innovative, competitive and cost-effective processes for the cultivation of microalgae, by applying sustainable development to maintain the quality of life for the future generations. It cultivates the microalgae by using available science and biotechnology innovation possibilities, via vertical farming technology, to reduce harmful environmental impact and strip greenhouse gases from atmosphere by creating better and healthier future.

* 3rd Generation Algal Biorefinery
* Production of Haematococcus pluvialis, Chlorella and Astaxanthin.

### Micro Algae-based Products Development

Activities: This is an Algae healthcare innovation company for food, animal feed and care products development and production.

* Technology In Development Since 2009
* 6 Employees
* 70% Protein In Haematococcus Pluvialis
* 2 Billion Years Green Algae Existence On The Planet

Contact: https://aa-biotech.hr/about-us/

call at CRO number: +385 956044244 or NL number: +31657202066

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Algaeba (Aquaculture Technology Solution)

Activities: Algaeba is an aquaculture technology company based in Bangkok, Thailand. The company is primarily focused on a Post-larvae and live feed counter, and automated hatchery that helps to produce high quality post-larvae. It can speed up the shrimp postlarvae selling process and claims to increase your profit. SeaThru Counter can count with > 95% accuracy in 15 seconds\* It can provide a **social report with a click** and share your results to colleagues and buyers in one click. It provides **non-destructive measurement**. With their method, shrimp postlarvae are kept alive untouched After measurement, all postlarvae are healthy and make buyers happier

Contact: <https://www.algaeba.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Algae 4 Future (Various Algae Based Projects, Technology and Solutions)

Activities: A4F is a biotechnology company, located in Portugal, with more than 20 years of accumulated experience in microalgae research & development and microalgae production (up to industrial scale). A4F is specialized in the design, build, operation and transfer (DBOT) of commercial-scale microalgae production units, using different technologies that better adapt to Customers’ business. A4F distinguishes itself through its methodology, which includes scaling-up from prototypes in their Experimental Unit in Lisbon to large-scale facilities. Additionally, A4F also develops standard operating procedures for optimized microalgae production, according to production goals and with industry best practices.A4F has a very close relationship with the leading research groups in national and international universities and institutes in microalgae biotechnology (and related R&D fields), as well as with the largest microalgae producers worldwide. A4F consider themselves the first choice for any large-scale contract as a specialist in microalgae production.

Contact: <https://a4f.pt/en/projects>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Algae Floating Systems (Algae Based CCS Systems, Cultivation Systems, Bio-oil and other Products)

Activities: Proprietary photobioreactor (PBR). They have built our own PBR. After conducting field experiments, they are certain of strong market advantages of our engineering. Proprietary harvesting system. AFS harvesting system developed as a result of the PBR design achieves at least 30% reduction of operating expenses for harvesting. Proprietary oil extraction system. Instead of drying microalgae and mechanically extracting oil, they developed a technology which allows them to extract oil from wet microalgae bypassing energy intensive (costly) drying.

AFS PBR:

* minimizes capital and operating costs of microalgae cultivation;
* maximizes utilization of sunlight energy per acre of land;
* is adaptable to most operating conditions and user parameters such as climate zones, intensity of light, microalgae strains (fresh and seawater), types and intensity of CO2 and nutrients intake;
* leverages upon an innovative solution to temperature control and surface fouling.

AFS Biofarm™ is a microalgae cultivation farm which consists of identical AFS Biounits™. In turn AFS Biounits™ are made of identical AFS PBR Modules™ which in turn consist of proprietary photobioreactors. Production capacity of the farm ranges from 10 to 100 million gallons of algal oil per year. The following are the specs of a typical AFS Biounit™:

* annual production capacity - 10 million US gallons of algal oil and 100,000 tonnes of algal cake;
* capital cost - USD35 million;
* footprint - 500 acres;
* useful life - 12 years;
* volume - 500 million litres (water is continuously recycled);
* annual amount of sequestered carbon dioxide (CO2) - 250,000 tonnes;
* annual amount of produced and collected oxygen (O2) - over 100,000 tonnes.

With break-through in science, technology, and the concept, they can grow algae in the controlled environment and produce renewable crude oil in a matter of hours rather than millions of years. But why these simple single-celled microalgae? Why can't we just grow the traditional crops that also due to photosynthesis produce biomass and oxygen? The answer is that over millions of years, microalgae have proven to be more productive and efficient in comparison to traditional plants.

Contact: <http://www.algaefloatingsystems.com/microalgae-1.html>

## Air Jet Global (Biocell and Clean Ocean Yarn//Textile Based Technology/Products)

Biodegradable anaerobic or aerobic synthetic fibre. Natural, Synthetic and artificial biodegradable must be brought together through Clean Ocean technology. Some products in textile chain must be biodegradable. For polyamide sportswear it is very difficult to have circularity as recycled polyamide clothing. It is a very complicated process to become clothing again. Biocell claims to gives you the opportunity for underwear and sportswear to degrade at naturally. For corn-based fibre there is the possibility to recycle several times, or if it goes to a landfill it will be biodegraded in 2 years. The solution claims to produce a cleaner ocean indirectly be reducing the quantities of PA, PET and PS and shredding fibre in the oceans and waterways. the combination of two fibres in the Clean Ocean process creates enormous durability in clothing and prevents fibre shedding. A second product Loop Cell also claims to prevent fibres from reaching the oceans.

https://www.biocell.life/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Algi-Sys (Omega 3 EPA Oil and Related Health Products)

Activities: Algal EPA not only helps the planet, but your health as well. They are reinventing how Omega-3 EPA oil is produced, not only helping to save the environment, but also delivering eco-friendly, healthy solutions for millions worldwide. They have a new proprietary strain of algae, reducing the need to over-fish our oceans to keep up with the demand for Omega-3 fish oil. AlgiSys Utilizes The Tech With Highest Yield. While the EPA and DHA components of omega-3 oils can be incredibly beneficial for health, the current resources that provide them can supply far below the demand if the population were keeping up with the recommended daily dose of these compounds. The featured chart on their website demonstrates the amount of fish in thousands of tons that would be required to supply the appropriate amount of EPA and DHA that are suggested by three highly respected health sources.

Contact: https://www.algisys.com/environmental

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Alune (Aquaculture Investment Source)

Activities: They have an investment fund which offers chosen investors exposure to the aquaculture farming industry in Asia while maximising the positive social and environmental impact of the fund. They claim high return investment opportunities in aquaculture, farm financing and optimisation. Alune enables high liquidity investment opportunities in aquaculture – a hard to access, fast growth, highly profitable industry. Aquaculture farmers can gain from operational capital, access to expertise and skills development along with leading technology. Alune believes aquaculture should always consider people and our planet. To achieve this, Alune targets and reports against 9 of the United Nations Sustainable Development Goals. To address the vast mangrove deforestation found around the archipelago of Indonesia, Alune is undertaking a number of projects, which will sequester 600,000 tonnes of carbon before 2050. To help communities and the future of aquaculture they claim they must mobilize, educate, and empower the new generation of shrimp farmers. To support this vision, Alune has launched the “Women in Aquaculture Apprenticeship”, to train and skill up the next generation of women to become farmers.

Contact: <http://aluneaqua.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### ANB Sensors’ pH Calibration Free Sensor Solutions

Activities: ANB Sensors design and develop the next generation of calibration-free, solid state pH sensors used for measuring pH in all industries. The problem with existing pH Sensors, existing pH technology, the glass electrode, has been around for almost 100 years. Millions of glass electrodes are sold each year to meet the need for measuring pH in fields such as pharmaceutical, water management, food & beverage, environmental & ocean monitoring. While the glass electrode is the accepted go to sensor for pH measurement, it suffers from a fundamental operating issue, the need for manual calibration because of reference electrode drift. Reference electrode drift reduces the accuracy of the sensor and adds up to 70% of the operating cost of the sensor. ANB have developed a new electrochemical sensor technology which uses the market accepted, ubiquitous glass electrode, but provides for autonomous, in-situ, calibration of the electrode. This lack of manual calibration provides the following value proposition:

* is at least 70% cheaper to operate and maintain.
* can be deployed for extended periods of time for autonomous sensing.
* can be deployed in an autonomous sensor network, extending use to new fields.

Their proposition is motivated as under:

Ocean Acidification: A decline of 0.1 from pre-industrial times has already been recorded in the pH of the oceans, corresponding to a 26% increase in acidity. However, despite the evidence behind ocean acidification, the data are limited in both coverage and quality and there is a need to develop complete sensor suites to monitor the oceans carbonate cycle, pH being the key parameter.

Ocean Alkalinity: This is exemplified by the fact that global ocean climate datasets like the World Ocean Circulation Experiment (WOCE), Hawaii Ocean Time-series (HOT), and Bermuda Atlantic Time-series (BATS) have only included carbon variables since the late 1980s. Typically large-scale sampling efforts and long-term time series have mostly concentrated on the open ocean. Not unsurprisingly coastal shallow water experience higher variation in pH and represent 10–20% of the oceanic CO2 sink.

Impact: Ocean acidiﬁcation reduces the concentration of carbonate ions having an extreme impact on the Oceans Health. Carbonate ions are the building blocks for many marine animals such as corals, oysters, clams, sea urchins, molluscs, crustaceans and echinoderms, helping them to produce shells and skeletons, as the concentration of carbonate ions reduces, their health decreases. Indeed, reef development is thought to cease at pH 7.8. This environmental impact on foundational species like coral, phytoplankton, and shellﬁsh will have cascading effects on community structure, food, biogeochemical cycling, and commercial ﬁsheries. Ocean acidification is forecast to cost the global economy around $1 trillion annually by 2100[1] through negative impacts on ecosystem services. Coral reefs provide a global economic value of $30 billion per year and the loss of them through ocean acidification is projected to cost tens of billions of dollars annually (or 0.18% of global GDP) by 2100.[2]

Contact: <http://www.anbsensors.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Aqua Nurch (Nature Dots - Improving Aquaculture Solution)

Activities: They aim to create 'Digital Twin' of all the freshwater bodies on the planet! At Nature Dots they are tackling the pain-points of 15 million Inland freshwater fish-farmers, who are reeling under acute stress due to the combined effect of deteriorating water bodies and climate impact, incurring economic losses and facing the nutritional insecurity. With their unique hard-tech product, AquaNurch® , which combines the power of ‘Nature + DeepTech’, they de-risk freshwater fisheries from ecological stressors, providing a multifold return to fish-farmer by increasing fish production/acreage; optimised input resource-usage; enables remote-control and real-time monitoring of aqua-farms operations and helps establish market connect. It ensures high revenue with ease to fish farmers and healthy protein for all. All this while creating a healthy surface water ecosystem. By delivering end-to-end Nature-based intelligent aquaculture solutions in emerging economies towards instituting climate-resilient sustainable fisheries, AquaNurch will also bridge data-gaps for resource management.

Phase 2. Pre-Funding: Prototyping

They are presently collecting baseline data and information for training their proprietary ML algorithms and conducting our alpha trials while gathering feedbacks from the customers to develop a Minimum Loveable Product

Targeted Challenges and Focus Areas

* Restoring, Protecting And Investing In The Ocean
* Investing in nature-based solutions for the blue economy
* Restorative aquaculture

Contact: <https://uplink.weforum.org/uplink/s/uplink-contribution/a012o00001OSm2bAAD/aquanurch>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Atlantic Sea Farms (Kelp Aquaculture)

Activities: At Atlantic Sea Farms, their kelp is never dried, never dyed, and is grown at home. They aim to make a powerful and positive impact on the health of their customers and oceans by creating craveable and innovative products made from sustainably farmed sea greens, all while expanding opportunities for Maine's fishing communities. They make and sell Fermented Seaweed Salad, Kelp Smoothie Cubes, Kelp Sauerkraut, Kelp Kimchi, along with T-shirts, hats and stickers.

Contact: https://atlanticseafarms.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Biofishency (Aquaculture Filtration Technology Solutions)

Activities: Founded in 2013 by Cobi Levanon and Igal Magen, BioFishency is an aquaculture solutions provider focused on increasing growers’ productivity and sustainability through its innovative filtration technology and more than 20 years of aquaculture industry know-how. The company is dedicated to helping growers around the world produce more fish with less water in an extremely cost-efficient way, using their own facilities and infrastructure to advance more effective aquaculture and aquaculture production. BioFishency is an aquaculture solutions provider, focused on dramatically increasing growers’ productivity and sustainability through its innovative technology and extensive know-how. BioFishency provides product and services, including —

* Single Pass Biofilters (SPBs) In Various Capacities
* Single-Pass Biofilter Full Water Treatment
* Fully Integrated Growing Apparatus In Various Capacities RAS
* Tailor Made Solution
* Professional Services (Design & Engineering, After-Sale Support, and Growing Facility Support Programs)

Contact: <https://biofishency.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Bio-Feyn (Enhanced Aquaculture Fish Feed)

Activities: At BioFeyn, they aim to create better feed for better fish. They are optimizing ocean nutrients in a way that decreases impact on the environment, while increasing the health and nutrient density of farmed fish. Making eating healthy fish sustainable, BioFeyn adapts nanotechnologies based on human medicine to deliver nutrients and natural disease preventatives to fish. BioFeyn’s goal is to produce the most sustainable and nutrient-packed farmed fish on the market by optimizing existing ingredients that are already proven to be safe and sustainable. They aim to add value for farmers, feed suppliers, and the environment.

Contact; <http://biofeyn.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Aqua International (Various Miscellaneous Aquaculture Products and Solutions)

Activities: Blue Aqua International is a one-stop solution provider for the aquaculture industry in the Asia-Pacific region and the United States. Blue Aqua group has a presence in 13 countries around the world, and is headquartered in Singapore. They provide expert views and solutions for the improvement of health, nutrition and feed quality, technology transfer, and project management services in livestock, poultry, and aquatic animals. Their mission is to provide solutions to assist customers in increasing their profits and to be able to operate their business sustainably and environmentally friendly.

Contact: https://www.blueaquaint.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Evolution Aquaculture (Aquaculture Technology)

Activities: Blue Evolution Aquatechnology provides live support solutions and water quality control equipment for a wide range of customers. From research labs to aquaculture to professional aquaria and Koi ponds, they offer state of the art products and service. Planning and installation of measurement and control technology, energy technology and emergency supply systems for aquaculture and labs In all aquatic husbandry systems, the measurement and control of the abiotic environmental factors is a prerequisite for the optimization of water quality. They can help develop an effective solution for the measurement and control of all parameters relevant to your application and thereby guarantee optimal water quality. Furthermore, they can integrate many additional factors such as automatic feeders, lighting and emergency systems in the event of a power failure or the failure of pumps into your control architecture. With an interdisciplinary team of experts, they design different types of technical aquaculture systems according to your requirements. By integrating specific biological aspects of the species to be cultivated into the design process, as well as hydrodynamic modelling and hydraulic dimensioning, they can optimize your husbandry system. They have several years of experience in the construction of housing systems for different types of freshwater and saltwater. This includes professional recirculating aquaculture systems and flow-through systems, as well as compact filter solutions and individualized multirack laboratory systems. Perfect water quality is ensured by multi-stage filtration processes according to the requirements of the target species.

Contact: https://www.blue-evo.com/companyprofile

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Lion Lab (AI Tech for Aquaculture Diseases/Organisms)

Activities: Based in Ontario, Canada, they develop AI-driven technology to automatically identify aquatic organisms and other micro-particles in water. Harmful Organisms: Sea Lice. They are currently developing an underwater imaging system to automatically identify and track the amount of sea lice in water. Their beachhead market for this technology is aquaculture with the goal of working toward a more sustainable food source. This gives fish farmers an early warning sign about incoming sea lice, allowing them to take preventative measures to safeguard their crop.

Contact: <https://bluelionlabs.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Nalu (Cell Based Aquaculture Products)

Activities: Blue Nalu, aim to be the global leader in "cellular aquaculture", providing consumers with great tasting, healthy, safe, and trusted seafood products, that support the sustainability and diversity of our oceans. We will produce real seafood products directly from fish cells, in a way that is healthy for people, humane for animals, and sustainable for our planet. Global demand for seafood is at an all time high, as consumers are increasingly choosing to eat the extraordinary variety of delicious and nutritious seafood products that exist worldwide. Unfortunately, our global supply for seafood cannot keep pace with this demand, as populations of marine species have halved since 1970. This is due to overfishing, illegal fishing, rising ocean temperatures, acidification, the effects of trawling, and a number of other environmental, social, and political challenges. At the same time, consumers are looking for more from their food choices. Consumers are increasingly concerned about animal welfare and the conditions in which fish are farmed and caught. In addition, they are increasingly concerned about their own personal welfare, as seafood can be a source of mercury, toxins and poisons; pathogens, viruses, and parasites; micro-particles of plastics due to plastic pollution in our ocean; and a variety of other environmental pollutants.

Contact: https://www.bluenalu.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Cage-Eye (Aquaculture Behaviour Monitoring Analysis)

Activities: CageEye gathers data on fish positioning in the cage from the installed transducers. Real-time data and logging of past feeding cycles gives the farmer objective data insight into fish behaviour. CageEye is a global company, headquartered in Oslo, Norway. Their mission is to optimize seafood production in the most responsible and sustainable way. To do so, they have developed a unique hydroacoustic technology that delivers deep analytical data and translates fish behaviour into knowledge and insights. “We understand fish behaviour – we speak Fish“ – as they like to call it. This means they can better match the feeding to the fish's natural behaviour and appetite than ever before, resulting in increased fish growth, less feed waste and increased fish welfare.”

Their proposition is motivated as under:

Demand for food will nearly double by 2050. As the world population grows to 10 billion and food preferences change to more protein rich diets, the demand for food will nearly double by 2050. At Cage-Eye, they believe we must all work together on optimizing seafood production in the most responsible and sustainable way, and see aquaculture as the answer.

The FAO expects a 37% growth in aquaculture production from 2016 to 2030, reaching 109 million tonnes annually. Aquaculture already is, and will remain, an important industry helping solve the challenge of the growing demand for more high quality proteins.

Aquatic precision farming: Down to zero feed waste, lower diseases and mortality, higher efficiency and yield and improved animal welfare. The future of fish feeding is based on data, algorithms, machine learning, and most of all: insights. If we all gain an even better understanding of fish behaviour, we are able to increase the global production in the most sustainable way. By understanding fish behaviour, they help farmers to feed according to the fishes' natural routines, appetite and needs. This results in more efficient feeding, increased fish growth, and ultimately, increased sustainable production, addressing the demand for more seafood directly.”

Contact: https://www.cageeye.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Calysta (Cell Based Protein Substitute for Fishmeal)

Activities: Calysta cultivates an efficient, methane-eating natural microbe that produces protein. This is a new and sustainable feed ingredient – a single cell protein that is a perfect replacement for fishmeal. Calysta is a biotechnology company ‘leading the world’ in the development and manufacture of protein ingredients from new sources, which will feed the growing population without causing further damage to our planet. Their first product, Feed-Kind®, is made using very little water and no agricultural land by fermenting natural gas, an abundant source of energy, to create a safe, nutritious, traceable and affordable protein. Feed-Kind has been commercially validated through extensive customer trials in aquaculture, agriculture and pet food. They are based in Silicon Valley, California.

Contact: <https://www.calysta.com/about-us/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Cascadia Seaweed (Seaweed Aquaculture Farm)

Activities: Growing to become North America’s largest provider of cultivated seaweed, Cascadia Seaweed aim to help to revitalize human health, improve coastal communities and benefit the environment. Their management team has a proven track record of building successful companies in the marine, innovation, and consumer packaged goods sectors. They address three global challenges: providing healthy plant-based nutritional food, climate action and ocean regeneration, and economic resiliency for Indigenous communities. Scaleable by partnering with First Nations, coastal communities and food processors alike help to reduce capital required. They were deploying 50kms of new line in autumn 2020. Their focus is on cultivation, know how, branded products and technology / IP.

Contact: <https://www.cascadiaseaweed.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Catchatrade (Integrated Online Seafood Marketplace China, Indonesia, India and Vietnam)

Activities:

An integrated B2B online seafood marketplace. Provider of a platform intended for risk free seafood trading. The company's platform offers its users to connect to a global community of approved seafood professionals instantly to discover new trading opportunities, enabling them to reduce cost of sale and increase sales volumes using a quick and easy to use trading platform that protects sellers and buyers. Demo product completed and consulting with key industry players in China. Catchatrade plans to target the top four aquaculture producing countries: China, Indonesia, India, and Vietnam.

**Global Access**

* 24/7 real-time Global Marketplace.
* Send quotes with just a touch of a button.

**Low Cost**

* Direct to market (no traders/middleman)
* Developed to drive value. Putting money into our suppliers pockets on every trade
* Easy & Intuitive
* Easy offer uploads (Auction or Flat price) to ensure best price execution.
* Full control over your offers and pricing.

**Security, Strength & Speed**

* 100% secure payment system. Cloud based technology with state of the art encryption.
* Robust but simple and easy to use. Better visibility and convenience.

**Trading Technology**

* 24/7 Tracking of Order flow and Pipeline.
* Alerts and notifications built into the system.

**Risk Management & Reporting**

* Generate customized business reports at whim.
* Know your exact trading position (accounts receivable, cash balance) instantly.

Contact: <https://www.youtube.com/watch?v=f1xArN_3OWE>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### C-Combinator (Sustainable Blue Carbon Seaweed Based Biomaterials and Other Products)

Activities: C-Combinator harvests the world's most sustainable material, in ocean-healing ways. They are a Public Benefit Corporation partnering with companies & institutions to research and develop seaweed into productive and innovative products, starting with biostimulants and natural fertilizers.

They motivate their activities as under:

Our oceans are out of balance. Deforestation & water pollution have significantly increased nutrient runoff. In combination with warming oceans, it has normalized the explosion of seaweed blooms suffocating costal ecosystems, and disrupting communities and livelihoods. Seaweed plants present a win-win model: a planet-saving resource that also transforms markets. Seaweeds grow faster than terrestrial plant, by efficiently absorbing nutrients found at sea, including CO2. That makes it an ultra-sustainable resource that can offset carbon at a global scale. Their proprietary harvesting and processing technology allows us to turn seaweed into innovative biomaterials for industries like pharma and agriculture, while avoiding or minimizing further release of harmful byproducts. Their model is built on bringing both economic viability & regenerative potential to carbon offset & ocean de-acidification. The Rainforests of the Ocean, powered by available water, nutrients and energy, their Marine Permaculture Arrays can vastly improve carbon drawdown compared to traditional land-based methods. Even more, it strengthens fish stocks and marine habitats by restoring important ecosystems like kelp forests, or even allows them to grow in coasts they couldn’t develop naturally before.

* 1 Km² Of Marine Permaculture 2022
* CO2 Sequestered 3k Tons
* Biostimulant For Soil Restoration & Organic Farming\*
* Bioplastic Materials Replaced: 1,200 Tons

Blue Economy for Island Nations: They believe that responsible stewardship of ocean resources will lead to transformative economies, sustainable development, environmental recovery, and resilient communities. Starting with a biorefinery in Puerto Rico & a processing hub in México, they focus on island nations & coastal economies that are most at risk of climate collapse & resource dependence. Marine Permaculture is an important component of resilient, low-carbon approaches to island sustainability, alongside renewable energy and food sovereignty. As a PB Corporation, they have a mandate to put their resources to work in restoring the health of the oceans & climate, and partner with institutions, citizen movements, governments, and other companies in this. Marine Permaculture™ is featured as one of four solutions that exist today that can improve the planet's sustainability. C-Combinator is aiming to address the global demand for food, feed, fertilizer and advanced materials while drawing down carbon and restoring life in the oceans.

Contact: Dr. Brian Von Herzen and Damon Gameau.

https://www.c-combinator.com/\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### C-Feed (Aquaculture Feed)

Activities: C-Feed AS was founded in 2014 and is based on more than 15 years of world-leading research and development at SINTEF Ocean. This includes breeding of various microalgae and zooplankton species, different breeding techniques and enrichment methods/diets, and with a large focus on water quality and microbial control, using new technology and automation of processes to achieve cost efficient production. In March 2016 C-Feed opened the world’s first commercial scale production facility for copepods in Vanvikan, Norway, which has been in continuous production ever since.

Team and ownership: Strong technical team with unique experience and a wide area of competence in the feeding and production of marine fry, combined with comprehensive commercial expertise and network. Their board members are senior executives with background from all parts of the farming industry. C-Feed’s largest shareholders are SINTEF Venture IV AS, Investitude AS and Cofounder AS. SINTEF Venture IV is a fund owned by SINTEF (48%), European Investment Fund (45%) and Sparebank 1 SMN Invest (7%). New selected investors are currently being invited.

They motivate their activities as under:

**Ballan Wrasse**

* Growth: increased by 30% during first feeding period
* Less mortality induced by stress: 0% vs 15-25%

**Atlantic Bluefin Tuna**

* Deformities: Reduced from 83 to 8%
* Survival: Increased from 0 to 10%
* Increased growth

**Sea Bream**

* Operculum deformity: Reduced by 50%
* Growth: Increased growth

**Atlantic Halibut**

* Increased growth and survival
* Normal pigmentation
* Increased larval quality

**Turbot**

* Growth: >35% increase
* Survival: >16% increase
* Normal pigmentation and increased larval quality

Contact; http://www.cfeed.no/references/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Chicoa Fish Farm

Activities: Chicoa Fish Farm [CFF] offers a vertically integrated solution to kick-start the freshwater aquaculture industry in Mozambique. CFF is a low cost, environmentally friendly producer.

They motivate their activities as under:

Africa is short of protein, and since some 20% of Africans get their protein intake primarily from fish, fish are crucial to solving this shortfall. Local capture fisheries, however, are in decline, and the supply crisis is compounded by Africa’s rising population, which is expected to double by 2050. By 2025, it is estimated that the region will need an extra three million tons of fish to meet demand, as the gap between per capita fish consumption in developing (26.8 kg per capita\*) and developed countries narrows. This cannot be supplied by capture fisheries. While some of the world’s best natural resources are in African river basins, Africa itself produces just 2% of the world’s aquaculture production, with the majority confined to Egypt. Chicoa has the potential to become a profitable and sustainable solution for this fish supply shortfall by tackling all the challenges of introducing a modern aquaculture to the continent, including a lack of technical expertise and the right quality of fish feed and fingerlings. By combining these elements in one facility, they aim to be on the frontier of developing a sustainable and highly efficient aquaculture industry in Africa.

Contact: <http://www.chicoa.fish/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Dynaspace (Information Analytics For Shrimp Farmers)

Activities: Based in Norway, Dynaspace deliver a dependable flow of information and intelligence to make decisions fast and effective for shrimp farmers using high-resolution satellite images. They are working with farmers, suppliers, importers/exporters, processors, investment-banks, consultants and authorities all around the globe to deliver unique analysis, insights, and answers. Dynaspace advances the transparency of aquaculture by utilizing satellite imagery to provide a cloud based platform with the most comprehensive map of aquaculture operations. This empowers farmers to gain access to the resources they need to ensure environmental and sustainable production. By using space technology we are solving global data gathering challenges, advancing aquaculture transparency. We believe that space technology can leapfrog the aquaculture industry with unique reliable insights and contribute to environmental and sustainable production for generations to come.

Contact; https://dynaspace.no/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ecto (Digital Aquaculture Biology Solutions)

Activities: Ecto is a digital biology company that is developing technology to make aquaculture production more efficient and sustainable. It delivers technologies and platforms for high precision fish farming. They work with aquaculture companies to help them generate new data and utilize existing data to increase yield and reduce production costs. They collaborate with farmers to streamline production and health management by leveraging advanced molecular tools and digital technologies. To date, their solutions have enabled farmers to create 51,510,714 additional healthy servings of protein. Ecto has offices in Boston, Atlanta, and Stavanger (Norway) and serves customers all over the world. The company was founded at Harvard Innovation Labs in 2013 by Dmitry Kozachenok, MBA and James Webb, Ph.D. The company has received competitive research grants from the US National Science Foundation, US Department of Agriculture, and Innovation Norway.

Contact: For more information contact@ecto.com

https://www.linkedin.com/company/ecto-inc

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### eFishery (Smart Fish Feeder Device for Aquaculture)

Activities: eFishery has developed a smart fish feeding machine, aiming to revolutionize commercial aquaculture. eFishery is an integrated feeding solution for fish and shrimp farming. As a fish farmer-turned-agriculture tech entrepreneur, eFishery founder and CEO Gibran Huzaifah is revolutionizing the relatively untapped $9.4 billion-valued Indonesian aquaculture market. eFishery uses cloud-based smart-feeding technology in fish and shrimp farms across the vast archipelago, to ensure the fish are healthy and waste minimized - to increase feed efficiency by 21%. In addition to selling products, this IoT startup also collects data from feeding, production, water quality and fish behaviour, to create predictive insights for farmers. The company uses the data platform to provide and connect farmers with services like financing, market access, and supply. He was part of Google Launchpad Accelerator in 2015 and Unreasonable Impact in 2018. He was listed as Forbes 30 Under 30 Asia 2017 and Ernst & Young Entrepreneur of the Year (Innovation category) 2018.

Since 2013, eFishery has continued to develop with innovations in the form of a Smart Feeder, which is an automatic feeder that is also able to record feeding data to fish growth. EFishery has evolved to become the first Aquaculture Intelligence company in Indonesia. It not only innovates to create a Smart Feeder, but also becomes a solution to solve bigger problems in the Aquaculture sector in an integrated manner from upstream to downstream. By using data and technology, eFishery is committed to helping all parties in the Aquaculture ecosystem; Cultivators can increase their productivity and quality of cultivation, find it easier to obtain capital, gain access to expand markets, while Indonesians can buy fish at a better price and quality. Until now, eFishery has spread across hundreds of points in Indonesia, from North Sumatra to West Nusa Tenggara and the Maluku Islands. They continue to strive to develop products and services so that they can reach across various regions in Indonesia

They claim:

* Hundreds Fish and shrimp farmer groups develop their business with eFishery.
* Thousands The eFishery Feeder unit is installed and operates in fish and shrimp Farms.
* Millions Fish and shrimp of various commodities are fed through eFishery Feeder
* 1996% Growth in the number of eFishery feeder users in the last year.

Contact: https://www.efishery.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Energaia (Sustainable Algae/Spirulina Aquaculture Products)

Activities: Based in Bangkok, Ener-Gaia specializes in producing fresh and sustainable algae products. Focused on making Spirulina a part of daily diets and utilizing otherwise unusable space and land, to cultivate healthy food, their team is leading the way towards tackling nutritional and environmental problems that plague the cities and residents of the world. The CEO founded the social enterprise EnerGaia to be a sustainable micro-algae producer and technology developer to address food security and environmental challenges facing our world. Their Business includes

Technology consisting of bioreactor systems to grow spirulina; Revolutionizing the way to grow spirulina: at their online store

Engineering & scientific consultation: helping clients setup and manage their bioreactor systems including microbiological consultation for their farms.

Fresh spirulina and a wide range of spirulina products ranging from fresh, powder, energy balls and pasta.

Contact: Springspirulina.com; https://energaia.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Exci-Plex (Aquaculture/Fishery Mycotoxin Detection Strategies)

Activities: ExciPlex is developing novel mycotoxin detection strategies to improve toxin traceability across the animal feed production chain and ultimately contribute to greater efficiency and productivity in livestock industries. They founded the company and invented a novel photochemical detection technique. Responsible for all functions related to bringing this disruptive innovation to feed and livestock industries all over the world, seeking to help ensure the health of these animals (aquatic and terrestrial) and to protect farmer profitability. Innovative technology for mycotoxin detection. ExciPlex is proud to be part of Cohort 4.0 in the Hatch aquaculture accelerator program. This is a phenomenal opportunity for ExciPlex to grow and develop under the talented Hatch team and alongside some incredibly innovative entrepreneurs. The program kick-off was Monday, August 17th, 2020. You can find all the initial pitches on the Hatch LinkedIn page. Based in Michigan, USA

Contact: <https://www.exciplexinc.com/news/event-one-23yxf>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Fishency Innovation (Automatic Sealice Solution For Fisheries and Aquaculture)

Activities: Fishency Innovation is a scale up that developed an AI solution for automated fish health monitoring for the aquaculture industry. Fishency’s primary goal is to accurately detect and categorize the level of sea lice infection in salmon cages and provide a decision support system for better control of the parasite. They have developed Fishency360, a hardware and software solution based on computer vision and machine learning to capture 360-degree view of individual fish at different depths in the water column. Sharp and high-resolution images of individual fish are used to detect and categorize sea lice. The images are used to measure growth and to detect health issues like winter ulcers, cataracts, scale loss, and other skin damages at an early stage. Fishency360 can be applied to traditional open sea farming as well as land-based and offshore. ‘One cage, one Fishency360.’ A simple and affordable solution, providing farmers and veterinarians remote access to high-quality fish health data.

Contact: <https://www.fishency.no/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Geneti-Rate Fish (Aquaculture Genetic Analysis)

Activities: Using informed Natural Selection to improve sustainability and production, GenetiRate sorts eyed eggs, embryonic fish, and spat based on metabolic rate. By sorting based on metabolic rate they identify animals that are genetically superior for growth. They use their proprietary diagnostic assay and sorter to test various aquatic eggs, embryos, hatchlings and tissues to select aquatic species with greater growth potential and feed efficiency. They understand that each producer will have their own needs and each species will have their own challenges. In turn, they offer a variety of services that we are happy to customize to meet their customers needs.

• On-Site Embryo/Egg/Spat Sorting - They come to you to test your eggs/embryos

• In-House Sorting - For species amenable to shipping costs can be reduced by shipping your eggs/embryos/spat to our lab for testing.

• On-Site Skeletal Muscle Biopsy - Feed Efficiency Test -They come to you, perform our skeletal muscle biopsies and return to our lab for analysis. Great for first time users of our biopsy test, we'll train you while on-site so that you can perform future biopsy analyses using our mail-in kit.

• Mail-In Skeletal Muscle Biopsy Kit - They send you a complete kit. You collect the biopsy and incubate for 4 hours. Freeze and ship frozen to our labs for analysis.

<https://www.genetirate.fish/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Glass Eels (UK Eel Sustainable Fisheries)

In 2012 Glass Eels moved to their current site supported by the European Fisheries Fund on the banks of the River Severn and they have continued to introduce sustainable fishery practices and solutions. This move was to reduce capacity from 15,000kg to 1,500kg, reflecting the objectives of the Marine Management Organisation, not only to protect the fishery for future generations but also to maintain the economic, cultural and social values for the local community. The majority of our eels are now sold to Europe for restocking projects. With a proportion for sustainable aquaculture. They also have our sister company, Civelle Durable, in Royan, France. We are both committed SEG certified farms and buy from SEG certified fisheries. They have been working with The Sustainable Eel Group since it’s concept in 2009. They have also been working with Severn and Wye Smokery with their ‘Eels in Schools Programme‘, introducing tanks of glass eels into classrooms. They have supplied eels to huge numbers of restocking projects all over Europe. For many decades we have been at the leading edge of Glass Eel Fishery management and innovation have pioneered many techniques to make our industry more complete and effective. They recognise that sustainability is the key not only for the future of the glass eels’ fishery but also, until it is possible to reproduce the eel in captivity, the future of the European Aquaculture industry. It is therefore not surprising that they are directing our resources and energies to promoting a sustainable fishery.

Contact: https://glasseel.com/services/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Green Wave (Regenerative Ocean Aquaculture)

Activities: Green Wave has a polyculture farming system which grows a mix of seaweeds and shellfish that require zero inputs — ‘making it the most sustainable form of food production on the planet’ — while sequestering carbon and rebuilding reef ecosystems. Since their farms sit vertically below the surface, they produce high yields of shellfish and seaweed with a small footprint. With a low barrier to entry, anyone with 20 acres, a boat, and $20-50K can start their own farm. Green Wave’s model is deployed for both reforestation, to restore ocean ecosystems and capture blue carbon and nitrogen, and commercial farming, to grow seaweed and shellfish – including scallops, mussels, oysters and clams - used for food, fertilizer, animal feed, bioplastics, and more. They are protective from storm surge and rebuild marine ecosystems.

<https://www.greenwave.org/our-model>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Impact-9 (Sustainable Aquaculture)

Activities: Impact-9 looks to answer the following questions: Where can seafood be sustainably produced in a natural environment? Where can farms get permits to increase production? How can livestock be grown closer to large markets? What port infrastructure and vessels are available form marine operations and maintenance? What capital equipment can the business model sustain? They developed the solution to say that the most profitable place to produce seafood is further offshore.

* Reduced Maintenance. Safer Stocks. Cleaner Water.
* Innovative Marine Structures Are In Our DNAa

They motivate their activities as under:

They have worked with synthetic fibre ropes and elastomeric materials in the marine environment to solve shallow water mooring problems: to control the dynamics of structures in big waves, without it costing the earth.

Salmon: land-based containment or open ocean solutions? Global salmon production is a $15.4 bn market, focused on sheltered water bodies in Norway, Chile and Scotland. There are efforts to double the sector’s production by 2030. Growth in conventional open net pens is becoming constrained due to increasing incidences of sea lice and disease as well as regulatory steps to restrict the number of licences in sensitive marine environments. The industry has reached a fork in the road: Does it move to costly “closed” aquaculture in controlled tanks or does it move into “open” solutions, submerged in resilient offshore environments. We know the latter will play a major role in future aquaculture production. A more energetic oceanic environment dilutes and dissipates bi-products as part of the natural process. Impact-9’s technology heralds a new era of growth for the aquaculture sector: an environmentally sustainable and responsible protein source for the growing world population.

* Fish Pen Technology
* Shellfish & Seaweed - New Beginnings
* Shellfish: Better Growth In Higher Flow Environments?

Mussel production is a well-established industry and is usually undertaken in very sheltered sites with limited flow. Mussel growth and quality are known to be better in higher energy environments. But how can cost-competitiveness be maintained. Impact-9’s Sea Strut solution seeks to address this using a robust and simple flotation technology for longlines and that can attenuate wave loads, while offering buoyancy control to compensate for biomass growth. The same solution can be applied to other bi-valve shellfish as well as seaweed and algae production which are rapidly growing sectors of aquaculture.

Contact: https://www.impact-9.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Indian Ocean Trepang (Sea Cucumber Aquaculture)

Activities: Indian Ocean Trepang (IOT) is an innovative sea cucumber farming operation in Madagascar. Following a successful pilot project initiated in 2008. Indian Ocean Trepang (IOT) is a SME, located in Tulear, South-West Madagascar, specialized in sandfish sea cucumber farming (Holothuria scabra species). IOT makes sustainable commercial, environmental and social impact due to: its industrial aquaculture production of Holothuria scabra; Next to its own farming sites, it has a substantial program for its partnerships with coastal fishermen villages. IOT is fully integrated with a hatchery, a nursery, sea pens and a processing factory. It currently employs 150 staff, out of which 30 are certified in Aquaculture. Today, sea cucumbers are critical to the Indo-Pacific region ecosystems, where local fishermen harvest them to meet rising global demand. But, due to the long-standing exploitation of the 70+ sea cucumber species - which have a commercial value -, tropical regions are seeing alarming extinctions of their respective local sea cucumber species. Indian Ocean Trepang (“IOT”) grows, processes and sells dried sea cucumbers to consumers worldwide, using a unique low-tech environmentally-sound model, for which a portion of its production is subcontracted to low-income fishermen giving them access to a growing and lucrative global market. IOT partners with local fishing villages, to return sea cucumber farming back to its natural spot, in the sea, and away from expensive facilities.

Contact: https://www.iotrepang.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Jala Improving Shrimp Production Using Data-driven Farming

Activities: JALA empowers shrimp farmers to increase their yields through technology and smart data. The company monitors water quality on shrimp ponds and this data can be accessed online in real-time. JALA offers one stop digital solution for farmer, leveraging their farming practices to ensure profitability and sustainability. They combine IoT water monitoring and data-analytics system to achieve precision farming. Digital farm management means you can record your pond and cultivation data like water quality condition, daily feed consumption, shrimp sample, harvest, and so on. Get the analysis and insights of your cultivation, as well as farming predictions like daily growth and the best time to harvest.

Contact; https://jala.tech/about/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Kuehnle (Aquafeed and other Marine Biotechnology Products)

Activities: Kuehnle AgroSystems, Inc. (KAS) is a Hawaii-based biotechnology company with a world-class team of professionals. They research, develop and produce specialty chemicals and raw materials to make life better. Their customers include multinational corporations along with valued regional companies and brands that require sustainable plant-based ingredients for aqua feeds, food, and personal care.

Kuehnle AgroSystems, Inc. (KAS) curates a unique set of algae originating from pristine waters and ecosystems of Hawaii, as well as tropical botanical accessions representing plants prized by Polynesian voyagers. KAS has numerous patents and patents pending to support products and processes that meet natural products standards under strict quality control for applications in personal care ingredients and aquaculture feed. Their technology, know-how and relational databases allow for high-performance strain and ingredient development using flow cytometry, multivariate gene expression and bioactivity screening; active ingredient extractions, upgrades, and formulations; and process development to pilot manufacturing. Increasingly, food, feed and personal care industries are pivoting to fermentation-derived extracts to meet the demand for natural, high quality, yet less expensive ingredients. They boast to take this one step further by enabling robust commercial production on pulp and paper industry residuals.

KAS intellectual property and products

◦ Fermentation manufacturing for natural botanical and algal ingredients.

◦ Culture medium containing volatile fatty acids and wood lignocellulosics.

◦ Isoprene and isoprenoid metabolic engineering.

◦ Pseudogene bioengineering strategy for chloroplast expression of product.

◦ Intergenic Spacer Region (IGS) strategy for stable nuclear expression of algae products, overcoming a major roadblock for transgenic algae. Includes unique inducible promoters.

◦ Use of “green” ionic liquids for oil extraction and protein enrichment of biomass.

◦ Wastewater treatment with CO2 capture. This process that uses microbial consortia to convert refinery and other industrial wastes, effluent nutrient loads and CO2 into biomass and bio-oils (for diesel and jet blendstock). This innovative approach leads to an increase in the effectiveness of wastewater clean-up and a decrease in wastewater disposal costs, and was recognized in August 2012 by a Clean Technology Award to KAS from the US Environmental Protection Agency.

◦ Their raw materials are proprietary ingredients manufactured in-house. Check back for upcoming product launches!

Contact: https://www.kuehnleagro.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Matorka (Arctic Char Aquaculture)

Activities: Matorka is an innovative Arctic Char farming operation based in Iceland, which makes optimal use of Iceland’s natural resources. For centuries, fishing and seafood has been an essential part of Icelandic society. They are located in Grindavik, a legendary seafood town with a 1,000 year old seafood tradition. They carry on the tradition by raising their fish in crystal-clear waters without antibiotics or hormones and by feeding them a quality diet. This results in ‘The world’s healthiest and best tasting choice for our consumers’. Their land-based aquaculture system makes them a consistent and trusted source of quality fish. You can find Matorka fish, including their Arctic Char and Steelhead, across North America and Europe. In Icelandic, “mat” means food and “orka” means energy. Matorka translates to food energy. Their operations run on sustainable, geothermal energy and any carbon footprint we produce is offset by tree planting. Their fish is more sustainable than wild catch and all other forms of aquaculture. Land-based aquaculture is a key component of responsible seafood production.

[Contact: https://matorka.is/our-story/](Contact:%09https://matorka.is/our-story/)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### MLK Waste Management: Recirculating Aquaculture Systems (RAS) + Aquaponics

Activities: MLK has developed a unique solution for increasing Fish Densities by employing their Recirculating Aquaculture Treatment Systems (MLK-RAS) in Earthen Ponds, Ponds lined with geomembranes, small fish tanks, etc. Growing population in the World and India has put increasing stress on the agricultural sector to cope up with food security and nutrient security concerns. With Fisheries gaining popularity as an excellent source of protein and essential nutrients in the country, natural habitats like oceans, rivers, dams, of the fish have been affected drastically. An alternate to natural habitat fishing is rearing fish in controlled environments like Ponds, Tanks.

They specialise in designing and manufacturing a RAS plant superior to other RAS systems, in terms of better efficiency and lower operation and maintenance expenses. MLK RAS runs both on pumps and on gravity leading to lower dependency on machine, and lower power requirement. They have seen high output rate with a quick growth of fishes with their customers. Warm water fishes are more suited for growth in RAS. Different types of fishes can be grown ranging from Carps, Pangasious, Striped bass, Tilapia, Singhi, Pabda, Fresh water Prawns and Shrimps, etc. RAS reduces the water consumption to up to 95% when compared with the standard process of fish farming and also reduces the area requirement by up to 80%. With their MLK-RAS system, they have clubbed soil-less farming, Aquaponics, with great success. Fish waste is natural food source for plants and growing them directly in the downstream of their treatment systems gives Organic, chemical free produce. Moreover, in Aquaponics, farmers can get 3 times the produce and 90% less water is required to cultivate the same amount of vegetables and fruits as compared to soil-based farming.

Key Features of MLK-RAS:

* Intensive aquaculture with up to 99% water recycling
* Capability of producing fish in densities of 100 Kg per cubic metre
* Efficiency of produce of up to 150 Kg per square metre of land area per year
* Monitoring and control of critical parameters in the RAS Plant:
* Dissolved Oxygen in biofilter and fish tanks
* Flow rate from pumps
* Temperature of water in fish tanks
* Ammonia, Nitrites and Nitrates
* Fish tank water levels
* Complete automation with alarms and mobile alert systems for brisk crisis management
* Energy saving/optimization according to fish sizes & feed rates
* Power Failure mitigation measures like dissipation of Oxygen directly in fish tanks in case of complete power failure

Their systems allow for complete recovery of nutrients produced in the process like fish waste for manure/fertilizers

* Reduced or Minimal environmental impact
* Great Returns for the farmer, maximum produce per unit area

Contact: http://www.mlkwastemanagement.com/ras.php

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Molofeed (Aquaculture Larval Feed Answers)

Activities: Molofeed has developed larval feed for marine finfish and shrimp based on proprietary micro-encapsulation technology. The original business idea was to develop new products based on raw material that otherwise would be treated as waste in the growing fish farming and fish processing industry. Micropro’s defining characteristic rests on its technical nature: it is a real microcapsule. The feeds currently available are microbound, which means that the components of the feed are held together by a binder that forms a network with the different ingredients. It is an innovative patented technology.

They motivate their activities as under:

Sufficient food production for a growing world population is one of the major global challenges and sustainable aquaculture is an important part of the solution. Molofeed uses ingredients that are either not suitable for human consumption (for example, some species of algae and rest raw materials from the fishery industry). Sustainability is at the heart of what Molofeed does, and they continuously look for new and alternative ingredients to make a long-term positive impact on the environment. Sustainability is also achieved by reducing dependency and use of live feed and the costs associated with it (energy and enrichments ingredients used to grow it). Furthermore, the significant reduction of water pollution in the tanks decreases the chance of diseases and the energy required to clean the water and tanks.

Contact; <https://www.molofeed.no/sustainability>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Nutrex Hawaii (Spirulina Aquaculture in Hawaii and Health Products)

Activities: Nutrex Hawaii was founded in Kailua-Kona, Hawaii in 1990 by Dr Gerald Cysewski, an expert in microalgae and carotenoids. Their mission is to utilize the benefits of microalgae to improve health and extend lives in the world wide community. Carved out of land that was once a barren lava flow, Nutrex Hawaii is located on the pristine Kona coast on the Big Island of Hawaii. Their farm draws on the natural resources that surround them – abundant warm sunlight, pure deep ocean water and 100% fresh water drawn from Hawaiian aquifers to cultivate:

They produce:

•Hawaiian Spirulina® – a superior strain of spirulina, with immune function and cardiovascular benefits.\*

•BioAstin® Hawaiian Astaxanthin® – one of the world’s strongest natural antioxidant with benefits for joints, skin, heart, and eye health as well as recovery from exercise.\*

They motivate their activities as under:

What Makes Nutrex Hawaii Products Unique? Situated on the Kona coast, their farm receives more sunlight than any other coastal location in the United States, enabling Nutrex Hawaiian Spirulina Pacifica to grow continuously for 12 months a year. Their ponds have been in operation since 1984. That means Hawaiian Spirulina has evolved into a nutritionally superior strain after more than 35 years of continuous cultivation in the intense Hawaiian sun.

BioSecure Zone: Nutrex Hawaii is the only microalgae farm located in a “BioSecure Zone” that prohibits the use of harmful pesticides and genetically modified organisms. Their Hawaiian Spirulina Pacifica and BioAstin Hawaiian Astaxanthin products are grown without using any harmful pesticides, herbicides. ‘They do not generate land erosion or water pollution. Our products are safe and pure’.

100% Potable Drinking Water: Their products are grown with 100% potable drinking water. This water is collected from the Big Island’s pristine aquifer. After being natural filtered through lava rock, this water is as fresh as it gets. To minimize water waste and return essential nutrients back into our growing ponds, the majority of the fresh water is recycled and returned to the pond for the next growing cycle. ‘This process contributes to providing the world’s most nutritious spirulina.’

Ultra-Pure Deep Ocean Water: 5% deep ocean water is added to the growing media for Hawaiian Spirulina. Hawaiian Spirulina is the only cultured microalgae grown with ultra-pure deep ocean water pumped up from a depth of 2,000 feet below sea level. This ocean water adds trace minerals and elements to their spirulina.

Ocean Chill Drying™:Nutrex Hawaii’s Ocean Chill Drying™ system eliminates oxidation and damage to carotenoids, enzymes and other fragile nutrients that occur in standard drying methods. This system dries our spirulina in just 3-7 seconds, relies on very cold deep ocean water to provide de-humidification and uses less than 1% oxygen to preserve the phytonutrients. And because of their superior packaging, their spirulina ‘arrives to the consumer as fresh as the day it was harvested.’ Nutrex Hawaii’s corporate philosophy is to leave the land and environment in better condition than when they started. All of their microalgae comes from their parent company Cyanotech’s 90-acre farm located on the pristine Kona Coast on Hawaii Island. Their microalgae farm was carved out of land that was once a barren lava flow. Their team is steadfast in its commitment to sustainability and everything we do is to create a cleaner, safer and healthier world.

Contact: <https://www.nutrex-hawaii.com/pages/about-us>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Basis (Aquaculture, Cosmetics and Other Related Ocean/Biotechnology Products)

Activities: In a maritime-inspiring environment, they develop and market innovative products from the sea for natural cosmetics and healthy food as a team. Protection and sustainable use of the oceans in the sense of the 2030 Agenda, in particular the sustainability goal SDG 14, are key objectives of their work.

They motivate their activities as under:

The intensive work in applied marine research in renowned marine research institutions and at their sister company CRM - Coastal Research & Management led them to want to set positive examples against the many horror reports on the subject of marine pollution and climate change. That was the main motivation for developing the first algae farm in Germany. With the success of the first harvest it was clear: the effort for this most environmentally friendly form of aquaculture is worthwhile. If they managed to translate the health benefits of sustainably cultivated algae into a product available to all, they could help convey the value of marine ecosystems and would even be able to make a living from it. That worked - then with four pioneers and today with 30 committed employees.

OceanBASIS has specialized in the development of extracts from marine algae for health for 20 years. Their maritime natural cosmetics brand “Oceanwell” and their new delicatessen brand “Meeresgarten” benefit from this know-how. The close interlinking of research, development, marketing and sales allows them to meet the requirements of the quickly and with high quality. In research projects with our sister company CRM - Coastal Research & Management, medical applications and forms are also becoming sustainable.

Aquaculture is studied intensively, and they carry out our knowledge-generated developments in close cooperation with universities and research institutions. The understanding of the sea plays a central role for us. They consider marine life as the source of their developments: its organisms, their behaviour, molecules and mechanisms. Inspired by this, they create “sea value” for customers and employees through marine protection, research and bioactive ingredients.

Not everyone at ocean-BASIS does everything, but nobody does only one job. They have different teams depending on talent, knowledge and motivation: Theresa Talg (cosmetics), Susanne Woldmann (actives, food), Diana Woldmann (food), Levent Piker (actives, biotech), Inez Linke (cosmetics.

* 1994: Foundation of CRM (Coastal Research & Management) and implementation of various reports in the field of coastal zone management
* 2000: First algae farm. Development of the first algae farm with the particularly natural substance-rich brown alga Laminaria saccharina in the Kiel Fjord
* 2001: Extraction technique. Development of an extraction technique to extract the valuable ingredients of Laminaria algae gently and without losing their bioactivity
* 2002: Baltic Care. Market launch of the natural cosmetics Baltic Care ° in cosmetic studios and wellness centres in Schleswig-Holstein
* 2004: Expansion of research. Research on new extraction techniques and effects of ingredients. Expansion of natural product research to include oceanic collagen
* 2009 :Start Oceanwell | Neue Algenfarm
* 2012: Launch Ocean Collagen
* 2015 Protect the Ocean Launch of Biomarine Cell Support Line
* Start of the Oceanwell initiative “Protect the Ocean ” - pilot project: turtle protection in Côte d'Ivoire
* 2017: Inez Linke is named entrepreneur of the year in Schleswig-Holstein Oceanwell website and packaging relaunch
* Biomarine Cell support Nourishing Cream receives 2nd place in the BSB Innovation Price. Oceanwell packaging relaunch
* 2017: Oceanwell packaging and website relaunch
* 2019: Conversion of company and private vehicles to e-mobility
* 2020: Expansion of exports to Hong Kong

Oceanwell Initiative "Protect the Ocean" supports new project: Rescue of ghost nets in the Baltic Sea. Relaunch of the Oceanwell shop: also have business areas ocean cosmetics and ocean food:

Contact: <https://www.oceanbasis.de/unternehmen/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Harvest Technologies (Sustainable Animal/Fish Feed and Other Aquaculture Products)

Activities: Ocean Harvest Technology Limited is the technology and manufacturing company responsible for the OceanFeed™ portfolio of branded seaweed feed ingredients. These sustainably produced feed ingredients are formulated by Ocean Harvest Technology in Vietnam and Ireland and offer many benefits for production and companion animals.

They motivate their activities as under:

Using OceanFeed™ products can help animals perform better in a natural way because the feed ingredients are derived from a natural, non-synthetic source. OceanFeed™ has been shown to support reduction of antibiotics and other synthetic feed ingredients. The proprietary formulae of the OceanFeed™ branded products combine multiple species of brown, green and red macroalgae (seaweed) specially selected for their benefits, including the support of a positive immune response and a healthy gut. OceanFeed™ seaweed products are specifically blended to support the nutrient needs of cattle, pigs, poultry, horses, salmon, shrimp, and pets. Clients have testified to the observed benefits of OceanFeed™ products including their ability to support and maintain a healthy immune system, which allows producers to reduce their use of synthetic feed additives and treat their animals more humanely while increasing farm profits.

Contact: https://oceanharvesttechnology.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Olooson (Sustainable Sturgeon Fish and Caviar Aquaculture)

Activities: The Innovative Farm – “OLOOSON Fish & Caviar Factory” company produces and sells a wide range of aquaculture systems, mechanical and biological filters and water treatment systems dedicated to the reproduction and grow of aquatic organisms. They want to become a partner in a vibrant aquaculture business in the Global Market. Driven by innovations and value-added in a totally new aquaculture farm technology, they claim to provide a new global standard and a reference in the quality of „Fish Farming„ and aim to become the first option in the world. Their objectives are to obtain high value profit without destroying the natural environment, to protect planetary fish reserves that are in extinction, and to build a business at a big commercial scale in the most sustainable way.

The core of their business is the water filtration system, performed with zeolites (natural volcanic rock) that filter the water molecules from all that is undesirable in aquaculture farm. There is a lot of technology and mathematical modelling in this project. Knowledge of chemistry, biochemistry, hydraulic, thermodynamics and electronics are all applied. The law that governs the entire technology is the „Mass Balance Law„ of the systems. ‘The fish are fed naturally and the environment is totally protected around our farm."

Contact: <http://www.caviarfactory.ro/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Planktovie (Nutrient and Other Solutions for Aquariums/Aquaculture)

Activities: PLANKTOVIE is a French Startup created in August 2016 (RCS of Marseille n ° 821987096) under the status of «young innovative company». PLANKTOVIE’s vision is the valorisation of marine species for various fields of biomedical research. PLANKTOVIE develops nutritional solutions meeting the highest standards for the maintenance of aquatic models (i.e. zebrafish), and helping to fulfil the 3Rs principles (Reduce, Refine, Replace) in relation with in vivo experimentation. PLANKTOVIE is conducting an ambitious R&D program aiming at identifying and producing at large scale level bioactive molecules from marine resources. They pay particular attention to molecules targeting ion channels and G-protein coupled receptors (GPCRs) that are major class of biological targets for public health issues (cancer, immune disorders, viruses, etc).

They motivate their activities as under:

In recent years there has been a renewed interest in keeping captive aquatic organisms in captivity. The advent of modern aquariology techniques has made it possible to keep and even reproduce in the aquarium species of corals and fish that could not be kept alive until recently. This greatly contributed to the positive evolution of the aquarium market, which today makes it possible to raise a portion of coral reef at home. In addition, biomedical research is increasingly using aquatic organisms for public health issues. Thus, the zebrafish (Danio rerio) is used in almost all research centres around the world to better understand the physio-pathological phenomena related to certain diseases such as cancer. Finally, the pharmacopoeia is very frequently turned to certain organisms such as corals to isolate molecules of interest that will give place in the near future, the development of drugs. Although there is undeniable interest in the maintenance of these aquatic organisms, the techniques related to their well-being have not evolved as quickly as the growth of this market. Nutritional solutions that meet the very specific needs of captive-bred fish are lacking and most of the products offered for sale do not achieve acceptable levels of survival and species reproduction rates. Worse than that, some brands, out of sheer ignorance, offer nutritional solutions or additives, detrimental to the overall health of the aquarium. With this in mind, PLANKTOVIE has decided to offer to laboratories and the aquarium market nutrient solutions as well as additives for the maintenance of aquatic organisms in captivity.

Contact: https://planktovie.biz/en/about/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Proteon Pharmaceuticals (Marine Aquaculture Bacteriophage Solutions)

Activities: Proteon Pharmaceuticals SA is an innovative biotech company using bacteriophages as the foundation for preventing and eradicating bacterial diseases in food animals, humans and plants. Bafador® is a bacteriophage cocktail that prevents and eliminates Pseudomonas and Aeromonas infections in commercial aquaculture and stimulates the immune system of fish. Proteon New Product Pipeline.

PROTEON’s mission is to improve human, animal and plant health, proactively reducing the reliance on antibiotics. They use natural, safe and environmentally sustainable solutions developed from their patented phage-platform technology. PROTEON partners with farmers in the field of animal health, focusing on solutions that improve the economic efficiency of farms, while promoting environmentally sound, natural and sustainable solutions.

https://www.proteonpharma.com/\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Protix (Aquaculture and Other Feed Solutions -Insect Based)

Activities: Protix is a highly technological and data driven insect producer based in the Netherlands, with feed products in over 12 countries, ranging from pig and poultry to pets and fish The leading insect company At Protix, they believe in harnessing the latest technology to produce the ingredient of the future: insects. They say they are the market leader when it comes to verifiable and scalable insect breeding. To change the food system, we need to deliver a quality product and a reliable output. The black soldier fly (hermetia illucens) is a key player in bringing their vision to life: their larvae provide them with a unique source of protein for food and feed! With high-tech solutions, artificial intelligence, genetic improvement programs and robotics, Protix ‘brings the food system back in balance with nature.’

They motivate their activities as under:

ProteinX (Insect Derived Aquaculture and other Nutrients): one of their flagship products for pet food and aqua feed. Insect-derived nutrients are the most logical and environmentally friendly animal proteins. Protix ProteinX contains high-quality amino acids, lipids and micro nutrients to boost the animal’s health naturally. It fully replaces conventional protein in many dry and wet pet food and aquaculture applications, while adding functional benefits and superior palatability. While the pets grow in balance with nature, the pet food industry works towards a more sustainable food system. ProteinX is used successfully in aquaculture: from early stage (hatchery) to grower diets for salmon, trout, shrimp and others. In view of the 2017 EU approval of the use of insect protein in aquaculture, application will grow further.

* Well-balanced combination of high-quality amino acids, lipids and micro nutrients
* Easily digestible proteins (>85%)
* Superior palatability
* High freshness index (BAI<1)
* Suitable for hypoallergenic diets in pet food
* Other functional characteristics (upon request)

ProteinX is produced from a patented extraction process that does not require any artificial solvents nor uses techniques that may create heat- or pressure damage to the desired characteristics. Thanks to the lipid extraction technology applied, the nutritional bandwidth of ProteinX will remain within a narrow range, even in case of fluctuating insect feed stock.

**Farming insects for our planet: The** insects can turn low-grade food waste into body mass quickly and sustainably. They need very little room to grow, making for a far smaller carbon footprint than alternative sources of protein. And even though the scale of production is industrial, they pay close attention to the wellbeing of their delicate larvae. It has been our life mission since 2009 to bring the food system back in balance with nature. They will do this by continuously looking for better solutions on both product and production technology.

Contact; https://protix.eu/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Pura Bioglitter (Seaweed Based Biodegradable Glitter Products)

Activities: Administrative, financial and commercial director of the first company to produce 100% biodegradable, handmade glitter, made from seaweed, vegan and organic in Brazil. Pura is made from agar-agar extracted from algae and mica (a bright coloured mineral). Some colours also take mineral dye. If kept away from moisture or sunlight the glitter remains divine for the next carnivals. After about 2 years it will lose volume, as it will dry out. Even so, it is still possible to use.

Contact: <https://www.purabioglitter.com.br/faq>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Seaentia (Portugal based aquaculture)

Activities: SEAentia aims to provide safe, sustainable and nutritious seafood by combining novel aquaculture engineering with scientific research. Its production methods will be fully transparent to everyone at all stages of the value chain. SEAentia (SEAentia-Food, Lda.) is a Portuguese start-up founded in September 2017 and set in Cantanhede, Coimbra. Their aim is to produce top quality fish in the most sustainable manner by combining novel aquaculture engineering with scientific research. SEAentia will pioneer in meagre production from hatchery to commercial size in a sustainable and environmental-friendly RAS where animal welfare is a major concern. They aim to become an international reference in aquaculture by exploring new species with great marketing potential and consumer acceptability. This will only be possible by combining new farming methods with novel technology and scientific knowledge, thereby contributing to address the global challenge of feeding the growing human population with high-quality products.

Contact: <https://www.seaentia.pt/about-us/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Nest (Automatic Fish Cleaning Station/Recirculating Aquaculture System Solutions -Noras Watertech

Activities: Sea-Nest produce the cleanerfish docking station. Wrasse/ cleanerfish hide rethink: Simple cleaning - easy to deploy and collect - no loose parts - reduces lice impact. Noras Watertech was established in 2005 and is 100% owned by Noras Group. They specialize in the design and installation of a recirculating aquaculture system (RAS) and water treatment management systems. RAS designs and pilot study trials are carried out at the headquarters in Norway. Noras cooperates with local partners to establish RAS farms locally. Currently, Noras Watertech and Noras LT have formed a partnership to establish a RAS farm in Lithuania with an annual fish production capacity of 1500Ton for Arctic charr in Klaipeda. The project is ongoing with phase 2 just completed with a capacity of 300Ton. Phase 3 for grow-out is expected to begin soon.

They motivate their activities as under:

This fish farm is designed to be energy efficient with a concept where no mechanical water pump is used for the main RAS operations. This RAS uses a custom-made Noras vacuum degassing unit that is used as the degassing, protein skimming, and as circulation pump. The degassing performance is very efficient compared to other conventional options available. The combination of these three features results in much higher energy savings compared to other RAS suppliers. It can be dimensioned after the size of the fish tank. Together with their solid removal technology head losses are eliminated for sufficient flow without the need for a pump. Noras vacuum degassing unit can be used alone or together with other RAS designs with and without a pump. Oxygenation is also optimized with the use of their nanobubble generator, where oxygen losses are reduced and to ensure oxygen is available for use by the fish.

The company has also designed and produced its own products which are mainly used for the design of RAS. These products include honeycomb bio-media for the biofilter designs, underwater fish light with a unique light spectrum that is designed to reduce fish stress, reduce fish maturation, and improve fish growth with 40 years of horticultural lighting experience. Noras has designed a highly intelligent, unique system control software that assists in decision-making on the RAS farm. Water inlet, dead fish trap, and particle settling systems are also designed for easy and efficient operation on RAS farms. Currently, three different pilot systems are under R&D operations in Lithuania intending to optimize their RAS design to be efficient and to reduce the production cost of salmonids by less than 3 euros/kg. Together with UAB Noras LT, they have made a RAS farm that we produce Arctic Charr from Egg to more than 4 kg. Sea-Nest cites the following advantages

* Less marine fouling
* Easy to use
* Easy to deploy and take out
* No loose parts
* ​Designed to be used for several seasons
* 45 cm when being stored - 10 meters in use
* Helps reduce sealice infestation

Contact: https://www.noras-wt.com/about

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Shiok Meats (Cell Based Meat/Seafood)

Activities: Shiok Meats is a cell-based, clean meat company. It is the first of its kind in Singapore and South-East Asia with a mission to deliver delicious, clean and healthy seafood and meats by harvesting from cells instead of animals. Shiok Meats will bring cell-based crustacean meats (shrimp, crab, lobster) to your table. Their meats are animal-, health- and environment-friendly with the same taste, texture, more nutrients and no cruelty. “Shiok” in Singapore and Malay slang means fantastic and delicious. They are currently in R&D phase and will commercialise in a few years.

Contact: <https://shiokmeats.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Spira Inc (Algae/Spirulina Based Dyes/Products)

Activities: SPIRA develops natural dyes, offering a sustainable alternative to petroleum and animal compounds for food, cosmetic and textile companies, based on algae. It uses a global network of farming partners to scale in response to the overwhelming demand for natural colours and plant-proteins. Spira develops proprietary spirulina strains that are grown by a global network of algae farming experts. They are specialists at helping you incorporate algae-based ingredients in your products. A network of algae farming experts handle the growing — from Indonesia, to Peru, India, and here in the U.S., these farmers grow spirulina for them. They then use their proprietary technology to extract high-value compounds from algae. ‘Those compounds, like Electric Sky™, are the future of food.’

From there their talented team of scientists and engineers help you incorporate algae-based ingredients in your products by assisting you with product development, food processing and formulation to ensure stability and long shelf life.

Contact: https://www.spirainc.com/tech

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Swedish Algae Factory (Algae Based Materials, Skin Care and other Aquaculture Products)

Activities: Swedish Algae Factory (SAF) offers an affordable, sustainable solution for farmers. Through its circular model, the algae cleans wastewater, absorbs carbon dioxide. Swedish Algae Factory is a Gothenburg-based company that exploits algae with growth properties suitable for a Nordic climate. By developing algae technologies SAF aims to be a contributing force in the global transition from an unsustainable fossil-based economy to a sustainable bio-based one.

Advanced materials from algae: their mesoporous silica replaces harmful and less efficient chemicals in solar panels and in high-end organic personal care, while cleaning the oceans. Deep down in the cold and dark seas, algae called diatoms evolved a unique shell to survive. Swedish Algae Factory is the only company in the world that cultivates these algae and sells their high-tech silica shells. Their material has unique light altering, absorptive and binding properties that are unmatched by synthetic materials. All these properties are valuable in a variety of industrial products. Their first market is organic & luxury skin care and their larger long term focus is to enhance the efficiency of solar panels. Their material replaces harmful chemicals in many products. Every kilo placed on solar panels causes at least 200 tons reduction in CO2 emissions through more solar power generation. In addition the material’s production process is climate-positive; it traps at least 8x its weight in CO2, 1x nitrogen and 0,1x phosphorous.

Contact: <https://swedishalgaefactory.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Triton Algae Innovations (Vegan/Algae Based Meat Substitute Products)

Activities: Triton Algae Innovations is a San Diego-based startup company committed to bringing to consumers a highly nutritious and non-GM algae, as a new plant-based food ingredient. Triton's algae contains high levels of protein, Vitamin A, Omega 3, 6 and 9 oils, and also features a complete amino acid profile. Triton has developed a proprietary fermentation production process that is scalable, affordable and sustainable. After a rigorous evaluation of a comprehensive science dossier prepared by Triton and notified to the US Food and Drug Administration (FDA), the FDA issued a “no questions” letter affirming that Triton’s algae is GRAS (Generally Recognized As Safe) for its intended uses in food. Triton's non-GM algae can be made in three colours (green, yellow and red, each with the same nutritional components) offering a broad range of food applications, such as pasta and noodles, bread and rolls, cookies, sauces, protein bars, and sport and energy drinks. Triton is now commercializing its green algae via production partnerships with food companies and restaurants. Triton’s red algae was innovated through tradition evolution and breeding practices, and is rich in heme, a small molecule common in meat that bleeds and sizzles when cooked. Triton is currently in pilot production mode of its red or “bloody" algae for use as an ingredient in plant-based alternative meat products, such as burger patties and sausages, that look, taste and smell like traditional meat.

Contact: https://www.tritonai.com/what-we-do

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### UMITRON (Automatic Fish Counting/Measurement Solution for Aquaculture)

Activities: Umitron have developed a new system that uses AI and IoT technology to automatically measure the size of the fish in aquaculture installations, by using a portable camera paired with a mobile app. has been developed by Umitron. UMITRON is a Singapore and Japan based deep-tech company whose aim is to solve worldwide food and environmental problems by empowering aquaculture through technology. They construct user-friendly data platforms for aquaculture by using IoT, satellite remote sensing, and AI. Their technology aids farmers improve farm efficiency, manage environmental risks, and increase business revenues. Their intended final goal is to utilize computer models in combination with aquaculture to help the world sustainably and efficiently deliver protein in a human-friendly and nature-friendly way. Ultimately, they profess a claim to “install Sustainable Aquaculture on Earth”. . The supply of capture fisheries is also limited and new sources of fish protein are needed to meet growing demand. The world is beginning to pay attention to aquaculture because of its potential to be a sustainable source of food production. Aquaculture has the advantage of being able to provide a stable supply of fish throughout the year. It also provides an improvement in working conditions as compared to traditional fisheries, and it will assist humanity to protect natural marine resources from further exploitation.

Contact: <https://thefishsite.com/articles/umitron-launches-automatic-fish-measuring-system>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### XpertSea (Aquaculture AI Solutions)

Activities: XpertSea is a Canadian Aquaculture Technology Company that is using data to transform aquaculture into a modern, efficient and sustainable source of food for our planet. XpertSea provides technology.

They motivate their activities as under:

*“As CEO, my co-founders and I assembled a team with a singular mission: to use technology to make aquaculture more profitable and sustainable. Our AI-powered innovations have helped shrimp farmers in more than 50 countries access better data, make better decisions, and achieve better financial outcomes. Our data-driven marketplace connects shrimp buyers and growers directly for fast, efficient and secure transactions -- the first step in creating a more transparent and profitable supply chain for the $45 billion global shrimp market. As the world’s population climbs toward ten billion people by mid-century, demand for sustainable, nutrient-dense protein will soar. To satisfy that need, aquaculture -- already the world’s fastest growing food sector -- must transform into a modern, efficient and sustainable food source for our planet. Through research, development and innovation, we’re helping turn that vision into reality.”*

Contact: <https://xpertsea.com/company/about-us>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 2. AQUACULTURE/MARINE BIOTECHNOLOGY

### Alga Bloom International (Algae Compact Bioreactors For Spirulina, Inoculum, Biofertilizer and Other Products)

Activities: Alga Bloom is the Innovator of the AlgaBox and of the AlgaCube, plug-and-play, ultra-compact bioreactors for large-scale algae farming such as Spirulina and for producing inoculum for valuable bio-ingredients of mother earth, on a very small footprint. The 40 foot long AlgaBox was designed in 2015 to produce a dense algae paste that is automatically harvested every 48 to 72 hours.. A new generation of cell bio-factories called AlgaCube will be launched at the forthcoming Globe Forum 2020. As part of BC's 5 Top Best Innovations - AlgaBloom was recognized as an Award-winning programmable cell bio-factory for culturing nature's raw ingredients : <https://www.youtube.com/watch?v=T001d4ypwvU&t=16s>

To combat global warming, AlgaBloom is preparing a collaboration with a number of NGOs to assist villages in developing countries to capture CO2 in a roll-and-play bioreactor called AlgaBag and produce highly nutritious algae and organic biofertilizers.

Contact; https://www.algabloom.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Alga Plus (Sustainable Macroalgae Aquaculture)

Activities: ALGA Plus’s main activity is the production of high-quality and sustainable macroalgae = seaweed Under the brand ALGA+®, they sell dried (whole, flaked and flour) and fresh seaweeds to be used as ingredients. The brand “Tok de Mar”® is used for seaweed-based foodstuffs developed by them or in partnership with other companies and can be found in specialty shops. All the phases of the production are mostly carried out in-house: land-based biomass production, processing (washing, drying, milling) and packaging. The final packaging for the gourmet-products is outsourced to a local social institution. The company also invests in R&D activities that contribute to find high-value applications to the seaweed biomass that is, or may be, produced by ALGA Plus. Current projects include the use of seaweeds in food (ready-meals), feed (supplement for farmed seabream), textiles (natural dyes) and biopolymers (PLA). Innovation is carried out with scientific institutions and private companies.

Contact: https://www.algaplus.pt/en/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Aquaai Norway (Optimised Aquaculture Data Platform)

Activities: Aquaai have developed a Fishlike Platform or specialized fishlike Autonomous Underwater Vehicles (AUV) equipped with 4K cameras and plug-in play sensors for superior data acquisition. It cN collect and deliver real-time visual and environmental data that is accessible on an AI powered online dashboard for multiple industries. They currently service Norwegian sustainable salmon farms near the Arctic Circle., is unobtrusive, designed ‘with mother nature in mind’ to immerse with natural habitat. It is reliable and affordable.

Optimized data: Aquaai Control System web dashboard gives real-time data readings and quality video. Mission mapped. AI, Computer Vision, Machine learning.

Contact: <https://www.aquaai.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Aquatic Livelihoods (Precision Aquaculture Solutions Using Sensor Data and AI)

Activities: Aquatic Livelihoods helps marginalised fishing communities build resilient livelihoods through sustainable backyard aquaculture. They leveraging Internet of Things (IoT), Machine Learning (ML), Fisheries Science and a proven grass-root connect with fishing communities. They design precision aquaculture systems with sub-systems for sensors based water quality monitoring and forwarding the sensor data to their machine learning algorithm, to generate data-driven, actionable insights. They are also working on self-sustaining local aquaculture ecosystem model with localized production of environmentally sustainable fish seed and fish feed, complemented with grow-out culture.

They motivate their activities as under;

Their motto is "Precision Aquaculture for All", and they want to make precision aquaculture systems a household success story. Along with the technology and people's participation as the driving force, Aquatic Livelihoods is committed to changing the status quo for fisheries in India and make inclusive the blue revolution growth story unfolding there. Along with the technology and people's participation as the driving force, Aquatic Livelihoods is committed to changing the status quo for fisheries in India and make inclusive the blue revolution growth story unfolding here. ‘We believe in gender justice and protecting our aquatic habitats for future generations. For the end consumer, our endeavour is to provide them a whole variety of safe-to-eat and traceable fishes/ allied products.’ Aquatic Livelihoods is currently incubated at Central Institute of Fisheries Education (CIFE), Mumbai, for Fisheries Sciences related assistance.

Contact: <http://www.aquaticlivelihoods.org/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Biomar (Aquaculture Feed)

Activities: Bio-Mar is committed to contribute to a sustainable global aquaculture through innovation for producing feed with a low impact on the environment, at the same time ensuring great tasting and healthy seafood. BioMar is a world leader in high performance diets for more than 45 different fish and shrimp species in more than 80 countries. Founded in 1962 by a group of Danish fish farmers, BioMar’s heritage is a long-term commitment to developing the aquaculture industry in a responsible and sustainable way. Their main focus is supporting our customers delivering healthy, great tasting seafood. They do this by innovating efficient, safe and nutritious feed for aquaculture with minimal environmental impact. Their global scale, local agility and execution focus ensure that they can meet individual customer needs – always with departure in proven results and a meticulous focus on food safety.

Contact: <https://www.biomar.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Bioprocess Algae (Commercial Scale Algae Bioreactors)

Activities: BPA, LLC designs, builds, and operates commercial scale Grower HarvesterTM bioreactors that enable efficient conversion of light and CO2 into high value microbial feedstock. They serve the following industries:

Animal Feed: Biomass from their algal strands provide a meaningful source of protein and other nutrients used in livestock feed.

Nutraceuticals: Focused on providing health and medical benefits such as fish oil, multivitamins and supplements.

Fish Feed: Focused on key high growth segments in the fish meal replacement market, providing a more sustainable source.

Chemicals: Their algal oil offers a high quality nutrient composition for the production of plastics, resins and lubricants.

Fuel: Biodiesel and ethanol represent a large part of the biofuels market that can be addressed by their products.

They motivate their activities as under:

Competitive advantage of cultivation technology: Rather than fighting biofilms, BioProcess Algae embraces them. The technology at the heart of BioProcess Algae cultivators is a unique high surface area, biofilm-based approach to enhance light penetration, productivity, harvest density and gas transfer – all traditional bottlenecks to low-cost algae cultivation. The Grower Harvester™ technology is a flexible platform that allows for economical production of biomass and secreted metabolites.

System integrators: BioProcess Algae LLC designs, manufactures, and operates integrated systems to support bioreactor operations and dewatering efforts. Current demonstration activities are supported by commercial scale modular systems that include Grower Harvester™ cultivators, flue gas tie-ins and fully automated operational support such as pH and temperature control, CO2 and nutrient delivery, CIP capability, dewatering and water reuse.

Strategic partnerships: They are currently engaged in strategic partnerships with industry, national laboratories, and academia to help support strain selection and optimization and downstream processing efforts. They welcome inquiries from potential new collaborators.

Contact: http://www.bioprocessalgae.com/technology/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Bluegrove (Integrated Aquaculture Cyber/Biophysical Solutions including Echofeeding)

Activities: Bluegrove is an Aquatech company, that helps feed our future population by offering tools and solutions to optimize seafood production in a sustainable way, while having a long-term focus. At Bluegrove,they believe that, by harnessing the power of nature, aquaculture industry can produce more food, with higher efficiency and less environmental impact than today. Bluegrove creates healthy environments for sustainable, wholesome seafood production. They offer complementary solutions that help farmers understand what is happening at their farm and make data-driven decisions to optimize food production, while using as little resources and energy as possible.

They motivate their activities as under:

Their strategy:

1 – Serving the species

2 – Understanding the population

3 – Acting upon the needs of the species and its surroundings

4 – Improving the ecological balance

They offer complementary, technological solutions to optimize seafood production in the most sustainable, respectful and responsible way. A cyber biophysical system (CBS) is a system using intelligent algorithms to monitor or control a natural environment. Their Bluegrove CBS uses a combination of measurements, analysis and human expertise to perform real-times adjustments of the feeding, based on the behaviour and appetite of the fish.

Scientific expertise:

* Multi Client Data Library14K production days monitored
* Pattern recognition
* 238 features identified from fish school measurements
* Data model simulation
* 1.2M meals simulated
* Collected data
* Biological and professional services
* Real time analysis, response and control
* 9.5K hours of machine assisted feeding; human observation
* Decision engine 3M hours of feeding activity analysed
* Analyse 5: This enables them to benefit from natural growth cycles and use the power of nature to optimize production, while taking care of her at the same time.
* Data driven decisions improve quality of life

By identifying anomalies in behavioural patterns or environmental circumstances, they predict disease outbreaks and act upon them. Biological solutions help fight some of the majors challenges farmers are facing today, such as sea lice in salmon farming or white spot disease in shrimp farming. They offer technological solutions to measure, act on and improve the quality of water, which is extremely important in aquaculture. This ranges from solutions to increase oxygen levels to alternative solutions to lower soil impact. The obvious results are improved animal welfare, higher quality production, lower environmental impact and optimized production.

Less feed waste, higher fish growth, improved animal welfare and lower mortality. Having their roots in salmon feeding, they offer data driven and even fully automated feeding based on the premises of the fish. Computer power combined with human monitoring results in less feed waste, higher fish growth, improved animal welfare and lower mortality.

High quality, sustainable and friendly produced seafood: Seafood production requires energy. ‘What if we can use clean alternatives to lower CO2 emissions and make production even more environmental friendly? Combining this with the most advanced monitoring and analyses tools that Bluegrove offers, we support high quality, sustainable and friendly produced seafood.’

Contact: <https://bluegrove.com/solutions/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Cellana (Algae Based Products)

Activities: Cellana have invested significant effort in developing technologies including through angel investments, government grants and contracts, strategic partner/joint venture funding, and investments made in the technologies in-licensed by Cellana. Cellana intends to construct and operate commercial facilities to produce their ReNew™ product line as integrated algae-based biorefineries. This includes:

Human Health: Renew Omega 3: High-value oils for human nutrition such as DHA and EPA (Omega-3 fatty acids)

Biofuel Feedstock: Bulk oil for biofuel applications in transportation, aviation and energy.

Animal Health: High-protein algal biomass to replace fishmeal for farmed fish and soymeal for livestock feed.

They motivate their activities as under:

**Sustainability, Better Health, Energy Security, and Climate Stability**

Algae use photosynthesis to efficiently and quickly convert CO2 and other greenhouse gasses into valuable oils and biomass as feedstocks to produce Omega-3 EPA and DHA oils, animal feed, and biofuels. As the earth’s most productive and sustainable plants, microalgae can double their mass daily with growth rates up to 100 times greater than land plants used to make similar products. In addition, microalgae cultivation is gentle on the planet. It does not need to be “farmed” on arable land which is better used for food production; instead microalgae farms and biorefineries can be established on marginal land unsuitable for growing food crops. Marine microalgae can also be grown in brackish or salt water, thereby preserving valuable fresh water sources for human, animal, and agricultural use.

*“Put quite simply, microalgae are remarkable and efficient biological factories capable of taking a waste (zero-energy) form of carbon (CO2) and converting it into a high density liquid form of energy (natural oil).”*

–A Look Back at the U.S. Department of Energy’s Aquatic Species Program: Biodiesel from Algae, National Renewable Energy Laboratory (NREL)

‘Marine microalgae are, quite simply, the planet’s most sustainable source of Omega-3 EPA and DHA nutritional oils, animal feed, and biofuel feedstock.’

Contact; <http://cellana.com/technology/the-algae-solution/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### ECOPEMER (Bivalve Mollusc Seed Aquaculture under company Acuinuga)

Activities: Bivalve seed is a scarce commodity worldwide which is becoming increasingly essential for sustainable food production, environmental restoration and carbon capture and storage (CCS) projects. ECOPEMER is a multi-stream project, addressing the production and sale of bivalve mollusc seed for planting, and organic seafood (seabass and bream, turbot) for human consumption. This project incorporates disruptive technology based on synergistic protocols, which facilitate further value addition and lower production costs. ECOPEMER delivers an ECO- or organic-certified final product (clams, oyster, scallops), targeting a strongly growing market of particular importance to the EU.

Key project features are:

* SRS-RAS containment, facilitating process automation and yield monitoring;
* AOPs water treatment technologies ensuring full biosecurity & traceability;
* Low environmental footprint, pursuing the improvement of social perception and sustainability of aquaculture;
* Heavy impact on local job generation, high traction potential;
* Highly profitable: IRR=11%@yr5, IRR=43%@yr10, NVP(6%)=5,2M€
* Strong replication potential worldwide

Phase 3. Seed Funding: Completing a private/public funding assemblage [target: 2M€]

**Targeted Challenges And Focus Areas: Restoring, Protecting And Investing In The Ocean**

With increasing emphasis on sustainability, the balance between aquaculture development and ecology/environment has become a new requirement and challenge in both research and commercial aspects. The development of sustainable bivalve aquaculture promotes employment in coastal fishing zones, supporting diversification in areas linked to changes in the fisheries sector. The main problem is the lack of biosecure, high performance bivalve aquaseed. Innovative solutions for the production of sustainable aquaseed are of great socio-economic importance because they will allow the recovery and enhancement of traditional activities carried out in fishing regions. New opportunities for local management of commercial fishing may open up from the ECO nature of the product being of great interest to the consumer.

They motivate their activities as under:

The main innovation is the reuse of finfish aquaculture effluents for the nursery of bivalve seed, reducing production costs under a multi-trophic approach and minimizing environmental impact. Key project assets are:

* An installation located in a pristine, sensitive environment, with strong productive potential
* New seawater recirculation system (SRS-RAS) that minimizes environmental impact,
* Novel nutritional techniques such as the in situ formulation of on growing feed from local ingredients;
* Advance Oxidative Process-based technologies for water treatment ensuring the health and biosecurity of the crop;
* Energy-efficient, highest water quality parameters;
* IPR (Patents and technical assets)

Key project processes are:

* Food management protocols allowing for the ecological certification of the final product;
* Novel production techniques monitoring growth, densities adjustment, mortality, yield and quality of the different crops;
* Genetic /biotechnologies ensuring high performance and full DNA traceability of the aquaseed;
* Improved design and choice of spawning substrates, hatcheries and nurseries;
* Low stocking densities and moderate feeding levels throughout the different production phases, ensuring sustainability.
* Integrated technologies and biotech
* Other Recirculation, Advanced Oxidation Processes (AOPs), Micro-agglomerated diets

Impact is measured in terms of the project's effect on the three sustainable pillars: people, profit and planet. In terms of people, it is expected that the implementation of ECOPEMER shall result in the generation of 11 direct jobs, 220 indirect jobs and up to 3.000 related jobs. In terms of profit, the project has an internal rate of return (IRR) of 11,1% after 5 years of implementation, and an IRR of 42,8% after 10 years. The return period is 3,48 years, and the net present value (NPV) is €5.18 million with an average weighted capital cost of 6%, which can be assimilated to companies in the food sector. In terms of planetary impact, it is estimated that the realization of the full project potential shall result in the removal of 27,500 metric tonnes of CO2 per annum. This is achieved from year 6 onwards.

* Operating model: B2B Year of founding: 1998
* Current stage: Seed Employees: 1-10

Operating Region: Europe, Launching from a well developed, temperate region for replication in Africa, Latin America, Asia-Pacific

Contact: Luis Antonio Pérez Carrasco Solution Owner

Organisation Details ACUINUGA (Acuicultura y Nutrición de Galicia SL)

Spain, Europe <http://www.acuinuga.com>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Finless Foods (Marine Cell Based Protein)

Activities: Finless Foods was founded by Michael Seldon and Brian Wyrwas. They grow healthy marine-animal cells instead of live fish to produce nutritious, environmentally-friendly versions of the fish and seafood products the world loves.

Impact: When fish can be produced in a bioreactor in the centre of a city, the costs and environmental impact of commercial fishing and shipping are significantly reduced.

Location: Emeryville, California, USA

Contact; https://www.finlessfoods.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Fish Coin (Blockchain Based Fish Traceability and Data Ecosystem)

Activities: Fishcoin is a blockchain based traceability and data ecosystem designed specifically for the global seafood industry. It creates an incentive for data capture in various forms beginning with key data elements captured and communicated by fishermen and fish farmers at the point of harvest for the purpose of traceability. By addressing the critical incentive problem they are effectively creating an ecosystem for rewarding fishermen and supply chain intermediaries through micro- transactions, creating a virtuous cycle (carrot) for sustainable practices that extends beyond government mandates (stick) for traceability.

Contact: <https://fishcoin.co/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Flex Base (Solar Powered Floating Fish Farm)

Activities: The Flex-Base floating fish farm is a floating base of 30 x 30 sqm. constructed with the base materials, Polystyrene and reinforced concrete. Within the floating base, there are several holes with a dimension of around 7 - 8 meters. In these open spots, there will be tanks which float on their own. Around these tanks, there is enough room for the processing equipment, such as pumps and filters to process the seawater. The floating base will support a steel structure which holds the roof with solar panels.

They motivate their activities as under:

The major advantages are the economics (much cheaper), maintenance (hardly any) and lifetime (at least 50 years) years.

SUSTAINABLE IMPACT ON BLUE ECONOMY: The floating base does not need any maintenance and all used materials can be recycled. The fish production will be self-sustainable, higher quality of fish breeding and will not create waste in the ocean by cleaning the process water.

Contact: http://flexbase.eu/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Green Ocean Farming (UK Seaweed Aquaculture Farming)

Activities: Green Ocean Farming is farming rope-grown seaweed, which is described as a versatile and tasty food that can be eaten raw or cooked in many different ways, it can also be used to make bio fuel, plastic alternatives, paper, healthy seaweed snacks, compostable food wrapping, seaweed building blocks and can help reduce methane from cattle.

They motivate their activities as under:

Marine plants (seaweed) produce around 70 percent of the oxygen we breathe, meaning if they disappeared from the face of the earth tomorrow, our species would struggle to survive. Seaweed is not only a nutritious healthy food source for humans, but it also provides a habitat for marine life while the seaweed is growing and is the first link in the aquatic food chain. Without it, the entire system collapses. Growing seaweeds also helps remove vast amounts of carbon from the oceans through carbon sequestering preventing ocean warming and reduces ocean acidity. Because seaweed grows 30 - 60 times faster than land plants it absorbs a lot more carbon than its land based cousins. Seaweed farming is the future - More than just food.

Contact: <https://www.greenoceanfarming.co.uk/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Hortimare (Seaweed Aquaculture and Seedlings)

Activities: Hortimare produces and supplies high quality seedlings to enable seaweed farmers to harvest good yields. They advise, support and collaborate closely with seaweed farmers in order for them to expand and scale up to essential volumes to make seaweed a competitive alternative for land-based products.

They motivate their activities as under:

At Hortimare they believe that sustainable and circular approaches are the only possible future for our planet. The global demand for food and industrial raw materials is growing fast and subsequently the pressure on land by extensive agriculture and exhausting raw materials rises, causing ecological disasters and political instability. Seaweed can be a realistic alternative for land-based products in many ways, if we learn to scale up production at sea.. Hortimare has over 10 years’ experience in breeding and propagating seaweed. Their expertise lies in the biological and technical area. However they also have a great deal of experience in the legal area where for instance it concerns the application for obtaining seaweed farm licences and concessions. ‘Whether you need a consultant to help you out start your own seaweed farm, you need hatching material or you are interested if we can breed a seaweed variety according to your specific needs, please don’t hesitate to contact us’.

<https://www.hortimare.com/> call +31 72 888 8768.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Inclita Seaweed Solutions

Activities: Inclita Seaweed Solutions was recently created as a start-up dedicated to the production, valorisation and commercialization of algal extracts for the food, cosmetic and pharmaceutical industries. The company aims to develop innovative, healthy and sustainable solutions with a global positive impact in the economy, society and the environment, thus supporting its ambition to act as a Benefit Corporation. ISS arose based on the work developed by two CIIMAR researchers in the field of algal biotechnology and with the joint vision and know-how of the two other partners from the business area, being granted the title of the 1st spin-off of CIIMAR. ISS has a well-defined B2B business model: to develop, produce and license or commercialize seaweed extracts, addressing customer unmet needs, while enhanced by own IP and through the AI based toolbox for customer-centric solutions, in an agile and iterative manner with prospect customers. This enables differentiation in the market and allows for premium value opportunities. In the future, ISS intends to design, pilot and build a bio-refinery in order to utilize all the seaweed biomass in multiple value-added solutions for the food, feed, cosmetic and possibly pharmaceutical industries, with positive impacts in the economy and the society. ISS is an early stage marine biotech start-up dedicated to the sustainable development, production, valorisation and commercialisation of functional seaweed extracts tailored to the needs of our customers in the food & beverages, nutraceutical, pet care and cosmetic industries

Contact: <https://www.inclitaseaweedsolutions.com/about-us.html>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Innomar (Live Fish Catch, Fisheries and Aquaculture Technology such as Sub Bottom Profilers)

Activities: Innomar AS is a technology company developing new tools and systems for deep water fisheries, aquaculture and white fish. They are also working on new systems for live fish catch. The activities are driven by better efficiency, sustainable utilization, safety and environmental awareness.

Efficient Sub-Bottom Profilers made by Innomar: For more than 20 years Innomar has been providing innovative and high-quality equipment and software for the marine and offshore business, mainly parametric sub-bottom profilers (SBP, sediment echo sounder) that are used to image sediment structures or objects within the seafloor or river beds. In December 2020 the first unit of the latest Innomar SES standard generation has been commissioned. Due to the smaller topside unit transport and mob/demob becomes easier. In September 2020 the first three systems of the latest Innomar SES medium-100 generation have been delivered. The new topside unit is smaller (25% lower volume) and weighs 20% less compared to the previous generation. Thus transportation and handling during mob/demob is much easier.

Products:

Innomar SES standard parametric sub-bottom profiler (top side unit and transducer): Innomar's main product line, the narrow-beam parametric sub-bottom profiler series Innomar SES, provides unequalled high-resolution sub-bottom data both laterally and vertically achieving excellent penetration. This product line covers all depth ranges and can be used in water depths between less than one meter and full ocean depth. Applications include the geophysical imaging of sediments and sub-seabed structures for dredging purposes, for route and offshore site surveys and to map buried pipelines/cables. Compared to conventional towed sub-bottom profilers, the Innomar parametric SBPs provide better position accuracy and availability at higher survey speed. All Innomar sub-bottom profilers come with a software package comprising a user-friendly data acquisition software (SESWIN) and the SES-Convert data export tool (export SES data to SEG-Y and XTF data formats). SES-2000 data can be processed using Innomar's ISE post-processing software or (after data export) with a wide range of third-party software

Parametric Sub-Bottom Profiler (SBP)

Their main product is the Innomar SES parametric sub-bottom profiler (sediment echosounder) family. There are models for a wide water-depth range available, starting at shallow-water with less than one meter water-depth to full-ocean depth (11,000m). Most models are vessel-based with transducers mounted over the side or at the vessel's hull, but there are also models to be used on ROV/AUV or USV. Based on its forerunner Innomar SES-96, the Innomar SES-2000 / Innomar SES product lines consist of high-quality sub-bottom profilers for a wide range of in- and offshore applications. Parametric acoustics give excellent resolution and good penetration into the seabed at low frequencies. The high frequency channel is used to determine the water depth with high accuracy.

SES-2000 standard SBP data example (SESWIN online visualisation)

"Innomar SES-2000 standard" parametric sediment echosounder data example as shown during data acquisition (frequency: 8kHz; very shallow water about 4m deep; penetration more than 8m).

Parametric SBP for shallow waters

Innomar offers a wide range of sediment echosounders for shallow waters with water depths between less than one meter and up to 500 meters. A unique feature of all of these Innomar SES SBP models is the ability to work in extremely shallow waters with water depths less than one metre.

* Innomar SES-2000 autonomous SBP with USV
* Innomar SES-2000 smart SBP
* Innomar SES-2000 compact SBP
* Innomar SES-2000 light SBP
* Innomar SES-2000 standard SBP
* Innomar SES-2000 quattro SBP with four transducers

Combined Sub-Bottom Profiler and Sidescan Sonar

There are two shallow-water Innomar SES SBPs with integrated dual-frequency sidescan sonar available for simultaneous operation of SBP, echo-sounder and sidescan. For these models sidescan transducers can be attached to the sub-bottom transducer and up to two out of three sidescan frequencies can be selected to operate at the same time as the parametric sub-bottom profiler.

* Innomar SES-2000 light plus SBP and Sidescan
* Innomar SES-2000 standard plus SBP and Sidescan
* Innomar SES-2000 Sidescan Extension

Parametric SBP for deep waters

Beside the shallow-water models there are several Innomar SES parametric sediment sounders for deep waters up to full ocean depth.

* Innomar SES medium-100 SBP for up to 2,000m water depth
* Innomar SES medium-70 SBP for up to 2,500m water depth
* Innomar SES-2000 deep-36 SBP for up to 6,000m water depth
* Innomar SES-2000 deep-15 SBP for up to 11,000m water depth
* Innomar SES-2000 ROV SBP for ROV installation (depth rating 2,000m)
* Innomar SES-2000 AUV SBP for AUV installation (depth rating 2,000m)

Innomar Software

All Innomar SES parametric sub-bottom profilers come with a software package for online data acquisition and converting the SES data into other data formats. For post-processing they recommend their ISE post-processing software, but you can also use third-party software.

* SESWIN online system control and data acquisition software
* ISE post-processing software, specialized on data acquired with the Innomar SES-2000 sub-bottom profilers.
* SES Convert data converter software (SEG-Y, XTF, ASCII), to convert Innomar SES-2000 data for using any other post-processing software.
* SES Netview Ethernet remote display software for quality assurance and supervision.

Contact; <https://www.innomar.com/index.php>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Innova-Sea (Aquaculture Data, Products and Technology Services)

Activities: Innovasea provides aquatic solutions that hold up in the most challenging conditions from land to open ocean. They deliver ‘the world’s most advanced aquatic technologies’ and continuously applying knowledge in science and engineering, fish tracking and farm operations to develop the ideal systems for each site. They work shoulder-to-shoulder with customers to cultivate and protect fish populations. They ‘consciously designing products and services to give back more to nature than we take’. They are driven by a commitment to make our ocean and freshwater ecosystems sustainable for future generations. A pioneer in developing end-to-end solutions for aquatic ecosystems, at’ Innovasea we’re intent on leading and feeding innovation’.

They motivate their activities as under:

A Data-Driven Approach:

Fish farming is entering a new era, one where day-to-day decisions need to be based on empirical data and analytics rather than past practice, gut instinct and best guesses. By embracing new tools and technologies to better understand their complex operations, today’s farmers are saving money, reducing mortalities and becoming more efficient. But in order to succeed with this data-driven approach, you need to start with accurate information – and that requires powerful monitoring tools backed by robust analytic capabilities. That’s where Innovasea comes in. They are taking environmental, biological and physical monitoring to new levels with their advanced aquaculture intelligence solutions, which provide unparalleled real-time visibility into every aspect of your operation.

The Future of Fish Farming

Using a mix of sophisticated sensors, high resolution cameras, artificial intelligence and cloud computing, their integrated solutions deliver unprecedented insights into how your farm is operating – from measuring oxygen levels to ensure fish remain healthy to accurately estimating biomass to reduce feeding costs.

Scalable and Versatile

Their solutions are easily scalable so you can monitor individual fish pens or entire farms, and their edge computing technology allows you to deploy them in situations where wireless or internet communications are unreliable or unavailable.

Contact: <https://www.innovasea.com/aquaculture-intelligence/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### i-Wi Life (Algae Based Aquaculture Products)

Activities: iWi/Qualitas Health is an algae based nutrition company, committed to our planet. They are building a sustainable and scalable platform to face the immediate world’s food challenge of growing from 8 to 10 billion people by 2050. Their products are vegan, to include everyone, with any dietary restriction or life style choice. They grow algae in deserts using non-arable land, salt water and the sun as the main source of energy, to produce ‘the best omega3 and most complex protein in the industry’, while supporting and developing local and rural communities.

They motivate their activities as under:

‘Our bodies do not produce omega-3s naturally. That’s why doctors recommend people take Omega-3 supplements to help support everything in our bodies. Many clinical studies have shown that taking Omega-3s supports a healthy heart, sharper vision, better brain function, a stronger immune system, and more resilient bones and joints. By taking iwi, you not only absorb higher quality Omega-3s, but you also get it from the most natural source on the planet – algae’.

* Get algae-based nutrition from iwi.
* 50% more Omega-3 absorption than fish or krill oil.
* Plant-based and sustainably farmed in the USA.
* Better for you and ocean life.

The Earth’s population is growing. It is set to reach 10 billion members by 2050. We need to work together to fix the problems that threaten us all, from climate change to food and land scarcity. That’s why iwi was founded. To develop sustainable farming methods, harvest nutrient-dense food, and to feed and protect the planet. iwi Omega-3 is sourced from nature’s richest supply, algae. they do not remove fish or krill from the eco-system to produce it. Their farms are powered by renewable energy: sunlight and saltwater. iWi algae yield more essential amino acids and vital nutrients using fewer resources per acre than traditional farming, providing 50% better absorption of Omega-3 than fish and krill oil.

Contact: <https://iwilife.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Kelp Blue (Kelp Aquaculture)

Activities: Kelp Blue cultivates giant kelp at vast scale, offshore, in upwelling currents rich in nutrients. The harvested kelp canopy is processed into pharma and neutraceuticals, protein for fish/animal feed, pure cellulose fibre for textiles, and highly potent organic fertiliser. Kelp forests improve regional fish stocks. They are a keystone species for enormous biodiversity and they draw down CO2 even faster than terrestrial forests.

Contact: http://kelp.blue/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Why Kelp**

* One of the fastest growing organisms on earth
* It creates habitats for many marine species
* It’s an amazingly efficient carbon sink
* It can be sustainably and repeatedly harvested for at least 7 years
* It provides valuable extracts including protein, cellulose, hydrocolloids, polyphenols, phlorotannins, mannitol, fucoidans, & bio-active compounds

PRODUCTS

* Feed supplement fish, livestock and poultry
* Abalone feed (fresh)
* Extracted protein as feedstock

BENEFITS

* 100% organic source of over 70 vitamins and minerals
* Reduces internal parasites in pigs
* Natural anti-inflammatory - reduces the need for zinc oxide
* Rich source of iodine
* Significant anti-methanogenic effect on livestock - reduces greenhouse gas emissions from farming

FERTILISER/BIO STIMULANTS

* Concentrated liquid fertiliser
* Fertiliser and soil improver (milled)

BENEFITS

* 100% organic
* active compounds improve root and fruit growth, and flowering
* Phenols & phlorotannins increase plant resilience to disease
* Improves water retention and nitrogen-fixing of soils

FRESH & DRIED MILLED KELP

* washed fronds for further processing (fresh)
* Input material for further isolation of polysaccharides

BENEFITS

100% organic

* Contains fucoidan
* Contains alginate
* Contains mannitol
* Contains glucanol

CELLULOSE FIBER

PRODUCTS

* Fibres for textiles
* Wound dressings and bio-medical textiles and implants
* Nanocellulose for paper-strengthening
* Nanocellulose for water-proofing cardboard

BENEFITS

* Wholly natural fibres with petrochemical characteristics
* 100% Organic with a positive environmental footprint
* Natural anti-septic and anti-inflammatory properties

All of these products include the following sustainable advantages

* No Land Use
* No Fresh Water
* No Pesticides or Fertilisers

### Kona Bay Shrimp Genetics

Activities: Kona Bay is a leading shrimp genetics company, based on Kauai, Hawaii. They breed and supply specific-pathogen-free shrimp broodstock, that yield high performance in the hatchery and farm. They are selected for fast growth, strong resistance to multiple pathogens, high nauplii production, and efficient feed utilization. Naturally well positioned, Kona Bay is headquartered in Waimea, Kauai, in the state of Hawaii, USA. Kona Bay is the largest aquaculture company in Hawaii and is one of the world’s leading suppliers of genetically-improved, specific-pathogen-free (SPF) shrimp broodstock. The Kona Bay breeding centre, hatchery, farm, and processing plant are the only shrimp farming facilities on the island of Kauai, which is separated from other Hawaiian islands by at least 200 km of deep ocean. Kona Bay’s isolated location, mild subtropical climate, and pure naturally-filtered seawater from deep wells offer an optimal environment for biosecure culture of shrimp.

They motivate their activities as under:

They are an aquaculture breeding company developing shrimp as a source of protein without the necessity of depleting wild stocks for human consumption. Their farm and hatchery use sustainable hydro-electric power to operate all electrical systems. Their water supply is highly biosecure as the well sourced, pristine, saltwater is filtered through the volcanic sub strata of the island for use in our shrimp breeding ponds. The ponds are reusable polyurethane lined ponds that enable continuous use of the same ponds without increasing their geographic foot print. Via the use of Bio-fluc technology in the grow-out farm they reduce the need for additional feed and decrease discharge frequency into their settlement basin. Clams are being grown in the shrimp ponds and they filter the water, decreasing the need for water exchange. The shrimp bi-products provide an excellent source of nutrition for the clams in a symbiotic relationship.

**Part of Hendrix Genetics**

Since 2017 Kona Bay is now part of Hendrix Genetics, a world-leading multispecies animal breeding company. This partnership aims to accelerate Kona Bay's shrimp breeding program by introducing advanced genetic and genomic technologies developed by Hendrix Genetics. The collaboration also provides the capital necessary for the development of state-of-the-art breeding facilities for both shrimp species in Kauai, as well as the development of model hatcheries for the production of quality post larvae in key market regions around the world. In addition, a comprehensive program for specific disease resistance will be implemented to further enhance the quality of Kona Bay broodstock.

Contact; <https://www.konabayshrimp.com/en/about-us/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Lagosta (Spiny Lobster Aquaculture and Regenerative Marine Biotechnology/Conservation)

Activities: LAGOSTA farm and produce high quality the European spiny lobster, Palinurus elephas, in an organic, respectful and sustainable manner, and recycle its associated by-products. Their innovative approach relies on an indoor semi Recirculating Aquaculture System (RAS). This platform offers great opportunities to LAGOSTA to limit its impact on the environment while generating added value. They also put great care in making sure this species’ population will survive sustainably in the wild. They are strongly committed to implement, in cooperation with Foundations and/or Governments, a spiny lobster conservation action plan and repopulation program for Mediterranean spiny lobster stocks replenishment. It is an absolute priority for LAGOSTA to make all the necessary efforts to preserve the natural population of this species on the long term. Accelerated depletion of wild stocks due to overfishing and failed management practices, leave aquaculture as the alternative choice to fulfil the fast growing seafood demand.

Contact; http://www.lagosta.com/conservation/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Manolin Inc (Aquaculture Data Solution)

Activities: Fish health is an aquaculture farm’s most important asset. Managing it is one of the most difficult jobs. Manolin invests in fish health, helping fish health teams use data insights to make better decisions. Track, measure, and predict outcomes quickly and easily — all in one platform. TRACK Organize your information. Passing spreadsheets and files between team members can be unreliable and inefficient. With Manolin, your production information is stored in one common, easy-to-use platform with pre-generated graphs and relevant industry information.

* Farm data timelines
* Map of farm activity across the country
* Nearby treatment alerts

MEASURE: Know if operational changes are improving your harvest. Is my new system leading to more targeted feeding? How has this generation's performance compared to others? Simple scorecards, standardized metrics, and quick summaries provide easy ways to benchmark these questions and many more across any farm, generation, or cage.

* Operational benchmarking
* Time period summations
* Generation and cage comparison

PREDICT: Spend less time looking at data, and more time looking at fish. Manolin can scan hundreds of millions of data points every 15 minutes, constantly on the lookout for anomalous treatment activity, fluctuations in your data, and other issues that could cause harm to your fish.

* Disease forecasting
* Anomaly detection
* Risk increase alerts

Contact; <https://manolinaqua.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Open Blue Fish Farms (Sustainable Cobia Aquaculture)

Activities: Open Blue claims to be the global leader in open ocean raised fish. Their deep sea platform is located 8 miles offshore in waters 230 feet deep, utilizing fully submerged net pen systems. This method allows for a natural and humane growing environment for the fish while using environmentally responsible and sustainable practices. The result is a fish with exceptional taste, freshness and quality. Over the next 50 years, the world is going to need more food than has been produced in the past 10,000 years. Experts say over 50% of the world’s wild caught fisheries are fully exploited and that if we carry on fishing at our current pace we will run out of fish by 2048. Aquaculture represents the best way to feed the planet now and into the future. Already half the fish we eat is farmed, but fish farming needs to be undertaken in a sustainable way to ensure minimal impact on the surrounding environment. At Open Blue, they strive to raise the healthiest fish in a responsible and sustainable way through every aspect of their operations.

They motivate their activities as under:

Preserving the Oceans

By moving far away from crowded coastal waters and sensitive ecosystems into the open ocean, they operate in harmony with their natural surroundings. They chose sites that don’t displace other marine life. They protect the waters where we raise our fish to keep them pure and pristine. Open Blue has created and manages a protected “no take” zone of 2,500 acres of water concessions where only artisanal fishing is permitted and no commercial fishing is allowed. They constantly monitor the water quality and the sea bottom at our farm location to ensure that everything they do is ocean-friendly. Supported by independent monitoring, they are proud to say from there has been no traceable impact to the marine environment around us. Their goal is to continually improve and evolve so that we can protect the ocean for generations to come. To this end, we collaborate with leading scientific laboratories and research institutions such as the Rosenstiel School of Marine and Atmospheric Science at the University of Miami.

Community Impact

They are committed to enriching the lives and improving the infrastructure of their people. Open Blue is the largest employer in the region, generating significant economic activity. They take business responsibility seriously and are proud to support their communities on the Caribbean coast of Panama. They are highly focused on the lives of their staff and supporting them. They contribute to the local economy in many ways – most significantly through employment and the purchasing of goods and supplies. In 2016, over 850 Panamanian companies provided them with a range of goods and services. Education and health are our main priorities. Each year they fund 48 scholarships and assist with bus maintenance to ensure students have access to schooling. They plan to extend our scholarship program to the secondary and university levels. By building relationships and connecting meaningfully, everyone wins. They support:

* Student scholarships (48 annually)
* Student transportation
* Regular community meetings
* Ongoing beach clean-up
* Drilling community wells to ensure clean drinking water
* Funding for emergency medical needs and natural disaster relief
* The food bank
* Company recycling programs that benefit the community

[Contact; https://www.openblue.com/our-commitment/](file:///C:\Users\Julie\Documents\jack\Contact;%09https:\www.openblue.com\our-commitment\)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Organic Illemba (Urban Aquaculture for Catfish)

Activities: Urban Aquaculture of Catfish farming on Raised Ponds System in Nairobi County in Kenya, to increase fish productivity, sustainability and by use of minimal space. The proven and high-performance agricultural technologies of a Raised Fish Ponds System uses less space, are easy to manage and also movable enabling a farmer move with them from one locality to another. It can be placed on any surface and require no excavation. The most exciting aspect related to the project is the availability of (Roof-Top) area of the buildings in urban areas, and the opportunities to create an integrated grouping of new sites (estates) for healthy food production, demonstration and learning. Their Small-scale processing plant will enable them to get better prices for the product by shortening the fish supply chain and increasing bargaining and lobbying power. The perishability of fish demands that it is handled properly immediately after catching and until it is preserved for human consumption. Because the traditional technologies available for fish processing have being contributing to post-harvest losses, fish processing equipment has been much improved in terms of the hygienic design and reduction of post-harvest losses. Also the hygienic challenges in fish processing are very complex. This equipment will enable them to produce quality fish fillets at a competitive price even across the borders.

Contact: https://solarimpulse.com/companies/organic-ilemba

<https://www.globalinnovationexchange.org/innovation/organic-ilemba>

\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Era (Mariculture and Technology Systems)

Activities: Ocean Era (formerly Kampachi Farms) is a leading innovator in offshore mariculture, with research activities in Hawaii (feeds development, selective breeding, herbivorous fish culture and offshore macroalgae culture), and the Gulf of Mexico (The Velella Epsilon project - pioneering offshore net pen systems in U.S. Federal waters). Ocean Era has successfully conducted two state-of-the-art offshore aquaculture trials in Federal waters around Hawaii. These trials tested numerous technologies necessary to take aquaculture “over-the-horizon.” The Velella Beta test involved use of an unmoored, copper-alloy meshed Aquapod®, stocked with around 2,000 kampachi, attached only to a feed barge / tender vessel, which drifted with the currents, between 3 – 75 miles offshore of the Big Island. This was the world’s first unanchored net pen trial, and was awarded one of TIME Magazine’s “25 Best Inventions of the Year” for 2012.

The Velella Gamma test used the same net pen, species and number of fish, but included a single-point mooring located in 6,000 ft deep water, some 6 nautical miles offshore of the Kona Coast. This trial used a remotely-controlled, unmanned feed barge to facilitate “over-the-horizon aquaculture”. Technicians could run the farm remotely, using an iPhone or iPad, and only needed to visit the site once a week to top up the feed in the hopper and the fuel in the generator. The Velella Beta and Gamma demonstrated the potential of open-ocean aquaculture to produce outstanding finfish, while having no significant impact on ocean ecosystems. As part of a national initiative to increase U.S. aquaculture production in the next four years, Ocean Era has been awarded a grant in partnership with Florida Sea Grant to trial a new Velella net pen pilot project in the Gulf of Mexico. Read more about the Velella Epsilon project.

They motivate their activities as under:

Ocean Era conducts industry-leading sustainable feeds research, focused on reducing our reliance on fishmeal and fish oil from wild stocks, and instead using scalable agricultural proteins and oils in fish diets. They have conducted dozens of feed trials since this work began, in 2006, and with their partners have been greatly encouraged by the array of new alternatives to traditional wild-caught fishmeal and fish oil. They have shown that their kampachi will readily accept - and thrive on - a diet where most of the fishmeal is replaced with agricultural proteins, such as U.S.-grown soybeans. Growth performance and health of the fish on the “vegetarian” diet has been equal to or exceeded that of traditional fishmeal-based diets. Their feed trials with soy protein concentrate (SPC; essentially tofu) compared the growth of kampachi on a 40% SPC diet with commercially available diets. After the trials, the fish were harvested and analysed for product quality in consumer taste tests at Oregon State University. The kampachi raised on the 40% SPC diet were indistinguishable from the kampachi raised on the control diet. Working with colleagues at USDA, they have been able to replace some portion of the fishmeal with (a) algal by-products of astaxanthin production, (b) fish peptides obtained by filtering the effluent water from fish processing plants; and (c) single-cell protein concentrates produced by fermenting bio-digesters. They have also shown that kampachi can thrive on a zero fishmeal diet (though the protein products used in these trials were too expensive for commercial grow-out diets).

Much of their work is done in collaboration with innovative companies and research organizations. One such example is the clean biotech firm KnipBio, whose single cell protein offers a sustainable fishmeal replacement. The Ocean Era MARINER (Macroalgae Research Inspiring Novel Energy Resources) team is applying for a three-year permit to deploy the Blue Fields Offshore Macroalgae (limu) Demonstration Project. This seaweed demonstration project is proposed to be deployed in the offshore waters adjacent to Pawai Bay and the Old Airport County Recreation Park, in Kailua-Kona, Hawaii. The submersible growing platform will be approximately 1.5 nautical miles offshore and will normally be below the water surface. The proposed demonstration array will be moored to the ocean bottom in approximately 120m (400 ft) water depth, which should mean that there are no significant impacts on water quality, coral reefs, or dolphin resting activity. This demonstration aims to validate technologies that would allow this type of cultivation using only the energy that exists in the natural environment (wind, wave, current, and solar energies). The project will culture only native or endemic Hawaiian macroalgae species. Currently, the suitability of a few native species is being testing in on-shore trials at the Kampachi Farms’ research yard at the Natural Energy Laboratory, in Kona, Hawaiʻi.

Their quest for more sustainable seafood means that they also want to be developing additional species, to further soften mankind’s footprint on the seas. They want to help develop the "next big thing" in responsible aquaculture. They are currently working with several other marine fish species at our Kona research site, ranging from plate-sized herbivores such as Nenue (Kyphosus spp., also known as rudderfish), to one of the fastest growing fish on the planet Mahimahi (Coryphaena hippurus), to gargantuan fish like the highly-esteemed and ecologically threatened Pacific Giant Grouper (Epinephelus lanceolatus), which has been so overfished that is now possibly the rarest coral reef fish in the world. Ocean Era along with many others in aquaculture research - have pursued enhanced sustainability by formulating "vegetarian" diets for carnivorous fish, such as Cabo Kampachi™. However, few have focused on the potential for growing a high-quality herbivorous marine fish. Herbivorous fish are less widely appreciated, but in Hawaii a local reef herbivore, the Nenue, has always been prized as a food fish. These seaweed-grazers have a fantastically efficient ruminant-like gut, which allows them to digest and utilize macroalgae (seaweed, or ‘limu’, in Hawaiian). Cultured nenue could therefore potentially be grown on a highly sustainable and economical diet including macroalgae, agricultural byproducts and other plant-based materials. Perhaps most importantly, the fish tastes great and is very nutritious.

Contact: <http://ocean-era.com/projects>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Origin by Ocean (Sustainable Blue Carbon Derived Aquaculture/Marine Biotechnology Products)

Activities: Origin by Ocean collects sea- and ocean-grown biomass such as blue-green algae and macroalgae like bladderwrack, sargassum, kelp and so on. From this biomass, they produce natural and biologically sustainable ingredients for use in the food, beverage, cosmetics, and pharmaceutical industries. They are driven by a strong dedication to the wellbeing of the natural world. In algae, they have found a great potential to create viable business opportunities while having a positive impact on the environment.

They motivate their activities as under:

The eutrophication of oceans, a consequence of agricultural nutrient overflow, and high levels of pollution is a serious danger to many coastal marine ecosystems around the world. Algae blooms limit light penetration, reducing growth and causing the death of other plants. This process suffocates entire ecosystems. We also know that algae and seaweeds are filled with nature’s building blocks and provide an endless pool of sustainable and healthy ingredients for various human applications. These two facts and their combined potential sparked our curiosity. As founders, their innovation is to make good use of algae which is everywhere. Algae are a true marvel of the natural world that have not been seen as a viable crop to grow and harvest. ‘What if we started to develop this huge unused potential for more sustainable products, enhancing both our daily lives and the natural world at the same time?’

Compounds extracted from algae are already used in food, cosmetics and medicines, across a diverse range of products as different as ice cream and body lotion. Currently, these products are mainly produced in Asia under non-sustainable conditions, for distribution around the world, including Europe. Around the world today, we see this everywhere we go. Blue-green algae are thriving due to excess nutrients from agriculture and industry flowing into oceans and lakes.

Contact: https://originbyocean.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Oyster Common (Virtual AI Powered Seafood Marketplace)

Activities:

Its eCommerce platform empowers oyster farms with a nationwide farm to table sales operation. A simple all in one solution with back office tools allows you to manage your inventory, schedule and track orders, process credit cards, and print shellfish tags. An eCommerce solution helps you build your brand and acquire new customers and sales. Built in FedEx overnight delivery means you decide when your orders are ready for pickup, and the rest is taken care of for delivery and logistics. The Oyster Common, which is building the first Virtual Fishmonger; an AI-powered marketplace for fresh seafood.

Contact: <https://oystercommon.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Pan Gaea Feed (Aquaculture Feed)

Activities: Pan-Gaea Feed is a biotechnology startup that works to redefine the value chain for fish feed production. The business model aims to replace conventional fishmeal derived from wild fisheries into a sustainable fish feed that is efficient and friendlier to the environment. Pan-Gaea Feed is formulated by converting by-products of agricultural commodities and food systems into highly nutritious insect-based proteins and fat substrates. This process reduces the footprint of agriculture and food waste while also supporting clean and environmental friendly fish feed industry for aquaculture.

Targeted Challenges and Focus Areas: Growing food in water

Restorative aquaculture: Restoring, Protecting and Investing in the Ocean

They motivate their activities as under:

Aquaculture is dependent on fishmeal, which constitutes of smaller fish such as anchovies caught from wild fisheries, being converted to feed. Only 7% of the global marine fish stock left is neither classified as over-fished or maximally sustainably fished. Against the backdrop of constant output from wild fisheries since the 1980s, this has caused the price of fishmeal to shoot up from USD$340 per tonne in 1999 to USD$1500 in 2019, and by 2030, it will be approximately USD$3800. There are several reasons why is Pan-Gaea Feed targeting the fish-feed market, firstly, the animal-feed end users that Pan-Gaea Feed is targeting is aquaculture. The sector is the fastest growing industry at CAGR of 5.3%, relative to ruminants (3.1%), poultry (4.5%), and pigs (2%). With every USD spent on purchasing by-product of agricultural commodities/bio-wastes to be fed to farmed animals, the wealth multiplier effect (based on farm-gate price) for fish is 30 times, compared to poultry at 16, and cattle at 8. Pan-Gaea Feed puts forward Integration of value chains and processes between insects and fish feed, lowering operating cost by at least USD500 per tonne relative to competitors and contribute to biotechnological advances including prophylaxis, taurine, omega-3 retention, and reduction in anti-nutritional factors.

Pan-Gaea Feed is aiming to generate at least USD$3.4 million in sales revenue by the fourth financial year. Subsequently, they want to perform economic case studies of increasing agricultural productivity per hectare by 50% (better land-use and resource use efficiency). Other than that, obtaining verification from Aquaculture Stewardship Council (ASC) can help to verify that Pan-Gaea Feed can help aquaculture businesses to be certified sustainable. Furthermore, they want to improve scalability in ASEAN especially nations around the Coral Triangle. Successful Pan-Gaea Feed can help reduce fishmeal catch in this area. Franchise licensing and brand recognition in industrial leadership for commercially viable circular economy is needed to inspire whole-scale change in the feed industry. And finally, they want to solidify value chain integration by equity investment from large players in agricultural commodities (plantations, centralised refineries) and from large players in aquaculture.

Contact: Daniel Mahadzir Solution Owner; Operating Region Asia

https://medium.com/@drchianwenchan/can-fish-feed-be-environmentally-sustainable-fc85695d639a

<https://medium.com/@drchianwenchan/how-to-make-insect-meal-more-economically-viable-in->agriculture-d9dee915c43a

<https://medium.com/@drchianwenchan/the-case-for-using-insect-meal-in-agricultural-production->b6256bed841a

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Planctonid Atlantic (Aquaculture/Coastal Eutrophication Solution)

Activities: Planctonid Atlantic are developing a game changer in microalgae culture, fighting against coastal eutrophication with a new sustainable and circular business model. In order to protect the environment by cleaning polluted industrial waters, hence taking care of the Oceans, and by immobilizing N, P and CO2 in microalgae and to feed the world with microalgae. Planctonid has already been recognized and awarded as the Best Biotech Startup in Europe in the Water category in the COP25 in Dec. 2019, at The United Nations Conference for Climate Change. Planctonid’s breakthrough combines three elements/ingredients: 1) polluted industrial waters; 2) CO2; and 3) specially selected micro-algae species to deliver clean waters and high quality biomass at industrial scale. Planctonid has created a Joint-Venture with Yara group, to build the first European water treatment plant with micro-algae in Mantes Saint Nazaire harbour/port and hence solving eutrophication of ocean coasts issue and currently developing the biggest microalgae biomass production solution in Europe. Microalgae biotech plants to clean industrial water in harbours and create circular blue bioeconomy.

Targeted Challenges and Focus Areas: Restoring, protecting and investing in the ocean

They motivate their activities as under;

Investing in nature-based solutions for the blue economy: Eutrophication is a process driven by the enrichment of water by discharged nutrients, especially compounds of nitrogen and/or phosphorus, leading to intense and potentially toxic algal growth; changes in the balance of organisms; and water quality degradation. Secondary impacts from large algal blooms can lead to various effects throughout the ecosystem, such as reduced sunlight, oxygen depletion, increased decomposition of organic matter, and shift in biodiversity, etc. The water quality can be also reduced due to decaying algae with foul odours and foam on beaches, or toxins from blooms In this context, conventional wastewater uses heterotrophic and nitrifying bacteria which allows for the removal of N & P nutrients but requires high energy consumption and has a negative environmental impact because it emits CO2 and experiences significant nutrient loss. Their biotechnology can fix CO2 massively, requires less electrical energy while creating a usable bio-by-product: microalgae biomass - rich in proteins and essential amino acids.

There are two aspects to the industrial waters treatment with microalgae: effectiveness in removing nitrogen and phosphorus and the possibility of recovering these microalgae. The microalgae are developed in photobioreactors. The hydraulic distribution was determined for the supply of the reactors. The system works by "units", once the effluent has been treated and purified of nitrogen (NO3, NH4) and phosphorus, the biomass is extracted, thickened, dehydrated (centrifugation or screw press) and can for example be lyophilized. The type of dehydration is correlated with the sources of recovery, in the form of powder or liquid. Thus, this efficient and innovative system fits perfectly with an objective of sustainable development, eliminating the disposal of waste harmful to our environment. It is a question of cultivating a living material which will be ultimately valued in dedicated sectors. The cultivated strain has significant purifying capacities and a significant protein level fully justifying its choice. New industrial process with very limited land need; New photobioreactors and disruptive biomass production process ; automation owing to real time dataset and modelisation to pilot the plant.

Achievement 1: Specified, designed and implemented a phytopurification water treatment station answering industrial operating constraints. This objective deals with engineering and operational issues.

Achievement 2: Demonstrated on a large scale the efficiency of the process for microalgae-based wastewater treatment and the generation of valuable bioproducts. The underlying objective here is to reduce CO2 and other compounds (especially nitrogen and phosphorus) emissions in rivers and oceans resulting from human activities in order to stop eutrophication and other environmental problems that arise from the bad condition of the effluents.

Objective 3: To validate the business model(s) for this phytopurification technology, especially by including the best valorisation routes of the microalgae biomass according to their final technical features.

Objective 4: Dissemination of the project and its results so as to promote the shift from traditional wastewater treatment to a more environmentally circular and sustainable solution, i.e. microalgae-based wastewater treatment.

Contact: <https://www.planctonid-environnement.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Plant based Seafood Company

Activities: This is an all-female, family owned company with a passion for creating healthy and delicious seafood experiences ‘that are so close to the real thing-it will blow your mind!’ Their background lies in the real seafood industry, where for nearly 20 years they successfully created and sold award-winning real seafood products. During these 20 years, they have witnessed unacceptable and often hidden practices in the seafood industry. From overfishing, to mislabelling, to "chemical glazing", to child labour, to human trafficking and modern day slavery - just to name a few. The industry, along with the $10 Billion illegal seafood industry, was hiding so many secrets from consumers and devastating oceans, communities and lives. Determined to be an agent of change, they set out to be the first seafood company to offer plant based alternatives in hopes to spur meaningful change. They believe in decreasing the demand for certain seafood species by offering alternatives that look, taste and perform like the real thing we've been making for 20 years, to create positive change and make a huge impact on the industry, our oceans and the global food system as we know it. They are located on Gwynn's Island, Virginia, a tiny little island in Chesapeake Bay. Being surrounded by water constantly reminds them of their mission and inspires them to do better for the environment and its beautiful resources.

Contact: <https://plantbasedseafoodco.com/pages/about-the-plant-based-seafood-co>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Pond Naturals/Pond Tech (Algae Bioreactor and Linked Technology)

Activities: Pond design and operate scalable bioreactors that use industrial greenhouse gases – and our specialized growing systems to cultivate algae and other crops. Their systems effectively close the carbon loop and create wealth from waste.

Their purpose is to make the world a better place. Their mission is to combine technology with the power of nature to tackle climate change and food insecurity. They are determined to massively scale their technology, unlock tremendous value, and leave a healthy planet. They aim to become a global cleantech leader by establishing algae as a foundation of the new low-carbon economy essential to a better and healthier life for people everywhere.

They motivate their activities as under;

Aquaculture

Algae contain all the key nutrients to supply a sustainable aquaculture industry. Microalgae like Spirulina and Chlorella are the true source of most nutrients on Earth, forming the base of the food pyramid in oceans, lakes, and rivers. Algae is a far superior feed ingredient compared to corn & soy as it can contain up to 70% protein and is rich in omega fatty acids and antioxidants Algae production at scale can alleviate widespread overfishing for anchovies and other feeder fish used in industrial fish farming

* The Aquaculture Market Price Per Tonne $1,400-$1,800 USD (bulk fish meal)
* Market Size: $108 billion USD in 2017 (total aqua feed market)
* Annual Growth Rate 10% (total aqua feed market)
* Regulatory: New bans on some synthetic additives like ethoxyquin in the EU & Chile driving demand for natural ingredients and antioxidants derived from algae

Fish and crustaceans have evolved to digest algae and algae-eating organisms, so feeding them algae-based feed can be beneficial to the health and growth rates of farmed fish vis a vis corn or soy-based feed Pond has successfully grown multiple strains of algae for use in fish feed:

1. Pond-grown Chlorella strain contains >55% protein and is rich in α-Linolenic acid (ALA), Lutein, and Astaxanthin

2. Pond-grown strain of Spirulina contains 60-70% of highly bioavailable protein.

3. Pond-grown Haematococcus algae can contain up to 5% Astaxanthin which can serve as a natural preservative of lipid-based fish feed

Pond has demonstrated growth rates for Spirulina and Chlorella that surpass other technologies by 20-50x at its pilot plant in St. Mary’s, Ontario Pond’s modular design allows them to build and scale a facility at any industrial site providing supply security for fishmeal producers who currently rely on volatile and declining harvests wild fish stocks. A commercial scale algae plant at Stelco on Lake Erie is anticipated to have an initial annual production capacity of over 2,000 tonnes of Spirulina, which can be scaled up by several orders of magnitude. Pond can supply you with industrial volumes of sustainable protein. As of 2011, people consume more farmed fish than beef. Demand for meat-based protein is growing as tens of millions enter the middle-class in growing economies like China or India. At the same time, overfishing of feeder fish like anchovies and sardines has reduced global fishmeal supply by 33% in the last 2 decades. Upon mass-adoption, Pond algae plants could alleviate some pressure on ocean ecosystems and provide a stable, reliable source of high-quality protein and nutrients. Algae has also been found to increase milk production in cows and could be used as a substitute during climate change-induced feed shortages. Fish2.0 provides a great investor overview of innovation in fish feed and highlights algae as a key building block of sustainable aquaculture.

Pond Algae is a Superior, Sustainable Feed:

* Algae contains up to 2x and 8x more protein than soy and corn, respectively
* Algae protein is more readily absorbed into animal and human bodies while soy, the main fish meal substitute, is deficient in several essential amino acids (especially methionine and lysine)
* Both corn and soy require vast amounts of land, water, and energy for fertilizers and farm equipment
* The main challenge to date has been growing cost-competitive algae at scale, without the need for vast amounts of land and water. Pond’s technology addresses these challenges. Learn more on our tech page.
* A Pond system powered by a new natural gas power plant can produce carbon-neutral protein, requires near-zero water for operations, and 1000x less land compared to soy or corn. The Pond plant could even reduce carbon in the atmosphere if it was powered renewable energy!
* Soycornpond Algae pond Algae (100% Renewable)
* T Ghg Emitted Per T Feed 0.58
* Protein Content 35%
* T Ghg Per T Protein Produced 1.657
* Tonnes Of Protein Per Acre 4.1

Contact: <https://www.pondtech.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Poseidon AI (AI Sensor Technology for Aquaculture)

Activities: Poseidon AI is reinventing aquaculture using deep-tech and IoT for food sustainability. Their story originates from the concern of farmers losing a big chunk of their saving in aqua feed, which amounts to up to 60-80% of the overall cost per year. There is an imbalance in this equation and it is a collapsing business model from many farmers in SEA. with a solution for feed optimization they are saving 15-20% of the feed by carefully applying their advanced sensors and AI driven algorithms to manage a sustainable aquaculture farm. At Poseidon-AI, they target the world food sustainability by revolutionizing the aquaculture industry. They are giving the power of modern technology right into the hands of farmers and they look forward to more farmers flourishing in aquaculture around the world. ‘Farmers provide us food and we are their keepers, we meet, we feel and we connect to their pain. We are a team passionate to make farmer life better in Aquaculture. Expand your business with Poseidon-AI expertise by adding more species in your Aquaculture farm with confidence’.

Contact: <https://www.poseidon-ai.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Renewable Algae Energy (Algae Based Products)

Activities: Headquartered in Johnson City, Tennessee, USA., Renewable Algal Energy (RAE) is an algal biotechnology firm committed to producing high-quality, refined raw materials. Their award-winning team of engineers and scientists has created novel breakthrough technology to produce sustainable, economically viable products from microalgae. Their patent-pending technology addresses the key challenges related to algal aquaculture, harvesting and conversion processes. The results are renewable fuels, nutraceuticals, and human and animal nutrition. RAE is focused on working with nature to provide sustainable processes that produce high-quality products to benefit the world.

Contact; <http://www.rae-energy.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Seafarming Systems

Activities: Seafarming Systems develops fish cages and fish farming systems that enable sustainable aquaculture with increased production and reduced environmental impact.

**Semi closed fish cage**

The escape-proof semi closed fish cage with deep skirts keep sea lice out, provides an excellent stimulating environment for the fish, with abundant water exchange and protection against salmon lice. Aquatraz can be lifted completely out of the water for washing, disinfection and maintenance using the specially developed lifting system. The fish farming volume can be divided into adjustable “pieces of pie” that allow for sorting, starving and delivery in batches, without raising the cage. Aquatraz has been developed under the scheme with development permits together with Midt-Norsk Havbruk, and the latest generation will be available to a group of Norwegian fish farmers from 2021.

**Closed containment fish farming systems**

Aquantum Leap is a ground-breaking project that consists of two different closed fish farming systems, Aquantum 500K, the world’s largest fish farm, holds 500,000 m3. Aquantum 12K consists of several fish cages gathered in a rigid frame, suitable for post-smolt production. 12K and 500K each have their own unique lifting system that can lift the fish farms completely out of the water. The lifting systems simplify washing, disinfection and maintenance. In addition, the facilities can be towed to new locations in an elevated position. Both facilities have built-in solutions for sectioning, sorting and delivery of fish. They can be operated in the majority of fjord locations where salmon is produced today, and each has its own solution to prevent sloshing. The Aquantum technologies are patented. Aquasafe is a closed fish cage in steel with sludge collection. In addition to preventing escape, the spread of sea lice and disease, it eliminates pollution of the sea and seabed. The fish cage can be lifted completely out of the water using a lifting systems based on compressed air. The Aquasafe fish farming system has many uses. It is well suited for post-smolt production, delousing, regular fish farming of adult salmon and as containment before slaughter. The unique construction and assembly method used for Aquasafe makes it a particularly cost-effective closed fish cage. The Aquasafe technology is patented.

* Sustainable fish farming
* Protecting against sea lice, algae and escape
* Increased productivity
* Sludge collection & circular economy
* Safe operations
* Improved fish health
* Automation & economies of scale

Contact; <https://seafarmingsystems.com/en/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Warden (Aquaculture Remote Monitoring Methods)

Activities: Latest annual figures estimate that production has reached 115 million tonnes, valued at USD $264.6 billion (FAO). Aquaculture employs a variety of methods, but most of this production occurs in ponds. The problem the aquaculture industry is facing is its own scale. How do you monitor production across millions of ponds? Without reliable data, how do you track environmental impact? How do you ensure that the millions of farmers in these areas have access to the resources they need? Sea Warden enables aquaculture producers to demonstrate commitments to responsible production by leveraging remote monitoring methods for the farmed seafood industry. Sea Warden advances the sustainability of farmed seafood through global satellite observation and a mobile platform enabling farmers to share and trade data. They’re solving data collection challenges in aquaculture, starting with shrimp. Why? Because shrimp is the most consumed seafood in the US and has a global value of USD 40 billion. In coastal regions around the world, more than a quarter million farmers are engaged in shrimp production.

Contact: <https://seawarden.io/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Seaweed Solutions (Aquaculture and Biomass Related Products)

Activities: Seaweed Solutions promote collaboration and strong partnerships in all areas of production to meet the growing demand for seaweed. They invite you to partner with them to unlock the potential of this fantastic raw material. Their goal is to seize the vast potential of seaweed as a new and sustainable biomass. To make this happen we need radical thinking and new, enabling technologies across the value chain. We need to rethink how we produce, process and use seaweed. They are proud to have worked with outstanding partners across the aquaculture sector - research institutes, universities and NGO's - on many cutting-edge projects in Norway and internationally.

**Team Hammarvik Farming partnerships**

In addition to operating their own farms they are growing through partnerships and joint ventures with other farmers, both in Norway and internationally. Excellence in seaweed biology and market focus is the formula for success. They offer partners a secure supply of high-quality seeds, training, quality control and market access.

**SES Harvest Carrier 2013 Cultivation technology**

For years they have worked to improve efficiency in deployment and harvest techniques, customising equipment, vessels and processes across the full value chain. Low-cost, modern cultivation technology is fundamental to unlock the full potential of seaweed and seaweed farms will gradually move further offshore where space and larger scale production is possible. Their first patent, the Seaweed Carrier, is now approved in 23 countries.

**Seaweed cultures R&D partnerships**

Seaweed Solutions is committed to innovation and have invested more than 20 million euros on research since they started. Their scientific team works with partners and customers to roll out new innovations and improved solutions along the whole seaweed value chain. They are always looking for new R&D partnerships to further develop key areas of seaweed cultivation, downstream applications and new areas.

Contact; <https://seaweedsolutions.com/solutions> For project and partnership opportunities contact: funderud@seaweedsolutions.com

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Seagrass Tech (Carbon Capture/Biomass Solutions)

Activities: SEAGRASS Tech Private Limited is a start-up from India that produces dry algal biomass from marine algae solving three major problems faced by algae producers today: sustainability (seawater), productivity and scalability issues. Seagrass Technologies has developed a harvesting technology platform that uses non-potable water, such as seawater, and non-arable tsunami affected land to grow marine micro algae. Their Platform captures carbon dioxide in open raceway ponds which provide them with renewable solutions that can improve people’s lives and make the planet more green and sustainable. Seagrass team is committed to support and create awareness on the benefits of Algae to increase broader literacy for consumer acceptance AND promote “Green Planet Initiative” with sustainable practices and technologies that are environmentally sound.

Their Vision is to develop technology to grow high value added algal “green” products that are sustainable, scalable and profitable globally

They motivate their activities as under:

**Why Seagrass Technologies?**

* First company to produce three most needed value added Marine Micro Algae, using sustainable practices and technologies that are environmentally sound.
* Seagrass harvesting techniques will offer excellent nutrition content value and highest quality than any other brand in the market.
* All our Algae Biomass products will be organic certified, quality tested and compliant with international safety standards.

**Key Milestones:**

Building India’s first production facility to harvest and cultivate Dunaliella salina (DS) micro-algae, a difficult marine species that uniquely delivers a high concentration of β-carotene for Antioxidant & nutritional food supplements.

Their Promise:

* Delivering quality certified Algal Biomass with stringent quality control measures and process.
* Offer product grading & certification from industry leading test labs for safety and quality.
* Use of approved harvesting and cultivation methods recognized by international standards.
* Create awareness on the benefits of Algae to increase broader literacy and promote consumer acceptance.
* Promote “Green Planet Initiative” with sustainable practices and technologies that are environmentally sound.

Contact; <https://seagrasstech.com/company-overview/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Smart Oysters (Aquaculture Farm Operations Platform)

Activities: Their platform allows farmers to record stock movements, automatically schedule farm tasks and manage workflow through a simple intuitive interface. It is designed to be customisable, scalable and to automate as much data collection as possible. Smart-Oysters includes comprehensive farm management and executive management reporting dashboards. Smart-Oysters is designed for all aquaculture species including oysters, mussels, clams, seaweed & fin fish. smart-oysters-app-iphone.png

**Sense & Respond Farming**

Smart-Oysters has the flexibility to utilise sensor data to drive better farm management and security. In response to sensor data their platform is designed to alert managers, automatically re-schedule and assign tasks. Their goal is to increase farm productivity and de-risk operations. Smart-Oysters will offer complete plug and play sensor systems for collection of lease and land based environmental data, as well as security and machinery breakdown alerts through the Smart-Oysters Platform.

**Farm Finance**

Smart-Oysters farm finance will allow farmers to upgrade equipment, invest in new sustainable cultivation methods, and scale up operations based on farm practice and environmental performance. Their future Farm Investment Fund will assist sustainable farming operations of all sizes to grow and improve practices using non-traditional security including aquaculture leases stock on water and non-fixed assets (oyster baskets).

**Provenance & Ecosystem Services and certification**

Smart-Oysters platform will provide an historic geo-spatial and farm practice view of your farmed product and providing certifiable quality and certifiable provenance to protect your brand. Many aquaculture products have a beneficial impact on the local environment and the community. Smart-Oysters will use real time validation of farm practice, environmental and economic metrics to measure the ecosystem services of your farm business.

Contact; <https://smartoysters.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### The Fish Farm (South Africa patented micro-fish farms)

Activities: The Fish Farm was developed in response to observed environmental, economic and social trends in poor communities. With increasing urbanisation, high unemployment, rising transport costs, a deteriorating marine environment, and global warming affecting food security, we have to start thinking differently about how and where we grow our food. By growing food close to where the vast majority of people live, The Fish Farm positively addresses many of these dilemmas: “A community based social business in aquaculture”

They motivate their activities as under;

What the Fish Farm Achieves

For the first time globally, profitable small scale but intensive fish farming has now been introduced to the inner city and urban areas. From poor communities in small towns to large cities, the global growth industry of aquaculture is now available as a small business opportunity. Aquaculture, until now, has mostly been restricted to large, low-employment operations with fairly high financial and technical barriers to entry. Now, as an example, instead of one fish farm producing 400 tons of fish, The Fish Farm empowers 100 individuals or families to produce four tons each, profitably, right where they live. The result is the same – 400 tons – but more people and communities are involved.

Fish Farm Design

Design criteria for The Fish Farm required it to be modular (same design, repeated), lockable, transportable, affordable and profitable. The profoundly simple solution was to fit retired 6m and 12m shipping containers with a series of tanks, pumps and filters thereby turning the containers into micro-intensive fish farms. Water consumption is minimal, because it’s like a swimming pool – the water circulates through filters and back into the tanks, and if necessary, expelled high-nutrient water goes onto a vegetable garden or through a vegetable aquaponics system. ‘In fact, every veggie garden needs a Fish Farm! Put the clean tap or borehole water into the tanks, and let the fish fertilise the water before it goes to the veggies!’ With The Fish Farm the urban dweller can access the means of production, earn income, learn new skills and make a difference environmentally. Designed to be operated by a family, a co-operative or one or two people on a part-time basis, it is profitable, affordable, repeatable, transportable, lockable and stackable. Whilst reducing pressure on our marine environment through low-carbon-footprint protein production, The Fish Farm creates wealth and empowers poor urban and rural communities, delivers job creation and food security, and contributes to sustainable cities.

Contact: https://www.thefishfarm.net/why-fish-farming.htm

-------------------------------------------------------------------------------------------------------------

### Urchinomics (Sea Urchin Aquaculture and Kelp Forest Restoration).

Activities: Urchinomics is helping to restore kelp forests by removing and ranching overgrazing sea urchins, converting them into premium urchin roe (“uni”) to sell to top tier restaurants and consumers globally. Our Urchinomics process is revolutionising the aquaculture industry as it targets the Biological, Economic and Ecological factors which need to be addressed if fundamental change is to be made in how business is conducted. They engage fishers, ecologists and scientists to identify and remove empty, unproductive urchins that hinder kelp forests from recovering. Once urchins are removed, nature takes over and kelp begins to grow. In as short as 5 days, juvenile kelp will begin to settle on the substrate, with some species then growing as fast as 18 inches per day until reaching the surface. The restoration of the kelp marks the beginning of the recovery of the entire ecosystem.

Contact; <https://www.urchinomics.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 3. BIOFOULING:

### Biofouling Solutions -Australia

### Biofouling Management Solutions Platform

Activities: Biofouling Management Solutions provide Software for best-practice biofouling management. Cleaner ships, cleaner seas, cleaner skies. BMP+ is a biofouling platform that helps vessel owners, operators & regulators to:

* Manage the growth of organisms on ship hulls
* Reduce fuel use, and
* Reduce the spread of Invasive Aquatic Species (IAS).

BMP+ goes beyond the IMO Biofouling Guidelines whilst saving fuel costs, regulatory compliance delays & operational overheads.

**Smart Kart 6**: DIVER OPERATED HULL GROOMING AND CLEANING MACHINE

* Hydraulically powerful central thruster, for easy deployment and manoeuvrability
* Engineered to be reliable and tough
* Minimises diver fatigue
* Designed by experienced Divers for divers
* Spare parts available
* Worldwide Distributors
* Built in Australia

Contact; <https://www.biofoulingsolutions.com.au/smart-kart-6>

### Bio Pass (Blockchain Based Biosecurity Management Platform)

Activities: Biopass claims to be the worlds first blockchain-based biosecurity management platform helping to reduce biofouling risk, improve operational efficiency and protect global marine life. It uses artificial intelligence, IoT and blockchain to manage vessel biosecurity risks by tracking ship hull inspection and cleaning interventions from start to finish. Other Factors include increase risk of invasive species migration and translocation, reduced speed, increased emissions and reduced vessel performance. It increases maintenance costs. Changing IMO Guidelines make this a worthy response to consider to these emerging problems.

Contact: https://www.biopass.solutions/#features

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Clean Sub-Sea/ The Envirocart:

Activities: CleanSubsea is a Western Australian based company which owns all licenses and patents associated with a revolutionary new fully enclosed capture and containment hull cleaning technology called the Envirocart. GRD and Franmarine’s history and experience with in-water survey and inspections, was the rationale behind the Envirocart. The successfully tested Envirocart enables the complete in-water removal, capture and containment of marine biofouling from a vessels hull without damaging the antifouling paint or polluting the surrounding marine environment. The Envirocart has already been the recipient of many awards, including the prestigious 2013 and 2014 Golden Gecko awards for environmental excellence, the 2014 Lloyd’s List Australia Environment Transport Award and 2014 Lloyds List Asia Environmental Award.

They motivate their activities as under:

The Envirocart is the only in-water hull cleaning technology on the global market that is capable of meeting the current water discharge quality guidelines and the new Australian Department of Agriculture, Fisheries and Forestry (DAFF) In-water Hull Cleaning guidelines. This innovative technology tested and supported by the required regulatory certifications in hand, removes the very costly and time-consuming exercise of dry-docking commercial vessels for hull cleaning. This in turn enables a viable, regular, in-water cleaning maintenance protocol that significantly reduces fuel consumption and carbon emissions, in the maritime sector. Envirocart In Water Hull Cleaning activity has received Operational Planning Approval from the Fremantle Port Authority and is registered with the Department of Water and Environmental Regulation, while the company also works closely with the Department of Fisheries. CleanSubsea has completed a number of commercial cleans and is working through its final optimisation process as it prepares to manufacture further units to establish operations in other locations. CleanSubSea believes the Envirocart will revolutionise the international hull cleaning industry as we know it today.

Contact: <https://www.cleansubsea.com.au/about-us>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Fleet Cleaner (Vessel Biofouling Cleaning Robots)

At Fleet Cleaner, they believe in a world where ships sail without fouling. Fouling on ship’s hulls increases fuel consumption, harmful emissions and results in the transport of alien invasive species: its global impact on the economy and environment is huge. Fleet Cleaner will reduce its impact to zero, offering worldwide hull cleaning services to ships just before sailing. When high quality cleaning without downtime for the ship operator becomes as normal as taking bunkers, ships will sail without fouling.

Activities: Fleet Cleaner develops and leases cleaning and inspection robots for ships to service providers in port. The robot is able to remove fouling (slime, algae, barnacles) from the ship’s hull, which saves significant fuel cost for shipping companies. Fleet Cleaner leases the robot including support system and qualified operator to its clients. Fleet Cleaner clients offer ship cleaning services in ports to shipping companies. Providing safe and sustainable ship hull cleaning & inspection services during loading and unloading in ports.

Contact; https://www.fleetcleaner.com/

### \_\_\_\_\_\_\_\_\_\_ Graphite Innovation and Technologies (Marine Biofouling, Noise and Emission Reducing Coating)

Activities: This company believes that the commercial value of graphene lies in the ability to transfer its intrinsic properties into other materials, thus creating higher value materials and products which possess specifically enhanced characteristics. As a disruptive technology, graphene has the potential to replace or enhance the performance of existing materials in a wide range of applications and sectors. We are Canada’s leading materials engineering firm focused on using graphene to deliver solutions for a wide range of applications.

**Marine Shipping**

Biofouling management can be an effective tool in enhancing energy efficiency and reducing air emissions from ships.

**Hydro Power**

Reservoirs and hydropower facilities are plagued by biofouling species, resulting in costly maintenance and repairs.

**Aquaculture**

The fouling of cages and netting, which is costly to remove, is detrimental to fish health and yield and can cause equipment failure.

**Yacht Racing**

Smooth hull and aero flow through the water is just as important to boat speed as the sails and ondeck systems, but it is an area that is often overlooked.

Contact: <https://www.grapheneenterprise.ca/about/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Harsonic (Sustainable Antifouling Solutions)

Activities: Harsonic has developed an electronic device based on soft cavitation (ultrasound) as an alternative to chemical cleaning. At the moment there is no permanent mechanical solution to remove biofilm. HARSONIC is a biofilm control system in which ultrasonic vibrations are spread by transducers into a liquid. These vibrations prevent microorganisms to attach to the walls and to form a biofilm. Ultrasonic vibrations can cover very long distances. The effectiveness of the vibrations is reinforced by the systems patented technology, which makes it the only solution against resistant biofilm. Thetechnology is patented and proven to deliver optimal results. The device is a real-time, 24/7 solution, prevents bio-fouling and offers a curative solution against biofilm. HARSONIC ultrasound biofilm control system is suitable for all water and other liquid nutrient transportation lines avoids the attachment of biofilm reduces or even totally avoid the usage of chemicals and antibiotics

They motivate their activities as under:

The widest range of applications within a big market range. The strongest ultrasound device on the market. ‘Our maturity level depends on the reformation of the sales-structure. Our current structure and limited team capacity delimits the sales potential. However, we trust that a joint-venture schema with a larger company active in the same market segment could double our sales rate’.

Harsonic is a sustainable antifouling device that has a direct positive environmental impact as antifouling paints are one of the biggest ocean pollutants. Harsonic® offers you the whole package for maintenance free boats, pipes, tubes and water tanks. Biofilm removal without chemicals

Contact: <http://www.harsonic.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Hull-Skater (Jotun (Biofouling Cleaning Robot/Marine Coatings)

Activities: Hull Skater have a completely new innovation for keeping the hulls of large vessels free from fouling. With Semcon as a technology partner, Jotun, ‘the world leader in marine coatings’, is contributing to reduced emissions and healthier oceans through its revolutionary Hull Skating Solutions (HSS).

If 25% of ships in challenging operations convert to HSS by 2030 (same as Jotun’s share of total antifouling market today), this would result in a CO2 emissions reduction of at least 10 million tons per year – equal to around a quarter of total Norwegian CO2 emissions in 2018. This means that if all ships in challenging operations converted to HSS, this would result in CO2 emissions reduction of at least 40 million tons per year – equal to the total Norwegian CO2 emissions in 2018.

**Benefits**

* Full operational flexibility with unlimited idle days
* Reduced fuel costs through a consistently clean hull and market leading hull performance
* Reduced environmental footprint through improved fuel consumption giving lower greenhouse gas emissions
* Reduced risk of spreading invasive species through early removal of hull fouling at its geographical origin
* Hull state verification capabilities available 24/7

Contact; <https://www.cnn.com/travel/article/robot-hullskater-biofouling-ship-cleaning-spc-intl/index.html>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### i-Tech AB (Marine Anti-biofouling agent Selektope).

Activities: I-Tech AB is a public held bio-technology company based in Mölndal, Sweden that owns all IP and regulatory rights to the antifouling agent Selektope® (generic name, medetomidine). I-Tech also controls the largest and most efficient source of medetomidine production. Since 2006, I-Tech has successfully transformed the scientific invention of Selektope® into a commercially ready and available antifouling agent. I-Tech is not a marine coatings manufacturer, instead they supply Selektope® to marine coatings manufacturers for inclusion in antifouling products. I-Tech’s quest to find, develop and commercialize a hard fouling prevention technology alternative commenced in the wake of the IMO decision to ban the application of tributyltin (TBT)-based paints on vessels as of 1 January 2003. The I-Tech ‘Eureka’ moment yielded an organic, non-metal compound named Selektope®. This innovation milestone for the industry was subsequently followed by 15 years of trials, and exhaustive regulatory hurdles. The business concept is for Selektope® to take a significant role in vessel performance optimization by offering the technology to the global paint industry as the principal active agent in marine antifouling paints. I-Tech’s vision is to establish Selektope® as the leading alternative biocide to prohibit marine growth in an effective and sustainable way.

**What is Selektope®?**

Selektope® is a bio-repellent ingredient for marine coatings that offers superior hard fouling prevention performance for ships. With a first of its kind mode of action in marine coatings, Selektope® protects ship hulls from barnacle settlement. This technology offers a new approach to fouling prevention that deliver state-of-the-art anti-barnacle performance while leaving room for marine coatings manufacturer innovation for existing and future industry demands. Selektope®, is an organic, non-metal compound that delivers unrivalled efficacy at minute concentrations of 0.1% w/w in a marine coating.

Selektope® conforms with global regulatory schemes and Selektope®-containing products adhere to IMO antifouling guidelines. The biocide has received approvals in all leading markets for new builds and dry-docking including China, South Korea and Japan. In the EU, Selektope® has been approved for all relevant use-types l. For Africa, South America and the rest of Asia, no registration is needed for the use of Selektope®.

They motivate their activities as under:

The biofouling issue: The variety among biofouling organisms is highly diverse and extends far beyond attachment of barnacles and seaweeds. According to some estimates, over 1,700 species comprising over 4,000 organisms are responsible for biofouling which occurs in all oceans around the globe. Barnacles are a global species that pose great threat to vessel operations and maintenance due to their rapid accumulation on the wetted surface of ships. Present in all marine and brackish waters, these crustaceans, once established, attract other barnacles to form colonies. When attached to a ship’s hull, their shells cause microturbulence, significantly increasing drag which is directly related to increased fuel consumption and carbon emissions. Once attached to a ship’s hull, barnacles must be mechanically removed – creating a headache and cost for the ship operator.

Fouled hulls act as vehicles of transportation for invasive aquatic species. There is a growing regulatory movement against the transportation of invasive species via bio-fouled ships and the issue is being addressed on a regional-basis and through IMO. The result of increased regulatory attention will be more hull inspections prior to port calls and increasing vessel detentions. Vessels are already being refused entry from certain ports due to their heavily fouled hulls.

Biofouling is increasing. Although marine biofouling occurs in all oceans, the fouling risk is different in different areas. In general, tropical or sub-tropical waters are considered high risk areas with rapid growth and settlement of organisms. With average global water temperatures increasing, high risk fouling is expanding, covering larger areas. Since the 1990s, trade patterns have shifted and a dominating portion of seaborne trade is frequenting ports located in warmer waters.

The impact of biofouling: The existing fleet is estimated to consume 350 million tonnes of fuel per year, emitting 1.1 billion tons of CO2 and over 10 million tons of SO2. If leaving hulls unprotected, the fuel consumption would increase by more than 40% on average on the world fleet due to the sharp increase in surface roughness caused by marine fouling. Yet, it is commonly believed that there is a potential to improve another 10% on average driving development of new, more efficient and environmentally sound coatings. If successful, approximately 30BIL USD may be taken out from the operating costs of the world fleet, not to mention the emissions to air and the reduced risk of carrying invasive aquatic species hidden on a fouled hull.

Superior static performance needed: The issue of biofouling is becoming an increasingly dominant issue for some Asian shipyards, with newly launched vessels laying idle in warming waters, suffering the effects of intense fouling during the ship outfitting process. This accumulation of biofouling on the hull can impact both the newly applied coating and the ship performance of a newbuild ship leaving the yard. Shipyards are pushing for antifouling solutions that ensure static performance during outfitting. Ship owners need marine coating solutions that deliver fouling prevention for vessels with differing activity levels, whether in constant active service, idle, or fluctuating between the two. Coatings that can cope with conditions in the biofouling “red zones” in which their ships operate, where water temperatures can be high and fouling can be problematic if a ship is at anchorage for three to four weeks, for example, need to be selected. Marine coatings that contain Selektope®, a technology that ensures both superior static and in-service performance, are the only answer.

Contact: <https://i-tech.se/selektope/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sonihull (Ultrasonic Anti-Biofouling Solutions)

Activities: Sonihull claims to be the market leading Environmentally friendly Ultrasonic Antifouling system for all marine markets. Sonihull not only cleans the hulls of vessels, it also provides protection to Sea Chests and suppresses the build of algae within Bio Fuels. Sonihull also provides applications for all Marine structures including Oil & Gas. Sonihull antifouling systems use the power of ultrasound to protect the inside and outside of marine vessels and structures from unwanted marine growth. Unlike conventional antifouling coating systems, Sonihull does not release poisonous biocides that kill marine organisms or use ablative coatings that leave microplastic pollution in their wake. Sonihull keeps surfaces clear using ultrasound-induced non-inertial cavitation, which disrupts the biofouling process and actively prevents barnacle and mussel attachment.

The Sonihull Ultrasonic Anti-fouling System is a Fit & Forget solution for hulls, marine structures, box coolers, sea chests, strainers ... wherever there is unwanted bio-fouling. The Sonihull system prevents marine organisms from colonising solid surfaces that are exposed to raw seawater. Unlike biocidal coatings and impressed-current systems, Sonihull is low cost and low maintenance, with zero poisonous environmental legacy. Fitting is very easy, there's no need to drydock and drain your box coolers, there's also no drilling, welding, or expensive copper anodes to replace regularly. When compared to impressed-current antifouling systems, the Sonihull system can reduce capital and MRO costs by up to 95%.

They motivate their activities as under:

Every year, biofouling is estimated to add $60-100 billion to commercial shipping costs. This includes increased fuel-consumption, drydocking costs, remedial measures and revenue lost due to regular maintenance and downtime. On hard surfaces in contact with raw seawater, the biofouling process can start in as little as 15 minutes. It starts with the settlement and build-up of slime and soon progresses to algae, weeds and then molluscs. When marine fouling grows on the outside of a ship's hull, hydrodynamic drag increases which causes fuel consumption to rise. On the inside of a vessel, marine fouling will reduce cooling water flow and lead to major equipment failure if left unchecked. On offshore structures like oil rigs and wind turbines, marine fouling will increase weight and hydrodynamic loading. Marine fouling will also account for around 30% of lifecycle corrosion in marine structures. For decades, ultrasound has been used in the food, brewing and hydroponic farming industries to prevent algal blooms and to keep water-handling equipment clean and free from blockages. Traditionally, poisons (biocides) have been used to kill organisms that settle on raw seawater surfaces like hulls and box cooler pipework. Environmental legislation covering the use of poisonous metallic biocides in antifouling systems is tightening and marine-based industries are looking for more effective means of preventing unwanted marine growth on their vessels and inside their equipment.

Our technology: NON-INERTIAL CAVITATION

Sonihull’s mission is to deliver environmentally safe, cost effective anti-fouling wherever unwanted bio-fouling persists. Our vision is:

* To make dosing the oceans with poisonous biocides and microplastics a thing of the past
* To deliver effective anti-fouling systems using the power of ultrasound
* To save the oceans, one ship at a time

CONTACT INFORMATION

Contact: <https://sonihull.com/> +44 2476 105 150; info@sonihull.com

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Symbytech (Underwater Hull Cleaning Drone)

Activities Growing up along the coast and witnessing the polluted state of the waters, Grant du Toit knew he would one day do work related to the ocean environment. As an electronics engineer, he has spent many years working with remotely operated vehicles (ROVs) in an underwater setting, and has now brought that experience to SymbyTech, a company he has founded to help reduce the greenhouse gases being emitted by ocean vessels. The robot he and his team are pioneering is an underwater drone that inspects and cleans the hulls of ships. Biofouling grows on the hulls, meaning the accumulation of micro-organisms like algae and bacteria on submerged artificial structures. This layer upon layer of undesirable growth causes a great reduction in the speed with which a vessel is able to glide through water. Because the increased drag slows boats down, hence they need to burn more fuel to go faster, resulting in an increase in greenhouse gases. The solid component of these gases, which ends up in the water, adds to the ocean acidity, destroying coral reefs that are essential for marine life, and contaminating fish consumed by humans. Although the SymbyTech underwater drone is still in its prototype phase, Grant has ambitious dreams for making it a tool international vessels can use in a proactive manner. “I would hope to have it located in many major ports, grooming vessels regularly to prevent the problem of biofouling before it even occurs.” They develop multifunctional and adaptable solutions for man and machine that deliver cost and environmental benefits to the maritime, oil & gas, and renewable energy industries, efficiently.

They motivate their activities as under:

They are inspired to develop solutions that perform in a symbiotic manner; the harmony of technology, man and machine delivering solutions that perform better and more efficiently. At SymbyTech, they are underpinned by a strong belief in delivering products and solutions that are practical, economical and offer world-class environmental benefits. Their investment in research and development provides answers to your maritime needs that require less capital outlay and improve your speed to market. Their flagship drone, can be scaled, be made fit-for-purpose to our client’s requirements and deployed into the field rapidly. Grant du Toit is a certified electronics engineer who has over more than a decade of hands-on experience in the oil and gas, subsea mineral research and renewable energy industries. Running and maintaining remotely operated vehicle (ROV) operations he has sought to develop solutions for the industry he loves that deliver more efficiently and cost-effectively and care for the environment. Merging these passions in a symbiotic way has led to SymbyTech. Their passionate team of engineers, programmers and designers have been hard at work developing multifunctional industrial robotic devices. These devices carry out numerous tasks that used to require large teams of personnel and costly equipment.

Contact: <http://symbytech.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 4. BIOTECHNOLOGY

### Aker Biomarine (Aquaculture Biotechnology, Krill and other Health/Nutrition Products)

Activities Aker BioMarine, develop krill-based ingredients, rich in the omega-3 fatty acids EPA and DHA, for nutraceutical, aquaculture, and animal feed applications. Krill is one of our planet’s largest biomasses. This tiny crustacean, present in all oceans, holds a vital position in the marine food chain. Through millions of years of evolution, krill’s bioactive components and molecules have sustained Nature’s diverse species. Here at

They motivate their activities as under:

‘In a world where just 3 percent of the population has adequate levels of omega-3, krill provides an easy means with which to reach optimal levels of EPA and DHA. Adequate omega-3 intake is considered important to maintaining a healthy lifestyle that can help prevent non-communicable diseases. Krill is a unique omega-3 option that offers many health benefits, plus it is 100 percent traceable, certified sustainable and comes from the pristine waters in the Southern Ocean. It offers health benefits for the heart, joints, skin, brain and much more.’

Contact: https://www.akerbiomarine.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Algae-C (Algae Biosynthetics and Derivative Products)

Activities Algae-C work with microalgae, one of nature’s most efficient and versatile organisms. Their Technology Platform leverages algae’s intrinsic abilities to produce the lowest cost, highest-quality and most sustainable plant derived APIs. They claim to be the largest algae biosynthetic company in North America, with over 30 dedicated researchers. Their technology enables the production of high-value plant-derived active pharmaceutical ingredients (APIs). Their molecules can be used for a variety pharmaceutical, nutraceutical, sport, and therapeutic products. Their first products are algae-derived cannabinoids, precisely tailored to meet their customers' needs.

* 95% Lower Production Cost
* 99%Water Recycling
* 90% Lower Environmental Footprint

Contact: <https://www.algae-c.com/our-platform>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Alga Energy (Microalgae Biotechnology)

Activities: AlgaEnergy is a biotech company exclusively focused on microalgae, which consolidates in one vehicle almost 5 decades of research in this field of science. It has spent its first 8 years exclusively doing research, scaling up technologies and developing microalgae-based solutions for different sectors. The company is managed by a team of reputed entrepreneurs and scientists and backed by two minor shareholders of reference that are amongst the Global 100 Most Sustainable Corporations. It is a multi-awarded company, with an innovations network comprised of 150 research partners across the world. The company produces microalgae and extracts valuable compounds thereof to produce agricultural biostimulants. It is the first company in the world focusing on microalgae applied to agriculture.

They motivate their activities as under:

Microalgae, a quality raw material with an immense potential of application…

* Rich Composition
* High Productivity
* Do Not Need Fertile Land
* Omega-3 Source
* They Capture Co2
* Great Adaptability

The problem we are solving: Greater agricultural yields (double-digit), optimized qualitative traits and increased resistance to abiotic stress (drought, extreme temperatures, etc.) Sustainable impact on blue economy: Reduces carbon emissions, increasing carbon capture, reducing the negative impact on the biodiversity

Technology readiness level 19

They are in the process of implementing their international expansion plans and are experiencing very fast growth in different countries, in particular in India, where they will harvest the majority of the revenues in the coming 24 months.

Contact: <https://www.algaenergy.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Algae-Pro

Activities AlgaePro is developing technology for cultivating sustainable microalgae through circular bioeconomy. With their mother company, Greentech Innovators AS, their aim is to recycle biowaste, CO2 and waste heat to fuel the microalgae cultivation. They utilise marine biotechnology to convert and ferment food waste into fertiliser, animal feed, oil, and other products. Their forthcoming aims are to attain full commercialisation via the following 4 stages.

1. 1: A pilot project for research and development.
2. 2: A Demo plant for 1000 tons of organic waste
3. 3: A Full Scale Plant for processing 30,000 tons of food waste.
4. 4: International Expansion In Cooperation with Local Waste Management Companies

Contact; <https://www.algaepro.no/>

### Algi-Knit (Kelp Based Textiles)

Activities: AlgiKnit is creating eco-conscious, renewable yarns for the circular economy. They’re developing durable yet rapidly degradable yarns from kelp, one of the most regenerative organisms on the planet. Their material aims to be built for everyone: a functional and accessible resource without environmental harm. They’re envisioning a future where the textile industry operates in a closed-loop product lifecycle, utilizing materials with a significantly lower footprint than conventional textiles.

“Kelp is one of the fastest growing organisms on earth -- up to 10 times faster than bamboo. “AlgiKnit’s production process has a minimal carbon footprint and fits into a closed loop life-cycle, utilizing materials that are non-toxic, and even safe to ear. When the material wears out, rather than adding to landfills, it becomes food for microorganisms and animals in the ocean and on land”.

Contact: <https://www.algiknit.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Algix

Activities: ALGIX® is a clean technology company finding creative answers to eco-questions.

They help existing industries rely less on environmentally harmful processes and materials by researching and developing brand new technologies to fill in those gaps. They also help sustainability-focused brands source innovative materials to help them achieve their goals and bring new eco-conscious products to market.

They motivate their activities as under;

In 2007, Ryan Hunt began researching algae technology as a way to solve emerging problems with pollution in our environment. He believed that algae could be used to help remove the harmful levels of phosphorus and ammonia present in industrial and agricultural waste-water that is causing ecologically harmful algae blooms and water quality issues. However, after years of research, he discovered that the protein-rich algae biomass, when placed under significant heat, pressure, and time, underwent a plasticization process. In 2010, Ryan teamed up with Mike Van Drunen, an engineer and entrepreneur, co-founding Algix, beginning the mission to use algae as a means of cleaning the environment while providing algae-based sustainable materials to the world.

Algix spent 2 years developing and refining the extrusion process, as well as developing a harvesting and drying technology, thus creating a commercially viable operation. Algix connected with governments, universities and private companies that were researching algae biotechnology, building a network of algae suppliers. In 2014, Algix secured a 70,000 sq. ft. modern manufacturing facility in Meridian, Mississippi: the heart of catfish country, where they could research and utilize algae from both lakes around the world and right in their backyard. In 2016, BLOOM, an Algix brand, launched the world’s first algae-blended EVA to the footwear industry as a sustainable ingredient in flexible foams for high rebound applications such as shoes, sporting products, and accessories. Their first footwear launch was the Vivo-barefoot Bloom Ultra III water shoe. It featured algae foam as the injection moulded upper to showcase the Bloom material in a highly visible way. Since then they have partnered with countless brands for everything from shoes to surfboards, helping them design eco-conscious products that have an active positive impact on the environment. They are looking forward to years to come of exciting innovations and partnerships. ‘Join us on our mission to help the footwear industry Tread Well’.

Contact; <https://www.bloomtreadwell.com/the-bloom-story/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Algalife (Algae Based Sustainable Textiles/Biomaterials)

Activities: Algalife develop innovative natural and healthy pigments and fibres, from the same microorganisms - algae. Algalife explores a holistic and sustainable development of new materials which positively affect both the environment and the human skin. It deals with relationships between biology, technology, man and nature, which are all intertwined to bring new sustainable solutions for the fashion industry. They are developing from the microorganism algae, which is renewable and healthy microorganism, new and innovative pigments and fibres that will dramatically change and reshape the fashion industry. The algae comes from a unique ecosystem and its valuable substances such as proteins, vitamins, anti-inflammatory and antioxidant, are released to the skin moisture when worn and offers nourishing and protection to our body and skin.

They motivate their activities as under:

The Textile of tomorrow

* 100% Chemicals And Pesticide Free
* Solar Energy
* Health Properties
* Biodegradable & Renewable Sources
* Water Reduction
* Zero Waste
* Textile is the second polluting industry in the world.
* 20% of global freshwater pollution caused by the dyeing process of textile.
* 10% of the chemicals in our clothes transfer to our skin and body.

The solution lies in Bio-tech-textile: innovative natural and healthy pigments and fibres, from the microorganisms the algae.

* ‘Our uniqueness lies in our innovation:
* Endless possibilities of colours (pigments) and fibres.
* Health properties – Protect and nourish our body and skin
* Renewable resource and biodegradable.
* fast growth rate, economically and efficiently.
* Disruption in the supply chain with zero waste.’

Contact Details: https://www.alga-life.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Aqua Biotechnology ASA (Cosmetics, Skincare, Dermatology From Algae/Other Products)

Activities: Aqua Bio Technology (ABT) is a driving force in the skin care industry’s green shift. They develop new active ingredients for skin care. Their ingredients are meeting an increasing demand from the cosmetics industry. All their ingredients are based on natural and sustainable substances, found in plants, algae and in the oceans. They are sustainable alternatives to petroleum based ingredients, which often have negative impacts on human health and the environment.

* ABT also markets and distributes natural and ground-breaking skin care products to consumers, retailers and professionals in Europe and the Middle East.
* ABT is well positioned in the fastest growing segment of the rapidly expanding cosmetics industry.
* Aqua Bio Technology ASA is listed on the Oslo Stock Exchange’s Axess market (ticker: ABT).

They motivate their activities as under:

Reaching out to the consumer: skin care is the fastest growing segment of the rapidly expanding cosmetics industry. Europe is one of the world’s largest markets for such products and the Middle East is one of the fastest growing markets. ABT holds marketing and distribution rights for Europe, Middle East and Africa (EMEA) for the products of two manufacturers of natural skin care products. The ABT portfolio of skin care products contains exclusive and high-end products as well as off the shelf products. They are distributed over the Internet, in stores and through professional channels such as skin care clinics.

Moana: Organic skin care: Moana of New Zealand has developed a broad portfolio of skin care products based on a variety of natural technologies and sources, ranging from the rain forests of New Zealand to the South Pacific. By combining knowledge held for centuries by the indigenous Māori people with modern biotechnology, Moana has succeeded in developing natural skin care products with astonishing effects.

Čuvget- Arctic skin care: ScandiDerma of Norway has developed the Cuvget series based on the chaga fungus, found on birch trees in the Arctic. Chaga contains powerful antioxidants with a number of positive features, including highly positive effects on the skin. The indigenous Sami people of the Arctic have known the secrets of chaga for centuries. The substance has been refined and is sold by ABT as a serum ampoules and as an active ingredient of the Cuvget day and night cream.

Contact; https://aquabiotechnology.com/pages/technology-by-nature

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Aquammodate/Water Purification

Activities: Aquaporin proteins are water channels that selectively facilitate water transport across the cell membrane of all living cells in an energy-efficient way. Aquammodate have developed a bioinspired method to stabilize aquaporins in order to make use of their extraordinary features in water purification and treatment processes. The key stabilization components are lipids and silicon dioxide (silica). The lipids are dual purpose since they both mimic the natural environment of the aquaporins and act as the impermeable component in the filter. Silica provides the biological components with mechanical and chemical robustness while preserving their structure. For details, see the PhD thesis that is downloaded by clicking the illustration on their website.

They motivate their activities as under:

Incorporating natural water purification into filters: they have conducted academic research since 2013 with the aim to harvest the incredible potential of natural water purification. Their patent-pending water purification technology has developed over the course of a PhD project within Chalmers University of Technology. Aquammodate was founded in 2019 with the aim to bring this technology for energy-efficient and high purity grade water purification to people and industry in need. They are situated in Gothenburg on the Swedish west coast.

Contact: <https://www.aquammodate.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Aquatic Biologicals (Aquaculture Pathogen Biobank, Vaccines and Phage Therapy/Medicine Solutions)

Activities: Aquatic Biologicals is focused on Aquaculture Health. It has 3 main axes of activities: (i) Advanced diagnostics with the use of modern high-end tools (-omics) and collection of pathogens (biobank), (ii) development and production of autogenous vaccines for aquaculture and (iii) phage therapy. Aquatic Biologicals offers expertise and services needed for the sustainable development of aquaculture aiming to the prevention of diseases, minimization of antibiotic use, promotion of alternative and personalized medicine. Currently, Aquatic Biologicals is looking for private investment to build GMP compliant facilities for the manufacturing of its products.

They motivate their activities as under:

Aquaculture is the fastest-growing food industry; however, diseases are a major impediment for their growth. Introduction of new cultured fishes (diversification), increasing demand for food supply (intensification) and climate change are challenges that eventually lead to novel pathogens requiring innovative solutions. The pharmaceutical industry is very reluctant to invest in licensing new therapeutics and new vaccines since aquaculture is relatively small and rather fragmented. Aquatic Biologicals fills in the gap created by the lack of commercially available products. They develop and produce innovative, customizable, eco-friendly technologies such as autogenous vaccines and phage therapy to combat diseases in a sustainable manner.

Sustainable impact on blue economy: Support of the sustainable aquaculture production by minimizing disease impacts and offering alternative tools to reduce antibiotic use with positive impact for the aquaculture industry, the consumers, and the environment. In Aquaculture, phage applications have enormous potential since phages can selectively exclude unwanted pathogenic bacteria from delicate environments such as those of fish hatcheries without affecting beneficial bacteria and thus disturbing microbial equilibrium and they leave no residues since they are self-restricted. Phage therapy is a natural biological way of controlling bacteria that could be compatible with organic farming.

Contact: <https://www.aquatic-biologicals.com/about.html>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Atlantic Sapphire (Bluehouse System for Salmon/Other Species)

Activities: Atlantic Sapphire raise salmon in a revolutionary Bluehouse system; the equivalent of a green house where fish are given ideal conditions to thrive. The water is always crystal clear as it is purified by a state of the art filtration system and the fish are free to swim against strong currents like they do in nature which helps them grow strong and healthy. This ensures that the salmon that arrives to your kitchen table is of the highest quality with the lowest environmental impact available anywhere in the world.

Contact: https://atlanticsapphire.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Biotech Marine (SEPPIC -Marine Biotechnology Products)

Activities: Located on the north coast of Brittany (France), near the Bréhat archipelago, BiotechMarine is their production site dedicated to wesource™ cosmetic active ingredients derived from marine biotechnologies (dedifferentiated marine plant cells and macroalgae cells) and seaweed or marine plant extraction. These marine active ingredients are intended for skin and hair care products. BiotechMarine selects marine plants and particular algae on remarkable sites, with an approach that respects biodiversity. The Bréhat archipelago is home to an exceptional marine flora, with over 800 species of algae and hundreds of species of marine plants. A true "Underwater Amazon," it is one of the most remarkable sites in the world due to its variety of algae favoured by the interplay of several factors:

* The purity and quality of its waters
* The confluence of a warm, nutritious current, the Gulf Stream from the Gulf of Mexico, and a cold, pure current, the North Stream from the North Sea
* An ecosystem conducive to the development of unique secondary metabolites by algae and marine plants related to environmental stresses.
* The site has four manufacturing units. It also houses innovation laboratories dedicated to marine active ingredients.

It is ISO 9001:2015 and RSPO certified and is being EFfCI certified. 100% of the ingredients are Halal certified and 100% of the ingredients whose production uses palm oil derivatives are Mass Balance certified.

* 39 employees on site
* 60 marine active ingredients
* 40 species of algae and selected marine plants
* 3.5 hectares surface area

BiotechMarine, a Seppic subsidiary based in Brittany (France), has developed several biotechnologies from algae and marine plants to create and produce marine cosmetic active ingredients for the wesourceTM brand. Culture of dedifferentiated cells from marine plants or macroalgae cells in a bioreactor not only preserves marine resources, but makes it possible to explore the full potential of these resources.

Contact: https://www.seppic.com/en/about-us/production-sites/biotechmarine-france

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Bluevert (Algae Based Cosmetics)

Exploring the potential of macroalgae: The Bréhat archipelago, also known as the “Underwater Amazon”, is a hot spot for biodiversity with thousands of species. The composition, and effects on the skin, of a wide variety of macroalgae can be explored in the laboratory. Biotech Marine has chosen to focus on lesser-known species. It is estimated around 9,000 macroalgae species exist worldwide, including 1,800 brown macroalgae, 6,000 red macroalgae and 1,200 green macroalgae. Less than 1% of these are valorised in cosmetics due to the low accessibility of biomass and the difficulty of cultivation.

Activities: Bluevert apparently is the first company capable of encapsulating the absolute of the sea – Plasmarine - a patented complex derived of marine microalgae. Marine microalgae carry many beneficial properties for health and nutrition and are heavily conquering the world of cosmetics. Behind the Bluevert is Buggypower, the world’s largest producer of marine microalgae in closed circuit.

PLASMARINE™. The marine absolute®: A powerful concentration based on marine microalgae, Plasmarine makes a unique and innovative debut into the cosmetic world. ‘A matchless product in the world of cosmetics, with the ability to repair cell damage and rapidly reverse the signs of ageing.’

Contact; https://bluevert.com/plasmarine/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Buggy Power (Mini Algae Closed Photoreactor Systems)

Activities: Buggy Power are a biotechnology company that produces marine microalgae in closed photobioreactors, a true “spa” to these microorganisms. They ‘do in a dedicated, rigorous and sustainable manner, what nature has been doing perfectly for thousands of years.’

They design, build and operate marine microalgae biomass production units. Evolving from the initial model that focused on biofuels, CO2 capture and full treatment of Greenhouse Gases, by integrating proprietary processes they can now generate biomass and high quality bio-compounds focused on food, feed and cosmetics.

A proprietary production technology:

* 8-meter high closed photobioreactors
* Air-lift system
* Optimizing the capture of solar energy
* Excellent control of the cultivation parameters

Contact; http://www.buggypower.eu/how/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Celtosome™, culture of dedifferentiated cells from marine plants

Activities: Celtosome is involved in the culture of plant cells and microalgae for use in the neutroceutical and cosmetics industry. They have an innovative approach to develop sustainable marine active ingredients from macroalgae.

Marine halophyte plants are naturally exposed to stressful conditions such as salinity and exposure to UV radiation. Their specific defence mechanisms developed in response makes them an unparalleled resource when creating effective active ingredients for skin care. The dedifferentiated cells of marine halophyte plants are reproduced and cultivated in bioreactors. Transformed into active ingredients, they can deliver exceptional performance as part of cosmetic formulas. What makes dedifferentiated cells special is their very absence of any character of specialization and their potential to contain all components of the plant. Dedifferentiated cells are both able to self-renew at an undifferentiated stage, and to differentiate in all cell types through regenerating an entire plant – depending on the conditions of cell culture. Each type of metabolism generates specific metabolites. Dedifferentiated cells behave like a ‘molecule factory’, waiting for the appropriate culture conditions to synthesize targeted active ingredients, in potentially different compositions to the original plant.

Celtosome™, a sustainable culture technology, undertakes the culture of dedifferentiated plant cells comprising several stages of growth in sterile conditions. The first step is to obtain dedifferentiated cells. Thin sections of plant tissue are cut from a fresh plant under sterile conditions and placed in a solid culture medium. This is specific to each plant species and guarantees the newly generated cells remain in a dedifferentiated state. This cell aggregate is designated by the term callus, and removed and transplanted onto a fresh solid culture medium. The callus subculture is repeated until its structure is smooth and dispersible in liquids. Second, small fragments of the callus are transferred to a liquid culture medium that is constantly stirred to disperse the cells. Successive culture stages take place in a photobioreactor for intensification. In the final step, drawing on our expertise in phytochemistry they select the most consistent form that can guarantee the maximum stability and bioavailability of natural active molecules. Examples include the centrifugation and lyophilization of cell cultures, the production of lysates, or plant extraction.

Celebrity™, the culture of macroalgae cells:

Macroalgae are commonly used for nutraceuticals and cosmetics because they contain biologically active compounds, known as metabolites. For their culture, ingredients are produced in bioreactors from macroalgae that are kept in a cellular state throughout the entire production process. The process begins with the selection of macroalgae cells in the laboratory, collected from a drop of seawater, shells, rocks, or other colonized algae from which monospecific cultures are obtained. The cells are then cultured in photobioreactors with an intensification process that produces the biomass on an industrial scale. It is essential to control conditions such as salinity, nature of the nutrients, agitation, introduction of gas, and temperature during culture to ensure optimal biomass production. The biomass is then shaped to create the active ingredient: a cell concentrate.

Contact: https://www.seppic.com/en/technologies/marine-biotechnologies

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Cuan Tec (Antibacterial, Plastic-Free Film and Packaging)

Activities: CuanTec has invented a low-energy way to convert marine waste into high quality materials that make revolutionary plastic-free film, to be used as an alternative to the plastic film we use to protect fresh food. It is also antimicrobial, so it keeps food fresher for longer. It biodegrades beautifully, so not only does it convert a waste product into something valuable and useful, it also doesn’t harm the planet when you’re finished with it. CuanTec developed a gentle, biological process to convert marine and aquaculture waste into high quality chitin and chitosan, which can be made into this environmentally-friendly and sustainable protective film for fresh produce. When the film breaks down, it is non-toxic.

They motivate their activities as under:

CuanTec’s mission is to work in harmony with our natural environment to reduce the human impact that food waste and plastic pollution have on our world. They have developed a method to extract the natural product chitin from different sources of waste from the food industry. They use this chitin to develop their formulations to create alternatives to single use plastic, creating new materials that work in harmony with the environment. Chitin and its derivative, chitosan, have fantastic properties. Their team has wide-ranging knowledge and expertise about how these natural resources can be formulated into a number of different products that are of interest to the food and pharmaceutical industries, as well as in medicine. Chitin is typically found in species with an external shell, like insects and shellfish (crabs, prawns, langoustine etc.), but also in mushrooms. They aim to have a zero-waste business and that starts by using waste from the food industry (shell waste from langoustines for example).

Contact: <https://www.cuantec.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Cyanotech (Health Based Products Through Hawaii Algae Aquaculture)

Activities: Cyanotech provide high quality microalgae products for health and human nutrition in a sustainable, reliable and environmentally sensitive operation. They wish to fulfil the promise of whole health through Hawaiian microalgae in the form of natural nutritional supplements.

BioAstin® Hawaiian Astaxanthin®

Hawaiian BioAstin natural astaxanthin – a powerful dietary antioxidant shown to support and maintain the body’s natural inflammatory response after strenuous exercise, to enhance skin, and to support eye and joint health.

Hawaiian Spirulina®

Hawaiian Spirulina – a nutrient-rich dietary supplement used for extra energy, a strengthened immune system, cardiovascular benefits and as a source of antioxidant carotenoids.

They produce these at the 90-acre facility on the Kailua-Kona Coast of the island of Hawaii, which provides several benefits. They selected the Keahole Point location in order to take advantage of relatively consistent warm temperatures, sunshine and low levels of rainfall needed for optimal cultivation of microalgae. This location also offers access to cold deep ocean water, drawn from an offshore depth of 2,000 feet, which they use in their Ocean-Chill Drying system to eliminate the oxidative damage caused by standard drying techniques and as a source of trace nutrients for microalgal cultures. The area is also designated a Biosecure Zone, with tight control of organisms allowed into the area and free of genetically modified organisms (GMO’s). They believe that their technology, systems, processes and favourable growing location generally permit year-round harvest of their microalgal products in a cost-effective manner.

They motivate their activities as under:

Microalgae are a diverse group of microscopic plants that have a wide range of physiological and biochemical characteristics and contain, among other things, high levels of natural protein, amino acids, vitamins, pigments and enzymes. Microalgae have the following properties that make commercial production attractive: (1) microalgae grow much faster than land grown plants, often up to 100 times faster; (2) microalgae have uniform cell structures with no bark, stems, branches or leaves, permitting easier extraction of products and higher utilization of the microalgae cells; and (3) the cellular uniformity of microalgae makes it practical to control the growing environment in order to optimize a particular cell characteristic. Efficient and effective cultivation of microalgae requires consistent light, warm temperatures, low rainfall and proper chemical balance in a very nutrient-rich environment, free of environmental contaminants and unwanted organisms. This is a challenge that has motivated them to design, develop and implement proprietary production and harvesting technologies, systems and processes in order to commercially produce human nutritional products derived from microalgae.

‘As a world leader in the production of high value natural products derived from microalgae, we are guided by the principle of providing high quality microalgae products for health and human nutrition in a sustainable, reliable and environmentally sensitive operation. We are third party certified to GMP (Good Manufacturing Practices) for dietary supplements, reinforcing our commitment to quality in our products, quality in our relationships (with our customers, suppliers, employees and the communities we live in), and quality of the environment in which we work.’

Contact: https://www.cyanotech.com/our-purpose/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Hydro Neo (Smart Shrimp Farming Management Systems)

Activities: HydroNeo's Smart Farm Management system enables aquaculture farmers to monitor water quality in real-time for better health and stronger growth of his animals. For risk management, their system notifies the farmer if specific conditions become unfavourable or other unforeseeable events like power outages that have the potential to kill the animals. Cloud-based algorithms automate the application of aerator motors and help farmers save up to 50% of energy, while creating benefits for the environment. Additionally, the system can integrate additional components like sludge or fresh water pumps which can also be automated based on a flexible set of rules the farmer sets depending on his individual demands. Currently, they are working on the integration of feeding. HydroNeo's smart solution saves resources, increases profit, improves water quality and is a crucial step towards sustainable aquaculture.

They motivate their activities as under;

Their strength is the clear focus on shrimp farmers in developing countries that have been ignored by technology providers so far. They developed a complex system to digitize and automate shrimp farming but have easy-to-understand frontends like their native app or the display at the Controller for the farmer and farm workers.

Sustainable impact on blue economy:

Shrimp farming is done largely in emerging countries with high-pollution-energy supply, mostly from coal but even Diesel/Oil power plants. In their pilot market, Thailand, at over 20,000 shrimp farms approximately 500,000 aerator motors run on average 19 hours a day, 220 days a year consuming 1.98 billion kWh of electricity every year. That produces a CO2 equivalent of more than 1 million tons. With their system they have saved in every installation so far between 15 and 50% of energy by monitoring water quality, especially Dissolved Oxygen levels and automating the usage of aerators. Additionally, by being confronted with the up to now wasteful behaviour, farmers realize that positive environmental impact is also has a positive result for them.

Contact: <https://hydroneo.net/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Innovakeme (Wind Powered Aquaculture Farm)

Activities: Innovakeme’s main project is Offshore Island Porto Santo (OIPS) and the main goal is to develop an offshore solution using a floating platform with two wind turbines, which will be situated 5 kilometres north from the island of Porto Santo in Portugal. This island aims to be the Smart Fossil Free Island in the future, in this context they wants to reduce the use fossil fuels to produce energy. Furthermore, their development is to focus in another market that is in high demand in Madeira islands: aquaculture. We intend to use the floating platform to share synergies with the aquaculture avoiding more visual impact in the ocean.

They motivate their activities as under:

With our platform we can integrate aquaculture and share synergies in the same area.

Sustainable impact on blue economy: Reduces carbon emissions, Increases the use of renewable energy resources. Reduce visual impact with the integration of the aquaculture in the platform. Innovakeme is focused in renewable energy and sustainability sectors, with special emphasis on new technologies such as:

* Floating Offshore wind
* Hybridization solar/biomass
* Blockchain for the Renewable Energy market
* Sustainable aquaculture
* Electric vehicle charging technology

Contact: <https://www.innovakeme.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Inseco (Insect Based Fishmeal Feed Solution)

Activities: Inseco farm insects and turn them into a high-protein powder that is used to replace resource-intensive products such as fishmeal and soybean meal, The Inseco team diverts organic food waste from landfill and uses black soldier flies to decompose this waste – solving another environmental issue simultaneously. The fly larvae consume the organic by-products and grow very quickly. They are then harvested and turned into an insect-protein powder that is both cost effective and environmentally sustainable. Inseco completed its pilot facility in 2019 and is in the process of setting up a factory where it will farm black soldier flies who feed on organic by-products from various industries. In so doing, it will save thousands of tonnes of forage fish from being caught, thereby nurturing our marine ecosystem.

They motivate their activities as under:

“For every tonne of fishmeal and fish oil produced, four tonnes of wild-caught fish are needed,” says Simon Hazell, the co-founder and CEO. This means that a staggering 30-million tonnes of fish are caught annually just for the eight-million tonnes of fishmeal and fish oil required in the aquaculture industry each year. There is a big problem in our oceans that many of us are not aware of, and that’s the amount of fish being caught simply to create fishmeal – something that has been produced for many, many years. Fishmeal is a brown powder obtained after cooking, drying and squeezing forage fish, which is then used as a source of protein to feed farmed fish, as well as pets and poultry. “These forage fish are very important to the marine ecosystem, and when you cut them out, a variety of other species are compromised,” says Simon Hazell, co-founder and CEO of Inseco, a start-up that has found a sustainable alternative to the problem.

Contact; <https://inseco.co.za/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Knip-Bio (Aquaculture Fishmeal Alternatives)

Activities: KnipBio is a biotechnology company developing responsible and sustainable commercial feed solutions for the aquaculture industry. They are business innovators committed to solving real-world challenges by working with leading global corporations. KnipBio's game-changing single cell protein combines the attributes of premium, protein-packed fishmeal and carotenoids into a single effective and affordable fishmeal replacement -- KnipBio Meal (KBM). KBM is a transformative breakthrough in the future of aquaculture feed.

Many aquaculture farms have turned to soy or corn-based protein, and chemically-derived products as a substitute for fishmeal in their fish feed formula. These inferior replacements often lead to increased fish-mortality, bloating, stomach inflammation, and a generally sub-optimal fish population. KnipBio has developed a set of naturally occurring microbe strains that convert ethanol, methanol and other abundant, low-cost feedstocks into premium, nutritious, single-cell protein. KnipBio's protein combines the attributes of protein-packed fishmeal and carotenoids into a single effective, affordable feed replacement -- KnipBio Meal (KBM) that offers a transformative breakthrough in the future of aquaculture feed. Studies comparing KBM to standard fish feed formulas have demonstrated impressive results: not only is KBM a suitable and palatable fishmeal replacement, but Atlantic salmon, rainbow trout, shrimp, and other commercially important species thrive on a diet consisting of KMB. Benefits included a higher digestibility and a reduced mortality rate. Their transformative value proposition represents a triple bottom line exceeding requirements for environmental, social, and economic consideration.

Their goal is to enable the continued growth of the aquaculture industry by offering a premium substitute to fishmeal made from overfished feeder species.

Contact: <https://www.knipbio.com/what-we-do>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Kverdi (CO2 Aqua Feed, Reverse Plastics & Other Circular/Blue Economy Biotech Innovations)

Activities: Kiverdi is working to solve global issues with technology that transforms carbon to address a range of challenges from the ocean’s plastic problem and sustainable agriculture. Kiverdi’s NASA-inspired technologies convert carbon dioxide into people and planet-friendly bio-based products. The company’s proprietary commercial solutions are being implemented by some of the leading manufacturers to remake supply chains and power a new era of sustainable production — all while tackling some of our most pressing global challenges.

The solutions include:

* Reverse Plastics ™ – transforming discarded plastics into biodegradable goods
* Revive Soil ™ – increasing crop yield with CO2-made soil nutrients
* CO2 Aquafeed ™ – feeding fish with food made from CO2
* Custom Cycle ™ – leveraging circular economy technology to create closed loop supply chains

Feeding fish through COo2 : CO2 AQUAFEED is a revolutionary new form of feed that is produced through carbon capture and transformation. Traditionally, fishmeal has been produced by harvesting forage fish or low trophic level fish from the ocean. These fish would otherwise fill an essential role in the base of the marine food chain. CO2 AQUAFEED offers a protein feed solution that is nutritionally comparable to traditional fish feed but can be scaled quickly, efficiently, and without the need for additional wild caught fish, and hence is more sustainable. It is a non-GMO option that has a more nutritious profile, resulting in healthier, nutrient-rich fish. The production of CO2 AQUAFEED also requires 10,000x less land and 2,000x less water compared to soy protein, and therefore more sustainable.

How they make Aquafeed from CO2 :

CO2, Nitrogen, Hydrogen, and water are added with mineral nutrients to their proprietary bio-reactors. Using renewable energy, they begin the gas process where their bio-catalysts convert the elements into nutrients. The result is CO2 Aquafeed - a complete protein that has the same nutritional value as protein from wild caught fish. CO2 Aquafeed is fed to fish farms, creating a more sustainable way of feeding fish by providing an alternative to the 15 million tons of wild caught fish currently used to support the aquaculture demand.

Contact: <https://www.kiverdi.com/co2-aquafeed>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Marina-Tex (Algae/Biodegradable Organic Packaging)

Activities: MarinaTex is a versatile material that can be an alternative to plastic in a variety of applications. From bags to single-use packaging, MarinaTex has a variety of different applications. The transparent film is well suited for packaging and will biodegrade in a soil environment. The organic formula does not leach harmful chemicals and can be consumed, causing no harm to wildlife or humans. Utilising Waste Fish. MarinaTex is a bioplastic material designed to serve as an alternative to single-use plastic in a variety of applications. It is translucent and stronger than LDPE plastic. This biodegradable bioplastic is made from red algae and organic waste from the fishing industry. Marina Tex is the 2019 International Winner of the James Dyson Award.

Contact: https://www.marinatex.co.uk/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### MicroSynbiotiX (Oral Vaccination: Disease Management for Aquaculture)

Activities: Aquaculture is the future of sustainable food production. It is the world's fastest growing food sector, with an estimated worth of 200 billion USD, but every year, farmers face a crisis with managing disease, losing more than 10 billion USD worth of fish stocks annually. MicroSynbiotiX is developing cost-effective oral vaccines to combat these infections and improve global food security. They are developing a novel, patent-pending method of producing oral vaccines using transgenic microalgae. Their solution will make disease management much more sustainable and reduce the need for antibiotics.

Contact: <http://www.microsynbiotix.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Neomerys (Algae Biotechnology, Biofuels and Direct Osmosis)

Activities: Néomerys are developing various breakthrough technologies: microalgae biotechnologies for innovative 3rd generation biofuels and nanostructured membranes for energy-generating direct osmosis. Néomerys is an applied research laboratory that develops new biotechnologies based on microalgae for various applications: ecological (eco-positive biofuels), pharmacological (diagnostic tools and new active ingredients for oncology and neurodegenerative diseases) and other environmental technologies (reforestation, desalination of seawater, etc.) Néomerys offers innovative solutions for tomorrow: reversing the greenhouse effect, replacing petroleum, producing Energy. Founded in 2014, the company is the result of a long-standing concern for ecological issues. Néomerys is the translation of their desire to offer an industrial and concrete solution to the greatest challenge of our time:

Their research areas

* Energy & biofuels
* Pharmaceutical active ingredients& new medical diagnostic tools
* Passive freshwater production systems

Promising results & projects: Kodama power plant:: An eco-virtuous energy capable of repairing the climate

IRMA: A co-development partnership with INRA to design cost-effective biocatalysts for the lipid fraction of microalgae. New techniques for the purification and extraction of molecules of interest based on microbiological engineering.

Molecules of interest: Innovative strategies for purification & improvement of spectral and pharmacological properties of active ingredients of interest

Contact: <https://www.neomerys.fr/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Norskin Materials AS (Sustainable Ocean Alternative to Leather)

Activities: Nordlandsbedriften Norskin Materials is an example of a start-up company that is investing. The company will produce materials from fish skin for the so-called high-end markets around the world. Norskin Materials will produce and deliver materials for tanneries with a higher degree of utilization, smaller climate footprint and with a focus on traceability and animal welfare. The company aims to create new knowledge-based jobs in Nordland and contribute positively to more resource utilization in Norwegian aquaculture and fisheries. Norskin is a modern, high-end material sourced from the cold, arctic seas in Northern Norway. It is a natural choice that adds value to any product. Not only is it extremely durable and formable, it is also sustainable, with a carbon footprint much smaller than traditional leather. Utilizing renewable sources to help build a better future, ‘Norskin is the material of tomorrow, available today.’

Contact: https://www.norskin.no/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Notpla (Alternative Seaweed/Plant Packaging)

Activities: Notpla is an innovative biodegradable packaging start-up, making alternative to plastic out of seaweed and plants. Over the past 4 years they have grown the team from 3 to 25, and they have raised over £6m in funding through a combination of VC investment, equity crowdfunding and grants. They have launched their first product - the Ooho edible capsule - which is used by events to deliver drinks with zero waste.

They have developed a proprietary manufacturing technology to produce a compostable sachet for sauces, and have two further packaging products in the pipeline soon to be commercialised. Their clients include Lucozade, Just Eat and Hellman's. Seaweed Sachets by Notpla.

They motivate their activities as under:

Most plastic packaging is used once before it is thrown away. It provides a few minutes of convenience, but can take hundreds of years to degrade, destroying our ocean ecosystem. Notpla have developed a material made from seaweed and other plants that’s 100% biodegradable. So it breaks down naturally, even in the ocean. The first Notpla product, the Ooho, is made from a seaweed extract and can be used to hold drinks like water and juice. They have developed a machine for on-site manufacture of the Ooho to create packaging on-demand. Notpla are pioneering the use of natural materials extracted from plants and seaweed to replace plastic packaging. Since their investment, over 250,000 plastic water bottles have been replaced with Ooho, preventing these from entering the environment.

Contact: <https://www.notpla.com>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Observe Technologies (AI Data Analysis for Aquaculture)

Activities: Observe Technologies use Artificial Intelligence for Aquaculture - they use state-of-the-art algorithms to maximise a farm's potential. They use artificial intelligence (AI) to give actionable insights to optimise the biggest costs on fish farms: from feeding to health. Their recommendations have been developed with farmers globally. By monitoring any deviations and abnormalities, their product helps you to manage your fish farm site more efficiently, minimize feed waste and increase profits.

Their unique approach includes:

Smart Alerts: The system monitors the whole site, learns individual cage behaviour and alerts the farmer about any anomalies.

Remote Management: The unification of all the data streams allow you to succinctly and securely process how the site is performing from anywhere.

Sustainable Goals: With the smart use of the data they can increase the sustainable approach of the fish farm.

No Extra Equipment: They sit on top of existing cage hardware - no new investment needed in intricate cage equipment.

* Their software aggregates all the existing data streams on your site: from vision, sensors, acoustics and many more. Then they carefully extract relevant information in real-time for their AI to analyse.
* Their AI immediately informs the farmer when to increase or decrease feeding in order to optimize FCRs and to alert the farmer of any other abnormality. The software becomes smarter over time: adaptively learning about the factors important to each cage as well as the whole site.
* Manage your site from anywhere: they use their tools to obtain a real-time view that summarizes the most important details you need to manage your site.

‘We are already working with a number of fish farms across the globe. Are you interested to find out more?’

Contact: https://observe.tech/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Oceanium (Sustainable Seaweed Packaging Answers)

Activities: Oceanium develops seaweed-based products to provide sustainable solutions for the increasing demand for sustainably-sourced, plant-based food products and circular life-cycle packaging material. Their impact mission is to enable the sustainable seaweed farming industry in the EU/ROW to mitigate climate change, create jobs and ensure responsible coastal management. Oceanium was selected as the People's Choice winner at The World Economic Forum's Ocean Solutions Sprint and Karen was a finalist in The Economist's Women and the Ocean: Changemakers Challenge. Oceanium is based at the European Marine Science Park with an office in London.

Oceanium's primary focus is on the development of two product streams:

* Home Compostable, Marine-Safe Food Packaging
* Natural Food Ingredients & Nutrition Products

All of their products are produced using sustainably-farmed seaweed and green chemistry. Their seaweed is sourced from the cold, clean waters of the North Atlantic offering traceable provenance. The algae products market was $3.98bn in 2018 and is expected to grow to $5.17 billion by 2023

Contact: <https://www.oceanium.co.uk/products>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Rainforest

Activities: Ocean Rainforest are a young blue growth company located in the Faroe Islands. They offer a collection of Nordic seaweed products, mostly for food and cosmetic producers, as well as take part in research projects with a number of different partners. They apply science, innovation and expertise, to grow premium quality seaweed for sale and for research.

Their purpose is to improve people’s wellbeing and to make a unique contribution to our blue planet. Ocean Rainforest began in 2010, when they combined their knowledge of this unique ocean environment with a strong entrepreneurial spirit, to cultivate seaweed. They started growing and harvesting the same species of wild seaweeds that were part of our ancestors’ diets over a thousand years ago because they wanted to support people and the environment. Their inbuilt focus on research and innovation enabled them to develop world-class cultivation methods - making them Europe's leading seaweed cultivator and a pioneer in the industry. Through a diverse set of skills and years of combined experience, they continue to explore the potential of this versatile sea plant to meet growing market demand.

Climate Feed

“Seaweed in cattle feed to reduce greenhouse gas from burping dairy cows”

Seaweed could contribute to reducing greenhouse gas emissions from agriculture. The research project Climate Feed will develop seaweed feed supplement with funding from Innovation Fund Denmark. There’s a huge potential in reducing cows’ emission of methane and, consequently, greenhouse gases. The major part of agriculture’s emissions of CO2 and greenhouse gases come from ruminant cows: each cow burps between 200-500 litres of methane every day. Through the research project Climate Feed, Danish researchers and companies are joining forces to change this trend. Certain types of seaweed contain strong antioxidants and tannins which can help stop the development of methane in the cows’ rumens. Climate Feed has a project budget amounting to 17M DKK, of which 11.7M have been donated by Innovation Fund Denmark. The research project will run from 2019-2023 to develop methods for cultivating, harvesting and processing/drying seaweed into finished goods, such as powder or pellets, which the farmer can easily supplement to the cattle. The product must contain verified and stable active substances, which reduce the emission of greenhouse gases from the cattle – without deteriorating the milk yield, flavour or quality.

Contact: <http://www.oceanrainforest.com/about-overview>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Oceanwell (Cosmetics)

Activities: Natural cosmetics from Oceanwell are based on the Laminaria algae and seawater. The entire assortment can be ordered online in the dispatch shop. Oceanwell claim to be the first certified natural cosmetics from the sea. Highly effective, pristine, and pure, it not only provides your skin with a lot of new energy, but their sustainably grown ingredients have been gained by the sea with respect and care. Protect it: so that this largest ecosystem of our planet can recover a little - just like your skin. ‘Here you will discover how Laminaria becomes a unique wonder of active ingredients for radiant, healthy skin’. Protect the Ocean is an initiative launched in January 2015 that specifically engages Oceanwell in global marine conservation activities. Our initial campaign supports the long-term protection of sea turtles near the village of Grand Béréby, Ivory Coast. And not just with 10 cents of every Oceanwell product sold.

We are concerned with the sustainable development of the region, because apart from fishing, collecting eggs and hunting for turtles is one way for the coastal inhabitants to earn money. Four turtle species live in this marine region. They are all in great danger, which in turn reduces the income of the inhabitants. We want to break this vicious circle by showing people sustainable alternatives (such as nature tourism) and actively participating in protection measures - a key factor in the success of the project. For the Ivorian initiators Alexandre Dah and Jose Gomez, however, the sensitization of the residents is the biggest challenge. But in the meantime, fellow combatants have already found their way into the dialogue as "Protecteur des Tortues" and actively campaign for the endangered species.

Contact: <https://www.oceanwell.de/en/products/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### PharmaMar (Marine Biotechnology Focusing On Oncology)

Activities: PharmaMar is a company focused on oncology and committed to research and development which takes inspiration from the sea to discover molecules with antitumor activity – marine inspired oncology. They are an integrated company that seeks innovative products to provide healthcare professionals with new tools to treat cancer. PharmaMar’s commitment to patients and to research has made it a world leader in the discovery of antitumor drugs of marine origin.

Contact; https://pharmamar.com/science-and-innovation/oncology-pipeline/?lang=en

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Provectus Algae (Algae platform for designer compound expression)

Activities: Provectus Algae is an Australian biotech startup specialising in the optimisation of Algae to produce high-value compounds for use in a wide array of industries and applications. The ground-breaking capabilities of the Provectus Algae team are enabled by a well-balanced fusion of its proprietary innovative technology and a thorough understanding of the unique biological traits of algae. Provectus Algae is an end-to-end biotech partner for the discovery, engineering and commercialisation of biologics from algae. Their automated algae platform optimises both product expression and biomass in a modular, remotely managed service that scales with you. Automating the process of growing micro-algae: their PC2 and FDA compliant range of automated bioreactors use micro-algae as a platform for high-value compounds at extreme densities.

* Nutraceuticals
* Pharmaceuticals
* Food & Feed Supplements
* Natural Pigments

High-value algae is the biosynthetic platform of the future

* +70,000 known algae species
* +15,000 natural products already identified
* Generally Regarded As Safe (GRAS) by the FDA
* Bioactive when consumed
* Low cost with a rapid grow rate

They motivate their activities as under:

Own the Supply: Mitigate the risk of supply-chain shortages and procurement through a production partnership. Certifiable quality and quantity in an end-to-end controlled environment.

Improved Economics: Controlled and targeted product expression in Algae provides exceptionally high quality and consistent production at low cost.

New Products: Discover new products through the process of bioprospecting or bring existing products to the market in new ways to service Natural, GMO Free and Vegan markets.

Product Salvage: Previously identified compounds with unfeasible production economics can be revisited for viability using Algae as the platform.

Corporate Social Responsibility: Compound production using Algae as the platform is a carbon negative process, the impact of which is a positive contribution towards Corporate Social Responsibility environmental goals.

Contact; <https://provectusalgae.com/about-us>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Recirculating Farms Coalition

Activities: The Recirculating Farms Coalition is a collaborative group of individuals and organizations - farmers, educators, chefs and many others - committed to building healthy communities through training, outreach and advocacy on innovative farming and food justice. They develop ecologically and socially responsible programs that grow local, affordable food, and create stable jobs in green businesses, in diverse communities, to foster physical, mental and financial wellness nationwide.

They motivate their activities as under:

Primary food production systems in the United States are overly industrialized — for example, concentrated animal feed lots, factory fishing boats, and massive fruit and vegetable farms. Reliance on imported foods, with minimal safety inspections and a huge carbon footprint to transport products around the globe, hurts us and our environment, providing fewer jobs, increasing pollution and delivering consumers lower quality food. The U.S. government, in response to the public’s growing complaints about our troubled food system, continues to explore various ways to boost domestic food production. Unfortunately, it mostly does so in a manner that encourages further industrialization and poor food quality. The challenge is to promote an alternative to this model, one that establishes healthy, natural, and community-based food production.

They envision a movement toward community-based food production. This can provide safer, fresher, better quality, accessible food and local green job opportunities. A different way of growing, “recirculating farming,” is emerging nationwide and can meet these goals. Recirculating farms use constantly cleaned, recycled water as the basis to grow food. They can grow plants (recirculating hydroponics), fish (recirculating aquaculture), or plants and fish together in one system (aquaponics). Recirculating farms come in a variety of shapes, sizes and styles, but they all have one main theme – recycled water. These farms are almost entirely closed loop, and can operate without chemicals or antibiotics, efficiently use water and energy, and be located virtually anywhere — importantly, near the people they serve. This cuts down on use of fuel for shipping and refrigeration and lowers costs of the farm; savings that can be passed on to the consumer, making good food more affordable. These farms can provide a wide range of products, including finfish, shellfish, herbs, fruits, vegetables, other plants and flowers. Their vision is for communities across the country to have recirculating farms as a source of local, healthy fresh food and stable jobs in green businesses.

The Recirculating Farms Coalition grew out of a program initiated at Food & Water Watch, a national consumer advocacy organization. In 2009, staff with the Fish and Oceans Program at Food & Water Watch coordinated a meeting of leading recirculating aquaculturists, hydroponic and aquaponic farmers, other scientists and government agencies involved in agriculture and fisheries fields. The outcome of this meeting was a unanimous call for a coordinating collaborative entity that could help raise the profile of recirculating farms in the United States and push for policy, legislative and educational initiatives. Thus, the Coalition was born. In its infancy it was a group of professionals, entrepreneurs and others interested in exploring a better, more local way to provide sustainably-produced, accessible food. Since that time, the Recirculating Farms Coalition has grown in membership and programs, developing strategic plans to promote policy, legislative, and educational activities throughout the U.S. They are headquartered in New Orleans, Louisiana where they have a dedicated local team and several urban farms in cooperation with veterans, musicians, senior housing and community health and wellness organizations, managed under "Growing Local NOLA". They run a mobile fresh food delivery and holistic health program "Growing Local On the Geaux", that brings various health-supportive services into New Orleans neighbourhoods with low-access to such resources.

Contact: <http://www.recirculatingfarms.org/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### SBIOTECH (Aquaculture Probiotic Solutions)

Activities: At SBiotech, their mission is to create sustainable aquafarming. With years of R&D at MicGene Labs and field trials, they have come up with a unique formulation that could replace the antibiotics and improve the growth of the shrimps. A growing population with increase per capita seafood consumption coupled with overexploitation of ocean to meet the expanding global seafood demand has created the conditions where aquaculture must move rapidly to play the leading role in providing our planet with healthy, sustainably produced seafood.

Live Probiotics

* SB 3A (Triple Advantage)
* SB GutCure (White Gut controller)
* SB LivePro
* SB ToxiNill (To clear toxins and gases in the pond water)
* SB VibroKill​ (Clear pathogenic Vibrio sp. in pond water)
* Powder Probiotics
* SB Bottom Care
* SB Pro Clean

Supplements

* SB GasoNill
* SB Soft
* SB VitC

Contact: <http://sbiotech.in/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Scot Bio (Spirulina Based Blue Dye, Protein, Reagents &other Blue Biotechnology Products)

Activities: ScotBio has unique patented technology, proven at factory scale, to produce very high levels of the natural blue dye phycocyanin from Spirulina, a recognised “Super Food” in a controlled environment. The company is led by a strong industry experienced board. The developments made will enable major food industry players with whom ScotBio is collaborating to eliminate chemical dyes from children's foods. After removal of the blue colour a Vegan protein with high nutritional value is a valuable by-product for which demand is growing. The process is protected by a very strong US approved patent that gives the ScotBio process extraordinary productivity. Process: Since the beginning of 2020 productivity has increased 4 -fold.

The original discovery was made at Newcastle University that a specific wavelength of light supplied by custom LEDs cause spirulina to overproduce a natural blue colour. These principles can be applied to other algae. The IP has grown over time by collaboration with world ranking institutions such as Edinburgh University. Process: The uniqueness is based on the discovery at Newcastle University that a specific wavelength of light supplied by custom LEDs cause spirulina to overproduce a natural blue colour, phycocyanin. These principles can be applied to other alga. This has been added to over time by collaboration with world ranking institutions such as Edinburgh University. The company has a very strong industry experienced board. ScotBio aim to close by Mid December, pre-money valuation of £26,700,000 (£51.17 per share) for funding of £3-5,000,000 between now and the end of 2020. They Also seek to raise a further £4,000,000 thereafter to complete their Lockerbie production site by April 2022. This would allow the business to be profitable and cash positive. The overall target for ScotBio remains the same – to create a business generating EBITDA of more than £40m per year within 5 years.

They motivate their activities as under:

As of July 2020 the European Union has required most foods containing artificial food dyes to carry a warning label. The leaders in the global food industry, such as Mars, have committed to a shift away from chemical dyes in foods but there are few solutions for blue. Phycocyanin from Spirulina, generally recognised as safe, is almost unique as a natural blue colour to replace chemical dyes. In combination with yellow such as from Saffron it also offers a natural green colour. These markets, worth over €500m, are currently under satisfied in terms of quality, price and reproducibility. Thanks to ScotBio’s strong IP, no competitor can compete on all the above criteria. The controlled production also opens markets in the pharmaceutical and diagnostics arena. From the residual Biomass a non-meat protein that is odourless, colourless, with good mouth feel and complies with Vegan standards is produced.

TECHNOLOGY READINESS LEVEL

The first product being sold is the Phycocyanin blue colour; Second product now with purchasers is the Vegan protein. Additional by-products include carotenoids, including Vitamin A Ultra pure phycocyanin is now available on e-commerce to pharma researchers. Under development is use of other species to produce Astaxanthin. R&D includes development of gene editing techniques to further optimise the production of valuable compounds from algae species

Sustainable impact on blue economy: The patented technology opens a new door to growing algae in controlled conditions with high level of expression and productivity. The methodology can be applied for example in aquaculture to produce the salmon pink colour astaxanthin. At scale the biomass provides an odourless protein of high nutritional value that can replace animal meat protein.

Contact: https://scotbio.com/products

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea-6 Energy (Sustainable Algae Based Food, Feed and Fuel)

Activities:

With the desire to revolutionise the seaweed supply chain, Sea6 Energy has invented a mechanised catamaran for the cultivation of tropical sea plants: SEACOMBINE - the next generation of seaweed production. Traditionally seaweed production is labour intensive, making labour costs the main components in the cost of production. Developed to tackle this problem the SeaCombine is a fully mechanized harvesting and seeding catamaran. Combined with their Marine Agronomy expertise and our proprietary Ocean Infrastructure technologies, the SeaCombine can farm anywhere in the oceans.

A complete solution:

* Fully mechanized for harvesting and seeding of seaweed on the ocean
* Capable of working in nutrient-rich deep and exposed waters unlike conventional systems
* Each Sea Combine unit is designed to farm about 50 hectares of the ocean surface

Products from the ocean: Sea6 is an Ocean Operating System that harnesses the power of the oceans in a sustainable and ethical way to create an alternative bio-economy for the world.

PRODUCTS: AgroGain, ERoyal, Poultry Feed Additive, Sea Veg Fibre, Biofilms, BioPlastics, Biofuels.

Contact: <https://www.sea6energy.com/automated-farming>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea-Qual Initiative (Recycle Plastic into Textiles Initiative)

Activities: Founded on the East Coast of America in 1949, GANT has a strong connection to the sea and a commitment to making their company more sustainable. This heritage and passion to maintain the oceans for generations to come, led to the launch of GANT Beacons Project. GANT partnered with SEAQUAL INITIATIVE to help clean our oceans and upcycle plastics collected from the sea to make SEAQUAL® YARN, which is used in their Tech Prep™ shirts and Ocean Prep™ Hightown Sneaker shoes. SEAQUAL INITIATIVE is a community with a single voice against plastic pollution. They bring together individuals, organizations and companies, to help clean our oceans, raise awareness of the issue of marine plastic and highlight the heroes who are working to solve it: a single voice against plastic pollution

They motivate their activities as under:

Ocean cleaning. Seaqual initiative works with ocean clean-ups around the world, to bring value to the waste they recover. Worldwide, there are a growing number of ocean clean-ups working hard to retrieve marine litter from our oceans, beaches, rivers and estuaries. Ocean clean-ups can be anything from small groups of local volunteers, all the way through to large international programs. They can be one-off beach clean-ups or involve whole communities of fishermen retrieving waste on a regular basis. These ocean clean-ups collect all types of waste; plastics, metals, glass, rubber, and mixed material items – everything from shoes to refrigerators! Because mixed waste is expensive to recycle, in the past much of this waste was destined to landfill or incineration. SEAQUAL INITIATIVE is dedicated to giving a second life to this material. At SEAQUAL INITIATIVE they don’t look for materials to recycle, they recycle the materials they find. This mixed waste is sorted into different material types; materials such as metals and glass are recycled through traditional routes, while organic material and other non-plastics are recycled or disposed of responsibly. Marine plastics are harder to recycle. Although plastics can survive in the ocean for hundreds of years, UV rays, salt water and friction mean they can degrade quickly. SEAQUAL INITIATIVE is dedicated to giving a new life to all types of marine plastic. The types of plastics found and the ratio of plastics to other materials depends upon many factors, including the type of ocean clean-up, the region and the season. Typically, beach clean-ups have higher percentages of plastics, because the waste has been carried there by the tides; for example, PET water bottles may represent 40% of waste collected on some beaches, but only 5-10% of the waste collected from the ocean floor by fishermen.

Contact: <https://www.seaqual.org/about-seaqual-initiative/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Run Holdings (Salmon Aquaculture Based Therapeutics and Reagents)

Activities: Salmon plasma proteins are purified and processed by Sea Run Holdings, Inc. Sea Run Holdings, Inc. discovers and develops innovative reagents and therapeutics from the blood of farmed salmon. Worldwide production of farmed salmon now exceeds two million metric tons annually. Therefore millions of litres of blood, free of mammalian pathogens, and with consistent quality are available from animals where genetics, nutrition and environment are controlled or closely monitored. Their technology allows them to turn the blood of farm-raised salmon into therapeutics and reagents with unique benefits.

Therapeutics:

Salmon blood clots rapidly and salmon can regenerate their spinal cord. Sea Run has found that these capabilities result in part from their coagulation proteins fibrinogen and thrombin (fibrin). Salmon plasma proteins are safe and effective, and could transform the treatment of acute pain, bleeding, and neural injury. Salmon proteins induce antibodies, but these antibodies do not cross-react with host proteins, and there has been no adverse response in hundreds of host animals.

**Product pipeline:**

SEA-STAT®TH is a salmon plasma product that provides an effective treatment for acute pain. In animal models, a single application of SEA-STAT®TH has:

* Reduced pain after neural and soft tissue injury (Smith JR et al. 2013 PLoS ONE 8(11) e80006) (Weisshaar et al. 2011 Biomaterials: 9738-9746)
* Maintained pain relief for up to 7 days
* Provided an effective alternative to opioids for post-surgical, bone, and burn pain.
* Prevented disruption of blood-brain barrier.

SEA-STAT® is a salmon fibrin product for haemostasis. Animal studies have demonstrated consistent performance equal or superior to mammalian-derived fibrin sealants. (Rothwell et al. 2005 J. Trauma 59(1):143-49) (Floyd et al. 2012. J. Spec. Oper. Med. 12(2):16-22)

SEA-STAT®CNS is a salmon fibrin product which has shown remarkable efficacy in animal trials of spinal cord injury (SCI) and traumatic brain injury (TBI). Salmon fibrin has:

Reduced neuroinflammation (Sharp KG et al. 2012 Exp. Neurol. 235(1):345-56)

* Spared inured neurons
* Enhanced neurite outgrowth and survival of stem cells
* Suppressed inhibitory cytokines and glial scar
* Promoted functional recovery

**Reagents for Research, Regenerative Medicine**

Salmon plasma proteins are purified from the blood of farmed salmon (S.salar). After the fish are stunned for harvest, the blood is drawn by needle using a process similar to that for human blood banking. All salmon blood products have unique properties, are naturally free of mammalian viruses and prions, and the lyophilized proteins can be rehydrated and used at room temperature and below.

Products

Salmon fibrinogen (SEA-133) and fibrin ECM

* Excellent proliferation of stem cells and retention of “stemness” (Zhou et al. Stem Cell Trans. Medicine. 2017;6(5):1412-1423)
* Superior to Matrigel for neurite outgrowth and neuronal cell growth (Ju et al. Biomaterials. 2007 April; 28 (12): 2097-2108)
* More efficient ECM (60-188%) than human derived fibrin gels for angiogenesis. (Sieminski et al. 2004. J Biomater Sci Polym. Ed 15(2):237-42)
* Slower gel degradation in vitro and in vivo
* Selection and growth of tumorigenic cells (Liu J et al. Nat. Mater. 2012 Jul 1, 11(8):734-41)

Salmon thrombin (SEA-135)

* Optimal polymerization of salmon fibrinogen
* Significant and sustained analgesia for pain studies (Weisshaar et al. 2011 Biomaterials:9738-9746)
* Potential alternative for opioids.
* Blocks disruption of blood-brain barrier. (Smith et al. 2016. BioMaterials 80: 96-105).

Salmon fibronectin (SEA-136) coming soon!

Significantly improved attachment and growth of mammalian cells compared to bovine and human fibronectin

Sea Block® (SEA-138) – a blocking agent for diagnostic applications.

Sea-Grow – a salmon plasma product for culture of fish and insect cells.

Contact: https://searunholdings.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Stellar Technologies (Sustainable Aquaculture Based Proteins and Other Immunology/Marine Biotech Solutions)

Activities: Stellar Biotechnologies is committed to developing novel immune-based products for the treatment and assessment of cancer, infectious diseases and immune disorders. Stellar holds a world-leading position in KLH, a highly valued protein used in immunology. The Company revolutionized the environmentally sound production of KLH and leveraged this expertise into a portfolio of Stellar KLH™ products including carriers for vaccine conjugation, protein for immune stimulation, and novel assays. Stellar is expanding with its own proprietary therapeutic vaccine program.

Sustainably Produced Stellar KLH™

* Only KLH produced from domesticated sources
* Controlled quality conditions, land-based aquaculture
* Fully traceable
* Non-destructive and environmentally sustainable extraction
* GMP and research grades

Contact; http://stellarklh.com/products/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### SuSeWi (Algal Biomass Biotechnology)

Activities: SuSeWi aims to become the world's largest producer of algal biomass, making them able to fully harness ‘the fastest growing, highest yielding, most nutritious, most carbon-absorbing organism on the planet’. They have developed, patented and fully tested the technology that gives them the means to recreate the natural growing conditions of algae. The technology itself is remarkably simple, combining leading edge knowledge of how algae behave with tried and tested, large scale pond engineering. This bio-industry will produce product for feed, human food, fertiliser, chemicals, pharmaceuticals and other uses.

Algae have the inherent qualities needed to solve some of the world’s intractable problems: feeding people alternative protein, cleaning the atmosphere of carbon, producing alternatives to plastics, repairing damaged soil and producing carbon-neutral energy. Fast, energy efficient, all year round growth enables algae to convert sunlight into food 20 times more efficiently than cultivable crops; and absorb and store carbon more efficiently than any other living organism - including Switchgrass or trees. It is also versatile: different types of algae produce different products, ranging from biomass which can be used as animal feed to chemical feedstock with which to replace petrochemicals.

Over the past 6 years, SuSeWi has grown from a three-square-meter experiment on the shores of the town of St Helena, South Africa, to a 30,000 square meter production facility with the world’s largest algae growth pond in the coastal desert of Morocco. And they are still growing. At scale, they aim to be the world’s largest algal producer. Marine microalgae provide a natural, abundant and sustainable source of protein, Omega 3 and many other ingredients. At SuSeWi, they have developed and proven innovative technology to produce microalgae on land just as nature has for billions of years – stimulating algae to ‘bloom’ faster than any other organism on earth, using only sun, sea and wind. Their process allows vast quantities of microalgae to grow on desert land, without using fresh water, duplicating a natural process that contributes to the health of our oceans and air, without depleting natural resources.

Contact: <https://www.susewi.life/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Symbrosia (Methane Reducing Seaweed Cattle Feeding Solutions)

Activities: Symbrosia is hard at work developing a breakthrough seaweed supplement that, when sprinkled into animal feed, reduces their methane emissions by over 90% (Kinley 2020). Methane emitted today will have about 80 times the global warming effect of CO2 over the next 20 years. Climate change is time sensitive. While CO2 remains in the atmosphere for thousands of years, slowly cooking the planet, methane stays in the atmosphere for only a dozen years but heats the planet intensely. In the short term, reducing methane emissions will have a much larger cooling effect than reducing CO2 emissions by the same amount. This is why Symbrosia is committed to drastically reducing methane emissions this decade. But why methane from livestock? Through their digestive process, called enteric fermentation, cattle and other livestock burps cause an astounding 6% of the world’s global warming. That means if cows were a country, they would produce just about as much GHG as the entire European Union. Symbrosia can help your farm to raise healthy livestock and reduce methane emissions. All it takes is a sprinkle. Adding a little seaweed to your feed goes a long way. Research on Asparagopsis to date suggests that it can be helpful in the following areas:

* Source of minerals
* Asparagopsis maintains ruminant production
* Iodine supports reproductive health

Research shows that by including Asparagopsis taxiformis seaweed as 0.2% of your livestock’s daily diet, you can reduce methane emissions by over 90%. That means for every cow you feed with seaweed, it is equivalent to conserving 4-6 acres of forest. Asparagopsis taxiformis also contains a variety of minerals, bioactive compounds, vitamins, antioxidants, essential fatty acids, and anti-microbial/parasitic/viral substances that support healthy farm animals. When provided daily, their seaweed can even contribute to nutritional needs.

* Market your farm or product as methane neutral
* Become a first-mover
* Future-proof your farm.

Beginning in 2024, new legislation slated in California SB 1383 (Short Lived Climate Pollutants: Organic Waste Methane Emissions Reductions) will require a 40% reduction in methane emissions from the agriculture sector to mitigate climate change. Any methods of reducing methane emissions must be beneficial to farmers, not an additional burden. Their seaweed can help.

Quantify the enteric methane emissions on your farm. The first step to improving farm emissions is taking inventory. They have developed a low cost methane prediction tool built with real on-farm methane measurements and can give you an estimate with just a few simple steps.

Contact: <https://symbrosia.co/why-methane>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### ViAqua Therapeutics

Activities: ViAqua (www.viaqua-t.com), is developing a novel delivery platform to address the challenges of treating and preventing disease in aquaculture. The Company’s first target is the $36 billion shellfish industry which has no effective and affordable treatment solution to combat viruses that are causing tremendous damage to growers around the world. ViAqua Therapeutics was established in September 2014 to address the growing need for effective, affordable health management of diseases in aquaculture. To date, ViAqua has received investments from The Trendlines Group , Nutreco, VisVires New Protein and the Technion–Israel Institute of Technology, with support from the Israel Innovation Authority.

Contact: <https://www.viaqua-t.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Viva Maris GMBH

Activities: Viva Maris GmbH is a processing company from the sustainable food sector. They are working with macroalgae to unlock the potential of seaweed, produced trough natural cultivation. They are a small start-up company based in Schenefeld / Schleswig Holstein that is breaking new and sustainable ways in nutrition.

As a "Blue Economy" company, they are committed to active dialogue to raise awareness of the oceans and preserve the beauty of the ocean. They want people to respect and understand the "wonder of the sea" in order to give something back to the sea and to protect it, as well as to preserve its uniqueness. They support this through the natural and sustainable cultivation of seaweed, the sale of high-quality products with seaweed and by maintaining jobs in the marine industry. ‘The sea is our future, but also the guide for our life and that of the following generations on the blue planet. Viva Maris sea life.’

Contact: <https://www.viva-maris.de/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Yemoja Limited (Micro-Algae Based Products)

Activities: Yemoja is an Israeli biotech company specializing in the production of microalgae-based bioactive ingredients, aimed to bring green, sustainable, powerful solutions for the cosmetics, food supplements and pharma industries. At Yemoja, they aim to boost the entire microalgae value chain with new varieties and yields. Using patented technology, they produce three species of pharmaceutical-grade microalgae in an indoor closed system. With their unique cultivation methodology, they have overcome many industry challenges including composition homogeneity, scalability, and contamination proofing, ensuring clean, safe microalgae throughout the process.

Commercial Photobioreactor Technology

* Flexible Manufacturing
* Fully Controlled
* GMP Compliance
* Scale Out System

Contact: <https://yemojaltd.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ynsect (Insect Based Aquaculture Feed)

Activities: Ÿnsect aquaculture premium products Ÿnmeal and Ÿnoil provide sustainable premium nutrition for aquaculture.

Aquaculture plays a decisive role in human nutrition: more than pig, sheep, cattle or poultry farming, aquaculture is the fastest growing animal production worldwide. Already half of the fish consumed comes from aquaculture (FAO 2014) and this figure will continue to increase. Fishmeal, the primary source of food for aquaculture fish, is a premium nutritional ingredient in crisis, given the decline in fish stocks. After a four-fold increase in fishmeal prices over the last 15 years, the FAO forecasts a drop in supply of 3 million tonnes by 2025. The lack of sustainable solutions for aquaculture negatively impacts prices and availability for consumers. Insects are a premium alternative, and are naturally present in the diet of wild fish and crustaceans and provide important nutritional benefits due to their high protein and polyunsaturated fatty acid content. Finally, if properly controlled and structured, insect farming has a low environmental impact: low greenhouse gas emissions, preservation of ocean biodiversity, and significant improvements in productivity linked to land use. Insects are thus positioning themselves as a new natural, sustainable and responsible resource to meet the nutritional challenges of aquaculture farms.

* 52% increase animal proteins consumption between 2007 and 2030
* 3x increase in fish meal price over 10 years
* 40% proportion of insects in certain wild trout species’ diet

Ÿnsect's premium ŸnMeal™ and ŸnOil™ Products are derived from Molitor, farmed and fed on cereal by-products at their Farm-hill.

**Ÿnoil : premium oil of Molitor**

Ÿnoil is a light oil, rich in polyunsaturated fatty acids, extracted by a mechanical process from Molitor larvae. Ÿnoil is perfectly adapted to the diet of farmed fish and shellfish.

**Ÿnmeal: premium proteins from Molitor**

Ÿnmeal is an ingredient naturally rich in highly digestible proteins (more than 70%). Formulated with Molitor larvae, and produced in powder form, Ÿnmeal is perfectly suitable for the nutrition of farmed fish and shellfish. It is used at a level of 5 to 30% in the formulation of nutritional rations. The technological performance of Ÿnsect products are scientifically tested and proven. Their R&D is dedicated to the continuous improvement of health, growth and survival rate with our partners. These studies, carried out by renowned independent organizations, focus on the added value of Ÿnsect products.

Contact: http://www.ynsect.com/en/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 5. DRONES, ROBOTICS, MARITIME SAFETY, SECURITY

### Aqua-Botix (Portable USV For Monitoring, Research, Defence and Surveillance)

Activities: AquaBotix, founded in 2011, has developed a portable Unmanned Surface Vehicle (USV) called Swarm Driver for monitoring, research, defence, and surveillance. The vehicles can swarm in groups of 40 or more, and dive to depths of 50 metres. The USVs can communicate and make autonomous decisions, just like an aerial drone swarm. In 2018, AquaBotix entered a special purpose cooperative research and development agreement (CRADA) with the US Navy.

Contact: https://www.aquabotix.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Aqua Smart (Inspection and Surveying Drones)

Activities: AquaSmartXL provides inspection and surveying services with their unique AquaDrone systems. Remotely Controlled Aquatic Drones:

* Flexible, easy and quick to deploy platform
* High quality sensors and data capturing
* Easy accessibility to difficult and dangerous to reach places
* Observation and inspection of assets as well as their surroundings

They help their customers with quick visual inspections, detailed and standardized inspections of complex structures as well as 3D modelling for engineering support. The remotely controlled drones from AquaSmartXL provides you a flexible, quick to deploy platform to operate several types of sensors so that you can reach places where normal inspection is difficult, too dangerous or simply not practical. Their aquatic drones help to observe and inspect assets as well as their surroundings, giving you all the information needed for maintenance, life span development, risk mitigation, engineering or insurance.

Contact: https://aquasmartxl.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Autonomous Marine Systems (Autonomous Wind/Solar Powered Ocean Observation Robot/System for Marine Surveys)

Activities: They have a Patented, unmanned, ocean-going robot: DATAMARAN - a satellite for the seas® his is described as:

* 100% Wind And Solar Powered
* Long-Dwell, Low-Cost, Simple Logistics
* Intelligent Platform For Sensing, Communications
* Sophisticated Navigation, Control Software
* Self-Deploying
* Dual Hulls
* Stability
* Large Payloads
* Frequent Updates To Shore Operations
* Mission Progress
* Health Status’’

Their low-cost, self-deploying DATAMARAN fleets form intelligent swarms, aiming to drive a quantum increase in our knowledge of the oceans that cover 70% of our planet. This will equip us to address biggest national security and climate challenges facing mankind. It is a tool for those seeking affordable, persistent, co-ordinated ocean observation.

Contact: https://www.automarinesys.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Atlas Robotics (AUV’s)

Activities: Blue Atlas Robotics ApS is a company dedicated to the development of autonomous operating underwater robots. Their vision is to provide high quality underwater images to all industries being exposed to the marine environment from the Shipping Industry, Offshore Oil & Gas and Windmill farms as well as any shore based structures. They build robots with six ultra-high-quality cameras that see underwater surface changes down to the millimetre and provide inspection packages that deliver clear, consistent, gapless imaging and detailed 3D surface maps.

* Collect valuable 3D maps to track surface changes over time
* Inspections provide proof and assurance of surface conditions
* Catch small faults before they turn into big, expensive ones
* Affordable solutions replace expensive dry-docks and diving

Contact: https://blueatlasrobotics.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Eye Robotics (Marine Drones Operated From a Smartphone)

Activities: Startup Blueye Robotics, which develops and sells underwater drones, has recently innovated drones that can be operated from a smartphone. The drones can explore depths far below the ocean's surface. Several NGOs in Norway, the US and Australia have used the startup's prototypes for ocean mapping and cleanups. Blueye was founded in 2015 by Erik Dyrkoren, Martin Ludvigsen, Christine Spiten and Erik Haugane. Erik D. came from his position with SINTEF Ocean, while Martin runs NTNU AMOS - Centre for Autonomous Marine Operations and Systems. Together with Christine Spiten they joined forces to create technology that made access to what´s below the surface easier. Angel investor Erik Haugane came on board and funded the foundation of the company. The company originally had the consumer market in mind but as the team never compromised on creating a user friendly and robust product, they pivoted into serving professional clients.

Blueye has delivered technology across a vast range of customer applications ranging from dam inspections, aquaculture, ship inspections, law enforcement, wastewater & drinking water management, marine surveillance, tourism and education (to mention some). Coming from Norway serving their home market has been the focus area, but they have clients in more than 40 countries worldwide. Today, the Blueye Team consists of 20 dedicated experts from different countries, working on many levels of software, robotics, mechanical- and industrial design, underwater technology, graphics design, business development, sales and marketing. Blueye is well funded with a commitment to develop more underwater technology to help clients solve the challenges they are struggling with, based on our principles of user friendliness and robustness.

They are growing and want more people to get to know our tech and therefore we are seeking both partners and salespersons to take part in their growth. Our engineers develop, test, manufacture and support our technology.

Contact: <https://www.blueyerobotics.com/page/our-story>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Cydome (Maritime Cybersecurity Solutions and Innovations)

* 90% Of the World Trade is carried by sea
* 200,000 Exposed Vessels
* 175 Million $ Average Cargo Value

Activities: Cydome developed a disruptive cyber solution seamlessly safeguarding the maritime and naval IoT ecosystem, including guidance, sensor, control, command, communication systems and linkage to coastal infrastructures; providing end-to-end protection from the kernel level using data and network isolation; rapid, reliable and automatic threat detection and protection. Cydome Security develops the first and most advanced cybersecurity end-to-end solutions for the maritime and naval industry. Cydome Security’s team includes industry experts from the cybersecurity, data protection, disaster recovery, and OT fields as well as former naval officers that lead nationwide cyber operations. Cydome aims to provide a seamless solution that protects and enhances the continuous operation of maritime vessels

Contact; <https://cydome.io/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Dive Technologies (AUV’s)

Activities: Dive Technologies has one goal: to produce the most reliable Autonomous Underwater Vehicles in the world's oceans at a disruptive price point. Best in class reliability will enable safe and successful access into the depths of the unknown. Dive Technologies is a Veteran-Owned Small Business (VOSB) founded by engineers with a passion for undersea exploration and the experience to bring novel subsea robotics to life. They believe that ocean exploration deserves a capable and reliable AUV to deliver data at an acceptable price and Dive Technologies AUVs are the answer. With a small, nimble, and focused team and a careful balance of engineering rigor, discipline, creativity, and agility, Dive Technologies is taking a new approach to AUVs with a simple elegance that delivers capability at an unparalleled level – changing ocean exploration forever.

Commercial Survey: Low cost, industry-leading endurance, and maximized vehicle availability make their vehicle ideal for littoral and deep-water survey and inspection missions.

Defence: Engineering & manufacturing services. Their large displacement vehicle (LDUUV) is based on a unique architecture that is robust, cost-efficient, and easily scaled for an extra-large (XLUUV) platform.

AUV Platform Services: Dive Technologies’ proprietary architecture and unmatched payload capacity provide an ideal platform to demonstrate developmental and next generation technologies.

Solutions

Dive Technologies’ AUV architecture promotes simple integration of industry leading and next generation energy, communications, and payload technologies. ‘Rapid adaptations to our core vehicle platform showcase unmatched versatility and efficiency while remaining steadfast on uncompromised reliability and affordability. Architected to support long duration missions at full ocean depth, Dive Technologies AUVs are the answer to boundless ocean exploration.’

Contact: https://divetechnologies.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### ECA Group (AUV’s to 6000 metres deep)

Activities: The ECA Groups’ ultra-deep water AUV is a 6,000 meters deep Autonomous Underwater Vehicle (AUV) for missions such as deep sea mining survey, oil / gas pipeline inspections, rescue missions and mineral resource exploration. From man-portable, mid-size to larger AUV, ECA Group's expertise in naval robotics enables to address the whole underwater market with high performance solutions to complete a wide range of missions. As an integrator, ECA Group offers mission driven interoperable systems using the best sensors on the market and a wide range of payload to be fitted on the equipment. Endurance and high quality imagery are the key advantage of ECA group underwater robotic systems. Their wide area coverage capabilities combined to a very stable architecture allow it to make the most of the data collected through the mission.

ECA Group's Autonomous Underwater Vehicles come with an user-friendly mission preparation and post analysis software. Missions can be prepared in advanced in order to be quickly deployed on field. The AUV performs its mission in a completely autonomous way enabling the operators to focuses on other important tasks and prepare post-mission treatment. The A- range of ECA Group AUVs can be easily automatically deployed from a Launch and Recovery System (LARS) on a vessel or an Unmanned Surface Vehicle (USV). Among the wide range of missions that can be conducted thanks to ECA group's naval drones. These solutions addresses the needs of Naval Forces, Coastal and Port authorities, Border control or any other operator involved in the defence or security of a sea or coastal area. Military applications include:

* Critical Infrastructure Protection
* Underwater Mine Warfare
* Rapid Environment Assessment (REA)
* Search and rescue operations
* Intelligence, Surveillance, Reconnaissance (ISR)
* Harbour / Costal Surveillance and Protection

ECA Group's AUV also finds applications in the commercial and Research sector, especially for Maritime purpose in the Subsea or Oil and Gas sector. From pipeline inspection operators to research institutes, ECA Group underwater robots capabilities in the civilian sector will address the operational requirements of a large panel of customers requiring missions of:

* Field Development | FPSO, Rigs | Subsea Works
* Mining | Bathymetry, Data Acquisition
* Deep Water Survey & Inspection

Contact; <https://www.ecagroup.com/en/find-your-eca-solutions/auv>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Eco Drone (Renewable Energy Powered Drones)

Activities: Eco Drone develops sea drones powered by renewable solar and wind energy for use in collecting valuable scientific data related to climate change, diffusion of pollutants, weather forecasting, and coastal law enforcement.

* Impact: Allows for data collection and monitoring with no emission or waste impact
* Founders: Marco Montagni, Nicola Di Luca, Andrea Bertini
* Location: Firenze, Tuscany, Italy

Contact; <https://www.globalinnovationexchange.org/innovation/ecodrone-srl>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ellipsis Earth (Drone Monitoring Solutions for Monitoring Material Pollution)

Activities: Ellipsis Earth are a technology-driven impact venture using drones, artificial intelligence and expertise to provide an end-to-end service for monitoring material pollution around the world. Ellipsis treasure hunts video and stills from around the world - from any source including drones, satellites, submarines and CCTV, and ingests them into our platform. Clients can submit their own images to Ellipsis, or one of their network of 500+ drone pilots can come to you.

**Stitch**

Drones take several thousand images when surveying the length of a beach, river or ocean. Artificial intelligence software then blends multiple photos into a master image for our enhanced geospatial mapping.

**Categorise**

Their software can then classify exactly what the plastic is, i.e plastic bottle, fishing net, bottle cap or toothbrush, to provide better context. They can even tailor our algorithm to uniquely detect specific plastic types (eg PVA, PET or styrofoam), particular local items (eg coffee capsules) or named brands.

**Identify**

Using our custom machine learning, Ellipsis software can identify plastic with a 93% accuracy and 95% certainty. Our data is therefore globally comparable and scientifically robust, works in submerged water, with defected or degraded plastic, and in all terrains.

Ellipsis Environmental

* Scans rivers and coastlines with drones, processes these images with a uniquely-trained algorithm to create detailed heatmaps of hotspots, and advises partners on the best approaches to tackle each pollution challenge.
* Impact: NGOs, authorities and industries can monitor pollution, take action and assess the effectiveness of initiatives, whilst optimizing clean-up.
* Founders: Ellie Mackay
* Location: London, England, United Kingdom

Contact: https://www.ellipsis.earth/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### F Drones (Autonomous Drones for Shore to Ship and Ship to Shore Deliveries)

Activities: F-drones is building autonomous drones for shore-to-ship and shore-to-oil rig deliveries. These drones would be able to lift 100kg loads over a 100km range, helping save 80% in costs, time and manpower for shipping agencies and helicopter operators. These are Drones that can save 80% of the costs, time, manpower and carbon emissions in marine & offshore logistics. They provide aerial transportation services to deliver supplies to ships and offshore platforms. ‘Just let us know what needs to be delivered, where to, pay us, and we'll get it done.’

Contact https://www.f-drones.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Fu-Vex Drones

Activities: Fu-Vex Drones’ vision is to bring drones to their next industrial stage: long range flights. To do so, they have developed a hybrid aircraft plane/multirotor with up to 5 times more range than helicopters/multirotors and capable of Vertical Take-Off and Landing (VTOL) from any flat surface. In addition, they are co-creating the systems required to fly long ranges legally collaborating with strategic partners. With their solution we save 78% cost compared with current solutions. They replace manned helicopters with long-range drones in linear infrastructure inspections (power lines, oil & gas pipelines) and maritime sector with up to 90% fewer costs. To do so, they have developed the aircraft with patented technology capable of replacing manned helicopters thanks to its Vertical Take-Off and Landing and its plane cruise with 2x range than conventional drones. To safely integrate their drones in civilian applications the main entry barrier is the regulation. To overcome this barrier, they have generated an ecosystem of key partners: regulators, clients, legal support, technological partners. Their business model is to manufacture the aircraft and sell it to clients and provide services.

Sustainable impact on blue economy: -Number of ships detected that do not comply with EU regulations in terms of fishing or emissions. -N of emergencies supported. -Number of spills or maritime litter detected.

Contact: http://www.fuvex.com/en/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Halona WEC Mobile AUV Docking Station (Wave Energy Powered)

Activities: The Hālona WEC is a mobile wave energy conversion platform that provides power for oceanographic sensors and autonomous underwater vehicles. The Hālona functions as a drifting charging platform to improve spatial and temporal resolution by utilizing ocean currents and known background flow patterns to propel the platform and navigate. Hālona is an Oscillating Water Column type WEC, that uses the rising and falling motion of the water to compress air into a turbine. The Halona WEC team will identify the needs of potential users of this device by interviewing government agency oceanographers, offshore oil industry personnel, and marine industry professionals. Based on these interviews, the team will develop a business plan and assess marketplace applicability and potential integration.

Contact <https://www.herox.com/oceanobserving/round/562/entry/24510>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Green Sea Systems (Commercial Open Architecture Source for Unmanned Marine Robotics)

Activities: The open architecture of OPENSEA allows easy and cost-effective integration of new vehicles, equipment, and devices. Its distributed and library-based architecture confines new software to small, easily managed, independent applications that are separate from mature, robust software. Together, these features enable the marine industry to quickly stand-up commercial-grade robotic systems and transition their focus to higher-level technologies providing differentiation and advancement. In cooperation with commercial manufacturers, developers, and vendors, OPENSEA continues to grow more capable and exponentially stronger every day. System builders benefit from thousands of hours of test time and an active development effort. By choosing OPENSEA for their core architecture, engineers are free to focus on their key areas of interest and expertise.

The OPENSEA architecture is designed to encapsulate the core of an unmanned system. The scope of the OPENSEA library includes interfaces and utilities essential to the robotics and unmanned systems community. Deriving from the OPENSEA library, the OPENSEA application suite provides hundreds of distributed independent applications that work together as building blocks for a complete system. These applications communicate with each other through the OPENSEA network and provide discrete capabilities required to integrate a system that is scalable, flexible, and severable. Greensea’s OPENSEA as a Platform business is designed to empower developers and innovators by leveraging the power of OPENSEA to reduce cost, reduce risk, and accelerate technology insertion within the industry. They price OPENSEA as a Platform programs based on the required license of OPENSEA and the support required from Greensea. Their goal is to drive to a standard product description from Greensea that the developer can then license as needed to field their final products.

A typical OPENSEA as a Platform engagement between a development partner and Greensea consists of four phases with the ultimate goal being a stable and mature product.

**Phase 0: Requirements**

Working together to scope out how OPENSEA can be of most value in the development. This effort culminates in a technical path forward.

**Phase 1: TRL6**

Initial development focuses on establishing a basic, robust operational system or minimum viable product.

**Phase 2: TRL8**

Further development of the product continues through addition of features and applications. Changes to the feature set are accompanied by testing and a continuous development cycle supporting product refinement.

**Phase 3: TRL9**

Phase 3 yields a commercial product, ready for wide distribution. The final system is fully documented and training materials are developed for operator and depot-level support.

Contact: GREENSEA SYSTEMS, INC.10 East Main Street :: PO Box 959 :: Richmond, VT 05477, USA

802.434.6080; [info@greensea.com](mailto:info@greensea.com); ‘https://greensea.com/opensea-platform/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Hydroswarm (AUV’s and Related Technology)

Activities: Hydroswarm is helping to make our oceans and borders safe and secure using intelligent connected technologies. Design and Dynamic Modelling of an Autonomous Underwater Vehicle for Submerged Surface Inspection exploiting Hydrodynamic Ground Effect. This includes design and development of a prototype micro AUV platform for submerged surface inspection; invention and application of hydrodynamic ground effect to the AUV for near surface motion reducing need for brute force control methods; and establishing a novel mathematical approach for robust estimation of complex non-linear elements using a linearized, data driven, high dimensional model. They are developing breakthrough products which will have a significant impact on maritime defence, security, and next generation asymmetric warfare. For the time being they are limited to what they can communicate publicly, but under the appropriate non-disclosures, they would be willing to discuss possibilities with selective parties.

* Port security
* ATFP
* MCM
* Recon & stealth
* Anti-submarine warfare

They are working tirelessly to develop new approaches to marine conservation, sustainability and preservation.

* Ocean And Climate Data
* Offshore Infrastructure
* Fisheries & Aquaculture
* Enclosed Water Facilities
* Ships/Fleets
* Coastal Areas And Rivers

Whether it is monitoring offshore assets, enabling sustainable fish farming, or preventing oil spill disasters, collecting data from remote marine areas has never been easier. Hydroswarm is committed to sustainability and preserving the earth's most precious asset, our oceans. If you are interested in exploring opportunities with Hydroswarm, they would be happy to engage in a conversation under an appropriate non-disclosure agreement.

Contact <https://www.hydroswarm.com/hydroswarmnews>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Kraken Robotics (AUV’s, Sensors, Software and Related Goods/Services)

Activities: Kraken Robotics Inc. (PNG-TSX) is a marine technology company engaged in the design, development and marketing of advanced sensors, software and underwater robotics for Unmanned Maritime Vehicles used in military and commercial applications. Products include 3D Laser imaging, AUV’s, Launch and recovery systems, sub-sea batteries and thrusters.

Robotics as a Service

With RaaS, Kraken offers leading underwater robotic solutions to meet the seabed survey needs of customers. As a complete service solution, they allow the customer to acquire survey data without the significant cost of asset ownership and maintenance. In paying in proportion to the equipment hours used, Kraken is providing customers with ultra-high definition seabed pixels by the hour.

The RaaS offering is a menu of services for our customers’ survey needs. They can provide this on a turn-key basis or can work in a support role with a customer’s vessel or other partners. Services range from:

* Mission planning
* Mobilization
* Survey operation
* Data analysis and mission reporting
* Demobilization
* Engineering Support

They can provide a range of services to help they customers meet their specific objectives:

* Integration support for our SAS and SeaVision™ sensors on customer vehicles
* Custom design of launch and recovery systems
* Robotics as a Service (RaaS) using either their tethered vehicle (KATFISH™) or AUV (THUNDERFISH®)
* Rental or lease purchase options
* Training
* Preventative maintenance plans
* Extended support and warranty plans
* Acoustic Signal Processing

Kraken’s Acoustic Signal Processing (ASPG) group focuses on developing passive sonar technologies for naval and civilian applications. The Acoustic Signal Processing Group (ASPG) has decades of experience in developing passive sonar signal processors and simulators, as well as providing lifecycle support for products in service with sophisticated naval customers. The ASPG is working to combine passive sonar signal processing with deep learning in order to substantially automate the classification of contacts, which is traditionally extremely operator-intensive. Deep learning neural network methods are well-suited to the Nvidia GPU architecture, which opens the door to performing real-time classification of signals on board an AUV with a relatively limited power budget.

Contact: https://krakenrobotics.com/products/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Maritime Robotics (AUV’s)

Activities: Their systems operate unmanned AUVs both in the air and on the surface. Their technology is developed in close collaboration with civilian, governmental and military partners. They focus on delivering high quality products and solutions that are cost-effective, reduce HSE risk exposure and are highly deployable in any conditions. Their products allow for the collection of data ranging from aerial to subsea. With their practical, user-friendly product design, data collection is possible anywhere in the world. They believe that the future of maritime operations is unmanned and that innovation in automation will drive industry standards and continually broaden operational possibilities.

Their headquarters are situated in Norway’s technology capital, Trondheim, staffed by a highly competent team with a global network of clients and partners. Their dedicated team is prepared to provide information and resources upon request, as well as assist you in finding the right solution for your maritime operation. Their goal is to make your unmanned endeavours as simple, successful and cost-effective as they can be.

MARINER: The Mariner Unmanned Surface Vehicle (USV) is a multipurpose unmanned vehicle for offshore and coastal applications.

OTTER: The Otter Unmanned Surface Vehicle (USV) is an easily deployable and portable USV, which provides a cost-effective turn-key solution for bathymetric surveys in sheltered waters.

CONVERSION SYSTEM

The Conversion System allows for a manned vessel to be converted to an unmanned vessel. Users are able to take advantage of the possibilities of surface operations, while still having the option of manned use.

Moored Balloon System OCEANEYE®

The OceanEye is a Moored Balloon System (MBS) which provides 24/7 maritime aerial surveillance from fixed locations or moving vehicles.

Contact: <https://www.maritimerobotics.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Marauder Robotics (AUV Platform, AUV Applications and Sea Urchin Resolving Robots)

Activities: Marauder Robotics is building a robust and rugged autonomous underwater vehicle platform. This marine management tool leverages computer vision (CV), machine learning (ML), and robotics to automate tasks done today by divers. Their platform continuously collects environmental, marine ecology, general ocean health, and security data sets used to create market management tools in the ocean restoration, sustainable artisanal fishing, and precision aquaculture industries.

They motivate their activities as under:

Kelp forests form the foundation of the world’s most productive fisheries and are in decline due to the overfishing of predators, global warming, and frequent severe storm events. Healthy kelp forests lead to healthy oceans, which provide up to 70% of the Earth's oxygen. Government marine habitat conservation program and corporate seaweed sourcing managers must uphold two conflicting mandates. The first mandate is to deploy and keep predators in sensitive fishery ecosystems to suppress herbivore populations at healthy and sustainable levels. The absence of natural predators like the sheepshead fish, lobsters, and crabs cause the predator/prey ratio to fall out of balance. This imbalance favour grazers (e.g., urchins) that consume all available plant biomass resulting in urchin barrens. In the worse cases, urchin barrens are devoid of all plant and animal life except for the malnourished and atrophied grazers. Urchin barrens have been documented over 3.3M acres in the ocean.

The second mandate is to allow fishers to earn a living by hunting natural ocean predators. Unfortunately, managers are struggling to uphold both of these competing commitments. Providing predators when and where they are needed is how Marauder Robotics technologies show up and support marine conservation and kelp sourcing managers. Marauder Robotics primary purpose is to develop marine technology that enables better ocean stewards. Their initial focus is to restore and maintain balance in ocean ecosystems that have been compromised by overfishing of natural predators. They are building and deploying efficient and cost-effective alternatives to disappearing natural predators that suppress prey populations to sustainable levels. They are currently developing an artificially intelligent and tunable autonomous underwater predator to augment disappearing natural predators. They have talked with stakeholders on multiple continents where urchin overpopulation is a problem, and are currently discussing where initial pilot deployment will occur. To understand the severity in one of these locations, predator-prey imbalances have led to urchin barrens, and pose a threat to a $150M lobster and abalone market, and an overall $10B related regional maritime economy.

Contact http://balancedoceans.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Nido Robotics (Underwater Robots)

Activities: Nido Robotics is a company dedicated to the development, manufacture and sale of underwater robots and all kinds of additional payment charges. They understand that underwater inspections, maintenance and repairs often carry a high risk to the people involved, and that pre-existing systems are cost prohibitive for most SMEs. That is why they have developed solutions that fit all budgets. At Nido Robotics, they manufacture underwater drones that allow them to perform inspection, maintenance or research efficiently, at very competitive prices, and without putting any human life at risk.

Contact https://www.nidorobotics.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Aero (Ocean Drones)

Activities: Ocean Aero is a company that designs, manufactures, and operates ‘the industry's only fully autonomous surface and subsurface ocean drones. As hybrid wind and solar powered vehicles, Ocean Aero's drones are a sustainable technology currently used in the ocean defence and data collection industries. From wildlife tracking to stealth-required intelligence, surveillance, and reconnaissance missions, Ocean Aero provides flexibility in state-of-the-art payload configurations that are easy to transport, launch and recover from anywhere in the world. Triton is’ the world’s only wind and solar powered, intelligent autonomous vehicle that both sails and submerges for unparalleled data collection and intelligence gathering in some of the hardest-to-reach-places on the planet’. Intelligently designed with advanced materials, Triton can be configured to carry an almost infinite variety of payloads to complete any mission.

Contact: <https://oceanaero.com/technology>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Infinity (AUV Marine Robotics)

Activities: Ocean Infinity’s Armada fleet revolutionises the acquisition of ocean data by using innovative, low emission fleet technology that can be launched from any shoreline on the globe. Their fleet comprises of fifteen robotic ships, all equipped with state-of-the-art sensors and pioneering navigational technology that allows information to be gathered from the shallowest and deepest waters. Sustainably providing answers at scale.

Remote Reach: They can serve a wide variety of client needs even in the most remote locations. Their unmanned robots can be easily transported by sea, air and land transport. Each vessel has been specifically designed to ensure. They can rapidly deploy their fleet anywhere on the globe.

Safety: Armada does not require anyone to be sent offshore. This is a step change in safety by keeping people physically out of harm’s way. They comply with and are helping to further enhance industry codes of practice. They are also developing positive relationships with national coastguards and associated bodies as they spearhead the deployment of robotic shipping.

Sustainability: Their marine robots use hybrid technology to offer a significant saving in CO2 emissions. An Armada robot emits up to 90% less CO2 than a conventional survey vessel. In certain applications they will be able to run fully electric, completely emission free.

Data: Unmanned systems operating 24/7, globally available and uploading data to control centres and experts onshore allow us to quickly and confidently provide you with results. Operating as fleets or individuals, Armada robots will gather data rapidly, efficiently and with levels of redundancy for peace of mind.

INFINITY FLEET

‘Our Autonomous Underwater Vehicles are the world's most advanced autonomous robots operating in the oceans worldwide: acquiring, analysing and expanding our unrivalled knowledge of the seafloor.’

Contact; https://oceaninfinity.com/marine-robotics/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Sensor Network and Trident Drone (Sofarocean Company)

Activities: Trident enables exploring the underwater world, surveying underwater bathymetry and reefs, or inspecting equipment and installations, without the cost, complexity and risk of diving. ‘We connect the world's oceans’. As a first step toward that goal they deployed and operate the largest open ocean weather sensor network in the world. Their mission is to provide unique ocean insights to science, society and industries to support a more sustainable interaction with our oceans and our planet. Collect your own data? Check out their ocean tools. They are passionate about enabling you to collect ocean data and explore the underwater world. Their ocean tools are built to last, designed for usability and affordability, and validated to provide high-fidelity ocean data.

Spotter: Get real-time marine weather data anywhere.

Wind, Wave, and Temperature Data: Spotter collects 3D displacement time series and water temperature data. The 2D wave spectrum, surface wind velocity, and Sea Surface Temperature (SST) are calculated and stored on-board, and user-selected data is transmitted through satellite to the Spotter Dashboard.

Compact & Portable

* Spotter can be shipped anywhere around the world, carried by hand, and deployed without any special equipment.
* Solar Powered
* Self-contained, low maintenance, and always ready to go.
* Explore the underwater world with ease.

Tough & Portable

Trident is a ruggedized underwater tool, designed to operate in any condition. The ultra-compact and lightweight design make it easy to carry in your backpack, and launch from your kayak. Trident's speed and manoeuvrability can get you to places that divers can’t go.

Amazing Underwater Video: Stream live from your phone or tablet in low-latency, and record in full HD simultaneously.

Elegant Controls: Trident’s intuitive controls make it easy to fly so you can focus on the mission at hand. For remote missions, the Strider autonomous surface vehicle can provide topside communications to Trident. Get real-time access to your underwater sensors.

Sensor modularity: Spotter + Smart Mooring provide unprecedented flexibility and modularity. The system is designed to integrate with most sensors. You pick the sensor and at what depth you want it, they take care of the rest.

Smart Mooring + Spotter comes as a single package that can be deployed from any size vessel. After deployment, data will start flowing to your Dashboard and API. It is that simple.

Realtime Data: ‘Never worry about whether your sensor is working. Data from sensors is available in real-time in the Spotter Dashboard and API so you always know what is going on’.

Contact: <https://www.sofarocean.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### (Ocean Server Technology)

Activities: Ocean Server, a subsidiary of global aerospace and defence technology company L3Harris, has designed and manufactured the first 'family' of low cost, lightweight AUVs. The AUVs, called Ivers, come in three iterations and are designed for coastal applications. The maximum depth of the Iver4 is 300m below surface level. Ivers can be operated from the shore by a single person, which has obvious safety benefits. There are currently over 300 Iver models in operation, with applications in energy, intelligence, marine biology, research, search and rescue, and inspections.

Contact https://www.l3harris.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Open Ocean Robotics (Autonomous Energy/Ocean Data Based Vessels)

Activities: Open Ocean Robotics is a company that develops autonomous energy-harvesting boats to collect information from our oceans and instantly relay it. Their goal is to protect our oceans, reduce greenhouse gas emissions and build an Internet of Things for the ocean. A clean tech solution to collecting ocean data

They motivate their activities as under:

**Solar powered autonomous boats providing real time information to protect our oceans.**

Our oceans are full of information. Information that can protect at-risk whale species, allow ships to voyage more fuel-efficient routes, crack down on illegal fishing, and enable us to better understand the impacts of climate change. Their boats are equipped with sensors, cameras and communication devices so that they can capture information from anywhere on the ocean and have instant access to it. Harvesting energy from the sun, their boats travel nonstop for months, without producing any greenhouse gas emissions, noise pollution or risk of oil spills. They are an essential component to creating a digital ocean, an Internet of Things for the sea, where we finally begin to understand some of the most mysterious regions of our planet. They provide complete mission services, collecting the data that you need and delivering it when you need it. Their team will help you plan the mission and execute it from start to finish, and work with you to ensure that you have the sensors you need for your data collection missions

Improved ship fuel efficiency: Boats produce 1000 megaton of greenhouse gas emissions every year, more than all of Canada emits. By helping ships plot more fuel-efficient routes using real-time information on ocean conditions, ships can conserve fuel and reduce emissions.

Reduce greenhouse gas emissions: Taking one offshore research vessel off the ocean for a week is like taking 100 cars off the road for a year. Their boats can replace or augment vessels that use sensors or cameras to observe, protect and understand the ocean, reducing the need for traditional fuel consuming vessels.

Crack down on illegal fishing: Illegal fishing accounts for 20% of all wild fish caught, earning poachers $30 billion a year. Their boats can patrol the ocean, safeguard Marine Protected Areas and facilitate the capture of illegally operating vessels.

Detect and clean up oil spills: 700 million litres of oil enters the ocean every year through boat spills, leaks and intentional discharges. Their boats can monitor for oil spills, detect intentional dumping and aid in the clean up effort.

Understand climate change: Oceans bear the brunt of climate change, causing acidification, sea level increases, and changes in temperature and currents, which impacts the health of marine species, ecosystems, and our coastal communities. The boats can measure the changes in our ocean so we can better understand how to respond.

Safeguard the arctic: Melting Arctic sea ice has tripled traffic in the north over the last 25 years yet only 1 per cent of the Canadian Arctic is charted to modern standards. They can provide a cost-effective method to map the Arctic to reduce the risks of ships running aground and observation in remote regions to expedite response time.

Contact: <https://openoceanrobotics.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Recon Robotics (Anti-Piracy, Surveillance and Maritime Security Micro Robot Reconnaissance Solutions)

Activities: Technology such as the Recon Scout Throwbot by Recon Robotics is a small, dumbbell-shaped robot that is able to infiltrate the main deck of a boat for stealth inspections. The device’s magnetic wheels allow it to climb up the side of a ship onto the deck and manoeuvre around. Operators are able to see what is happening in real-time, even during the night, thanks to the featured camera and infrared sensors. The device can be controlled by a joystick from the nearby command centre.

Contact: <https://reconrobotics.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Saildrone

Activities: Saildrone is a revolutionary unmanned surface vehicle, powered by wind and solar energy, that is capable of navigating to any part of the world's oceans. Carrying high precision scientific sensors, the Saildrone samples key atmospheric and ocean variables as it goes, sending data to the cloud in real time via satellite. The speed, payload, range and affordability of the Saildrone platform is ‘unprecedented among ocean sensing platforms.’

Contact: <https://www.saildrone.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Proven (Drones for Sea Rescue and Other Applications)

Activities: SEA PROVEN imagines the boats of the future and positions itself as a key player in the market for surface marine drones. In addition to the design and manufacture of marine drones for its own account, the SEA PROVEN design office uses its skills in marine robotics to meet the specific demands of its customers: dronisation of a boat or engine up to the design and custom marine drone manufacturing. “The seas and oceans cover 70% of our planet. The challenge of the 21st century is to discover and master these vast territories thanks to new robotics solutions’. Designer and manufacturer of the most innovative nautical drones of their generation, SEA PROVEN offers:

* the Sphyrna: the largest civilian surface drone in the world, its unique conception and design make it autonomous over great distances.
* The Speed Rescue, nautical drone for sea rescue
* The Speed Survey, an agile and efficient nautical drone

Contact: www.seaproven.com

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Trac (Solar Powered Autonomous Drones)

Activities: Sea Trac have a complete system for autonomous observation, data collection, and reconnaissance. The boat is electric: it gets energy from the sun, and stores it in large batteries, enabling it to operate through varying weather conditions. The boat is autonomous: it runs programmed missions that can last from several hours up to several months. It normally makes decisions on its own, but it supports “person in-the-loop” and can be remotely controlled. Missions can be easily changed on the fly.

Communications: The base package includes several wireless links for basic inshore and offshore operations. Additional options are available to satisfy a variety of control and data requirements.

Environment: The boat is designed to operate in a wide range of conditions, from shallow embayments with significant current, out to the open ocean.

Mission control software: The system is designed to tackle a wide range of missions.

Sensors: The base package includes a variety of built-in sensors, and the system is designed to support a wide range of customer payload sensors.

Launch and recovery: The base package includes a trailer for towing behind a car. There is also a single point lift at the center of the boat for crane pickup.

Contact: <https://www.seatrac.com/the-seatrac-system/how-it-works/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Shoreline (Maritime and Cybersecurity Insurance)

Activities: In today’s online interconnected world it is a matter of when not if your company will be hacked. With this eventuality in mind, Shoreline is pleased to offer a bespoke marine cyber cover that will provide flexible risk transfer, tailored to the needs of the individual shipowner, at favourable premium rates. Shoreline’s innovative solutions meet pressing, specialist marine insurance needs. Working alongside the shipping community and global marine insurance brokers, and as a satellite resource for the International Group of P&I (IG) Clubs, they find answers to complex insurance challenges.

Contact: https://www.shoreline.bm/profile/people/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Unseen Labs (Maritime Surveillance Solutions)

Activities: Unseen Labs provides civil and military actors in the maritime surveillance sector, the localisation of ships by listening and characterizing their passive electromagnetic signature. UNSEENLABS is a French company from Brittany whose core business is the development, production and operation of innovative Earth observation instruments, specialized in the detection of electromagnetic emissions. Innovative: The service proposed by UNSEENLABS is a maritime surveillance service, allowing the location and characterization of ships at sea from space, based on the electromagnetic intelligence instruments developed by UNSEENLABS, and deployed on a constellation of Cube satellites. Technologies: UNSEENLABS stands out from the other players in the field of maritime surveillance with an innovative and unique electromagnetic intelligence service capable of observing maritime traffic, even without any cooperative beacon. UNSEENLABS is a maritime surveillance data provider. Its service will provide every actors of this domain the capability to find and follow ships, even in uncooperative use cases.

They motivate their activities as under:

**Targeted Challenges and Focus Areas**

Illegal Fishing:

* It is difficult to monitor fishing activity at sea
* Sharing data on fishing is challenging
* Fishing boats can change their identity and jurisdiction
* Monitor, Control and Surveillance may not be possible for some countries

Unseen Labs provides ready-to-use data, easily integrated. With 90% of the traffic of goods is maritime, climate change, lots of things to do to monitor the seas. Earth observation from space provides large and fast maritime situational awareness.

What's the impact? - To be able to find, identify and track the illegal activities at sea. To provide relevant information to the decision-makers

Contact: https://unseenlabs.space/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 6. LNG AND OTHER MARINE FUEL SOLUTIONS

### Algae Production Systems (Base for Biodiesel and Organic Fertiliser)

Activities: Algae Production Systems manufactures equipment to grow and harvest algae and extract algae oil for use as a feedstock for the biodiesel industry and organic fertilizer for the farming industry. The world of renewable energy is experiencing explosive growth. Algae Production Systems, Inc. was formed with the goal of producing and marketing turnkey, commercial scale, economically viable algae production systems. This growth should continue unabated for the next decade or longer. Companies engaged in all aspects of this industry can expect high profits. The most promising and potentially profitable segment of the "renewables" industry is that segment dealing with algae and algae related products. Algae consume the Green House Gas (GHG) CO2 and produce algae oil (lipid) which can be turned into fuel. An algae farm for the production of algae oil and biomass in large quantities will fill what is currently a significant void in the alternative energy arena. The Algae Oil from the farm can be processed into environmentally friendly, zero sulphur biodiesel fuel, while the biomass can be processed into organic fertilizer. The revenue potential is tremendous for an algae facility producing biodiesel fuel and organic fertilizer on a commercial scale.

They motivate their activities as under:

Many nations produce no crude oil or refined fuels of their own, e.g.in the Caribbean, and therefore their diesel fuel cost are extremely high, making them a prime candidate for the implementation of algae based fuel systems. There are many other uses for the algae biomass, such as for organic fertilizer, in order to replace environmentally damaging chemical fertilizers. APS will provide a turn-key operation, in that APS will install all equipment and make the farm fully operational, to include training of the farm operators. Market demand and pricing for the biodiesel fuel and the organic fertilizer made from the biomass is easily determined as these are universal products that are in global demand. The positive economic impact from lower fuel cost will be significant. Additional products that can be made from algae include pharmaceuticals, cosmetics, nutraceuticals and animal feeds.

The cultivation of algae is a perfect match to the mission of such governmental agencies, as the DoE, which was formed almost 30 years ago with the mandate to eliminate our dependency on foreign oil. Algae also have the potential to make the United States energy independent with regard to liquid fuels. With only 16,000 square miles turned to algae production there is the potential to eliminate the need for 60% of the transportation fuel produced by US refineries. By contrast, it would take approximately 2 million square miles to accomplish the same result using alternative sources of plant based oils, such as Soy Bean Oil. Algae Production Systems has designed state of the art systems that will produce algae and extract the algae oil on a commercial scale. The success of algae farming does not rely on the creation of a new market, but has multiple existing markets that are extremely large and in which there are currently few competitors. Algae farming is a sound venture with high return and low risk. APS is ready to fulfil the demand for the equipment and systems that will be needed in this new market.

Contact: //www.algaeproductionsystems.com

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Culture Biosystems (Marine Fuel, Culture Feeds and Nutraceuticals)

Activities: Culture BioSystems' technology platforms address many of the challenges associated with traditional oils, such as price volatility and negative environmental impacts. Their technology enables the organic growth of the algae in a system that minimizes contamination from other algae strains while still being low cost. Therefore, they believe that the algae grown from their cultivation platform can address the needs of the market areas including nutraceuticals, feeds, fuels, and nutrition. Algae are rapidly growing organisms which contain oil, protein and carbohydrates in their biomass. After cultivation and harvesting, these algae components can be processed into final products for use by humans and animals.

They motivate their activities as under;

Culture Feeds

Fresh, live algae are a superior feed for aquaculture hatcheries compared to frozen or dry paste. With Culture Biosystem’s cultivation platform, the cost of producing this superior product is comparable to existing products. Live algae can be used in the following types of hatcheries: Marine fish; Shellfish and Shrimp.

Nutraceutical

Demand for natural health products, such as omega-3, is increasing globally. The principal current source of omega3 - fish - consume algae oil which provides them with omega3. Thus, algae can be grown directly and cut out the “middle fish”. Additionally, algae can be grown to produce beta-carotene and astaxanthin.

Fuels

Integrated algae companies and industrial companies in adjoining sectors (oil companies, CO2 emitters, phosphate mining companies) use the large Float-Algae and Land-Algae platforms to produce scalable, low-cost algae for conversion into fuel.

Contact: <https://www.culturebiosystems.com/our-products>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### CWP Renewables (Hydrogen Fuel and Renewable Energy/Desalination)

Activities: CWP Renewables is a renewable energy developer, part of the PostScriptum Group. They are driven by a need to build a sustainable future, and their projects across the world have already displaced over 3 million tons of CO2 emissions. From the big to the small, working with local communities to help them decarbonize by providing them with low-cost, clean electricity is what they do best. WP Renewables is one of the global pioneers of large scale “PtX” (Power-to-‘X’) where ultra-low cost renewable energy is used to make green hydrogen and its derivatives. Beginning five years ago with the 26GW Asian Renewable Energy Hub , and continuing with newer projects, they are developing several vast green hydrogen projects, an essential component of any viable solution for the decarbonization of the global economy and solving the climate crisis. These bold projects of massive scale are the only way to make a dent in global emissions and to put the world on track to achieving the temperature limit goals in the Paris Agreement.

They motivate their activities as under:

The cost of renewable energy continues to fall, below the cost of all alternative generating technologies, to the point where green hydrogen produced using renewable energy is already cost-competitive with fossil-fuel-based alternatives and is heading lower. Produced using wind and solar powered electrolysis, green hydrogen can be used to substitute for fossil-fuel alternatives in multiple sectors, including power generation, shipping and steel production, always doing the same function as the fossil-fuel alternatives but with zero CO2 emissions Only by developing these new green PtX projects at massive scale can the economics of the new technology be made competitive. It has been estimated that green hydrogen could contribute a significant percentage of the world’s energy mix by 2050 and could represent a $2.5 trillion new industry by 2050, and a critical contributor to the pace of decarbonization required. CWP Renewables and its consortium partners commenced work on the flagship Asian Renewable Energy Hub (AREH) in 2015. Situated on more than 6.500 square kilometres in the remote Pilbara region of Western Australia, and with an estimated capital cost of US$36 billion, the 26GW hybrid wind and solar power plant for hydrogen production will be the world’s biggest energy project, and the largest single infrastructure project ever developed in Australia. The AREH project received a double boost recently, with the Australian Government announcing Major Project Status, and the Western Australian State Government announcing a critical approval for the project’s first phase of 15GW hybrid wind and solar power. These momentous announcements set the stage for detailed design work and the next stage of discussions with off-takers and investors for what will be the first ultra-large clean energy facility on the planet, exporting green hydrogen and green ammonia to global markets.

Contact: <https://www.cwprenewables.com/hydrogen/>

### DNV GL (LNG Fuel Provider and LNG Powered Containership Pilot Project)

Activities: This is a leading service provider with long experience in the maritime and oil and gas industries. They have gained extensive knowledge across the entire LNG value chain - from the wellhead along the full value chain to end consumers.

A large number of LNG fuelled ships and LNG tankers sailing the oceans today have been certified and classed by them, while they have also conducted numerous terminal feasibility and safety studies as well as certification and survey work. They run studies on behalf of private organisations and governmental bodies to prepare clients for the introduction of a small scale LNG value chain.

They motivate their activities as under:

LNG as a fuel is both a proven and available commercial solution. LNG offers huge advantages, especially for ships in the light of ever-tightening emission regulations. Conventional oil-based fuels will remain the main fuel option for most vessels in the near future, and, at the same time, the commercial opportunities of LNG are interesting for many projects. While different technologies can be used to comply with air emission limits, LNG technology is a smart way to meet existing and upcoming requirements for the main types of emissions (SOx, NOx, PM, CO2). LNG can be competitive pricewise with distillate fuels and, unlike other solutions, in many cases does not require the installation of additional process technology.

LNG safety**:** Gas carriers around the world have been using liquefied natural gas (LNG) as part of their fuel source for decades. The safety record of LNG carriers is extremely good. Even though most of the principles remain the same, using LNG as fuel for conventional ships introduces new systems on board together with their associated risks. In order to design, build and operate a gas-fuelled vessel in a safe and sustainable way, these risks will have to be thoroughly investigated and minimised.

Important risk-related items to consider include:

* High energy content of the LNG tank
* Explosion hazard in case of gas leakage
* Extremely low temperatures of the LNG fuel
* Location/arrangements of system
* Hazardous vs. non-hazardous spaces
* Inexperienced crew (new fuel source)

The technical main systems used in LNG as fuel technology are the containment systems, used to store the LNG on board, the process systems for conditioning the LNG and the engines to generate propulsion power and electrical energy.

**Piston Engine Room Free Efficient Containership (PERFECT)**

In late 2015 GTT, CMA CGM (and its subsidiary CMA Ships) and DNV GL released a technical and feasibility study for a new mega box ship – the Piston Engine Room Free Efficient Containership PERFECT. The concept vessel is LNG-fuelled, powered by a combined gas and steam turbine, and is electrically driven. The feasibility study established that technically and economically, a COGES-powered electric ship was worth a more detailed study. In 2016, ABB as expert in electric propulsion, OMT as naval architect, and Caterpillar’s Solar Turbines as the COGES supplier joined the consortium. Exploring this novel configuration resulted in the partners identifying and analysing a propulsion concept that has the potential to offer a more efficient, more flexible and greener box ship design than current 20,000 TEU two-stroke diesel engine driven ultra large container vessels.

PERFECT II

Piston Engine Room Free Efficient Containership (PERFECT)

Containment systems

The containment systems which store LNG on board ships follow the design principles known from gas carriers. Nevertheless, LNG as a ship fuel has initiated new design concepts for containment systems. To drive forward these innovations, DNV GL is working with a number of LNG containment system suppliers to gain approval of their new systems.

Process systems: To use LNG as fuel it is necessary to extract it from the tank with pumps or pressure, to condition it by vaporisation, pressurisation and warming. Finally, the natural gas has to be routed to the engine’s gas valve unit and into the engine itself. All these process technology steps must be accomplished without any gas leakage into the ship.

Engines for gas-fuelled ships: The switch to natural gas as a ship fuel is possible today. In light of the sulphur limits in Emission Control Areas and the upcoming global sulphur cap, LNG-fuelled ships are a viable option to achieve compliance. However, many ship owners and operators are asking themselves which engines are the best for changing over to a gas-fuelled ship. The two key engines on the market today are dual-fuel and gas-only types. ‘To support the decision-making process, we take a closer look at the differences and benefits of these two engine types, as well as their positive effects on emissions to air’.

Contact: <https://www.dnvgl.com/maritime/lng/index.html>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Farwind (Zero Emission Fuel Production via Offshore Wind Energy)

Activities: The core technology in FARWIND energy solutions is the energy ship, which is an autonomous sailing ship propelled by wind. FARWIND's ambition is to consolidate the new concept of net zero-emissions fuel production from the far-offshore wind energy resource. This requires demonstrating the viability of a radically new enabling technology: the FARWIND energy system, which is based on (i) mobile off-grid energy converters (FARWINDERs) producing sustainable fuels and (ii) specific tankers providing support to the converters (fuel transport, feedstock supply, control, maintenance, security). This breakthrough technology will enable clean fuel production from the yet-untapped tremendous far-offshore wind energy resource. It will contribute to decreasing greenhouse gas emissions, in line with the objectives set out in the Paris agreement, increase energy security in Europe, strengthen the EU leadership on renewables, and is expected to disrupt the energy supply market, creating jobs and growth through the development of the new FARWIND industry.

They motivate their activities as under:

FARWIND is a clean renewable source of energy. It taps into far shore wind energy. It provides on-demand renewable energy through batteries or liquid fuel. It offers a plug-and-play solution, fully compatible with existing infrastructures and uses. It is scalable thanks to the abundant availability of far shore wind zones. It only requires more ships (ports are not likely to be constraining). It is already affordable on niche non-interconnected areas where fuel delivery is expensive and uncertain. The future short-terms revenues will be achieved through the monetization of the small-scale prototype through battery recharge. This should act as a market proof of concept rather than as a continuous and sustainable revenue stream.

Sustainable impact on blue economy: Reduces carbon emissions, Increases the use of renewable energy resources, Encourages sustainable use of maritime resources

Contact: https://farwind-energy.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Genifuels (Aquatic Biomass and Other Emissions Reducing Fuel Solutions)

Activities: Genifuel designs and produces hydrothermal processing (HTP) systems to produce biofuel from wet organic material. The systems can be designed for a wide variety of feedstocks and in various sizes depending on feedstock availability. Output products can be bio-oil, natural gas, or both. Genifuel is currently focusing on waste-to-energy applications using various waste materials as feedstock. The most important application is the use of HTP for processing wastewater sludges and biosolids. This completely eliminates the solids and creates significant savings for utilities while producing valuable renewable fuels and reducing greenhouse gases.

They motivate their activities as under:

Advantages of Hydrothermal Processing:

* Genifuel's Hydrothermal Processing (HTP) works with almost any organic feedstock, converting more than 99% of the organic content to fuels or inert products
* Most of the feedstocks processed with HTP are wet wastes. A list of some feedstocks which have been tested with HTP is shown here.
* When processing wet wastes, Genifuel's HTP "Solves Three Problems At Once"™: (1) HTP cleanly disposes of the wet waste material; (2) It produces renewable fuel; and (3) It produces clean, clear, sterile water.
* No other process, whether wet or dry, achieves the technical and economic efficiency of HTP. Dry processes such as pyrolysis waste considerable energy simply drying the feedstock, while wet processes such as anaerobic digestion typically convert only half or less of the feedstock to usable fuel.
* The quality of oil and gas produced by HTP is better than any other process. The biocrude oil is much less oxygenated and contains far less water than pyrolysis oil, and is correspondingly easier and less expensive to refine. It is also low in sulphur, making it similar to a light, sweet crude. The gas product is clean, and contains no sulphur, nitrogen, silanes, and very little water. It can be burned directly or easily stripped of carbon dioxide for insertion into a natural gas pipeline.
* The renewable fuels from HTP can make a substantial contribution to world energy supplies--up to 25% or more of the transportation fuel supplied by fossil sources. This is far more than today's contribution by wind and solar.
* The economics of HTP do not depend solely on the price of oil and gas. This is because the process is also disposing of wet wastes and providing clean water, both of which are economically valuable results. Other valuable products can include fertilizer, waste heat from Combined Heat and Power (CHP), carbon credits, and others.
* HTP is inherently distributed, meaning it can be located close to the source of the wet feedstock. This eliminates the need for transportation of wet, heavy material and makes better use of existing infrastructure.
* Renewable fuels and electricity made with HTP often qualify for renewable credits and subsidies.
* Energy made from wet wastes does not compete with food production--in fact, food wastes from processing or food service facilities can be used as feedstock, creating a "virtuous cycle".

Contact: <http://www.genifuel.com/advantages.html>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Hy-Sil Labs (Hydrogen Carrier Storage, Transport and Utilisation Solutions)

Activities: Although hydrogen is considered as one of the most powerful energy sources, its storage is the major technical obstacle to democratization. By offering a unique solution of on-demand hydrogen production, HySiLabs removes hydrogen gas from storage. The HySiLabs solution - combined with a H2 Fuel Cell - is the only source of liquid energy without emitting CO2 on the off-grid energy market. After demonstrating technical viability of the solution, HySiLabs offers to integrate this unique (patented) energy source to customers eager to generate new value to their products.

PROJECT DESCRIPTION

HySiLabs introduces its expertise in the hydrogen mobility sector with its liquid hydrogen carrier unique solution: HydroSil. This patented molecule is stable at ambient conditions and safe, with a similar handling (logistics and infrastructures) as existing fuels. It can carry seven time more hydrogen than traditional carriers. The technology maintains the advantages of an energy-dense hydrogen carrier without any storage or transportation issues encountered for gaseous hydrogen.

They motivate their activities as under:

HySiLabs revolutionises the hydrogen delivery market with its unique liquid carrier solution. HySiLabs offers to industrial players in the energy sector an emission-free and handy solution to transport and deliver substantial quantities of hydrogen. This liquid hydrogen-carrier enables the release of hydrogen on-demand, with no energy input. The liquid hydrogen-carrier is stable, and can be transported in the same logistics as conventional fuels.

The solution comprises two innovations, referring to two different TRL. Concerning the process of charge (charging a liquid carrier with green hydrogen), the Proof of Concept has already been done and validated at small scale in an industrial environment. The next 18 months will then mainly focus on the pre-industrialisation of the process, with the construction of a demonstrator as the next major milestone. This part of the development is now at a TRL3 and will reach TRL5 in the coming months. Concerning the process of hydrogen release from the carrier, the innovation is in a more mature stage: a demonstrator for a small stationary application (backup power for an IoT tower) has been installed in Technopôle de l’Arbois. This demonstrator validated the process of release of hydrogen and demonstrates the simplicity and safety of the solution (compared to pressurised hydrogen for example). Following this demonstrator, a prototype for increased rates of hydrogen release has been built. This part of the development is now at a TRL7.

Sustainable impact on blue economy: Our non-organic, silicon-based carrier, can carry green hydrogen.

Contact: https://hysilabs.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Iberola (Hydrogen and Renewable Energy)

Activities: Puertollano Green Hydrogen Plant: Iberdrola will construct the largest green hydrogen plant for industrial use in Europe. The Puertollano (Ciudad Real) plant will consist of a 100 MW photovoltaic solar plant, a lithium-ion battery system with a storage capacity of 20 MWh and one of the largest electrolytic hydrogen production systems in the world (20 MW). All from 100 % renewable sources.

* Total installed capacity 100 MW + 20 MW + 20 MWh storage
* Jobs created: 700 jobs
* Investment:150 million euros
* Commissioning date: 2021

With an investment of 150 million euros, the initiative will create up to 700 jobs and prevent emissions of 39,000 tCO2/year. The green hydrogen produced there will be used at Fertiberia's local ammonia plant., which is already one of the most efficient plants in the European Union with a production capacity of more than 200,000 t/year. Fertiberia will update and modify the plant to be able to use the green hydrogen to manufacture green fertilisers. Thanks to this technology, it will be able to reduce natural gas requirements at the plant by over 10 % and will be the first European company in the sector to develop expertise in large-scale green ammonia generation. The new plant, which will become operational in 2021, will be developed in the municipality of Puertollano, a prime location with an important industrial hub. It is also the location of the National Hydrogen Centre, which has advised on the project since its inception. In addition, the project will help advance the technological maturity of green hydrogen and make it a solution for efficient decarbonisation in the medium term, both for the industry that uses it as a raw material, and for processes that are difficult to electrify, such as heavy haulage. Iberdrola has selected to the European company Nel Hydrogen Electrolyser — a division of Nel ASA — as its preferred supplier for the construction of the hydrogen production system using electrolysis, which will be based on its Proton PEM® solution.

IBERDROLA AND FERTIBERIA PLAN 800 MW OF GREEN HYDROGEN

The alliance between Iberdrola and Fertiberia aims to place Spain at the forefront of green hydrogen in Europe and make it a technological benchmark in the production and use of this resource, especially in the field of electrolysis. To this end, both companies have launched a comprehensive project that includes the development of 800 MW of green hydrogen with an investment of 1.8 billion euros until 2027. The innovation initiative, which will start with the commissioning of the Puertollano complex, could be completed with a plan to multiply the capacity of this first plant by 40 with the development of three other projects between 2023 and 2027, which would be carried out at the Fertiberia plant in this municipality of Ciudad Real and at the Palos de la Frontera plant in Huelva. The plan would achieve 800 MW of electrolysis, equivalent to 20 % of the national target of 4 GW installed by 2030, and would ensure that around 25 % of the hydrogen currently consumed in Spain would not generate CO2 emissions.

They motivate their activities as under:

The annual production of hydrogen, which is used as a raw material in the refining, chemical and fertiliser industries, is 0.5 Mt H2/year and this generates emissions of 5 Mt CO2/year. Worldwide this figure grows to 830 Mt of CO2/year (more than 2 % of global emissions).Tthe initiative would contribute to the development of the entire value chain, creating almost 4,000 skilled jobs (2,000 of them already in 2023) through 500 local suppliers. The public/private project would require support from the European Recovery Fund for the implementation of the last three stages. The European Union has launched a strategy to boost green hydrogen: it aims to have 40 GW of green hydrogen electrolysers in just 10 years.

Iberdrola, together with six leading global industrial companies, has announced the creation of a global alliance to speed up the scale and production of green hydrogen 50-fold over the next six years to boost the transformation of the world's most carbon-intensive industries, including power generation, chemicals, steel manufacturing and heavy transport. The new initiative, Green Hydrogen Catapult is made up of leaders in the green hydrogen industry (ACWA Power, CWP Renewables, Envision, Iberdrola, Ørsted, Snam and Yara), which are working to deploy 25 GW of hydrogen production based on renewable energies by 2026 and to halve the current cost of green hydrogen to less than $2 per kilogramme. Through this newly-created initiative, the founding partners will work together to speed up the technological transformation and make progress in component manufacturing and construction, market development and investment. Achieving the goals set for Catapult will entail an investment of approximately 11 billion dollars and will create more than 120,000 jobs, which will also boost the recovery from the COVID-19 catastrophe. Green Hydrogen Catapult is a key part of the private sector climate action promoted by the United Nations' High Level Climate Champions, Nigel Topping and Gonzalo Muñoz, through the Race to Zero campaign.

‘We develop a chain of suppliers to manufacture electrolysers’: Iberdrola has also entered into an agreement with Norwegian company Nel to develop electrolysers on a major scale and promote the value chain of this technology in Spain. Nel is world's leading electrolyser manufacturer and offers optimal solutions for producing, storing and distributing hydrogen from renewable energy.

Iberdrola has joined forces with Basque company Ingeteam to create Iberlyzer for this project, a company that will become Spain's first mass manufacturer of electrolysers. Iberlyzer will start operating in 2021 and will supply more than 200 MW of electrolysers in 2023. This output — which will account for more than 50 % of installed electrolyser capacity planned for Spain by that date — will be used in the second project to emerge from the alliance between Iberdrola and Fertiberia, which will produce green hydrogen for the plant in Palos de la Frontera. The Iberlyzer industrial project will entail an investment of almost 100 million euros and will create jobs for 150 qualified workers.

WORLD LEADERS IN GREEN HYDROGEN

Iberdrola will create a new business unit of green hydrogen with the aim of positioning the group as a world leader in this technology, taking leadership of the new technological challenge of producing and supplying hydrogen from clean energy sources. In order to do so, the company will use 100 % renewable electricity in the electrolysis process, thus responding to the electrification and decarbonization needs of sectors such as industry or heavy transport.

Furthermore, it has joined the Choose Renewable Hydrogen initiative, through which companies in the energy sector are urging the European Commission to take appropriate measures to make the most of the potential of green hydrogen. Scottish Power, Iberdrola`s subsidiary in the UK, has joined Green Hydrogen for Scotland— a partnership of SP Renewables, BOC (a Linde company) and ITM Power bringing together industry-leading names in the renewables and clean fuel industries — to create new green hydrogen production facilities with clusters of refuelling stations across Scotland, supporting the country's efforts to achieve net zero by 2045. It is estimated that decarbonising global hydrogen production through the use of 100 % renewable energy would also increase electricity demand by over 10 %.

IBERDROLA IN CASTILLA-LA MANCHA

Iberdrola already operates 2,229 MW of renewable energy in Castilla-La Mancha which is mainly wind power and because of this the Castilla-La Mancha community has the second most "green" megawatts installed by the company. Beside these, it will develop three new photovoltaic projects more in the region with an installed capacity of 150 MW.

Contact: https://www.iberdrola.com/about-us/lines-business/flagship-projects

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Jalvasub Engineering (Hydrogen/PEM Fuel Cells and Drone Solutions)

Activities: HYCOGEN provides a high-tech solution both for the propulsion and auxiliaries of marine manned or unmanned vehicles, as well as providing connectivity shore to ship and / or as portable or distributed electric generation, especially in isolated places. It is a new and totally disruptive electric power generation system, based on an integration of new and proprietary technologies of hydrogen and PEM fuel cells, that includes a new conception of higher-efficient and low-cost fuel cell (called ULPHE-PEM Fuel Cells).

They motivate their activities as under:

The main competitive advantages of the HYCOGEN systems are the drastic reduction of the weight and volume of the systems, thanks to the proprietary technologies of integration of their ULPHE-PEM fuel cells (they can reduce the weight of their systems by more than three times with respect to the systems of their competitors), its greater efficiency (exceeding 60% compared to 50% on average of their competitors) and its reduced cost (30% lower than the competitors). They are currently developing 4 prototypes of their innovative compact energy systems called HYCOGEN that their potential markets have requested through key customers: systems that will supply energy to compact systems such as rescue and rescue systems, aerial drones, and wheelchairs for invalids.

Sustainable impact on blue economy: Reduces carbon emissions, Contributes to waste reduction, Increases the use of renewable energy resources, Encourages sustainable use of maritime resources

JALVASUB Engineering SL has at its disposal the energy technologies indicated below:

* More efficient procedures for the manufacture of fuel cell MEAs.
* Innovative PEM fuel cell configurations.
* Hydrogen generation from biofuels.
* Clean, on-demand and on-site generation of hydrogen.
* Integrated generation of oxygen and hydrogen, for AIP systems.
* Clean hydrogen generation, for the energy recovery of organic waste.
* New generation of thermionic materials.

The integration of these energy technologies in their Products facilitate their high performance, ‘well above what is currently available on the market.’

Contact: <https://jalvasub.com/tecnolog%C3%ADas/index>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Manta Biofuel (Algae Based Biofuel)

Activities: Their vision is to transform the energy market by providing a renewable replacement for crude oil. They are taking a radically different approach to algae biofuel. Other companies have failed to grow algae cheaply enough for biofuel. These companies have grown algae in expensive, highly controlled environments. At Manta, they are taking inspiration from agriculture to make a system that’s scalable, reliable, and cost effective. They are farming algae, instead of manufacturing it.

GROW: They grow algae in open ponds, which allows their system to be robust and scalable.

HARVEST: They collect algae from the ponds using their patented magnetic harvesting technology.

CONVERT: Finally, they convert the algae to crude oil using their high temperature and pressure reactor.

PRODUCT: Their oil can be used in the existing liquid fuels infrastructure, with one key difference: the fuels produced from their product are renewable and carbon neutral. Since the company was founded in 2014, we’ve raised $3 million in funding, including a Department of Energy SBIR Phase II award. They have used these funds to validate each step of our process in the field, and are currently working on developing a 15 acre pilot scale facility.

Contact: https://mantabiofuel.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Nauticor (LNG Marine Fuel Provider)

Activities: Beside supplying LNG, Nauticor covers the entire value chain ensuring that customers are supplied with LNG of the highest quality - on time, every time. Nauticor offers customers access to a unique wealth of experience as well as an extensive network of important partners. In addition to the storage, transport and delivery of LNG, the portfolio of Nauticor also includes solutions for LNG bunkering (land-to-ship and ship-to-ship). Each solution is customised to meet the specific requirements of every customer.

Contact: <https://nauticor.de/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Phycobloom (Marine Biofuel)

Activities: ’Imagine a fuel that is made from pollution in the sky, instead of the oil from the ground Imagine a world where living organisms are used to fuel our world. Phycobloom: Algae reimagined. Our civilization burns dinosaur juice and pollutes the air we breathe. This carbon dioxide warms our planet and changes our climate. Luckily, algae love to gobble up that carbon. They are nature’s most efficient photosynthesisers, transforming that carbon dioxide into oils that we can use’. By using synthetic biology to adapt their algae, Phycobloom can make them produce oil in a way that makes harvesting it cheaper and easier. This algae oil can be used as a fuel where solar, wind and lithium are not suitable. It can be used to fly a plane, to power a ship, or be turned into a plastic. We have to quit fossil fuels as soon as possible. Algae oil can be the sustainable replacement.

Contact: <https://www.phycobloom.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Plast2Oil (Converting Plastic Waste into Marine Fuel)

Activities: Plast2Oil’s product is a pyrolysis reactor that is able to convert non-recyclable waste plastic into carbon fuel. The reactor is produced in different sizes. The biggest will be used in land-based plants. The smallest will be built into a standard 20ft ship container and make it mobile. The mobile solution will be used in countries like Sri Lanka and Indonesia where it will be included in the cleaning of polluted rivers. They have customer requests for this product. The mobile solution will also be classified for use at sea which enables vessels handling ocean plastic to take the plastic onboard and convert it immediately. It will save them from sailing back and forth between harbours and the ocean plastic islands. Additionally, today there is a challenge to get rid of the plastic when the ship reaches a harbour.

They motivate their activities as under:

Waste plastic is efficiently removed. The solution is mobile and can be used where needed onshore and offshore. Oil from our plants replaces crude oil which has a very high environmental impact. Our oil has a quality better than car diesel found at the local gas station. Our plant is operating on the gas produced in the pyrolysis process. External energy is only needed during start-up.

Sustainable impact on blue economy: Their plants can reduce Ocean Plastic. 1) By participating in river clean-ups before plastic reaches the ocean and by taking their mobile container solution onboard ships and converting ocean plastic directly at sea. It will reduce sailing to/from harbours and plastic islands and the oil has a quality the utility engines onboard can use the oil as an energy source.

For a cleaner future: Plastic is a necessity in our everyday lives. Plastic is part of almost everything we surround ourselves with. Unfortunately, plastic has also become a very big environmental challenge, as only a tiny part of the plastic waste can be recycled. We can do something about that. This technology, which is chemical recycling, can turn contaminated waste plastics into oil, which in turn is converted into new chemicals. ‘Together with mechanical recycling, we can effectively do something about plastic waste.’

Contact: <https://plast2oil.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Pro-Bunkers LNG

Activities: LNG PRO Bunkers Ltd. (Probunkers) vision is to become the first independent global physical supplier of LNG bunkers (marine fuel); a Trader / Seller of LNG (back-to-back margin-based business, no exposure to commodity price risk) and a premier carrier of small scale LNG (ssLNG) cargoes between the increasing small LNG facilities. They have designed and will build, own, manage and operate a fleet of small oceangoing LNG carriers which will be equipped to serve also as bunkering vessels. In the near future, they will combine LNG with BioLNG and synthetic LNG to have future proof vessels and contribute to a substantial reduction of emissions of the maritime industry.

First Global LNG physical supplier - they bring the bunkering and shipping specialisation in LNG bunkering while competitors focus on LNG commodity specialisation. They do thorough vessel design research to achieve optimisation, compatibility with all terminals and vessel types, cost reduction, flexibility. Timing also is very important. They plan to start end of 2022 when demand is projected to be sufficient for a profitable business.

The management has completed the design of the vessel to be built. Negotiations completed with a top shipbuilder by global standards with expertise in the particular type of vessels. The technical specification and the shipbuilding contract have been agreed. A capital commitment of US$10,000,000 by an anchor investor has been secured on the condition that there will be at least one more investor to match this commitment and then place the order for the first 2 vessels out of the total 7 vessels of the business plan. Upon securing of at least the above funding they are ready in all respects to order their first 2 vessels. This will substantially advance the project as they will be controlling 2 assets, which is key and a prerequisite for the following 2 important milestones: - secure supply of LNG at each intended port of operations. The suppliers need to see that their counterpart actually controls the assets in order to commit; - Endeavor off take/sales agreements with end-users of LNG bunkers (shipowners, ship-operators) to secure revenue; - Negotiate with charterers of ssLNG business to secure time charters and hence hire revenue.

Sustainable impact on blue economy:

For every MT of LNG marine fuel sold, they contribute to a reduction of CO2 emissions by 21-25%, NOx emissions by 85%, 99,5% of SOx emissions, and virtually 100% of particulate matters. In the future, when Bio-methane and Synthetic methane production by using renewable energy will be available in big scale, their vessels will be able to seamlessly carry these products in a liquified form in a mix with LNG. They will then contribute to reducing GHG emissions from the maritime industry by more than 40%.

Contact: <https://probunkers.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Snam Hydrogen

Activities: Snam, one of the world's leading energy infrastructure companies, is heavily involved in the energy transition, with investments of € 1.4 billion in 2023 (as part of an overall 6.5 billion plan) dedicated to the SnamTec (Tomorrow's Energy Company) program aimed at increasing efficiency and reducing emissions, innovation and new activities such as energy efficiency, sustainable mobility and renewable gases. The latter strand includes research and development initiatives launched in hydrogen market, which represents the keystone in the fight against climate change. In 2019, Snam set up a business unit specifically dedicated to hydrogen and in 2020 started collaborations on hydrogen with RINA and Alstom, respectively in the industrial and rail transport sectors. Snam and RINA team up to accelerate the development of hydrogen. Agreement between Alstom and Snam for the development of hydrogen trains in Italy

TRIALS

In April 2019, Snam was the first energy company in Europe to introduce of a mix of 5% hydrogen by volume and natural gas into its transmission network. The trial, which successfully took place in Contursi Terme, in the province of Salerno, involved the supply, for about a month, of H2NG (hydrogen-gas mixture) to two industrial companies in the area, a pasta factory and a mineral water bottling plant. The initiative received international recognition, with dedicated coverage from Bloomberg, Financial Times and New York Times. The Contursi experiment was replicated in December 2019, doubling the percentage of hydrogen by volume to 10%. By applying the percentage of 10% of hydrogen to the total gas transported annually by Snam, 7 billion cubic meters of it could be introduced into the network every year, an amount equivalent to the annual consumption of 3 million families, allowing for a reduction in carbon dioxide emissions of 5 million tons. In 2020, Snam also tested the world's first "hybrid" hydrogen turbine designed for a natural gas transportation infrastructure. The turbine, produced by Baker Hughes in Italy and fuelled up to 10% with hydrogen, will be installed by 2021 in the Snam thrust plant in Istrana, in the province of Treviso. The company is now engaged in verifying the full compatibility of its infrastructures with increasing quantities of hydrogen mixed with natural gas, as well as in supporting the development of the Italian supply chain, to encourage the use of hydrogen in multiple sectors, from industry to transport. Currently about 70% of Snam's natural gas pipelines are compatible with hydrogen.

* Snam: Europe’s first supply of hydrogen and natural gas blend into transmission network to industrial users
* Snam: hydrogen blend doubled to 10% in Contursi trial
* Snam and Baker Hughes test world’s first hydrogen blend turbine for gas networks

In order to guide the energy transition towards a greater use of hydrogen, Snam is acting as a leader carrying out its vision based on three fundamental pillars:

Asset readiness: Assess the compatibility of the existing infrastructure with regard to the transport of hydrogen, with a focus on: storage, transportation, measure, compressor stations

Development of the value chain: Define the strategy to encourage the growth of all phases of the value chain, with a focus on:

* Conduct pilot projects to increase the production and use of H2, through strategic partnerships in the hard-to-abate industries (e.g. steel mills, refineries, other energy-intensive industrials, mobility...)
* Scouting for investment opportunities in innovative technologies (fuel cell, hydrogen production and storage)
* System design

Define the roadmap for integrating hydrogen into the existing energy system with a focus on:

* Evolution of the regulatory framework
* Analysis of medium-long term scenarios of the role of hydrogen in the energy mix

RESEARCH AND DEVELOPMENT

Snam is part of the Clean Hydrogen Alliance launched at European level to support the strategy of the EU Commission that leverages hydrogen to achieve the Green Deal by eliminating net CO2 emissions on the continent by 2050. At the European level, it is also a member of Hydrogen Europe, while in Italy it is represented in the H2IT category association - Italian Hydrogen and Fuel Cell Association. Globally, the company is part of the Hydrogen Council, an initiative launched in 2017 at the World Economic Forum in Davos to create a coalition of leading companies in their respective sectors committed to accelerating investments in hydrogen. According to a study conducted by Navigant and commissioned by the European Gas for Climate consortium, which also includes Snam, our continent has a hydrogen and biomethane production potential of 270 billion cubic meters by 2050, which would lead to full decarbonisation with economic savings of 217 billion euros per year compared to an energy scenario that does not involve the use of gas. Another research, conducted by Snam in collaboration with McKinsey, showed that hydrogen could meet around a quarter of Italy's final energy consumption by 2050 (up to 22 billion equivalent cubic meters) in a scenario of profound decarbonisation. As part of the research, Snam also collaborates with the Bruno Kessler Foundation, which develops studies on technologies destined to revolutionize the production of clean hydrogen in the near future, making it an integral part of the long-term solution for a carbon neutral energy system. Finally, the company has signed a research and development agreement with the Polytechnic of Bari to create a prototype of an autonomous energy network based on the use of hydrogen produced from renewable sources.

Contact: <https://www.snam.it/en/energy_transition/hydrogen/snam_and_hydrogen/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Titan LNG (Fuel Provider Solutions)

Activities: Titan LNG is the leading LNG supplier to industrial & shipping customers in Germany, the Benelux, Austria and Switzerland. Titan serves its marine customers with bunkering services with a focus on smaller vessels (50-600 cbm). Most LNG is delivered truck-to-ship, other solutions are in development. For the industrial sector Titan LNG provides a complete solution: LNG supply, LNG transport and on-site LNG storage equipment. Industrial users currently not connected to the natural gas grid have the option to switch from industrial heating oil or propane to economic and clean natural gas. Titan LNG’s mission is to contribute to a cleaner future by supplying (bio)LNG as a fuel. Together with their partners, Titan LNG is building a global supply network. Titan LNG believes LNG is the best transport fuel and essential in the energy transition during the coming decades. In creating the infrastructure for further decarbonization via (bio) LNG and synthetic LNG, carbon neutral solutions become completed. LNG distinguishes itself from oil-based fuels, as a cleaner, economical, and safe fuel. It is abundantly available and has been used for over 50 years.

Contact: <https://titan-lng.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Tre-Soil Biofuels (Waste Plastic to Hydrogen Ocean Retriever)

Activities: TRESOIL BIOFUELS SRL: will build or refit a specialised vessel with Waste to Hydrogen (W2H2 DMG) on-board energy production technology, to rid the Canary Islands of unrecyclable plastic and other waste wherever it accumulates around each island beaches and ports. The vessel will travel to wherever large amounts of plastic and end of life tires are ready to be collected. The W2H2 DMG zero-emissions system unique Ultra-High Temperature (UHT) (+1200 Co) process of the waste-streaming to synthetic gas (syngas) which is rich in hydrogen (up to70%). The W2H2 DMG distributed small scale reactor is lined with of metal composite material developed by PHE. The material is extraordinarily hard-wearing and resistant to all usual acids and chemicals that would rip apart virtually all other materials. This is why the system can process everything from tires and batteries to biomass and municipal/industrial waste. Also to locally produced a low-cost H2 alternative to fossil fuels.

This Waste Plastic to Hydrogen Ocean Retriever project meets 7 of the 8 eligibility criteria for the EU Green Deal

Sustainable impact on blue economy: Ocean Retriever Waste to Energy Power Ship solution to succeed in the Energy Transition for European Islands Ocean Retriever a Giant Mobile Billboard for The EU Green Deal making each island energy self-sufficient and emission-free, and solving its waste management issues. This new business model waste management and energy production model would be replicated in island spaces all around the world. Eliminating toxic waste, air pollution, indiscriminate dumping into landfill, illegal dumps and the ocean. The hydrogen produced will be used by each island for its entire energy requirements including mobility, lighting and cooling/heat in tandem with wind and solar facility energy production.

Contact: <https://www.tresoil.com/services>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Wartsila LNGPac (Marine Integrated LNG Bunkering, Fuel and Technology Solutions)

Activities: Wärtsilä LNGPac™ is a complete fuel gas handling system for LNG fuelled ships and includes the bunkering station, LNG tank and related process equipment as well as the control and monitoring system. The LNG fuel system can be offered as a standalone product, as well as a part of a complete propulsion system. Wärtsilä can deliver LNG systems for propulsion and power generation for any applicable types of ship or engine.

Contact; https://www.wartsila.com/marine/build/gas-solutions/fuel-gas-supply-system/lngpac

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 7. ECOSYSTEM RESTORATION INCLUDING COASTAL EROSION, CORAL REHABILITATION ETC

## Beyond Coral Foundation (Coral Planting Robot CHARM)

**Activities**: Research conducted by the inventor Stephen Rodan estimates 10,000 coral fragments requires three full time employees a year, working for 4000 hours. Yet the oceans would need over 100,000 corals planted everyday for coral reefs. Currently over 50% of coral nursery and site costs are labour related. CHARM (Coral Husbandry Automated Raceway Machine) aims to automate repetitive coral farming tasks such as cleaning and replanting; when growing coral in a coral nursery or laboratory. CHARM also offers the opportunity for combining coral farming with computer automation to reduce costs and save time.

Contact: <https://reefbuilders.com/2020/05/05/automated-coral-husbandry-charm/>

### Biorock/Global Coral Reef Alliance

Activities: Biorock Technology, or mineral accretion technology, is a method that applies safe, low voltage electrical currents through seawater, causing dissolved minerals to crystallize on structures, growing into a white limestone similar to that which naturally makes up coral reefs and tropical white sand beaches. Biorock™ technology is an innovative process to produce natural building materials in the sea. Biorock materials are the only marine construction material that grow, get stronger with age, and are self-repairing. It not only grows hard limestone rock for structural purposes, it greatly increases growth of corals and all marine organisms. The Global Coral Reef Alliance was founded to pursue research and development of Biorock™ Technology.

Biorock™ technology has been successfully applied to fish and shellfish mariculture, as well as to growing limestone breakwaters to protect islands and coastal areas from erosion and rising sea levels. It is a unique method that allows coral reefs, and other marine ecosystems including seagrass, salt marsh, mangrove, and oyster reefs to survive and recover from damage caused by excessive nutrients, climate change, and physical destruction by greatly increasing the settlement, growth, survival, and resistance to stresses, including high temperature and pollution, of all marine organisms. As a result, it keeps ecosystems alive when they would otherwise die from severe stress, and restore them at record rates where there has been no natural recovery. Around 500 Biorock™ reef structures have been built in around 40 countries all around the world, mostly in small islands, with around 400 of them in Indonesia with local partners, Biorock™ Indonesia. This technology can be powered by energy from the sun, winds, waves, and ocean currents, generated directly at the site. Ocean energy reduces global warming caused by oil, coal, and natural gas. Pioneering innovators in wave and tidal current energy work with them, providing their prototype devices to build demonstration Biorock™ pilot projects to demonstrate the vast potential of clean and underutilized ocean energy. Biorock™ technology provides greater benefits, faster results and lower costs then any other alternative to solve a wide range of crucial marine management problems:

They motivate their activities as under:

**1. Coral Reef Restoration and Protection against Global warming**

Biorock™ coral reefs turn barren dead and dying areas into pristine reefs swarming with fishes in a few years, even where natural recovery is impossible. All other coral reef restoration methods work well only under perfect water quality conditions (but Biorock™ grows coral 2-10 times faster), but all fail when water becomes too hot, muddy, or polluted. Biorock™ corals continue to thrive when others die, and Biorock™ reefs cost less than other methods. This technology greatly accelerates coral settlement, growth, healing, survival, and resistance to environmental stresses such as high temperature, sediment, and pollution. All other marine organisms examined also benefit. The Biorock™ process creates the ideal biophysical conditions that all forms of life use to make biochemical energy. p. Before the Biorock project, the reef was dead with only a few percent live coral cover. 10 years afterwards the bottom at the same site is completely covered with pristine reef. . Every coral reef region of the world has already suffered from severe high temperature coral bleaching and mortality, and any further warming will destroy the little coral that is left. Corals growing on Biorock™ reefs have 1600% to 5000% times higher survival after severe bleaching than corals on nearby reefs. Biorock™ Coral Arks, designed to save coral reef species from local extinction, are currently growing around 80% of all the coral reef genera in the world. There is an urgent need to establish them in all major reef areas and include all coral reef species, as this may be the only hope when global warming intensifies.

**2. Marine Construction**

The Biorock™ process uses electrically conductive materials like ordinary steel, the cheapest and most widely used construction material, to build structures of any size of shape in the sea. With this technology, the steel is completely protected from corrosion, first the rusty steel is un-rusted as red rust quickly turns grey and black and is converted back to iron. Then the structure turns white as limestone minerals that are naturally dissolved in seawater grow over the surface, producing a constantly growing hard rock coating. When grown slowly (less than 1-2 cms per year) this material is around three times stronger than ordinary concrete. The process produces the only marine construction material that gets stronger and harder with age. It is also self-­repairing: if the mineral layer is broken, the damaged area grows back first.. Biorock™ structures save money by never needing replacement, and are many times cheaper to build than concrete or rock structures of the same size. They can easily be added onto later or changed to meet evolving needs. Biorock™ cements grown from salt water under different conditions are even harder after they set than primary Biorock™ materials. Moreover they actually absorb CO2 from the atmosphere as they set (Portland cement manufacture produces about 5-10% as much CO2 as fossil fuel combustion), and can be cheaper than cement in many places.

The Biorock™ process repairs rusted, cracked, and crumbling steel-­reinforced concrete structures like docks, piers, and sea walls. Rusting of interior reinforcing bar is stopped, and the cracks and holes in concrete fill in with rock - hard limestone, from the inside out. Deteriorating structures that would have to be destroyed and replaced can be permanently repaired at low cost. Conventional concrete “repair” methods hide the outer appearance of damage by sealing it in, while internal deterioration continues. The Biorock™ process internally repairs and permanently stops rusting of steel pilings and bulkheads below the high tide line. Shipworms do not attack Biorock™ treated wood, and wood structures such as pilings can be impregnated with limestone: turning “sticks into stones”.

**3. Shore Protection**

Biorock™ provides the ideal breakwater material because it grows stronger with age and repairs itself if damaged by heavy waves. Its structures can be powered by wave energy generators that produce the most energy and fastest growth precisely when wave erosion is highest. The shore protection structures are designed and engineered in a site-specific way to withstand maximum wave energies. They are faster and cheaper to build than concrete or rock structures of the same size. Biorock™ breakwaters are designed and constructed as open frameworks that allow waves to pass through them, slowing them by friction. They operate under completely different physical principles than conventional breakwaters, using refraction instead of reflection. Waves passing through the structures reach the shore with less energy, so they deposit sand on beaches instead of eroding them. The breakwaters avoid increased scour and erosion caused by solid breakwaters, which washes away all the sand in front, and then underneath them, accelerating undermining, cracking, settlement, and collapse. Rock and concrete module breakwaters can be armoured over and cemented together with limestone, forming massive units that prevent rocks and concrete modules moving apart in heavy storms, and having to be reset with cranes at great cost. Biorock™ breakwaters gain strength with age, becoming more effective over time as surface area increases and corals, oysters, and mussels proliferate.

**4. Beach Erosion**

Biorock™ shore protection reefs naturally re-grow severely eroded beaches faster and more cheaply than any other method. Most beaches worldwide are disappearing due to global sea level rise and increased storm wave energy caused by global warming. Biorock™ reefs have the best, cheapest, and fastest results growing these beaches back. For example in the Maldives, one of the lowest lying countries in the world, a Biorock™ coral reef was grown in front of a beach that had disappeared. Trees were falling into the sea and buildings about to collapse. A new beach 50 feet (15 meters) wide grew behind the Biorock™ reef in 2-­3 years, and has remained stable for more than 15 years. The beach and reef were not damaged by the Asian Tsunami, which washed right over the island. Biorock™ shore protection structures on a severely eroding low island in Indonesia caused new beach growth that could be clearly seen on Google Earth satellite images after only 8 months. A sea wall that was undermined and about to fall was half buried in new sand a year after the Biorock™ shore protection structures were placed offshore, while new sea walls on nearby properties that were not protected by Biorock reefs were undermined and collapsed in a year.

**5. Adaptation to sea level rise**

Biorock™ shore protection structures are the most cost-­effective solution for protecting low-­lying coasts and islands from global sea level rise. They can grow upwards at around 20 mm/year, and much faster when growth of corals and oysters on them is taken into account, so they provide the only opportunity for growing shore protection that can keep up with sea level rise. Conventional concrete or rock seawalls cost around $15 million per kilometre, Biorock™ shore protection reefs gain strength with age, are self-repairing, cost much less than conventional structures, and can protect whole islands from submergence.

**6. Oyster Reef Restoration**

Biorock™ oysters grow up to 10 times faster in length (1000 times faster in volume) and have up to 10 times higher survival under severe stress. The first Biorock™ project was completely overgrown by spontaneously settling oysters that grew to adult size in a few months. It allows oyster reefs to be rapidly grown in habitats where there has been no previous recovery. Oyster reefs play a critical role in shore protection, water purification, fisheries habitat, and food supplies in cold waters, but almost all have been destroyed. Conventional oyster restoration techniques have failed because they lack the increased growth rates and survival that Biorock™ methods provide. Floating oyster and mussel reefs can be grown to filter and clarify polluted water.

**7. Sea Grass Restoration**

Biorock™ method increases sea grass growth and survival, even promoting growth and proliferation of roots on hard rock bottom where they are normally unable to survive. Sea grasses are critical juvenile fish and shellfish habitat. They also provide crucial shore protection services by stabilizing sand. Sea grasses are rapidly being destroyed worldwide, and Biorock™ technology provides the fastest way to restore them.

**8. Salt Marsh Restoration**

Biorock™ technology greatly accelerates growth and budding of salt marsh grass, and allows the grass to survive in water deeper than its normal limit. As a result, salt marsh that has been damaged by pollution and oil spills can be rapidly regenerated. This technology allows salt marsh to be extended seawards, deeper than it would normally grow, adding land where the coast is vanishing. Salt marshes provide critical shore protection services and essential habitat for juvenile fish, shellfish, and birds, but salt marshes worldwide are rapidly vanishing. Louisiana salt marshes are currently disappearing at rates up to hundreds of meters a year. Biorock™ provides the only hope to restore them, along with oyster and mussel reefs, and naturally regain land that has been lost to the sea.

**9. Fisheries Restoration**

Biorock™ methods create ideal habitat to restore damaged fisheries, especially on barren sand, mud or rock, where there are no reefs or seagrass to provide nursery habitat for baby fishes to hide in. Populations of fish, oysters, mussels, lobsters, crabs, and giant clams rapidly increase around Biorock™ projects, generating enormous fish schools. Indonesian fishermen report increased numbers, sizes, and diversity of fish in areas near their projects. Each species needs habitat with different size and shaped spaces to attach to or hide in. Biorock™ habitat can be made in shapes that certain desired species prefer. Biorock™ reefs can be restocked with baby fishes collected in the open sea, turning >95% mortality into >95% survival, and is the fastest possible way to restore coastal fisheries, eliminating limitations caused by lack of juvenile recruitment, habitat, and food. Floating Biorock™ habitats moored in deeper water create floating reefs in deep blue water and can increase populations of valuable open ocean fish like tuna and mahi-­mahi.

**10. Sustainable Aquaculture**

Biorock™ habitats specifically designed for economically valuable marine species greatly increase their populations, growth, and health. For example, spiny lobsters crowd densely into Biorock™ lobster habitat, greatly increasing their populations. These structures create a new paradigm for sustainable aquaculture: rapid growth of highly diverse marine ecosystems that grow their own food, eliminating pollution and the need for costly imported feeds. This is diametrically opposed to current practices that grow single species, usually single clones, promoting parasites, disease, genetic pollution of wild stocks, and harmful algae blooms that damage surrounding ecosystems and fisheries. Biorock™ methods avoid these problems, at lower cost.

‘A warning note: Biorock™ process is elegantly simple, and easily executed by those with special training and materials, but will fail if imitated without authorized expertise and maintenance.’

Contact: <http://www.globalcoral.org/biorock-coral-reef-marine-habitat-restoration/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue-Bot (Bajan Digital Creations Inc –AI Assistant to Create Marine Reef Ecosystem Monitoring Data)

Activities: Scylla in the case of Bluebot is an AI assistant that uses computer #vision, classification algorithms, image compression and statistical measures to do two things: Scylla is product Barbadian problem-solving. It shows how machine learning can be used to solve their unique problems that are too specialised for Big Tech. Coupled with their soon arriving underwater #robotic fleet. ‘#Barbados will lead the way in emerging technology in the Blue Economy’. This project is done in conjunction with the UNDP Blue Labs Accelerator. Any queries concerning Scylla should be forwarded to UNDP Barbados and the Eastern Caribbean.

1. Build an ever-growing marine #dataset from underwater video images.

2. Use the encoded statistics as a metric to determine the general #health of an area of the #reef.

They motivate their activities as under:

Blue-Bot was born when BDCI answered the UNDP Barbados and the Eastern Caribbean's call for sustainable solutions to assist the Blue Economy. This was a timely opportunity, which was perfectly aligned with their strategic goals, as well as the services and skills already at the company’s disposal. An evolving technologies and business development start up, Bajan Digital Creations Inc. (BDCI) utilises, designs, builds and deploys intelligent technology that can respond to the Caribbean's unique entrepreneurial, social, economic and climate resilience challenges. At BDCI they are driven by the vision of a smart Caribbean. This is an essential variable to the socio-economic viability and survival of the Caribbean region.

Contact: <https://www.bluebotproject.com/#About>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Bio Yarn (Recycled Coastal and Marine Textile Solutions)

Activities: BIONIC® is a material engineering company supplying the consumer and industrial markets with fully traceable, high-grade textiles and polymers, made with coastal and marine plastic. It is a mission-driven materials science company built around the belief that performance and sustainability are not mutually exclusive. A producer of textiles, polymers, and other materials made from recovered, recycled, or regenerative sources, BIONIC first made its name manufacturing high-grade yarns and fabrics using rescued marine and coastal plastic that would otherwise have been left to pollute the world’s oceans. Adopting a deeply holistic approach, BIONIC not only designs and manufactures finished products, but ensures the traceability of their raw materials by building plastic recovery infrastructure along the coastlines of developing nations. This infrastructure serves as a public utility in places that often have little or no municipal waste management, and provides jobs, education, and empowerment opportunities to local communities and environmental organizations. Founded and headquartered in New York City, the company operates in Central America, North America, and Asia, and has established vertical supply chains worldwide, tracking their product from coastline to commercial shelves. BIONIC entered the market in 2009 with its patented HLX yarn construction, which ensured durability and a refined finish without sacrificing sustainability. Since then, the diversity of the company’s product line has grown alongside its impact.

* Materials
* Fabrics
* Yarn
* Hlx®
* Dpx®
* Flx™
* Polymer
* Applications
* Apparel
* Footwear
* Bags & luggage
* Interiors

They Believe:

* In materials that break boundaries in all directions. Materials that are stronger, faster, AND more sustainable. Performance is essential, but the environment will not be sacrificed in its name.
* In harmony between nature and technology, a balance between the economy and the environment. Their innovations should drive change in the real world as well as the marketplace. Their profits drive progress.
* In transparency and full traceability. Their materials lead rich lives before they reach them and their sourcing is as important as what they make with them.
* That too much potential is wasted. In companies. In societies. In life. Their favourite materials are good at many things - they help them to excel.
* In acting locally on an international scale. Global capitalism can benefit a small community without stealing its soul. It just takes work and care and creativity.
* Great organizations are driven by purpose, not profit, but profits can help the mission. You can achieve sustainability through materials science.

Contact: <https://bionicyarn.com/about/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Mater (Environmental Remediation Using Cork Floating Islands)

Activities: BLUEMATER developed the CORK FLOATING ISLAND® that can be used on hydroponics, bioremediation and habitat recovery. BLUEMATER is a Portuguese company that has also developed an innovative Waste Water Treatment Plant, based on biological processes - ALGAMATER WWTP. It is an innovative and cost-efficient WWTP and it uses a disruptive process when compared to existing WWTP based on biological processes without the use of chemicals. It includes the cultivation of microalgae in the exclusive GREEN DUNE® Photobioreactors, responsible for the tertiary and final treatment of the wastewater.

Developed by Bluemater in collaboration with Amorim Cork Composites, CORK FLOATING ISLAND® is specially designed for bioremediation in wetlands, rivers and dams but also used as phyto-based pond wastewater treatment and hydroponics. The support structure is made of cork, which makes it a sustainable and durable solution in addition to create an aesthetically pleasing aspect.

The CORK FLOATING ISLAND® is an exclusive product developed by Bluemater, in partnership with the cork innovation leader – Amorim Cork Composites. These floating islands are modular cork platforms designed specifically for the recovery of degraded ecosystems, in the treatment of wastewater, aquatic gardening, among other possible uses. Floating islands are the most ecological solution to ensure a healthy balance of surface water, allowing the growth of plants on the surface of the water and thus restore riparian and palustrine ecosystems and biodiversity itself. They can also be applied in pond wastewater treatment, replacing the plants that are traditionally planted in the bottom of the Phyto-WWTP tanks, avoiding the known problems of collapse of these systems, keeping them healthy and efficient.

They motivate their activities as under;

**Advantages**

* Sustainable cork platform
* Low density and good buoyancy
* Low maintenance costs
* Highly durable platforms
* Sustainable water treatment
* Modular design with easy connection between modules

**Technical Characteristics**

* Material: crushed and agglomerated cork, natural colour
* Size of the cork grain 4-14 mm
* Dimensions: 100x50x6 cm
* Durability: +/- 10 years

**Applications**

* Biological treatment of wastewater
* Restoration of habitats in degraded or polluted areas
* Recovery of riverside banks of rivers and canals
* Creation of marsh habitats in lakes and reservoirs
* Rehabilitation and maintenance of protected aquatic ecosystems
* Creation of marsh habitats in urban gardens, lakes and biological pools

Contact: <https://www.bluemater.com/equipment/cork-floating-island/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Carbon Kapture (Offsetting Climate Change Via Kelp

**Activities:** Their mission is to help rebalance nature and remove CO₂ from our oceans and atmosphere to reduce damage to our environment and ecosystems. Their goal is to extract millions of tonnes of CO₂ from our oceans by 2030. According to the United Nations the next decade is crucial. Our overuse of fossil fuels has led to excess CO₂ that traps heat, causing icecaps to melt and sea levels to rise. What if there was a way to remove your carbon impact on our planet within a year? Would you take it?

**Reverse the damage**

Now you can go one step further than carbon neutral. Together, we can literally reverse some of the environmental damage that’s already been done. Their global network of kelp farms capture carbon dioxide through sea kelp photosynthesis – cleaning it from the ocean and helping marine life thrive in new ocean habitats. It’s a fast, sustainable way to rebalance nature. The average European’s carbon footprint is just over ½ tonne of CO₂ a month. A recent European Commission study into UN-approved offset projects found only 2% actually offset additional CO₂. Time isn’t on our side. The best time to plant trees to reverse carbon pollution was 10 years ago. Sea kelp grows 30x faster than trees. Kelp as well as removing carbon from our oceans, can be used for animal feed on a huge scale - cutting harmful methane gases by up to a massive 90%. Make a pledge with Ocean Carer Bonds. Their Ocean Carer Bonds provide you a way to reverse your carbon impact sustainably. Just one bond removes at least an additional ¼ tonne of CO₂ from our oceans. For you, for a friend, for a gift that keeps on giving... Are you ready to safeguard the future of marine ecology?

Contact: <https://www.carbonkapture.org/ocean-carer-bond>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Coral Gardeners (Coral Reef Restoration)

Activities: Coral Gardeners create hope for coral reefs by using several restoration techniques which either make coral reefs more resistant to global warming or give a new life to broken pieces of coral. Their restoration team maps damaged areas to be restored, collects super coral fragments and places them onto coral nurseries until they're mature enough to be transplanted back onto the reef. They apply rigorous monitoring protocols to maximize the survival rate of the corals they transplant.

Their vision: If we want to save the world’s coral reefs, we need to think bigger. They are constantly improving their methods and collaborating with experts, scientists, and engineers to create a scalable model that will allow them to set up Coral Gardeners branches around the world.

Super corals: They define Super Corals as corals that have survived a bleaching event in the wild and should hypothetically spawn. Their restoration team is growing Super Corals' species in order to build stronger reefs, while ensuring the genetic diversity of the reef.

Contact: https://coralgardeners.org/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Coral Guardian

Activities: Coral Guardian and Equilibrio Marino are collaborating on the SOS Corals project, in the Punta de la Mona area in Spain, to repopulate degraded coral reefs, in response to local pressure generated by human activities such as tourism and fishing. The Punta de la Mona region is a biodiversity hotspot, with the largest amount of Dendrophyllia ramea corals in the entire Mediterranean region. Despite protective measures taken by the government, corals are damaged in the area due to anthropogenic activities. By raising awareness and involving traditional fishermen in the protection and restoration of the area, SOS Corals would have a direct impact on the area. The return of biodiversity would allow local populations that depend on these ecosystems to meet their needs, which would also have a positive effect on the local economy by ensuring a stable economic model and the promotion of sustainable tourism.

Contact: <https://www.coralguardian.org/en/our-actions/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Coral Lok

Activities: The Coral Lok is a device created to enhance coral out planting restoration through the rapid and easy attachment of coral. Threaded frag plugs are implemented into a variety of Coral Lok modules and receivers which enables 15-20 corals to be out-planted at one time. Each Coral Lok and module is created with eco-friendly materials designed to eliminate the use of plastic and epoxy in restoration practices. Coral Lok technologies enable coral restoration on natural and artificial reefs more rapidly and at higher volumes than any existing method. With over 5 different Coral Lok mini habitat module designs, they target specific species and habitat restoration. ORA intends to restore reefs around the globe including developing countries and highly impacted reefs. Prospective reefs include(Barbuda, Florida Keys, Tulum Mexico, Fiji,& more). ORA artificial reefs incorporate artistic reef modules, biodiverse habitat, & the Coral Lok. Our reef sites engage and give back to the local communities contributing to sustainable restoration.

**Phase 3. Seed Funding**

Fully funded by patent holder, prototypes tested, implemented in both artificial & natural reefs. Ready to distribute mass scale. Used to out plant coral with the Coral Restoration Foundation, NOAA, & University of Miami on natural reefs in Florida.

Targeted Challenges and Focus Areas: Restoring, protecting and investing in the ocean; investing in nature-based solutions for the blue economy; protecting and restoring coral reefs.

Coral restoration is time and resource intensive, and often limited by the ability to out-plant coral effectively. The process of scarifying desired substrate, applying epoxy or other adhesives, and attaching one individual coral at a time, limits the quantity of coral out-planted and takes a significant amount of time. The Coral Lok enables restoration practitioners the ability to out-plant 10-20 corals at one time on the Coral Lok mini habitat modules.. Easily screw in coral fragments without the use of epoxy, plastics, or cements. Habitat modules are secured to natural reefs with eco-friendly concrete (currently tested Florida Keys). Each module can have propagated coral attached or grown on the module in a nursery. An in-situ nursery can be set up with an artificial reef module embedded with Coral Lok technologies. The Coral Lok redues the time taken and increases the efficiency of out-planting coral and creates a securing foundation that will maintain reef integrity, along with reducing handling stress. These modules will last through storms and give the unique species specific considerations to enhance restoration. Such as boulder vs branching coral strategies, module designs are accommodated for species success.

* Integrated technologies
* Biotech
* 3D scanning & Virtual Reality for education, outreach and design modifications

They utilize restoration practitioners and universities to collect data on the Coral Lok technologies compared to traditional restoration techniques. Groups such as the Coral Restoration Foundation, Secore international, University of Miami have implemented the Coral Lok technologies in their restoration practices (Florida Keys & Biscayne National Park) and are comparing its efficiency using both quantitative and qualitative data. They have monitoring programs that implement a variety of studies on the Coral Lok and their artificial reefs.

Contact: <https://1000mermaids.com/coral-lok-coral-frag-plugs>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Coral Reef Arks

Activities: Coral Reef Arks are massive floating structures in the open ocean colonized with luminescent corals, anemones, crabs and urchins, and circled by giant schools of fish. These are Coral Reef Arks, tools for building new coral reefs and restoring those that have degraded due to microbialization and climate change.

Building Coral Reef Arks: ARMS placed near natural reefs aggregate millions of reef species into one-square-foot structures.

They motivate their activities as under:

**ARMS units**

They found that nearly all biodiversity on coral reefs will settle on these foot-squared structures, and, that divers can move ARMS without disturbing the biodiversity living on them. Like building blocks, hundreds of ARMS will be aggregated onto Coral Reef Arks to assemble large reef communities.

**Coral Ark**

They will place multiple ARMS on healthy reefs

* ARMS will be moved after seeding, bringing representatives of nearly all reef biodiversity
* ARMS will be attached to the Arks
* Arks will be placed in sites less vulnerable to climate change and other stressors, ensuring the survival of the entire ecosystem
* A global system of Coral Reef Arks will generate immediate benefits

A global system of Coral Reef Arks will:

* Create new conservation technologies
* Expand coral reefs to new sites
* Create fisheries
* Preserve coral reef functions and biodiversity
* Build tourist sites
* Stimulate scientific discovery
* Mitigate damage to or removal of reefs for construction projects (e.g., refurbishing piers).

. So far they have raised nearly $10 million dollars from the National Science Foundation, National Institutes of Health, Gordon and Betty Moore Foundation, and Spruance Foundation.

### Coral Reef Arks Strategic Plan

Activities: The Coral Reef Arks collaboration is a cross-disciplinary, synergistic group of passionate scientists, engineer, lawyers and business people working to conserve, restore, and migrate coral reefs for recreation, food, natural products, and ecosystem services.

They are seeking financial support to...

* Deploy the first restoration-aimed ARMS in Curaçao.
* Develop and fabricate test Arks in Curaçao.
* Deploy 10,000 ARMS units in the ten coral reef regions of the world.
* Fabricate, assemble, and implement ten Reef Arks Parks.

Contact: https://coralarks.org

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Coral Maker (Coral Replanting Robot Solutions)

Activities: Coral Maker is founded on the concept of redesigning and repurposing existing manufacturing technology to address the scale issue in coral production. This approach is based on relationships and collaborations between coral reef scientists and manufacturing technology experts. Coral Maker integrates concepts from the manufacturing industry (design, automation, mass production) with concepts from coral science (propagation, fusing and recoating surfaces) to both remove manual tasks and bypass much of the calcification required for coral colonies to achieve adult size. The idea is to design and mass manufacture pre-made coral skeletons, with built in fittings for easy or automated seeding with live coral material. These coral “seeds” will then recoat the pre-made skeleton with live material, achieving adult, habitat-forming size, over months instead of years. The seeding process, which is currently a repetitive, manual task, can be automated in places where there are available resources. In locations where automation is not feasible, the manual seeding process will be far quicker and more user-friendly, with the seeds designed to click into place in the manufactured skeleton and the base also designed for rapid attachment to the reef. In both cases (automation or manual seeding), using design to create a more user-friendly and streamlined product and process, has the potential to increase production of corals by orders of magnitude. Most importantly, the designs will allow for mass production with currently scalable manufacturing technology. Our designs are specifically for mass production using dry cast moulding, a ubiquitous and highly scalable masonry manufacturing technique

Contact: https://www.coralmaker.org/about

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Coral Restoration Foundation

Activities: Coral Restoration Foundation™ (CRF) is the world's largest non-profit marine-conservation organization dedicated to restoring coral reefs to a healthy state, in Florida and globally. Their core mission is to restore coral reefs, to educate others on the importance of our oceans, and to use science to further coral research and coral reef monitoring techniques. They work to support the reefs’ natural recovery processes through the large-scale cultivation, outplanting, and monitoring of genetically diverse, reef-building corals. They engage and empower others in the mission to save our planet’s coral reef with dive programs, educational activities, scientific collaborations, and outreach.

Contact: https://www.coralrestoration.org/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Coral Vita

Activities:Coral Vita is a mission-driven company working to restore our world's dying coral reefs. They create land-based coral farms that incorporate the latest coral farming methods to scale reef restoration to unprecedented levels. They can accelerate coral growth rates while boosting their resilience to climate change, enabling them to restore and sustain coral reef ecosystems. Their work has resulted in a number of awards and prizes including:

Forbes 30 Under 30 | Echoing Green Climate Fellowship | Fast Company's World Changing Ideas Award | Halcyon Incubator | JMK Innovation Prize | Yale Entrepreneurial Institute Summer Fellowship | WeWork Creator Awards | Summit Fellowship

Contact: <https://www.coralvita.co/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Dalula Marine SL (Seagrass Restoration)

Activities: Their Project is the development of the necessary technology, capacity and business model for large-scale marine ecological restoration, especially seagrass meadows in the Mediterranean. This includes commercial scale production, stocking and growth in innovative land-based and marine facilities; site selection and environmental engineering and biological enhancement and control; mechanisation and up-scaling; best use of underwater and 4.0 technologies; long-term management and monitoring reliable and sufficient fund raising (carbon compensation, impact investment and commercial restoration).

They believe large scale seagrass meadow restoration will be viable in the medium term if an ambitious and multidisciplinary RDI effort is made to develop the tools necessary for commercial production and replanting at large scale. This way, they will be able to select plants and sites, reproduce and grow them industrially, and replant and restore ecosystems with 4.0 monitoring and sustainable management plans.

They motivate their activities as under:

Scientific knowledge is available for all fields, but needs confrontation and RDI to develop solutions for cost reduction, ensuring results and large scale restoration of seagrass: breed selection and enhancement industrial cloning, industrial growth and stock conditions, biological control and enhancement, environmental engineering and 4.0 monitoring, machine and tool development, independent revenue streams, long-term planning for local stakeholders and land-based and marine infrastructures. They foresee three stages to achieve commercial viability within 5 to 7 years: 12M for (new) company set up and transversal benchmarking, leading to a) a blue carbon compensation fund for maritime sectors to generate resources and b) a large-scale 24-36M EU-funded RDI project; together leading to necessary technology and business model for a large public-private facility to start large-scale production.

Sustainable impact on blue economy: Seagrass meadow restoration is critical for coastal resilience to climate change, for biological resources and sustainable tourism, for good environmental status and for long-term carbon sequestration. Currently and despite accumulated impact, large scale marine restoration is not done because of costs and lack of reliable tools.

Contact: https://dalula.eu/projects

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Eco Cubes (Eco-friendly Artificial Reef Blocks By ARC Marine)

Activities: Man Made Seaweed Reef : After a lot of time money and trials, Green Ocean Farming are now able to offer Eco friendly pre seeded artificial reef blocks. These galvanized metal cubes are seeded with a variety of seaweed seedlings on lines, that are threaded through the mesh, the Eco cubes are weighted and dropped into the sea at chosen locations to form a eco reef. Once in the sea water, the varieties of sea weeds start to grow, quickly forming safe environments and nurseries for a wide variety of sea life. The seaweed also reduces carbon in the oceans through carbon sequestering which helps prevent ocean warming and reduces acidity in the seas. The mesh structure provides a safe area for small fish and other marine life forms by protecting them from predators as the seaweed grows. An Eco seaweed mesh reef matures within nine months, absorbing carbon from the Oceans and providing safe habitats for a variety of life.

Prices start at £299 per block. They can position the reefs on your behalf if you don't have access to the sea and just want to help the oceans and marine life. If you have a business with a large carbon footprint, this is an ideal way to offset that carbon foot print, by sponsoring a seaweed reef. All their seaweed reefs are made to order, so where ever you are in the world they can help, whether you need one or one hundred.

Contact: [acwdevon@tiscali.co.uk](mailto:acwdevon@tiscali.co.uk).

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Equilbrio Marino

Activities: Equilibrio Marino is a non-profit association, with the aim of recovering and conserving the Alboran Sea. By spreading the benefits of conservation, they want to raise awareness and unite more people every day. And that is why every year they create and participate in many of the most relevant projects and campaigns on the marine world. They develop different projects for Marine Protected Areas, Research and Conservation, Marine Cleanings, Diving Ecotourism, Awareness and Communication, Documentaries and Audiovisuals and Artificial Reefs. A union movement to regain Marine Balance.

They motivate their activities as under:

A diverse, unique, essential sea: the sea of Alboran. In the Alboran Sea, the waters of the Mediterranean and the Atlantic meet causing the greatest biodiversity of marine species in Europe. It is a priority place for the birth, feeding and migratory passage of highly valued commercial species such as sardines, anchovies or bluefin tuna and the habitat of others of enormous ecological value such as grasslands of seagrass, algae and corals. In addition, the strait is the area of greatest variety of cetaceans in the Mediterranean with abundant dolphins, pilot whales, killer whales, sperm whales and fin whales. The Alboran Sea is unique and essential for the marine life of the Mediterranean. It is our responsibility to preserve it.

We are close to the collapse of our seas. Overfishing, climate change and pollution are destroying marine life. Microplastics present in the body of the fish have reached the food chain affecting the health of people. Urgent measures are needed before the situation becomes irreversible. The good news is that if we act now, we reconcile human activity with life at sea. The latest scientific research shows that if a properly protected marine area in less than 5 years can triple its biomass. This explosion generates life benefits of the aquatic eco-tourism and diving and acts as a nursery for sustainable fishing outside the protected area. Another model of conservation is possible with the commitment of institutions, economic sectors and citizens. Because if the sea wins, we all win, it is time to regain the marine balance.

Contact: <http://www.equilibriomarino.com/doc/quienes-somos/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### GEA@275 Oceanic Carbon Capture (Possible Marine Snow Solution to Climate Change)

Activities: The GEA@275TM carbon dioxide removal technology is a new method of inducing Marine snow formation in the Southern oceans in order to absorb excess carbon dioxide from the atmosphere. The natural technology could remove up to 20% of the world’s annual emissions. By minimally increasing the amount of iron chelates in the High Nitrate – Low Chlorophyll regions of the world´s oceans, GEA@275TM induces the formation of Marine snow. Marine snow has the ability to remove “new” carbon from the ocean surface down to the deep sea floor. The ocean surface can then again capture new atmospheric carbon. This process will remove atmospheric carbon, and bury it on the deep ocean floor, and restore it as carbon captured in organic matter. This process is the only natural system powerful enough to reverse the current trends of global warming and the only known method of sequestering large quantities of CO2 into the geological cycle. If the conditions observed in the Adriatic in 1997 could be replicated in an area of 100.000 m2 in the Southern oceans, it could remove up to 1 billion tons of carbon during a 4-month period.

They motivate their activities as under:

One single process operated annually by which they would be able to ultimately reduce the 410+ ppm back down to 300 or further to 275. To date, no other process that has been publicized has this comprehensive capability. The process in addition brings an appreciable amount of microplastics and heavy metals out of the ocean and buried in the Marine Snow deep into ocean floor.

**Technology Readiness Level**

The Scientist overall spent more than 15 years working on this process in the laboratory. After he created marine snow (a proverbial lab error) he spent half that time analyzing the precise process that led to the error and then proving the repeatability of the process and studying the ecological safety of GEA short and long term in the HNLC regions of the world’s oceans. They currently have a patent, a business plan and budget, and a clear cut path to market readiness.

The next and critical steps include: 1. preparations for the Southern Ocean and the application work in situ. 2; the subsequent laboratory work, scientific publication, and UN approval. 3. return to the Southern Ocean for first full large-scale direct application. 4. registration with the IPCC and the first international sales. For the pre-departure work of phase one, they need to cover the costs of: development of a new type of remotely operated vertical profiler equipped with a specific array of sensors and a new type of samplers; development of mobile (container type) lab for measurements on site (use of 14C isotope); equipment for the collection and treatment of large volumes of seawater (cca. 20.000 litres); development of specific incubation equipment for this particular purpose to be used on-board the research vessel; on-board personnel salaries and research vessel with crew rental cost for three to eight week period to the Southern Ocean. There are UN moratoria prohibiting "dumping" in the ocean, so they must first that the GEA method works in the "real world" by an intended series of on-site on-board experiments and later in the Institute of Marine Research in Bergen, Norway. Their results must be published in relevant scientific magazines. This is essential for obtaining permission from the UN and other regulatory institutions to conduct direct application in the natural environment in the Southern Oceans on the second trip.

During the initial Southern Ocean work, they must measure oceanographic and atmospheric parameters; measure in situ primary productivity; measure primary productivity (the goal is to calculate the detailed kinetic responses of the entire system) after spiking the samples with different concentrations of FE-chelates at in situ conditions; isolate dominant phytoplankton species (including cyanobacteria and heterotrophic bacteria) and initiate cultures. When this work is done, they will either do the work on the REV Ocean vessel or transport samples, seawater and equipment to the Institute in Norway for intensive testing in their laboratories and mesocosms in Bergen. During this phase 2 they will: test each species and its responses to different Fe-chelates and condition; repeat above, but tested in mesocosms conditions with mixed populations; test production of marine snow in mesocosms simulating conditions as measured in the Southern Ocean. They will then publish in full these results from this proprietary technology in a peer reviewed scientific journal. Upon UN approvals, they will return to the Southern Ocean for the first full scale application of GEA@275™ and the eventual capture and sequestration of, ultimately, billions of tons of atmospheric CO2.

**Sustainable impact on blue economy**: Marine snow is a huge part of the carbon cycle. As phytoplankton do photosynthesis, they incorporate carbon into their bodies. They may also incorporate carbon into shells, or tests, made of calcium carbonate. As phytoplankton die or get eaten, this carbon becomes part of the marine snow, either in the body parts of the plankton or in the faecal matter of animals that have ingested the phytoplankton. That marine snow settles to the ocean bottom, where the carbon dioxide is stored. The ocean's ability to store carbon in this way reduces carbon concentrations in Earth's atmosphere and can reduce the threat of ocean acidification. In addition, marine snow transports heavy metals as well as microplastics, on the journey to the ocean floor where stored.

Contact: <https://gea275.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Girlfriend Collective (Female Activewear/Clothing From Recycled Plastic Bottles/Fishnets)

Activities: A relatively green (but growing) athleisure company, Girlfriend Collective makes clothing from recycled materials that include plastic bottles recovered from the sea. Their original leggings (through which they became famous with a giveaway during their debut), are made from 25 recycled water bottles each. And the brand's new LITE collection comes from recycled fishing nets. ‘Sure, it's becoming a trend, but being that abandoned fishing nets are among the worst scourge of the sea (save for maybe cruise and cargo ships), is that really such a bad thing?’

Contact: <https://www.girlfriend.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Global Coralition (Integrated Coral Reef and Eco-Sustainable/Blue Carbon Solutions)

Activities: The Dominican Republic has a land area of 48,484 km2, with a coastline of 1,389 km, of these 166 km or 11% are coral reefs. Dominicans recognize the importance of coral reefs as they provide safe ports, shelter, and habitats for biodiversity, food, and beaches. The reefs here are under serious threat from rapid ocean-front development, sedimentation, pollution, hurricanes, and overfishing. They are building a 14’ tall sculpture of Atabey, the Mother Earth Spirit and Spirit of Horizontal Waters from Taino mythology. She is the beginning of an expansive sculpture garden that will be dedicated to coral reef restoration. They are working with our team of designers and fabricators along with Irka Mateo, a Taino elder and shaman to design the garden. They are partnered with local schools here in the Dominican Republic. Some of the students are showing deep curiosity and passion for conservation work. Their local ecological partner, Magua Foundacion, will work with them to empower these children to be the next generation of coral conservationists on the island. They are prototyping a land-based farm that will function as a species bank, rehabilitating endangered species and growing resilient species. They are building their marine farm at the Sosua Fishing Village to support shifting the community to a new economic model with greater financial and ecological stability. Reef degradation and fish population decline has made fishing no longer sustainable. ‘By empowering this community, we can improve both local ecology and quality of life together.’

Contact: <https://www.globalcoralition.org/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Intelli-Reefs (Coral Reef Life Repair, Restoration and Support)

Activities: Intelli Reefs Engineered Reef Systems: The reef restoration project has been in the works since 2007 including major patent research for trademarked and proprietary Nano Reef Habitats. The REEF LIFE Foundation focuses on restructuring marine food chains from macro-biotic particles to increased production of oysters, clams and vital fish species to medical compounds, seaweeds and marine flora and fauna. Reef Repair & Regeneration Projects use compatible reef biology in constructing living shorelines, barrier reefs, "Reef Forest Farms" underwater sculpture gardens, and architectural masterpieces for reef diving. The architecture of Ancient Atlantis is very exciting to them as a recreation project. Their field of research, reef science on nano levels, combined with long standing construction and stone casting expertise is perfectly suited to reef rebuilding. Their experience and creativity lends to casting reef sculptures, reef defence security walls, reef mooring stations for boats and complete reef science eco systems.

The innovation of their materials and designs bring them to the forefront in the marine research world. This innovation will make Reef Life Restoration a draw for Marine Biologists, divers, countries seeking reef repair solutions, and reef species habitats for oysters, clams, fish growth and migration within their reef structures throughout the world. IntelliReefs are innovative reef restoration systems; the result of breakthroughs in science and nanotechnology, these engineered structures mimic established coral reefs to build an oceanic infrastructure that improves resistance to climate stressors and diseases. IntelliReefs is a division of Reef Life Restoration, LLC with 20 years of earned experience in advanced materials, manufacturing methods and delivering custom projects, using scientific research and architectural innovation, combine to offer high performance marine restoration systems designed from nano to industrial scale. ‘We work with you to create an IntelliReefs system that enhances your specific conservation goals to revitalize, restore, and protect delicate ocean ecosystems.’

Contact: <https://www.intellireefs.com/> https://www.reefliferestoration.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Loliware (Seaweed Based Substitutes to Straws and Other Single Based Plastics)

Activities: Loliware is ingeniously using a seaweed-based material to create sturdy single-use straws that are both compostable and… straight up edible. Designed to disappear, Loliware reasons: “Plastic straws are being used and discarded in the billions every day globally. They last forever though we only need them for about 28 minutes. They’re one of the most common plastic pollutants found in waterways and on shorelines. If something is only going to be used once, why is it engineered to last for centuries?” The material they’ve produced for the straw of the future is plastic free, ocean safe, non-GMO, and hyper-compostable. Plus, it can withstand 18+ hours of continuous use and fully degrades once composted.

Contact; https://www.loliware.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Naecoware (Ocean Recycled Plastic Bottles, Coral Planting and Other Products)

Activities: NAECO, a rapidly-growing sustainable products brand whose mission is to help reverse damage to our ocean (notably, NAECO plants a piece of coral for every bottle sold). Their mission is to create the most sustainable options currently available in cups, lids and other eco-friendly cafe products, so you can provide the high-quality experience your customers expect from you. The tide has turned on single-use plastics, and consumers are demanding better options. They offer cups in a variety of sizes, all from high-quality sustainably forested resources. Their new, innovative 100% biodegradable lids are the most high-quality sustainable option available, as are their new sugarcane hot cups. Together, they send a strong message, and will delight your customers. ‘We'll always be transparent about our products, and in some cases, we don't have a perfect solution. If we don't have it, we can confidently say no one else does either. If and when you need a one-time option, we're here for you.’

Contact: https://getnaeco.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### NORI (Blockchain Based Global Voluntary Carbon Removal Marketplace)

Activities: Nori was founded in 2017 on the frustration that there is no easy way for people to pay for pulling carbon dioxide out of the atmosphere. They are leading the development for helping US farmers generate NRTs (Nori Carbon Removal Tonnes) -- a sellable digital asset that represents one Tonne of CO2 removed.

Follow them at nori.com the world's first voluntary carbon removal marketplace. This includes

* -Lead engagement with suppliers and supply partners of Carbon Removal Certificates
* -Launch peer review committee to ensure scientific integrity for system to estimate and quantify carbon dioxide removal from different processes
* -Devise and implement strategic initiatives to engage buyers and suppliers into marketplace
* -Co-host the weekly "Reversing Climate Change" podcast
* -Produce content about and relevant to Nori

Contact: <https://nori.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Oceaneos (Ocean Seeding, Fertilisation and Nutrient Enrichment Technology)

Activities: Oceaneos is a marine research organization engaged in the scientific research and development of nutrient enrichment technology; a method that increases wild fish populations at a local scale, through targeted ocean fertilisation focused on rehabilitating the human-impacted marine ecosystem. Oceaneos has a strong management team covering many years of oceanographic and environmental science supported by a team of leading marine scientists.

What is ocean seeding? Ocean fertilization is the natural process by which iron particles reach the sunlit upper layers of the ocean and enhance primary productivity. This can happen due to upwelling currents at the western seaboard of continents, iceberg melting, seasonal glacier runoff, riverine input, iron-rich dust in winds, and volcanic eruptions that deposit iron over the ocean surface. More specifically, ocean iron fertilization, commonly abbreviated as OIF, is the artificial mimicry of ocean fertilization. OIF adds iron to nutrient-limited areas of the ocean, and it has been implemented in the past to study the flow of carbon in the marine ecosystem, testing ideas related to carbon dioxide removal from the atmosphere to mitigate climate change. Therefore, OIF has a been historically linked to geoengineering. In contrast, Ocean Seeding is the application of iron for the purpose of enhancing primary productivity and the trophic cascade that depends on the phytoplankton bloom, specifically diatoms, for energy and nutrients. Ocean Seeding tests hypotheses related to marine ecology and trophic dynamics, in order to build a better understanding of energy pathways in the marine food web. Under this research focus, Ocean Seeding is not geoengineering.

Contact; http://oceaneos.org/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Foresters (Ocean Macroalgal Afforestation)

Activities: Since 2006, the Ocean Foresters have developed methods to use natural biological processes to produce renewable energy, improve ocean health, reduce global warming, and feed the world’s people. They are an international team planning to grow natural forests of kelp and other seaweed. Part of each forest is harvested to produce enough biofuels to eventually replace 100% of the world’s fossil fuel use. It also sequesters carbon dioxide to reverse global warming, recycles nutrients to sustain the algae, increases seafood harvest, and improves ocean species diversity and habitat.

Contact: http://oceanforesters.org/Home\_Page.html

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Habitats (Artificial Reefs)

Activities: Ocean Habitats, Inc. creates, sells, and maintains artificial reef structures that can be attached to docks in canals and waterways. This encourages the growth of barnacles, tunicates, and other filter-feeding organisms that clean seawater and create an environment to mimic the safety of mangroves for juvenile fish. More than 4,000 units are installed in Florida and close to 5,000 elsewhere in the US and other countries. Almost 3 decades of research produced the company’s Mini Reef, which starts at $297. Their reef replicates nursery habitat, something more like mangrove trees. They are trying to grow baby shrimp, crabs, and fish.

They motivate their activities as under:

Ocean Habitats, Inc. has developed an artificial habitat system that is called a “Mini Reef ” which establishes a micro ecosystem of aquatic life under existing boat docks. The mini reef mimics the environment that is normally found in the prop root system of mangrove trees. This natural environment was long ago removed from area waters when large scale coastal development took place in the 1950’s and 1960’s. Where once there were mangrove forests there are now man-made canal systems with seawalls and boat docks. This man-made world is designed to limit the amount of growth that takes place on in order to slow the rate of decay of all surfaces. On May 18th, 2016, Ocean Habitats, Inc. with funding from the City of Marco Island, installed 25 mini reef habitat systems in a test canal on Marco Island. Since this installation, numerous residents have also purchased mini reefs so that now there are over 100 installed units in the canals of Marco Island. Each one of these mini reefs is developing its own ecosystem of life. First, small shrimp and baby fish use the structure as a safe place to avoid predators, but soon other residents move in. Over 150 different filter feeders like sea squirts and oysters grow on the mini reef and spend their days eating the green plankton out of the water passing by. A fully developed mini reef can on average clean all the plankton out of 30,000 gallons of seawater.

Currently, all the mini reefs on the island are filtering over 3.1 million gallons of water every single day. The waste products from these filter feeders is a food source for small marine animals, which in turn are food for those same baby shrimp, crabs and fish which started using the mini reef for protection. A mini food chain is set up which brings larger fish around a dock with a mini reef looking for a meal. Over the course of a year, residents with these mini reefs report seeing young goliath groupers, barracuda, snapper and many more fish species visiting and sometimes taking up residence under their dock. To date, over 50 types of fish have been seen in or around the mini reefs as well as blue and stone crabs. The goal of Ocean Habitats is to bring to life the canals of Marco Island and other coastal cities like it. It wants to restore some of the wildlife that has been lost to development and help improve the water quality in the canals of the island.

Contact: <https://www.oceanhabitatsinc.com/> , Executive director David Wolff at 218-841-5932

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Nourishment (Ocean Nourishment or Negative Emission Technology)

Activities: Developing the Ocean Nourishment technology so that it is suitable for deployment over the deep ocean (>500m) and can play a role in the restoration of degraded ocean ecosystems. Their research is focused on the careful manipulation of Ocean Nourishment to achieve site specific ecological outcomes, for example, the enhancement of the oceans biological pump in sequestering carbon to the deep ocean or the enhancement of the marine food-chain to support specific fisheries. ONC works in partnership with universities and marine institutions to investigate the potential of Ocean Nourishment in different regions of the world’s oceans. Ocean Nourishment is an ocean restoration technology focused on the health of microscopic phytoplankton at the base of the marine food chain. By focusing on ocean restoration, Ocean Nourishment can support enhanced removal of carbon from the atmosphere to the deep ocean (Ocean NET - Negative Emissions Technology), enhance small pelagic fisheries and help to reduce the acidification of the surface ocean. Their team of scientists, engineers and oceanographers are working on ocean solutions that are both sustainable and scalable. Their aim is to make a positive difference for a more sustainable world.

Contact: <http://www.oceannourishment.com/> or LinkedIn

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Rescue Alliance (Ecosystem Restoration)

Activities: Their artistically crafted reefs enable every individual the opportunity to create an eternal reef for their loved one or company by creating a lasting memory on the ocean floor that will also help restore our marine ecosystems.

**Marine Conservation & Education**

Their education program seeks to empower and inspire our future generations to maintain our marine environments. Their citizen science program, Coral Rangers, engages local communities in reef monitoring and coral restoration efforts, allowing everyone an opportunity to impact reef restoration.

**Research & Restoration**

Their research investigates artificial reef design improvements, coral restoration, fish population dynamics and recruitment to contribute to effective restoration. Their goal is to spread awareness and create marine habitats that will last for generations to come.

‘Saving Our Oceans, One Reef At A Time!

Memorial Reefs ~ Artistic Sculptures ~ Conservation ~ Restoration ~ Research ~ Education’

Contact: https://www.oceanrescuealliance.org/our-mission

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Plant a Million Corals

**Why Plant A Million Corals?**

With 25-40% already lost, the worldwide coral population is in incredible danger. Ocean Biodiversity Corals cover less than 1% of the ocean’s floors, however, our fisheries depend on the reefs for 25-40% of the catch globally. Coral reefs are places for fish to breed, feed, grow, and live. But there is hope. Dr David Vaughan has been able to reproduce thousands of fast growing & resilient corals that can help to recover the lost reefs. With your support, we can help to ensure the survival of our reefs globally. 700 million people depend on these reef fish for their subsistence

**Tourism**

Every year, eco tourists spend over $30 billion in tourism dollars visiting coral reefs and the communities that surround them. They provide the living habitat for hundreds of species of fish and thousands of species of invertebrates.

**Air quality**

Coral reefs are the rainforests of the sea, and along with other ocean plants, produce a large amount of the oxygen we breathe

**Protect our Coastlines**

* Reefs protect the shore lines from wave and storm damage.
* Slow waves that break on shore during storms.
* In the United States of America alone, coral reefs provide more than $1.8 billion in flood protection benefits, protecting at least 18,000 people. –S. Geological Study.

## The Eureka Mistake

Branching Corals, such as staghorn, have always been known as fragile branches that can break, or fragment, from a massive coral after a storm, or artificially in a home aquarium, and can grow fast and reattach on their own. This became the early method of choice in a field nursery. The slow growth of coral seemed to make the original fragmentation a technology that would not be fast enough to make a difference in coral restoration. It was during this realization that Dr. Vaughan made his “eureka mistake”. When moving coral samples from the top level of the aquarium to the bottom, one of the corals had grown attached to the wall and broke apart when it was removed, not only ripping a hole in the coral, but leaving three small polyps at the bottom of the tank. His immediate thought was that those corals would not make it, and moved the broken piece to another tank, to be almost forgotten. Almost two weeks later, he decided to check on the broken coral and found that it had already regrown the damaged tissue! Growth that had taken 2 years had occurred in a fraction of that time. This gave him such hope that he rushed to check the other tank with the polyps to find that they had not only survived, but had multiplied and grown to the size of a dime. After this discovery, Dr. Vaughan has continued his research to find that if all corals can continue to cut smaller and smaller pieces of coral, down to one polyp they produce large numbers of fast growing corals. These small pieces of coral, when placed in proximity to each other, will grow together and fuse back as one piece. Using this method, he can grow a coral in 1-2 years that would normally have taken 15-25 years. We can regrow our reefs at a rate that can make a difference!

Read New York Times, November 25, 2014- A Lifesaving Transplant for Coral Reefs

Contact: <http://plantamillioncorals.org/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Pro-Co Reef (Ecotourism and Coral Reef Restoration).

Activities: ProCoReef, talked about her company’s ecotourism initiatives that allow tourists to participate in coral-reef restoration activities. Alliances with companies help to finance the company’s coral-reef restoration effort. Coral sowing Join their activities and contribute to the restauration of the marine ecosystems while having a wonderful experience. ProCo Reef focuses on the development of sustainable tourism through marine conservation activities. We seek to promote education and sensitization by the means of live learning and experience. We also contribute to the protection and conservation of the hawksbill sea-turtle (Eretmochelys imbricata), mangrove restauration and environmental education.

Contact: https://procoreef.com/home-en/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### The Eureka Mistake

Activities: Branching Corals, such as staghorn, have always been known as fragile branches that can break, or fragment, from a massive coral after a storm, or artificially in a home aquarium, and can grow fast and reattach on their own. This became the early method of choice in a field nursery. The slow growth of coral seemed to make the original fragmentation a technology that would not be fast enough to make a difference in coral restoration. It was during this realization that Dr Vaughan made his “eureka mistake”. When moving coral samples from the top level of the aquarium to the bottom, one of the corals had grown attached to the wall and broke apart when it was removed, not only ripping a hole in the coral, but leaving three small polyps at the bottom of the tank. His immediate thought was that those corals would not make it, and moved the broken piece to another tank, to be almost forgotten. Almost two weeks later, he decided to check on the broken coral and found that it had already regrown the damaged tissue! Growth that had taken 2 years had occurred in a fraction of that time. This gave him such hope that he rushed to check the other tank with the polyps to find that they had not only survived, but had multiplied and grown to the size of a dime. After this discovery, he he found that if all corals can continue to cut smaller and smaller pieces of coral, down to one polyp they produce large numbers of fast growing corals. These small pieces of coral, when placed in proximity to each other, will grow together and fuse back as one piece. Using this method, he can grow a coral in 1-2 years that would normally have taken 15-25 years. ‘We can regrow our reefs at a rate that can make a difference!’

Contact: Read New York Times, November 25, 2014- A Lifesaving Transplant for Coral Reefs

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Project Vesta (Coastal Enhanced Weathering for CO2 Removal)

Activities: Project Vesta is advancing the science of coastal enhanced weathering to remove carbon dioxide from the atmosphere. Their project proposes utilizing beaches and the power of wave energy to efficiently accelerate the breakdown of a rock called olivine. Each 1 tonne of olivine that weathers removes up to 1.25 tonnes of CO2 from the atmosphere/ocean. Olivine is highly abundant and inexpensive, and the process has the ability to scale up to billions of tonnes of CO2 removed per year yet lacks pilot projects demonstrating bot the safety and speed. Project Vesta is a non-profit entity working to bridge the research gap and perform experiments to prove the weathering rate, safety, and logistics and then certify its ability to remove carbon so that this process is available to be deployed on a global scale.

Contact; https://www.projectvesta.org/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Reef Ball Foundation

Activities: The Reef Ball Foundation is a 501(c) 3 publicly supported non-profit and international environmental NGO. Their mission is to rehabilitate our world's ocean reef ecosystems and to protect our natural reef systems using Reef Ball artificial reef technologies. Reef Balls are artificial reef modules placed in the ocean to form reef habitat. They have placed Reef Balls™ in 59+ countries and their projects have a global reach of 70+ countries. They have conducted over 3,500 projects and deployed over 1/2 million Reef Balls. Their projects include designed artificial reefs, ground breaking coral propagation and planting systems, estuary restoration, red mangrove plantings, oyster reef restoration, erosion control (often beach erosion), and expert collaboration on a variety of oceanic issues. They work with governments, other NGOs, businesses, schools, research institutes, private individuals and community organizations and emphasize public education on preserving and protecting our natural reefs. The Reef Ball Foundation is an international non-profit foundation whose mission is to rehabilitate and protect our world's ocean ecosystems through the development and use of ecologically sound designed reefs and related systems. They emphasize on-going research, community involvement, and reefs that promote and support natural species diversity and population density designed reefs and related ecosystems

**Designed reefs and related ecosystems**

World ocean systems are at a tipping point and one stark indicator is a worldwide decline of reefs. Sadly, 20% of the world's coral reefs have effectively been destroyed and an estimated 24% of the remaining are under imminent risk, with 26% under longer-term threat of collapse. Reefs matter for the environment in countless ways and designed reefs are useful tools for restoring our reef systems to a natural and productive balance.

**Why reef balls?**

‘Reef Balls are the world's leading designed artificial reef modules because they are simply the most effective way to create sustainable aquatic habitat and achieve it in a safe, long term, environmentally compatible way’. Reef Ball modules are designed to mimic natural reefs. These basic modules and related adaptations using Reef Ball technology are the backbone of our restoration and protection efforts and are ideally suited for a wide-range of aquatic habitats even when used in engineering applications.

Contact: <http://www.reefball.org/index.htm>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Reef Builders

Activities: Reef Builders use CHARM, which is a frag cleaning robot. CHARM (Coral Husbandry Automated Raceway Machine) aims to automate repetitive tasks when growing coral in a coral nursery or laboratory. CHARM also offers the opportunity for combining coral farming with computer automation to reduce costs and save time.

Contact: https://reefbuilders.com/2020/05/05/automated-coral-husbandry-charm/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Reef Cells

Activities Reef cells are a new and unique solution to bio-marine enhancement. Reef modules designed to look and act like natural reefs, reef cells are designed to provide the maximum amount of surface area and the largest number of interconnected varied spaces using the smallest amount of material.

Traditional man-made habitat structure has been limited to sinking scuttled ships, obsolete equipment, and previously purposed concrete items; none of these artificial reefs look natural and many appear out of place in the marine environment. Many currently engineered artificial reef designs appear geometric, symmetrical and uniform; these shapes usually conform to the limitations of their fabrication method and usually emphasize ease of construction or deployment rather than compatibility with any natural aesthetic. Even reefs built from piled limestone boulders usually look like a pile of rocks and, given the mass of material used, these rock piles produce very few opportunities for habitat or colonization.

REEF CELLS maximize the productive capacity of the artificial reef by providing many interconnected cavities and internal surfaces exposed to sunlight and water current. The ratio of overall surface area and interconnected interior space to the amount of material used and the minimum sea floor area occupied is the highest of any artificial reef design. The size and spatial organization of the interior voids are designed to provide a specific habitat environment favoured by a wide range of varied and diverse marine organisms.

Contact: http://www.reefcells.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Reef Cubes (ARC Marine -UK).

Activities Reef Cubes® provide a real opportunity for eco-responsible companies and individuals to genuinely enhance the marine environment in a sustainable way to leave a positive legacy for future generations. Reef Cubes® are an award winning, patented innovation, developed and owned by ARC Marine. Their resilient and deceptively simple interlocking design makes them perfect for creating and restoring complex marine habitats whilst serving a dual purpose protecting subsea assets such as monopiles, cables, foundations and pipelines. Every project impacting the marine environment now has the potential to work with nature by physically enhancing and restoring the capacity of the ocean to what it once was. Embracing the simple concept of using Reef Cubes® technology to create reef ecosystems that, in a very short time, will become a resilient incubator for marine fauna and flora.

They motivate their activities as under:

**Ecological Benefits of Reef Cubes®**

* Habitat complexity for multiple species
* Food and shelter for marine flora and fauna
* ARC Marine Nursing or Spawning grounds for aquatic species
* ARC Marine Boosting Commercial Fish Stocks
* Sequestration of Carbon
* Increased Biodiversity
* Species Preservation
* Improved Water Quality
* Stimulates Biogenic reef creation
* Zero Plastic

Surface texture – advanced casting techniques that create surface textures that replicate natural reef features and niches which in turn enhance biological recruitment. Reef Cubes® have been scientifically engineered and are manufactured from a marine friendly material which is the perfect substrate for marine flora and fauna to adhere to. They use a new group of Portland replacement cements which are low-carbon and use 100% recycled sand and aggregate.

Contact; <https://arcmarine.co.uk/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Reef Worlds

Activities: Sustainable resort reef, shark & ray programs. Reef Worlds is a collection of underwater tourism designers, thinkers, and creators, who started their company in 2003 as the leading global designer and builder of art inspired artificial reefs for resort hotels helping properties stay competitive by offering low cost, high revenue, artificial reef tourism design on their waterfronts. Reef Worlds now goes beyond art reefs to offer coral programs, wildlife tourism programs, and sustainable reef programs with a fusion of art and science tailored for tourism and the environment to create the "next big thing" on at resorts.

* Sustainable Shark & Ray Encounters
* Environmental Habitat Rehabilitation programs
* Floating Marine Research Bases
* Coral transplant and Farming

They motivate their activities as under:

Tourism research has found that guests value vacation experiences over amenities, which has led many brands to rework the way they deliver unique tourism experiences to their guests. Additionally, guests who are fully engaged are less sensitive to price because their emotional connection with the brand moderates their concerns about cost. Their vision for your resort hotel waterfront attracts clients to your property from around the globe seeking completely unique, sustainable and educational tourism experiences. Easy access and underwater exploration from your beach will reveal reef adventures and memories that last a lifetime for the entire family. Their tourism vision follows in the footsteps of legendary American architect Frank Lloyd Wright - they believe in his "Organic Architecture" philosophy of design. The end result for your hotel is the creation of a new, fully monetized, sustainable and educational reef environment inclusive of dramatically enhanced snorkel and wildlife encounter programs branded to your property; in places where none previously existed.

Green tourism development: Sustainable reefs are thriving reef communities. The success of sustainable resort reefs is due to the provision of greater shelter, new food sources, greater juvenile protection and more space for marine organisms. Your new, full monetized sustainable reef, also acts as a mini marine park. A space where local fishing pressure is greatly diminished and regional wildlife can thrive. Resort owners across the globe are beginning to realize acres of new tourism spaces right off their beaches.

Contact: <http://www.reefworlds.com/about>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Reef Design Lab (3D Printed Coral Reef Based Structures)

Activities: Reef Design Lab works closely with researchers to develop marine habitat infrastructure for a range of applications. Their particular focus is how they can use innovative design and manufacturing methods to create more effective habitat solutions. Their extensive knowledge of how 3D printing can be used to minimise cost, while increasing geometric complexity, makes them especially unique. In 2017 RDL designed a series of 3D printed reef units for the WWF Netherlands oyster reef restoration research project in the North Sea. The units were 3D printed in Rotterdam by Boskalis using D-shape technology. 50 units were printed in sizes ranging from 50cm high to 120cm high and will be monitored over the coming years. This will be one of the largest research based projects assessing the effectiveness of the material and technology.

Contact: https://www.reefdesignlab.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Reefy (Restoring Coral Reefs)

Activities: In Reefy, they believe marine construction can change its impact from negative to positive. One reef at the time, Reefy looks to help asset owners have reliable and resilient solutions that kick start ecosystems and help life under the sea thrive. For this, they are constantly developing hybrid solutions that can offer immediate coastal protection while creating a new complex reef for nature to flourish, hence safety and beach quality are assured while providing a new home for marine life to settle and thrive. Engineering and innovating with nature is the core of the startup. Reefy has designed a new way to build artificial reefs with a patent pending solution. The product consists on “lego-like” blocks that can be assembled to form an underwater artificial reef structure. This structure has sufficient complexity to host a flourishing reef ecosystem and stability against unfavourable storms and sea conditions. It can be used for coastal protection, nature enhancement, sediment reuse and scour protection applications. The Reefy solution promotes a multipurpose design that brings many economic benefits to nearby communities and businesses. Using multipurpose nature-based solutions is the best way to develop resilient coastal protection solutions that can favour several stakeholders. The Reefy solution contains the following innovative aspects:

* Customizable design
* Interlocking system
* Depth of complexity
* Use of local/recycled materials
* LowerCO2 emissions

**Applications**

**Coastal protection:** The stability and energy dissipating capabilities of the Reefy solution can be used as a nature-enhancing breakwater to protect the shoreline against erosion and flooding. The stability offered by the design allows for placement in rough sea conditions, having a capability to withstand unfavourable storms and weather conditions. Based on complex modelling, NOAA has concluded that the intensity and frequency of severe storms is likely to increase due to climate change, with a larger percentage increase in the destructive potential per storm. Stronger hurricanes will cause critical damage to coastal infrastructure and ecosystems, as well as threaten human lives. Action is required to have coastal protection that is adaptable and resilient to climate change.

They motivate their activities as under:

Traditional and hard engineering solutions have protected and will protect us for many years. Nevertheless, with an increasingly changing climate they cannot always solve the problems where adaptive and resilient coastal protections are needed. Nature based solutions are becoming the preferred approach in projects around the world due to their adaptability and additional values that they provide, a great example being coral reefs. Coral reefs are one of the most biodiverse ecosystems in the world and also a significant food source for over a billion people worldwide. These amazing ecosystems are the most potential medicine source for the 21st century and promote a value of $9.6 billion USD in tourism and recreation. But not only that, they are a perfect natural barrier against waves. Coral reefs can dissipate up to 97% of the wave energy before reaching the shoreline. Other ecosystems are also important when discussing coastal protection, mangroves and seagrasses have been reported to store more carbon than rainforest and pay themselves as coastal protection investments. Oyster reefs and other ecosystem architects’ can build structures that act as natural barriers against waves. Unfortunately, we have already lost or severely damaged more than 50% of coral reefs and 85% of oyster beds worldwide. Studies estimate nearly all reefs will be at risk by 2050 unless action is taken now to reduce the threats. These alarming projections are increasingly becoming a major challenge in many parts of the world.

* More than 150000 km of shoreline in 100 countries receive coastal protection from Reefs
* Over 1 billion people depend on coral reefs for coastal protection, food and tourism income.
* 97 % of wave energy is reduced by coral reefs on average
* 50 % of beaches world-wide are expected to disappear by 2050
* 600 million people live in coastal areas that are less than 10 meters above sea level
* 25 % of all sandy beaches are eroding at a rate of 0.5 meters per year or higher

Reefy sees marine infrastructure not as an individual component but as a part of the existing environment, we look to develop designs that enhance these qualities by harmonizing engineering and nature. Monitoring and understanding the system will provide them with the insights not only to design the solution to the specific ecosystem, but to understand the existing threats and stresses for its development. The Reefy solution will increase the dissipation of the structure, resiliency, and additional streams for our clients. It is built on a three-pillar foundation consisting of innovation, science and respect for nature.. Reefy aims to innovate in the blue economy market. Their main objectives are a net zero carbon footprint in our production processes and to help bring back lost reef ecosystems using nature as their inspiration. Reefy is always on the run to be up to date on what is happening with technology around the world in order to offer the best solutions possible. They are constantly working on improving our processes and products to satisfy our clients’ needs.

Contact: https://reefy.nl/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### ReShore Living Breakwaters

Activities: Protecting coasts and rebuilding ecosystems. The ‘living breakwater’ can be a building block for ecosystem regeneration around the world and implemented in coastal infrastructure or restoration projects of any scale. The living breakwater protects shorelines and marine ecosystems, and prevents coastal erosion using nature-based solutions. The floating, living breakwater project is targeted for shorelines of high ecological, economical, and cultural value. ReShore is designing a living breakwater that uses traditional breakwater technology with mussel and kelp cultivation, creating an integrated breakwater from sea surface to seafloor. The living breakwater combines the protection of a traditional breakwater with the benefits of restoration.

**Technology and Innovation**

The innovative aspect of their living breakwater solution is the combination of two proven technologies, in the form of a floating breakwater and integrated multi-trophic aquaculture. They are seeking to redefine infrastructure and restoration investment, creating a new space for nature-based solutions to become essential, sustainable building blocks for traditionally unsustainable blue economy sectors. The benefits of their living breakwater are immediate — like grey infrastructure — and strengthen over time — like restoration — creating more resilient coastlines, ecosystems, and communities.

Contact: <https://www.reshore.blue/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Remora Robotics (Waterway Cleaning Drone)

Activities: Trash, algae, weeds, and oil plague waterways worldwide. Plastic packaging represents the majority of the macroscopic waste found in waterways around the globe. Plastic does not degrade quickly, and it can take decades or longer for degradation to occur. This has led to an epidemic of sorts, as plastic waste keeps stacking up in the ocean. At current rates plastic waste will outweigh fish by 2050. Current solutions to the epidemic are either ineffective, inefficient, or too expensive. Remora Robotics intends to capitalize on these shortcomings via a drone-ship, the Remora. The Remora solution hinges on four factors: it relies on minimal human interaction, it’s highly scalable, it can target all types of waterways, and it collects large amounts of waste daily. The drone that cleans your waterway for you. Think of a Roomba on water. For marinas, ports, and smart cities. Remora Robotics produces waste cleaning drone technology to make the world’s lakes, rivers, bays, and coastlines waste free.

How does it work?

1) Charges in Docking Hub

2) Monitors Coastline

3) Locates Waste

4) Captures Waste Using Inertia

5) Returns to Hub When Full

6) Empties Waste and Recharges

Test out a Remora Water Drone on your waterway today.

Contact: https://www.remorarobotics.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Seaweed Biofilter

Activities: Seaweed Biofilter are developing a transformational technology for seaweed to help protect the Great Barrier Reef. Through a network of seaweed biofilters between the coast and the reef, nitrogen and carbon dioxide would be captured by the seaweed and then harvested for use in products such as animal feed and biofertilizer. This circular economy innovation is anticipated to provide a significant opportunity for new jobs and economic development while improving water quality essential for reef health. The concept design is the first stage in a multiyear project to develop this nature based solution to help protect the Great Barrier Reef.

**Phase 1. Pre-Funding: Ideation:** They have R&D funding for the Concept Design Stage

**Targeted Challenges and Focus Areas:** Restoring, protecting and investing in the ocean

* Investing in nature-based solutions for the blue economy
* Protecting and restoring coral reefs
* Restorative aquaculture

Jo Kelly Solution Owner

Oceania, Australia - Great Barrier Reef

Contact; <https://uplink.weforum.org/uplink/s/uplink-contribution/a012o00001OSmJmAAL/seaweed-biofilter-for-protection-of-the-great-barrier-reef>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Forester (Restoring Sea Forests)

Activities: Sea Forester have a mission to restore the forgotten forests in the ocean. We know about deforestation and the devastating disappearance of forests on land, from the burning of the Amazon and California, to wildfires in southern Europe and Siberia. But something similar is happening under the ocean destroying marine vegetation and our ‘forgotten forests’. Many seaweed forests have simply completely disappeared, destroyed by pollution, ocean heatwaves and other factors. They used to cover most coastlines in temperate climates. Now, from Antarctica to Australia, Canada and Norway, they are under threat. Restoring those forests could be a crucial step to mitigating climate change and limiting the loss of biodiversity in the ocean. There are already dozens of such efforts under way across the globe – in Australia, Portugal, Korea, California and elsewhere – but much more needs to be done. Far too little attention is paid to seaweed, yet these plants can reverse acidification in our oceans, build up depleted fish stocks and capture carbon at least five times more efficiently than tropical forests. At the same time the total area along our coasts, in the Northern and Southern Hemispheres where the sea is sufficiently shallow to allow sunlight to penetrate and sustain marine vegetation, is roughly the same as all of the world’s tropical forests combined, about the size of Europe or the United States.

Seaweed species, such as kelp, are among the world’s fastest growing plants, delivering rapid rates of photosynthesis, and require no fertilizer or soil. They can grow many meters in just a few months. In theory, spores can be sprayed under water and there will be a seaweed forest within a year. When it is grown it can sustain about 100 grams of fish per square meter of forest because of the nutrients it contains and the habitat it creates, according to scientific studies. If we take an area of 5,000km2 which represents just 0.03 percent of their global target coastal zone with shallow water, kelp forests can support 500,000 tons of fish. All other benefits follow from there, including the ability of seaweed forests to reduce coastal erosion. Growing seaweed forests, or restoring ones that have disappeared, is a viable method of helping nature help itself to mitigate climate change. A crucial task to restore our seaweed forests is data. We do not yet have a complete survey of the world’s seaweed and kelp forests, nor exact information on how much of them and how fast they have disappeared. This is key to know how and where to act with most urgency. What we do know is that industrial and agricultural waste discharged on our coasts has helped destroy seaweed forests in many coastal regions. Warming seas, sudden extreme water temperature changes and overfishing have also played big parts.

With greater scientific knowledge some of this may be mitigated. There are thousands of seaweed species in the world and they grow in different water temperatures. Different approaches can be used, from seeding on stones and artificial structures, to restore seaweed forests and the huge ecological benefits they bring. Our ocean accounts for nearly two thirds of the world’s carbon sinks and seaweed forests, along with sea grass and mangroves, are all key ecosystems in that process. They all need urgent attention.

**Objectives**

Four teams servicing seaforesters worldwide:

* Seaforestation: Initiate and participate in projects Research and Development
* Finance: Fund projects globally Novel financing mechanisms
* Data: Collect, monitor and process data Shared knowledge hub
* Communication: Communicator and educator Events and networking

Contact: <http://seaforester.org/#project>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Trees

Activities: SeaTrees claim to be the world’s 1st blue-carbon-focused reforestation platform. Allowing brands and individuals to reverse climate change by funding communities to plant and protect coastal ecosystems. Launched in June 2019 - projected to be sustainably-funded by June 2020. By empowering millions of individuals to make small contributions that fund SeaTree Projects, they can make a huge environmental impact and accelerate nature’s ability to recover.

Brands: By offering like-minded brands a way to directly fund projects that restore blue carbon coastal ecosystems, they can leverage the power of business to accelerate change.

**Project of Sustainable Surf:**

Sustainable Surf is a 501(c)(3) non-profit based in California. Their mission is to transform surf culture into a powerful force for to protect ocean health. Their programs engage individuals and businesses to solve the most pressing environmental issues threatening our oceans.

SeaTrees by Sustainable Surf - 501c3 Non Profit #45-3220205; 1% FOR THE PLANET SustainableSurf.org

Contact: <https://sea-trees.org/pages/about>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Shorelock LLC (Coastal Erosion)

Activities: ShoreLock LLC is an early stage B Corp with a vision to slow coastal erosion across the planet by 2040. The ShoreLock technology is an innovative beach erosion treatment that aids in maximizing a beach’s capacity to dewater quickly and retain sand. Their revolutionary technology utilizes the application of a proprietary compound composed of naturally occurring organic marine materials and laboratory tested to be non-toxic. When applied, the solution enables the sand to re-establish natural cohesion and allow the beach ecosystem to thrive at its full capacity. Wave action is essential to the treatment process as the waves push new sand on to the shore helping to re-nourish the eroded beaches. As treated sand interacts with untreated sand, the migratory properties of the solution allow all sand in the treatment area to receive the benefits. Coastlines around the globe are critically eroding placing millions of homes and businesses at risk every year. Current methods of protection are reactive measures that often cause further damage to the environment by disrupting marine ecosystems and scarring the ocean floor. ShoreLock's mission is to shift the current conversation and proactively protect the coast lines and help reduce the use of harmful methods.

Contact: <https://www.shorelock.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Smart Reef

Activities: Smart Reef™ is a patent-pending data-driven artificial reef system that protects coastlines,, reduces coastal erosion, promotes marine life and restores a healthy ecosystem.

**Coastal Land Loss:** In the past 50 years, more than 1500 square miles of coastal Louisiana have been lost. **(**Source: Coalition to Restore Coastal Louisiana)

**Marine Habitat Decline**

Reef sites that are properly located, constructed and managed can enhance the marine habitat for associated important sport fishes and other organisms. As of 2017, there are 69 inshore reefs, 15 offshore reefs and 8 rigs-to-reef sites that enhance and support important marine species. (Source: Mississippi Department of Marine Resources).

**Ecosystem Degradation**

Between 1930 and 1973, approximately 8,170 acres of coastal marshes were filled for industrial and residential uses. (Source: Environmental Protection Agency).

Contact;

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Subcon (Artificial Reef Solutions)

Activities: Subcon is a leading provider of Blue Solutions for marine habitats, marine foundations and seabed stabilisation. They are pioneering engineered reef solutions that promote coastal erosion control, enhance fisheries and enable sustainable coastal development. Subcon is the leader in Engineered Reef Solutions, with over 20 projects delivered globally. Their solutions are proven, productive and large scale. Their designs use advanced computer modelling and tank testing to support stability in harshest environments. They are pioneering the use of low carbon footprint reef materials, advanced fabrication methods and remote installation. Subcon have delivered industrial scale habitat solutions for fisheries enhancement, reef restoration, coastal erosion control, offshore wind, decommissioning, tourism, and living harbours. Independent scientific monitoring has recorded significant and sustained increases in marine abundance.

Contact; [info@subcon.com](mailto:info@subcon.com);

www.subcon.com.au or visit us on LinkedIn http://www.linkedin.com/company/subcon.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sustainable Oceans International

Activities: SOI is an innovative Australian company with an international team, including a branch in Bahrain, specialising in the design and construction of artificial reefs/habitats for restoration, ecological enhancement of marine infrastructure (e.g. living seawalls), tourist attractions and coral relocations. They provide specialist services to environmental-engineering companies, government, NGO's and resorts that need artificial reefs, coral relocation plans, mitigation of dredging impacts, ecological enhancement of coastal infrastructure, or coral relocation and restoration. Project locations include: Middle East, PNG, Thailand, Mauritius, Maldives, Indonesia, Antigua and Australia.

Contact: <http://www.sustainableoceans.com.au/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sustainable Now (Algae Based Biotechnology that Captures CO2)

Activities: At Sustainable Now Technologies, they have developed biotechnology that captures carbon from the atmosphere, and that can eliminate costs associated with carbon emissions and carbon construction footprints. Their carbon capture systems are designed to run on renewable energy, and can be implemented anywhere on Earth, independent of established infrastructure. They believe that a sustainable future starts with a sustainable now. Sustainable Now Technologies develops an innovative carbon capture system using algae to convert carbon into biomass. Its systems are designed to run on renewable energy and can be implemented anywhere on Earth.

Contact; https://sites.google.com/view/sustainablenowtechnologies/home

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 8. ILLEGAL FISHERIES, BYCATCH WASTE, MARINE CONSERVATION AND OCEAN GOVERNANCE

### Abalobi

Activities: In 2015, the founder launched the ‘Abalobi’ initiative in South Africa. The Abalobi initiative is an open, transdisciplinary and social learning endeavour, bringing together various stakeholders, with traditional fishers taking centre stage. It is a participatory action research project with a strong community development interface. Abalobi, as a free mobile app and programme, is aimed at social justice and poverty alleviation in the small-scale fisheries chain, transformation in the way we produce knowledge, stewardship of our marine resources, and resilience building in the face of Climate Change. Their approach is focused on tangible milestones, driven by a suite of mobile apps, that relate to seafood traceability, fully documented fisheries, fair and transparent supply chains, and community cohesion and entrepreneurship as important precursors to launching longer-term ecological improvement actions associated with a transition towards ecological sustainability.

Contact: http://www.abalobi.info

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Atlan Space (AI Ocean Drones)

Activities: ATLAN Space protects Life by helping institutions to manage very large, beyond the horizon areas. Their patented Artificial Intelligence, mimics human pilots on board drones to fight environmental crimes and provide support to distressed populations. They develop artificial intelligence to guide networks of drones, for a cost-effective monitoring of large maritime areas. The drones identify all surface activities and advise the best course of action to neutralise risks. ATLAN Space is a software company founded in Morocco that builds deep learning technologies which are capable of autonomous navigation, cognitive vision and contextual behaviour. As a framework AI technology, it can be used to monitor activities beyond marine areas ocean such as supporting distressed populations, deforestation, trafficking etc.

**Targeted Challenges and Focus Areas**

Illegal fishing: It is difficult to monitor fishing activity at sea.

As ATLAN Space is a technology company that develops a framework solution to monitor and collect information over very large beyond the horizon areas with the purpose to fight environmental crimes and protect distressed populations, they build partnerships with field experts organizations that have an deep understanding of the their customers problems and help integrate their solution in their customers’ operational and judiciary process. With their partners they build customized trainings, not only to enable customers to use the technology but also to provide them with the legal tools to prosecute illegal activities. As ATLAN Space is supporting countries to execute their sustainable development strategies for the Ocean and fight IUU Fishing, they have defined areas to measure our success : Short term measurements that are directly related to fighting illegal fishing such as the total sum of areas that have been monitored, the number of vessels that have been identified, the number of illegal activities that have been notified and the outcome of their prosecution. Long term indicators related to the execution of the sustainable development strategy, such as the increase in marine biodiversity, the increase of local job creation and the growth of fisheries industry in the country.

Contact: http://www.atlanspace.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Ocean Gear (IoT Connected Smart Buoys to Monitor Fishing Equipment)

Activities: Blue Ocean Gear develops Internet of Things (IoT) tracking products for the ocean, starting with Smart Buoys to track gear for the fishing industry. Smart Buoys utilize GPS and other sensors to track gear at all times and sends an alert if gear positioning is out of the desired area.

**Impact**: Using Smart Buoys to track gear on the ocean can reduce plastic pollution in the ocean, reduce "ghost" fishing, improve ocean ecosystem health, and aid detection and response to marine mammal entanglements.

They motivate their activities as under:

**The Problem:** Lost fishing gear has global economic and environmental impacts on the ocean, as well as the people and industries that rely on it. Despite fishermen’s best efforts, fishing gear is lost due to many uncontrollable forces including storms and strong currents. Lost gear continues fishing indiscriminately—both target species and bycatch—without being harvested. This ‘ghost gear’ depletes the current biomass, reduces future harvests and fishing industry revenue. 640,000 metrics tons of fishing gear are lost in the ocean every year. Unrealized harvest due to ghost fishing costs the industry billions of dollars. Valuable resources, such as time, fuel and money, are wasted searching for and replacing lost gear

**Their Solution:** Blue Ocean Gear’s Smart Buoy technology tracks fishing gear at all times, including traps and nets that are far offshore. These buoys alert fishermen of their new location when gear has moved too far, allowing for direct retrieval rather than aimless searching. A wide variety of data from the buoys can be used to help ocean businesses run more efficient and cost-effective operations, both on- and off-shore.

* Improve fleet costs and efficiency by preventing gear loss, reducing time and fuel spent searching for missing gear.
* Optimize fleet operations through data analytics that help identify seasonal trends.
* Lets fishermen assist marine mammal rescue teams by providing coordinates of gear that may be entangled

Contact: https://blueoceangear.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### FAME (Fish Catch Documentation and Traceability)

Activities: FAME is in the business of uplifting the lives of fishermen through their maritime transponders for tracking, fish catch documentation and traceability. They provide technology based tools to fight IUU and promote sustainability. Their transponders are equipped with LoRaWAN radio modules to transmit location and sensor data from the boats in the ocean to gateways installed on ports more than 50 km away. They incorporated NFC technology to get the exact time, location, and information needed to be able to provide the needed documentation and traceability data and transmit it electronically without too much human intervention. When a fisherman catches fish (Ex. Yellow fin tuna), he gets an NFC card, taps it on the transponder, and immediately latitude, longitude, timestamp, tuna ID, fisherman name, license, boat name, and registration is saved on the card. It is then secure on the tail of the tuna to for traceability.

Phase3. Seed Funding

They have proven that their transponder and NFC solution works though the projects that they had with USAID and WWF. They are now ready to scale it to be able to help fight IUU fishing.

Targeted Challenges and Focus Areas: Restoring, protecting and investing in the ocean; Investing in nature-based solutions for the blue economy; Technology supporting Marine Protected Areas.

They motivate their activities as under:

There is a need to track boats in order to know their fishing grounds and to see that they don't do fishing in marine protected areas. They also found out that there is a need to document where the fishes are caught, when they are caught and how they are caught. Right now nearly all of this is being done manually. There is a need to provide technology based tools aside from manual documentation to be able to religiously record fish catch and provide accurate information. That's where are transponders with NFC comes in. They provide a simple (just TAP) yet powerful solution (platform) to provide accurate fish catch documentation from point of catch until it reaches the consumers, through their platform. Sustainability can be achieved using the technology from their transponders to their web platform and make it interoperable. ‘We trace the fish from hook to cook.’

How does the solution address the problem? Currently fish catch documentation is mainly done manually, fishermen make use of pen, paper, ribbons to tag their fish catch. Other technology solutions are working but are very expensive to implement. They talked with fishermen and according to them their main job is to fish and not to document or record – they consider it as a burden while fishing. In order to solve this, their technology replaces the manual encoding and manual capturing of traceability data. When a fish is caught, they just follow 3 steps: 1. Get an NFC card. 2. Tap it on the transponder, 3. Tie it on the fish (one NFC per fish if big, one NFC per tub if small fishes). That's all that they need to do, but they were able to get all the needed information for traceability and fish catch documentation. The key data elements are well captured.

* Integrated technologies
* Big Data
* Other

They make use of the LoRaWAN network to send data more than 50km away. They also make use of NFC (Near Field Communication) to store point of catch traceability data and tag fishes. Since they can now track boats using their transponders, they can provide safety and security to fishermen. They can also determine if there are fishermen going in to marine protected areas to fish. Since they can now provide electronic documentation and traceability, processors want to know that what they buy did not come from IUU fishing and they can provide a full fish catch traceability to their buyers. They also give incentives to fishermen who use this technology since they provide valuable data. Since their platform captures and stores all the data, they can generate valuable data for research and for local governments to monitor their catch. Through their platform they provide collaboration between the government, fishermen, buyers, processors and consumers. ‘We give them information that they need captured by our transponders and NFC technology. We add value to the fish with the data we provide’.

Contact: https://uplink.weforum.org/uplink/s/uplink-contribution/a012o00001OSkKLAA1/fame-fish-catch-documentation-and-traceability-using-rf-and-nfc-technology?nocache=https%3A%2F%2Fuplink.weforum.org%2Fuplink%2Fs%2Fuplink-contribution%2Fa012o00001OSkKLAA1%2Ffame-fish-catch-documentation-and-traceability-using-rf-and-nfc-technology

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Fish Face (Marine Fisheries/Aquaculture Facial Recognition and Analysis Technology)

Activities: Fish Face will be developed by the Swedish firm, Refind Technologies and use facial recognition technology to, as it says, “automate the collation, at sea, of information on the species and numbers of fish caught, and use this data to inform management decisions. The first steps are to trial the technology in Indonesia’s deep-water snapper and grouper fisheries. Their latest application is fish species identification in a project called FISH FACE, where they are working together with The Nature Conservancy.

Contacts: <https://www.refind.se/new-applications> http://www.refind.se/blog/2016/1/15/fish-face-refind-software-enables-sustainable-fishing

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### OLSPS (Electronic Logbook Solutions)

Activities: In recent years, driven mainly by the huge costs of deploying and managing onboard human observers, two relatively new technologies have been attracting significant interest. These are: On-board Camera Monitoring (EM for Electronic Monitoring) and eLog Reporting (ER). While the underlining technologies of the EM and ER core components are different from each other, they are complimentary in that together they can deliver effective Monitoring, Control and Surveillance (MCS) of fishing operations and related activities. The Olrac iEMR project will combine EM and ER technology to offer a novel and holistic solution to fisheries management. By significantly modernizing fisheries data management systems and processes, Olrac iEMR has the potential to make a dramatic, positive impact on the Blue Economy. The overall aims of the iEMR project are to: • Improve the quality, quantity, accessibility and transparency of fishing data for compliance, scientific and management purposes; • Accurately and efficiently monitor and report on fishing activity; • Avoid unsustainable fishing practices and combat Illegal Unreported and Unregulated (IUU) fishing; • Improve economic efficiency in the fishing sector; and • Empower fishers through technology and data-collection, equipping them with a cost-effective tool that far outstrips the capabilities of paper logbooks, at-sea observers and existing compliance-based electronic logbooks.

Olrac iEMR is an innovative and complete technological system, providing tangible benefits to fishers and managers alike. The technology The Olrac iEMR solution will combine EM and ER technology into a single, integrated system wherein: • The ER component will act as the core tool for skippers to accurately record all vessel, effort, catch, discard, and other operational and environmental information; while, • The EM component will serve a surveillance and verification function in regard to the above data collected and reported upon; and, • The ER tool and EM tools will be synchronised for easy verification of reported information against images captured at the reported activity date/time/location.

To achieve this, Olrac iEMR will comprise 3, integrated components:

1. Olrac Dynamic Data Logger (OlracDDL): The vessel unit/electronic logbook The OlracDDL is an on-board, touchscreen-ready, Windows-based software solution for the recording, visualization, reporting and management of commercial fishing data. The OlracDDL system can record operational data and produce reports intended for multiple purposes, including commercial, scientific, statutory and traceability services.

2. Olrac Dynamic Data Manager (OlracDDM): The web-based data management unit (shore unit) OlracDDM is a web-based data and reports management system. It can read and store data from an entire fishing fleet, aggregating it for further analysis. The OlracDDM has many built-in, smart and user-friendly queries and visualization tools that can be accessed via its web interface. The OlracDDM is also customizable to suit the needs of any fishery and fishing method.

3. On-board smart camera technology. The latest generation of marine surveillance cameras is very efficient and reliable (producing and storing thousands of hours of ongoing, high quality video/still footage on a single storage disk. However, this creates a new challenge: how to utilise, inspect, analyse and derive meaningful insight from this massive “pile” of imagery data. Manual inspection of thousands of hours of imagery data, most of little to no value, can be expensive, tedious, partial (normally only about 10% of the entire fishing trip footage is inspected) and inaccurate.

Olrac iEMR resolves this issue by connecting the latest marine surveillance technology directly with OlracDDL and OlracDDM: • The solution links images, taken at selected intervals by on-board cameras, directly to the OlracDDL data entry tool, which allows for timely and accurate visual auditing of critical events during a fishing operation. The solution is linked to a GPS and can use any on-board transmission system to send reports. • The solution will also use image and video integration and an auditing module within OlracDDM to scrutinise time and date-stamped images provided by the on-board monitoring system. This capability allows compliance officers to check, compare and validate image information against compliance reports provided by fishers. In action, Olrac iEMR will allow users to record footage of fishing activities, operations and notable events and enable fishers, managers and compliance agencies to monitor and validate all catch logbooks.

Contact: <https://marine.olsps.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ol-Trace (Seafood Traceability Solution)

Activities: . OlTrace is an integrated traceability system for small-scale and artisanal fisheries. Through OlTrace, fish-products are tagged at the point of capture on the vessel. This unique, verifiable and tamper-proof tag is tracked with the product as it moves through the supply chain. The system consists of tried and tested: • Hardware (on-board computers, cameras, scales and scanners, as well as transport and processing computers, scales and scanners); • Software (on-board electronic logbook, image capture and web-based data management software); and, • Management systems (e.g. key data elements and critical tracking events).

Traceability systems are integral to the monitoring of fish products as they move through the supply chain from source to table. Technology-driven traceability presents the following, core benefits: • Ensures that products have originated from legitimate sources and have therefore undergone required permitting; • Allows buyers, including importing countries, commercial entities and end-product consumers, to distinguish between legally and illegally caught fish products and make informed purchasing decisions; • Educates consumers on the importance of legal and ethical purchasing habits; • Provides confidence to buyers due to technologically verifiable “chain of custody” records; and, • Allows for data to be stored and exchanged between stakeholders throughout a seafood supply chain (including catch source, distribution channels and final destination), promoting operational efficiencies and transparency. Collectively, these benefits contribute meaningfully to the species conservation efforts which depend on the curtailment of illegal fishing practices. OlTrace and the future of fish-product supply chain transparency: to succeed, a traceability system must be simple, user-friendly, cost-effective and robust. While a few fisheries have incorporated some form of labelling or traceability, existing systems are limited in scope, and available for only a short segment of the supply chain.

The OlTrace system will incorporate the technology of proven vessel-based electronic logbook technology, tailor-made for use on fishing vessels. This technology will record key catch data including the vessel identity, species caught, catch location and catch time. Using a combination of electronic and physical tagging (with tag types tailored to predefined product types), the product will be tracked through the supply chain through processor, distributor all the way through to consumer. Once designed, OlTrace will be field-tested with vessels and processors, supported by a user guide and training, with motioning and evaluation taking place at each stage of the supply chain. The implementation of OlTrace will ultimately assist both with combatting trade in illegal product and in providing accurate and tamper-proof data on catch information, and their associated fishing operations, in both developed and developing countries.

Contact: <https://uplink.weforum.org/uplink/s/uplink-contribution/a012o00001G7jkTAAR/oltrace-a-mobile-fishproduct-traceability-solution>?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### PISCES Safety Net Technologies (Reduce Bycatch/Improve Fishery Yields)

Activities: Pisces have developed products that can lower bycatch by 90% and improve fishing revenues by up to 25% – saving more fish, helping fishermen, and protecting an increasingly essential food source now and for the future. Underwater lights that fit to your fishing gear with a science-based service to reduce bycatch of unwanted species. Saving more fish, helping fishermen, and protecting an increasingly essential food source now and for the future. The commercial fishing industry is undergoing a regulatory sea change, putting it under increasing pressure to ensure that profitability is supported by sustainability. Low quotas on threatened species make it really hard for fishing vessels operating in a mixed fishery, where they might be mistakenly catching those endangered species alongside abundant commercial species. Pisces can help dramatically lower the likelihood of catching non-target species, meaning fishing crews have a higher chance of operating their business without fines or regulatory issues. This is great for the individual companies, but also the wider industry, as it helps safeguard the sustainability of fish stocks into the future.

They motivate their actvities as under:

Currently, about 1 out of every 5 fish caught is unmarketable, endangered or too small to land legally, leading to 16m tons of fish wasted every year globally and 20% wasted space on vessels. This leads to great environmental, economic, and ecological cost as oceans are being depleted, coastal communities suffer, and the demand in food supply is not being met. There is now new legislation, such as the EU Discard Ban, that makes discarding illegal, but a lack of technical solutions to enable sustainable fishing means it is difficult for fishermen to easily comply.

* 1 in 5 fish caught is the wrong fish
* 16m tons discarded globally per year
* Fishing Vessel $500,000 lost per vessel per year
* Fish On Plate +70% fish demand by 2050

Their solution: SafetyNet continually tries to set the bar higher in terms of fishing conservation technology. They have brought skills such as Human-Centred Design to all their work in the fishing sector, showing other organisations new ways of working and getting to the nub of real user needs. They also had to figure out how to scale up the impact their technology could have, and the means to produce it at that scale. They have demonstrated that conservation technology can yield positive financial returns for fishing businesses and companies innovating to build technologies in this space, demonstrated by their successful Seed investment round. This all moves the sector forward, and hopefully inspires others to work in a similar way – with fewer barriers than they faced.

What role does SafetyNet play in the future of sustainable fishing? SafetyNet is entirely focused on breaking down technical and scalability barriers to industry-changing ideas achieving success. ‘We’ve started this through applying science to fishing with Pisces, but we’ve got so many other ideas we’re excited to pursue, on our own or in collaboration with others. The future is bright!’

Contact: [www.sntech.co.uk](http://www.sntech.co.uk)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sedna (Seafood Traceability Systems)

Activities: Through RFID, environmental sensors and mobile applications Sedna Technologies is able to track trace and monitor seafood from catch to plate. Currently being used by harvesters, processors and traders the Sedna traceability ecosystem goes beyond traceability to prove conditions as well as quality through the supply chain. Sedna Technologies is a fisheries technology firm based out of Nova Scotia, Canada. The focus of Sedna is to increase the traceability of seafood products by creating innovative and simple to use software solutions for exporters, processors, distributors and harvesters involved in international and domestic trade.

**Targeted Challenges and Focus Areas: illegal fishing.**

Following seafood from catch to consumption is tricky. As they have well established roots in North America and Oceania, they are looking to expand into other areas including Europe, Africa and Asia. ‘Connecting with mentors who have connections and expertise in these areas would be of great value to share our traceability ecosystem with new and emerging markets.’

Contact: www.sednatech.io.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Shark Safe Barrier

Activities: Shark Safe BarrierTM successfully bio-mimics the visual effects of a kelp forest, and combines this with a series of permanent magnetic stimuli, to form a barrier that dissuades sharks from passing through. The SharkSafe BarrierTM can be the first 100% effective eco-friendly technology to protect humans from sharks without harming the marine life. The SharkSafe BarrierTM does not affect marine life such as seals or bony fishes that naturally utilize kelp forests as effective refuge areas. The SharkSafe BarrierTM scientific testing was developed in three phases: (1) magnets as shark deterrents (2) visual and magnetic barrier deterrents and (3) exclusion capability of the barrier. All the phases of this study demonstrated that the SharkSafe Barrier TM successfully manipulate the swimming patterns of all interacting sharks and were published in peer review scientific journals. They deployed prototypes in South Africa and the Bahamas, attracted the sharks with chum, to motivate them to go through it and observed that none of them (84 white sharks and 41 bull sharks) swam through the barrier. By installing the SharkSafe BarrierTM around a beach, beachgoers will be protected and the marine life will not be harmed. With the exclusion tests in South Africa and The Bahamas they could prove that itcan effectively keep sharks away from a food source. This was the last step of the scientific tests to prove that SharkSafe BarrierTM can effectively protect a swimming area, by keep sharks separated from people.

**The application**

The SharkSafe BarrierTM design is suitable for many different locations. It can undertake strong waves and currents, and has had a 100% success rate of keeping highly motivated sharks out. While all other technologies in use affect large marine animals, excluding them for the “protected zone”, this technology is the only one that is shark-specific, since it allows other marine animals to freely swim through it. It has proven to resist swells as high as 8 metres, and has been maintenance free for the past 2 years in full scale tests in Gansbaai (South Africa). It can be deployed at different depths (from 0 to 12 meters), making it the ideal solution for protecting both swimmers and surfers. The elongated elements (pipes) can be adapted to any depth, since the units can be built in different sizes, and are flexible enough to allow boats and divers to easily go through. The SharkSafe BarrierTM is also the first technology that was invented by bio-mimicking the habitat naturally avoided by large sharks (it creates a visual barrier between sharks and humans, by utilizing the natural instinct of sharks the avoiding entering a thick kelp forests). The addition of a strong magnetic field adds an extra safety measure, since large magnets have proven to be strong deterrents for shark species.

From an engineering perspective SharkSafe BarrierTM technology has achieved the following objectives: The pipe material was changed from PVC to LDPE (Low-density polyethylene) which does not require toxic plasticizer such as the vinyl chloride monomer (contained in the PVC). The pipe design was reduced to two feasible options – deployed in Shark Alley in August 2015. They still show no signs of damage two years later. The buoyancy of the pipes was measured and tested with different options (pool noodles, foam and air bottles) and the longest lasting solution proved to be air bottles. The design for the anchorage system was completed for rock substrates

Contact: <https://www.sharksafesolution.com/our-product/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Smart-Catch (Reduce Fisheries Bycatch Waste)

Activities: Technology solutions for sustainable commercial fishing. Business development: Technical product design and development of:

* \*deep sea hardware and software systems, devices, sensors, and controllers
* \*high capacity information networks, video imaging, and recognition technologies

Smart Catch, is committed to helping fishermen harvest with greater precision and in raising public awareness about the health of our fisheries.

**DigiCatch.**

SmartCatch’s DigiCatch is part of the trawl-net suite of solutions. The DigiCatch Video monitoring system features a live video camera, lighting, cables, and sensors collecting data for analysis. The System is designed to be simple to install and deploy. The product and cables are strong enough to work under the harshest conditions. The cables are installed to withstand the deep seas of the Aleutian Islands. The live feed comes directly into the Wheel House giving the Captain and the Crew eyes in their net.

**DigiServices From Sea to Cloud**

DigiServices helps manage and maximize the value of the video and information captured in your net with DigiCatch. DigiServices facilitates software management tools designed to improve operational transparency, quality, compliance, and efficiency. Fleet owners can remotely access relevant information.

* Perform analytics
* Fleet and vessel oversight
* Catch density assessments
* Optimize fleet deployment
* Fishermen can plan cost-effective tows based on past successful harvests.

Contact: <http://www.smart-catch.com/news/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### TEDEPAD: Technological Device for Avoiding Parasitic Discarding at Sea (Marexi Technologies)

Activities: TEDEPAD® is the first system specially designed to treat guts that are generated when processing fish on board fishing vessels, with the aim of completely exterminate their parasites; especially the Anisákidos, obtaining that those viscera can be returned to the sea without adversely affecting the marine ecosystems. In this way it contributes to the reduction of the concentration of these parasites in the fishing grounds where their fleet operates.

They motivate their activities as under:

Marexi is a new, dynamic and young company from Galicia that bases its activity on the constant research and development of tools, equipment and technological solutions applied to the marine sector. Sciences such as acoustics, optics and other branches of physics are focusing increasingly their investigations into the marine environment. Marexi as a technology company specialized in the research work directly generating products and solutions to move increasingly in the exploration, research and development and conservation of marine resources.

The success of the system has been proven in several ships for months working on board. The next step is to market it thanks to specialized companies and to the will of governments and fishing companies so that the resource does not collapse, that the fishing economic activity continues and increases food security and consumer confidence

Sustainable impact on blue economy: A medium fishing trawler working, for example, in the grand sole fishing ground, introduces to the sea around 50.000 anisakis larvae/day (750.000 larvae/trip). Annually, during the on-board evisceration practices, this fleet flows into the sea around 3000 million anisakis larvae along with the discarded guts. Parasite Project EU http://parasite-project.eu

Contact: http://www.marexi.com/tedepad.html

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### This-Fish (Seafood Traceability Software)

Activities: This Fish Inc., a Vancouver-based software startup building traceability software for the seafood industry. They have a passion for sustainability, the ocean and social entrepreneurship.

1: DIGITIZE: They use data to cut labour costs by reducing paperwork, speeding up reporting and decreasing errors.

2: MONITOR: Their solution provides dashboards to improve compliance by using chart real-time data.

3: ANALYZE: Analyse your data to increase productivity, producing powerful reports.

Built for the seafood industry, Tally makes data entry with wireless devices easy for workers, saves managers time with reporting and provides executives with top quality data for their bottom line. ‘Our software helps people.’

Contact: <https://this.fish/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Trademodo (Online Canadian Ethical Seafood Supply Chain Marketplace and Data Solution)

Activities: Trademodo, Vancouver, Canada: Supporting sustainable trade by providing a platform for users to easily find, research and connect with ethical seafood businesses throughout all levels of the supply chain. Trademodo is a trusted source for great seafood industry businesses and makes data gathered from governments, NGOs, and seafood professionals digitally accessible. They are a global trade platform that is redefining the way B2B businesses find and connect with each other, starting with the seafood industry. Their search engine is being used to find thousands of seafood businesses from all levels of the supply chain. With these tools, Trademodo helps users find suppliers and services providers, select the right business partners, and help businesses reach and engage with their customers.

Contact: <https://trademodo.com/about-us>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### TraSeable Solutions (Seafood Traceability Software)

Activities: Fijian traceability tech start-up, TraSeable Solutions, supports global food sustainability by providing a blockchain-ready software-as-a-service (SaaS) platform for fisheries and agriculture traceability. Experienced ICT professional with over 10 years of experience in the Pacific region specialising in Enterprise Management Information Systems (MIS) in various fields including fisheries, human resources, finance, banking, and student administration. They are the first certified Ethereum blockchain developer in Fiji and the Pacific Islands with experience in designing and building decentralised applications for provenance use cases.

TraSeable Fisheries:

They provide a number of information products as a service to key stakeholders along the seafood supply chain. These products are delivered through their secure TraSeable cloud-based collaborative platform on a subscription basis.

* Fishers – the fishing fleets and companies
* Processors – the processing plants and companies
* Exporters and Importers – the transport and logistics companies
* End Buyers – chefs & restaurants and final consumers
* Regulatory Authorities – government, public sector and regulatory authorities

Contact: <https://www.traseable.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Verifik8 (Integrated Aquaculture Data Analytics Platform).

Activities: Verifik8 is an integrated data analytics platform. ‘Connecting the dots in the supply chain in three simple steps.’

**Analytics**

With multiple data streams from across the supply chain, Verifik8 crunches data using algorithms to assess and verify the socio-environmental performance of your farms. Verifik8 delivers real-time analytics and assessments of your supply chain visualised on the application dashboard.

**Monitoring**

Designed as a user-friendly mobile and web application, Verifik8 enables real-time data collection from your farms, suppliers, and processors. Using an extensive number of indicators, aligned with industry- and commodity-relevant standards and conventions, Verifik8 monitors the socio-environmental responsibility of your farms.

**Reporting**

Verifik8 produces quarterly reports on your farms' socio-environmental performance. By providing insights on how to improve their environmental and social responsibility, Verifik8 facilitates your farms' achievement of relevant sustainability certifications.

Contact: https://www.verifik8.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 9. MARITIME EDUCATION AND TRAINING/GENERAL VR AND SIMULATION TECH

### Artemis Technologies (Maritime Simulators/Zero Emission Vessels)

Activities: Artemis Technologies has developed a range of Maritime simulator packages from desktop, to full motion platform, working with customers on bespoke hardware and software, to create the most accurate simulated environment. Artemis Technologies simulators ensure optimal correlation and project efficiency, prior to build; as well as providing the opportunity to train skippers and crew ahead of sailing new vessels. Their highly detailed dynamic models and realistic sea surface description are tightly linked to the visual system creating a perfect match between sea surface appearance, and feel. Dynamic water modelling depends on actual changing physical wind parameters (force and direction) in addition to swell. Multiple simulators can be combined in a shared scenario and additional boats can be inserted.

Artemis Technologies can build a bespoke physical model of any customer vessel, and provide a truly immersive experience, can create a realistic platform for the helm and crew, that has an identical look and feel to the real deck or cockpit. The growing global desire to cut CO2 emissions from all modes of transport has finally begun to drive significant change within the maritime industry. Under a new international agreement issued by the International Maritime Organisation, the global maritime sector has committed to cutting emissions by at least half, by 2050, however a number of countries have more ambitious targets. For example, the UK has committed to being carbon neutral by 2050; its Clean Maritime Plan, building on its Maritime 2050 strategy, aims to reduce pollution to improve public health and protect the environment, calling for all new maritime vessels to be designed with zero-emissions capable technologies, from 2025 onwards. Artemis Technologies has developed a new approach to maritime design, more in line with aerospace and motorsport, using bespoke simulation and performance prediction tools to develop digital twins in the design process, and utilise new lightweight structures and modern manufacturing techniques. Artemis Technologies is taking this approach to the commercial maritime world, and is on a mission to take a global lead in the decarbonisation of the maritime industry. The company name, ‘Artemis’, comes from the ancient Greek goddess, she is a protector of nature. Artemis Technologies will deliver its vision by utilising its innovative intellectual property in hydrofoiling and wingsail technology, developed over the last decade of America’s Cup racing by its sister company, Artemis Racing.

**Artemis eFoiler™ Propulsion System**

A hydrofoil is a wing-like appendage under the hull of a vessel. As the vessel increases its speed the hydrofoils lift the hull up and out of the water, greatly reducing wetted area, resulting in an order of magnitude reduction in drag. Over the last two years Artemis Technologies has been developing a commercial application for this technology, named the Artemis eFoiler™ The Artemis eFoiler™ is based on the integration of an electric drivetrain into an autonomously controlled carbon fibre hydrofoil. With minimal increase in wetted surface area and drag, it provides the first viable solution for the early adoption of high-speed zero-emissions maritime transport. This truly transformative and complex technology will reduce the drag of a conventional fast ferry or traditional passive 'V' hydrofoil, by up to 90%, uniquely making electric propulsion, with high-speed and range, commercially viable.

The Artemis eFoiler™ is available as a stand-alone product for both new vessels and retrofitting of current fleets.

**Strength in Places**

Artemis Technologies is leading a Belfast-based Innovate UK Strength in Places bid, to fast track the proof of concept prototyping of the world's first autonomously controlled 'fully submerged' hydrofoiling electric high-speed ferry, and develop the technical & operational requirements for a maritime Transport System of the future. This project will reinvigorate a strategically important maritime cluster in Belfast, through the research & development of transformative technologies that have the potential to change maritime transportation forever. Belfast will become a global lead in zero-emissions maritime technology, just as the world is waking up to the need for urgent action to decarbonise the sector.

The Belfast Maritime Consortium includes Ards & North Down Borough Council, Belfast City Council, Belfast Harbour, Belfast Metropolitan College, Short Bros Plc (Bombardier), Catalyst, Creative Composites, Energia, NIACE, Queen's University Belfast, and Ulster University; and has a collective pedigree of successfully delivering high value, complex, new product development projects. As a result, Belfast will possess a world class maritime design and build capability with a proven track record of converting innovative concepts to validated solutions, with a supply chain primed to support future commercialisation, leading to significant regional economic growth. The project will not only create new commercial opportunities, but also help tackle major environmental challenges in line with wider government policy, which calls for all new vessels to be designed with zero-emissions capable technologies by 2025, as well as lay the foundations for future product development pathways by Consortium members, spin outs, and foreign direct investment in the region.

**Wind Electric Hybrid**

As a progression from the hydrofoiling electric vessels, Artemis Technologies is also developing a 45-metre autonomous sailing vessel (ASV). The ASV will be the world’s first hydro-foiling and self-regenerating commercial vessel, capable of operating without the consumption of any fossil fuels. The 45-metre catamaran, based on the Artemis Racing America’s Cup boat design, will travel at a top speed of 50 knots and can enjoy speeds of up to 30 knots even when there is zero wind due to innovative energy recovery systems developed in Formula 1. The ASV will have wide ranging applications across environmental monitoring, maritime search and rescue, humanitarian relief, security and surveillance, and seabed mapping.

Contact: https://www.artemistechnologies.co.uk/en/technologies/products/zero-emissions-vessels

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Kongsberg Digital (Cloud Based Maritime Radar and Other Training/Simulator Solutions)

Activities: Kongsberg Digital has launched a cloud-based simulation service for maritime radar training. The K-Sim Navigation radar application introduces a new line of navigation instruments based on IMO performance standards, leveraging the K-Sim Navigation functionality and cloud technology, Used as an advanced e-learning tool, K-Sim Navigation enables instructors to manage and control exercises with realistic radar simulations to students, who can practice anywhere and anytime using their own laptop and an internet connection‘ The next-generation digital training tools are flexible, adaptable to changing training needs and specifically designed to enhance knowledge, safety and sustainability in the evolving maritime industry.. Other elements of K-Sim Navigation include a bridge simulator. This offers a scalable range of bridge designs and can be delivered from a PC-based desktop or as a full mission bridge simulator. Specially designed simulator configurations are also available, such as aft bridge, tug bridge and fast craft vessel bridge. Major naval customers include the Royal Australian Navy.

Contact; https://www.kongsberg.com/digital/products/maritime-simulation/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Tapiit Maritime (Online Database for Maritime Training Solutions)

Activities: Tapiit Maritime is a company changing the way the industry trains its people. Tapiit has a large and growing database of training suppliers, training centres, learning centres, educational colleges, and academies. Created for all, from individual refreshing of certificates through to retraining for a new profession, or a company looking for multiple training options for their crew, Tapiit is the solution. Having worked in the maritime sector for many years they know the difficulties customers face in finding the right maritime training at the right time, location and cost. They decided to do something about it.

It is common for customers to pay excesses to gain places on courses through increased travel and accommodation costs, along with last minute price rises and limited availability. Tapiit not only helps take control of training needs, it helps save money with access to a global bank of courses and training providers. It saves time with its one stop booking option and removes the frustration of endless emails trying to find the right course within the time frame. In some cases customers can spend up to a week searching for the right course, exploring various travel and hotel options, possibly visa options, finally booking it only to find out later there is a training centre less than 20 minutes away, and at a lower cost! Tapiit exists to solve these problems and more, and is revolutionising the way customers find and book training. ‘Everything needed in one place, at the tap of a button.’

Contact; https://www.tapiit.com/tapiit-maritime

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### VINCI VR

Activities: VINCI is preparing people for an increasingly complex world by creating affordable and accessible next-gen Virtual Reality technologies. The company is innovating along the entire VR software delivery process, from the integration of 3D scanners to running on low-cost hardware to its flagship content creation platform CODEX; the end goal is to enable anyone to create their own simulations in the Virtual World. Currently, VINCI is working heavily with enterprise markets to develop its technologies; VINCI simulations are being used for maintenance training with the US Army through Natick Soldier Research Centre and with the US Air Force through an SBIR contract with AFWERX, the Air Force's innovation program.

Contact: https://www.vinci-vr.com/about

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Wärtsilä Voyage (Marine Simulators)

Activities: Wärtsilä Marine Voyage is a leading systems partner to the marine industry and a key contributor to Wärtsilä's Smart Marine vision. They provide automation, navigation and communication systems, dynamic positioning and situational awareness technology, safety and security solutions, as well as sonar and sensor technology for vessels of all types. In addition, they offer electronic charts, professional training and simulation services, ship traffic control, fleet monitoring and decision-support tools. Wärtsilä Simulation & Training solutions connect maritime stakeholders by providing integrated solutions and high quality content that bridges the gap between STCW and required level of competency. Wärtsilä Voyage steps up to the challenges of providing training in a digital world characterised by increased emphasis on learning methods that accommodate flexibility and collaboration. Wärtsilä Simulation & Training solutions are built from the ground up to train and prepare seafarers of the future. They enable education anytime from anywhere. They offer training, drawn from real-life situations and virtually recreated, to make it more engaging for individual learning or for building team skills.

Contact: <https://www.wartsila.com/marine/voyage/simulation-and-training>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 10. MARINE POLLUTION INCLUDING OIL SPILLS, PLASTIC, GHOST FISHING GEAR AND THE CIRCULAR ECONOMY

### 4Oceans (Recycled Beach Plastic Bracelets, Beachwear and Other Sustainable Apparel)

Activities: 4ocean is a for-profit company founded in Boca Raton, Florida, in 2017 that sells bracelets made mostly from recycled materials, as well as apparel and other merchandise for which the materials are environmentally and socially responsibly sourced. Together, we can end the ocean plastic crisis. 4ocean was founded on the belief that business can be a force for good and that the single actions of individual people, collectively, have the power to change the world. They are a Certified B Corp and Public Benefit Corporation made up of passionate and hard-working educators, researchers, and action-takers who are fighting every single day to end the ocean plastic crisis. While their full-time captains and crews recover harmful marine debris that’s already polluting the ocean, rivers, and coastlines, they also work to stop plastic pollution at its source by educating people about this global crisis and empowering them to end their dependence on single-use plastic. Every 4ocean product purchased comes with their One Pound Promise to pull a pound of trash from the ocean, rivers, and coastlines. Every purchase helps fund their global ocean cleanup operation and supports a movement to end the world’s reliance on single-use plastic.

Contact: https://www.4ocean.com/collections/shop-all

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Algae-Sys (Algae Powered Wastewater Treatment Systems)

Activities: The ALGAESYS technology uses naturally occurring colonised micro-algae and phototrophic bacteria that obtain their treatment energy from the sun, not electricity. They establish an algae colony that attach to rotary logs that induce optimal conditions to maximise their efficacy in breaking down and oxidising pollutants. Under the right conditions, the algae are extremely effective at pathogen kill and oxidising persistent organics such as hormones, pharmaceutical pollutants and endocrine disruptors, which conventional treatment facilities cannot achieve without expensive add-ons.

Motivation Conventional treatments typical harness multi-species heterotrophic bacterial colonies which require vigorous aeration and mixing in deep tanks that consume substantial energy. The ALGAESYS technology has been developed and extensively demonstrated at full scale in the USA and further optimised in China.

Contact: <https://www.algaewwt.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ambercycle (Covert Ocean Plastics into Textile Fabrics)

Activities: Ambercycle are developing a process to convert plastic debris in oceans into clean polymer resins that can be used in new fabrics. There is currently little or no market value for plastics recovered from the ocean. Their innovation converts mixed plastic waste from oceans into raw materials that can be turned into new textiles. Their process also avoids typical industrial fermentation, gasification, and depolymerization techniques, which also contribute to environmental issues. Ambercycle’s novel process lowers the cost of recycling plastics and provides waste-generators and producers a sustainable and economically sensible choice for the disposal and synthesis of plastics.

They motivate their activities as under:

Plastics are pervasive; they composite many products from cars to clothing. The market for plastics depend heavily on the price of oil but also on all of the economic, environmental, and political ramifications associated with petroleum-based products. Most people assume the solution is recycling. While this is partially true, current recycling technologies actually epitomize inefficiency, utilizing millions of kilojoules of energy at extremely low efficiency rates and often yielding low quality products.

The innovation: Ambercycle focuses on making plastic recycling profitable and sustainable by using synthetic biology to engineer custom-tailored organisms that can degrade plastics into its chemical components. The new technology harnesses engineered enzymes to degrade plastic bottles, such as PET soda bottles, and transform them into PTA. The process lowers the cost of recycling PET plastics utilizing organic processes with no carbon footprint to generate PTA. Plastic producers will be able to make high quality plastic from renewable feedstocks with Ambercycle’s products, thereby removing it from landfills and away from petroleum, all at a cheaper cost than current methods.

The vision: Ambercycle’s process will be able to redirect waste streams away from landfills. Almost all contemporary clothing contains polyester, and with rapidly expanding populations, polyester is the fabric of choice for mass-produced clothing. More sustainable plastic fibres produced by Ambercycle will lead to the application of environmentally friendly fabric, which will not only be more cost effective, but also beneficial to the environment.

Contact; https://www.ambercycle.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Biosolvit (Bio Blue Natural Absorber)

Activities: Almost 6 tons of oil were spilled in the last five decades in our seas. This damage can be irreversible. Besides that, the costs to remediate these accidents are extremely high. Biosolvit’s product is a natural absorber, made from vegetable fibres discarded in many crops around the world. The Bioblue Natural Absorber is natural, hydrofobic and was considered as the most efficient oil absorber in the world by Cedre Institute of France. Besides being the most efficient, it is the only one that allows the reuse of spilled oil.

Products intended for the absorption of any oil derivative on land or at sea that, among other differentials, eliminate the possibility of a serious environmental problem, retro-contamination. Organic or synthetic, Bioblue products also allow the reuse of the absorbed material, which guarantees customers the possibility of significant additional gains. Ecological and sustainable alternatives that surprise by the great absorption of water and nutrients. 100% organic products, with natural manufacturing processes contribute to wide public acceptance wherever they arrive and strengthen Biogreen's positioning as the correct alternatives to products with commercialization prohibited by law.

Contact: https://www.biosolvit.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Biodegradable Plastic from Sweet Potatoes

Activities: The founder realised that many local factories use starchy ingredients such as breadfruit, cassava and sweet potatoes to make products, such as flour. The skins of the provisions are discarded completely or, at best, used for compost. She came to the realisation that there may be another effective way to utilise this waste product in a food-secure manner and, hence, the idea was born. The process of creating plastic from sweet potatoes is a careful and complex science starting with extraction of the starch. This is then poured into the mould that is currently a flat surface, and a material similar to a plastic wrap is formed. The vision is to create pellets that can be used to make plastic bags, cups, pep bottles and other products. However, further testing is needed to make the product a perfect substitute to petro-based plastics, as not all bio-based plastics are the same.

They still have to test it to ensure it is insoluble at certain temperatures and conditions for food; so if you have something hot and you put the plastic on it, it will not melt. Bovell’s research was featured late last year at the launch of Blue Lab, an initiative of the United Nations Development Programme to promote, among young people, innovation and experimentation as it relates to sustainable development in the Caribbean.

Contact: <https://www.cavehill.uwi.edu/chill/current-issue/from-sweet-potato-to-plastic.aspx>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### BitEgreen Market Venture (Circular Economy & Waste Recycling Gamification Solution)

Activities: BitEgreen developed a technological system for all persons and businesses that (1) educates on best practices, (2) ethically analyses data for greater resource efficiency, (3) markets general products & services, (4) motivates participation via gamification, (5) provides awards, and (6) assigns monetary value, all around reusing & recycling materials and the reduction of various forms of waste via the circular economy and other sustainable actions; making it easy to efficiently market, launch, sell and purchase your products and services while being socially and environmentally responsible.

.

Contact: <https://www.cembi.org/bitegreen-a-deeper-view/> https://www.bb.undp.org/content/barbados/en/home/presscenter/articles/2019/the-blue-tank.html

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Eco Line (River Cleaner -Marine Pollution Solution)

Activities: River Cleaner is an automated collection system, positioned on a river bank, which allows the collection of waste and its transport to the road level , in complete autonomy . Once in the temporary storage bins, the plastic waste can be sent for disposal, with the regular means already available to the companies involved in the management of urban and extra-urban waste. This allows the plant to be installed in any portion of the river and guarantees its complete integration into the local waste disposal system, without the need to adapt the fleet for collection. Furthermore, being in operation 24 hours a day, it is possible to collect waste from the river in a continuous cycle, so as not to create obstructions inside the riverbed.

Contact: <https://blueecoline.com/river-cleaner-impianto-ecosostenibile-per-ripulire-i-fiumi/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Phin (Floating Waste Collecting Robot)

Activities: Blue Phin is a smart robot that can collect floating waste in commercial water bodies. It is one of the world’s most technologically advanced waste management solutions. It collects plastic, algae and other debris to tackle marine pollution in lakes, ponds, canals, marinas, ports and coastlines. Its endurance lasts for 8 hours and capacity up to 336 kg of marine waste can be removed at a time.

Contact: <https://www.bluephin.io/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Bureo (Recycled Fishing Gear and Debris Solutions)

Activities: Through the team’s initiative, Net Positiva, Bureo works together with fisheries and fishing communities across Chile, Argentina, and Peru to transform this once harmful marine debris into a fully-traceable, innovative raw material supply known as NetPlus. Bureo’s NetPlus material is utilized in a growing number of like-minded brands including Patagonia Outdoor Apparel, Costa Sunglasses, Humanscale Office Chairs, Jenga Game Sets, and Carver Skateboards. Bureo is a certified B-Corp and proud member of 1% for the Planet.

Contact: <https://bureo.co/> [www.bureo.co](http://www.bureo.co)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Clean Up Data (Mobile App Solution to Report Volunteer Clean Up Data)

Activities: Every year, thousands of beach (and land) clean-ups are organized all across the world, with thousands of volunteers participating. However, most of these clean-ups do not report the amount of (plastic) waste collected, do not conduct a waste audit to segregate the waste types, and do not follow a standardized clean-up protocol (including data collection). Most importantly, there is no central repository for all clean-ups and associated waste data.

CleanUpData is a mobile application, open-source data platform, which will enable users from across the world to log their clean-up data using a standardized, user-friendly data collection template. First, the user (an individual or organization) will create the clean-up event, notifying other users/volunteers nearby to join the clean-up if they want to. Secondly, a short, easy-to-understand tutorial will be made available to the clean-up organizer. This tutorial, created by the CleanUpData team based on best practices, will inform the user about the standardized clean-up protocol such as types of waste and how to segregate them, how to conduct a waste audit, health and safety of volunteers, etc. Thirdly, after the clean-up is conducted, the user will be able to log their data on the app. Data to be logged will include location, type of clean-up (e.g. beach, underwater, land), no. of volunteers, time dedicated to clean-up, total waste collected, types of waste collected (with individual weightage), total plastic waste collected by type (e.g. PET bottles, plastic bottle caps, packaging, straws, etc.), total recyclable v/s non-recyclable waste collected, amongst others. This data can then be filtered based on region, type of waste, amongst others. The app will also include a special clean-up protocol and data collection for smaller items found on beaches (e.g. small pieces of plastic and cigarette butts). As a result, this citizen science-based, open-source platform, will contribute to global plastic pollution data. Concerned stakeholders, including policy-makers, will be able to identify which locations get littered the most and which plastic products pollute the most.

Phase 1. Pre-Funding: Ideation. Basic prototyping done

**Targeted Challenges and Focus Areas:** plastic ocean pollution.

‘We need better systems to manage waste. Plastic pollution data is incomplete’ KARUNA RANA Solution Owner.

Operating Region Global, with a pilot in African small island nations

Contact: https://uplink.weforum.org/uplink/s/uplink-contribution/a012o00001G7jp4AAB/cleanupdata

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Clear Blue Sea; FRED - Our Floating Robot for Eliminating Debris

Activities: Clear Blue Sea as a non-profit organization with the mission of cleaning up the massive marine plastics garbage dumps called the Pacific Gyres - the largest of which is the size of Texas. Marine mammals, fish, and birds living in the Pacific have their health and survival threatened by billions of microplastic debris that is readily mistaken for food, and ingested without being able to be digested. Clear Blue Sea's Mission is to Cleanse the Oceans of Plastic Pollution. Clear Blue Sea is a 501(c)3 nonprofit located in San Diego. Together with government, private companies, other nonprofits, and the public, they believe in implementing solutions to fighting the problem of ocean plastic pollution. Clear Blue Sea’s innovation is FRED – the Floating Robot for Eliminating Debris. FRED is a solar powered marine vessel capable of harvesting floating marine debris. Clear Blue Sea is currently in Phase II – FRED Prototyping. Their staff is comprised of founder-managers, student interns, volunteers, and senior advisers collaborating on initiatives to increase awareness of the environmental crisis of ocean plastic pollution and potential sustainable solutions. Given that it will take decades to clean up the tons of plastic accumulated in the oceans, Clear Blue Sea’s organizational strategy is to transition management and decision-making to an all Millennial Management Team.

Contact; <https://www.clearbluesea.org/about/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Coastruction (Eco-Friendly Carbon Reducing Concrete Construction Via 3D Printing)

Activities: Coastruction create unique concrete structures and destroy Carbon Dioxide using 3D printing technology. Coastal construction concerns all of us. The ocean drives global systems that make the Earth habitable for humankind. Our rainwater, drinking water, weather, climate, coastlines, much of our food, and even the oxygen in the air we breathe, are all ultimately regulated and dependent on the sea. ‘Is your business interested in a collaboration, or are you looking for more sustainably produced concrete structures?’

Their technology is turning environmental polluters into contributors. They are applying knowledge from nature by translating them into smart design structures. They are engaging in local challenges by moving their production facility where the structures come to sit. They are closing the loop by using concrete as a secondary raw material. By using concrete they can destroy CO2 in the process.

**Biomimicry:** Their design and solutions are based on structures and phenomena found in nature, therefore their technology enables them to create complex objects that are as strong as solid concrete structures with less material.

**Efficiency**: Their production approach makes use of local resources such as sand and water. Consequently, they save transportation costs and energy compared to traditional manufacturing.

**Science:** Using binder jetting technology allows them to use carbonated water as a binder together with recycled concrete. When injected into concrete, the carbonated water reacts with the calcium within the concrete and forms solid structures. They want to advance coastal protection with 3D printing technology. One of their founding principles is creative destruction, manifesting as a mindset: long-standing arrangements and assumptions must be destroyed to free up resources and energy to be deployed for innovation. The same way creative destruction guides their technological innovation, learnings from the science of biomimicry inspires the design of their structures.

* Artificial reefs, which are produced, using 50% less material.
* Marine applications, which capture CO2 permanently.
* Breakwater structures, which are produced locally.

Their technology proves that design does not need to be restricted by technical boundaries and enables them to use materials more efficiently. ‘We envision coastal construction which does not compromise the wellbeing of our ecosystem and lives.’

Contact: https://www.coastruction.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Collect Nets (Ghost Fishing Gear Solutions)

Activities: Discarded fishing nets and gear, commonly called “ghost gear”, make up a significant percentage of ocean plastics and disproportionately contribute to marine life mortality. Some estimates 540,000 tons of ghost gear enters the ocean each year. Unlike plastic pollution from land, circular solutions for fishing nets remain relatively undeveloped. Taiwan, the Philippines, and Peru are all major fishing countries and, while some Atlantic countries have made commitments to eliminating ghost-gear, the Pacific is relatively behind. The primary reason fishermen discard nets into the sea is because nets take up valuable space for fish, and disposal at sea costs the ships nothing.

In order to re-engineer incentives and develop upcycling solutions a study is proposed to understand how Taiwan created a nation-wide net recycling program in order to scale this solution for the Philippines and Peru. To achieve scale, the project considers two phases to explore the feasibility of implementing a net collection and certification program in Philippines and Peru, based on the Taiwan experience.

**Phase 1**: Technology exists for the processing of nets into more valuable upcycled products. However, incentivizing collection remains a challenge with limited international success. During phase 1 the team will codify and share best practices from Taiwan while aggregating fisheries information about the Philippines and Peru. Phase 2: Once best practices for collection are established the next steps are to analyze the economic impact on existing nylon value chains to determine commercial value. Since recycled fishing net collection is relatively new and certification can be prohibitively expensive for smaller fisher-folk an urgent need exists for open-sourced best practices. Instead of a for profit or CSR model, a platform for ghost-net collection can not only remove bottle-necks for collection, it can also incentivize demand for recycled net products.

Phase1. Pre-Funding: Ideation.

Targeted Challenges and Focus Areas: PLASTIC OCEAN POLLUTION

Pre-phase: Proof-of-concept study Small-scale pilot test tracking ghost-gear from target country to final product. Phase 1: Create open source best practices for ghost net collection. Sign cooperation agreements between relevant organizations in the three countries. Phase 2: Remove 100 tons of ghost-fish nets from the Pacific Ocean as a trial to establish a net supply chain. Design global marketplace to connect nets with demand.

Contact: https://uplink.weforum.org/uplink/s/uplink-contribution/a012o00001G7jlHAAR/collectnets

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Cruz Foam (Recyclable Foam Products)

Activities: Cruz Foam is building partnerships around the world with industry leaders in crustacean processing, wherein a re-capturing process has been developed to isolate what was previously waste material for use in consumer grade products such as packing materials, containers, and more. Under multiple patents, Cruz Foam has created a highly scalable eco-friendly production process by which a bio-benign foam is created from entirely natural ingredients. Cruz Foam product range can offer anything from consumer packaging and shipping materials utilizing industry standard, scalable processes including thermoforming, die cutting, and three-dimensional moulded parts.

They motivate their activities as under:

The use of non-renewable and single use foams is a problem for every person on this planet: plastic pollution in the ocean is a persistent contaminant that harms both humans and animals. Among single use plastics, polystyrene foam takes over 500 years to degrade, but most often is closer to 1,000 years; currently US landfills contain over 30% plastics with the majority attributed to polystyrene and polyurethane. Further, government legislation is now being passed that will require businesses to rapidly transition to natural, alternative materials.

**All-Natural Processing**

They are proud to offer a solution that is 100% natural. They use no petrol-based additives, no toxins, and no harmful processes behind their production.

**Made From Shell Waste, Not Oil:** From day-1 they have focused on the reindustrialization of pre-existing waste streams. The ocean crustacean and chitin waste stream is the second most abundant biopolymer on the planet, only second to cellulose.

**Zero Landfill**

They offer multiple ranges of products to their customer base which all are designed to redefine the gold standard for waste-disposal. Exceeding both national and local regulations, they will leave the customer with a guilt free solution to their product packaging needs. Derived from entirely natural materials, their products are engineered to enable their customers to lead in green-waste initiatives, by offering a product set which is ahead of any and all regulatory mandates for compost and recyclability standards.

Contact: <https://cruzfoam.com/technology/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Dot Ocean NV (Autonomous, Renewable Energy Powered Unmanned Vessels for Ocean Waste)

Activities: Dot Ocean NV make Autonomous unmanned robot vessels which operate in swarm and collect, store and transport ocean waste. The vessels are using ocean data for navigating to spots of accumulated waste. The vessels are electrically driven based on renewable energy.

They produce cost effective control units independent of the vessel type; cloud control using external data source, and they are scalable.

Sustainable impact on blue economy: they collect a measurable amount of ocean waste with unmanned robot vessels using renewable energy.

The Automate-Your-Boat (AYB) unit is deployed to automate an existing vessel.

* Intelligent Self-learning to improve navigation
* Redundant: Dual control via cloud or radio, dual motor control
* Cloud connected: WW cloud based navigation and survey data visualization via Atlantis online SaaS-platform
* Tablet control: Use waypoints, circles or grids to control your vessel and follow your mission live from the tablet
* Electric power: Support for most battery types
* Propulsion control: Compatible with most electric propulsion systems

Contact: <https://www.dotocean.eu/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Eco Spears (For PCB and Dioxin Contaminant Removal Solutions)

Activities: Echo Spears have a green cleanup solution for PCB and Dioxin contaminated sediment, soil and groundwater. Their technology is based on a simple idea: In order to meet the challenges of the world’s growing population, we need innovative environmental cleanup technologies that are not only protective of the environment, wildlife and people but will completely destroy the contamination forever. More so, we need green cleanup solutions that are safe, sustainable and cost-effective. Their technologies were discovered and validated by ‘brilliant NASA environmental scientists and engineers’ seeking a better way to destroy contaminants while protecting the environment. Contaminated Media:

**Sediments**

Their SPEARS (Sorbent Polymer Extraction and Remediation System) is an in-situ system to extract PCBs, dioxins and other chlorinated contaminants from sediments.

**Soil**

Their ADS (Additive Desorption System) is a mobile ex-situ system to extract PCBs, dioxins and other chlorinated contaminants from dry soil or sediments.

**Groundwater**

The Ultraviolet Advanced Oxidization with Peroxide (UV/AOP) is an on-site system, pump and treat solution to degrade polychlorinated biphenyls (PCBs) in water.

**Cost-Effective**

Their technology solutions use a calculated total waste volume reduction approach which decreases cleanup costs by eliminating transportation needs.

**Environmentally-Friendly**

Their transformative cleanup solution claims to be the greenest on the planet using far less water and energy while reducing the overall carbon footprint.

**Sustainable Approach**

Their sustainable approach is rooted in green chemistry using non-toxic reagents while occurring in ambient pressures and temperatures.

**Scalable System**

Their technology systems are modular, developed with scalability “from the get-go” knowing that our solutions will be deployed throughout the world.

Contact: <https://ecospears.com/solution/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### EEL (Pyro-E) (Hydrodynamic Energy Harvester)

Activities: EEL are involved in submersible ocean and aquatic power. They have a Hydrodynamic energy harvester, which works by mimicking the undulatory motion of slender body animals. It is designed to provide up to 5 W RMS when attached to ocean instrumentation or towed by unmanned gliders. They help build a sustainable world using smart material technology to enable smart cities and a blue economy. Pyro-E custom designs and deploys solid-state technologies for energy harvesting applications. Their electromechanical device could extract energy from low-frequency, intermittent vibrations befitting of buildings, train rails, oil/gas pipelines, etc. By coupling with commercial sensors, vibrational energy harvesting enables other devices to operate without wiring, thus paving for an interconnected future that is attainable today. Applications include ocean observation, smart pavements, , water metering and machine health. Foreseeably, Pyro-E's perpetual sensor solution will 1) enable Smart Cities, 2) improve urban mobility, and 3) utilize a greater portion of the renewable energy resources.

Contact: <https://www.pyro-e.com/diy>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### End Ocean Plastic (Sri Lanka)

Activities: Sri Lanka is top 5 marine plastic polluters in the world. An activist empowering youth in Sri Lanka on coastal and ocean conservation has formed a working team in Sri Lanka to conduct reef cleaning. He has two solutions to solve this issue. Solution 1 - The youth team is PADI certified and need to purchase diving equipment to remove ocean plastic from the sea. Ongoing activities will increase to collect ocean plastic and can be sent to recycle to companies in Sri Lanka. Solution 2 - Setting up natural barriers in inland water sources to avoid plastic entering to ocean, this activity can be also an income generation scheme for communities after setting up the barriers.

Phase2. Pre-Funding: Prototyping:

Initial Training for youth provided for cleaning the reefs.

Targeted Challenges and Focus Areas: plastic ocean pollution.

* Investment is lacking to fuel action on plastic pollution at scale
* We need more ambitious plastic reduction targets
* It is difficult for us to disengage from plastic
* We need better systems to manage waste
* Plastic pollution data is incomplete

They motivate their activities as under:

EarthLanka Youth Network: Just a year into its operations EarthLanka is slowly yet steadily beginning to expanding its outreach and form strategic partnerships with likeminded organizations and individuals through the youth online community which was registered under Central Environment Authority, Ministry of Environment Sri Lanka in 2010. The online youth network which became an organization is working heavily with young people in recognizing them in the society and to bring up their Initiatives for the development in Sri-Lanka. Impact and Achievement

* As a leading organization contributed for the National Voluntary People’s Review for the Agenda 2030 that was held in High-level Political Forum July 2018.
* Global Goals Youth Campaign” Youth-Power” for 2030 where they will be the official representatives for the youth campaign in Sri Lanka. • Leading Organization that contributed to the establishment of the Sri Lanka SDG Stakeholder Platform. • Empowered school children in the coastal belt on environment protection.
* Created the first ever side event for Sri Lanka in UNFCCC and created a digital media campaign n Human Ecological footprint.
* One of the global partners for Action 2015 and Local Focal point for Sri Lanka and their key activities of SL campaign was featured every part of the world through social media.
* Partnered for the firsts ever regional youth climate summit for climate action
* Local Focal point for Global power shift Sri Lankan chapter.

• Country focal point Asia Pacific Regional CSO Engagement Mechanism UN ESCAP.

As a leading organization they contributed for the youth draft for Rio+20 national statement held in Rio 2012. • Country Focal Point for Global Youth Biodiversity Network under the UNCBD. Vision Towards building a generation of young people committed to positive social change protecting the Ecology, the fauna, the flora and exploring and promoting active global awareness for safeguarding the earth’s natural resources.

**Mission:** To create and sustain and protect the environment creating spaces for young people to express themselves and take action on Environment issues, which they feel strongly for safeguarding the earth’s natural resources. Project Title - Better Future Tomorrow.

Contact: <https://uplink.weforum.org/uplink/s/uplink-contribution/a012o00001G7jq7AAB/end-ocean-plastic>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Enaleia (Incentives for Fishing Communities to Collect Ocean Waste Recycled into Clothing)

Activities: They created the first professional fishing school in Greece at 2016. The aim was not just to train young people into the fishing sector, create new jobs and make sure that the professional fishing will survive in the future but, at the same time, to provide a high-quality, eco-friendly and ethical education. They teach fishermen how to earn more money, while catching less fish, making sure that the fish stocks stay at healthy levels. Also, they train, empower and motivate old & new fishermen to collect plastic from the sea, in a more effective and efficient way than the ones being implemented now. It is a system-based solution, where they want to create motivation for the fishermen to catch less fish, and more plastic, so as to enjoy long term benefits in their work. They focus not only on ocean waste cleanups, but in ocean waste management as well (recycling & upcycling). That means they collaborate with companies and organizations to find ways to utilize this marine litter/plastic at the maximum level possible. The UN Environment Program selected them among the Top 5 best initiatives in Europe for 2019 for its positive impact on the environment.

Contact; <https://enaleia.com/en/homepage/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Enviro-Buggy (Waste Collecting Beach Buggy -Sea The Bigger Picture)

Activities: Enviro-Buggy is a convenient and efficient way to collect small plastic particles. The Enviro Buggy was born out of a necessity. Tash Krauss, a conservationist at STBP said that they were tired of trying to pick up so many tiny degraded particles of plastic. It was near impossible by hand, even with a large-scale crew. So they built the Enviro Buggy to suck up pesky microplastics, pieces of plastic that have broken down and now are smaller than 5mm, sieving them out from ordinary beach sand. It would take humans days to do the same using manual methods.

Contact: <https://seathebiggerpicture.org/about/>

<https://www.businessinsider.co.za/meet-enviro-buggy-a-beach-friendly-vacuum-designed-to-suck-up-rubbish-and-filter-hard-to-clean-up-mircoplastics-2020-10>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Fishy Filaments (Recycling Fishing Nets into Engineering Filament Via 3D Printing)

Activities: Ian Falconer founded Fishy Filaments in 2016 after several years R&D in the field of raw materials production for metal-based 3D printing. The skills gained in that activity and from previous roles provided him with insights into how to address some hard-to-recycle polymers, and by doing so provide significant positive environmental and social impact. The company was incorporated in July 2017 and, in social distanced configuration, currently has production capacity of over 400 kg per month of engineering grade Nylon 6. They are currently in an upscaling phase as they see demand materialising both in 3DP and injection moulding sectors. They work in partnership with sustainable fisheries. Their first products are 100% recycled from fishing nets that have reached end-of-life within the MSC Certified Cornish Hake fishery. They completed their first product Life Cycle Assessment with The University of Exeter Consulting, which showed production of their recycled Nylon 6 micro-pellet has between 97-98% lower environmental impact than virgin nylons. In effect that it has up to 46x less environmental impact than the average product. The company was founded to help address climate change but along the way they are helping prevent the wave of plastics waste and problems around bycatch, so called 'ghost fishing'.

Contact: https://fishyfilaments.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Flipflopi (Eco-Sustainable Sailing Dhows/Boats from Recycled Plastic and Flipflops)

Activities: Flipflopi are taking an African #plasticrevolution to the world! They are the Flipflopi - a movement for change with a mission to end single-use plastic and lead a plastic-reuse revolution through education, sailing expeditions, positive storytelling and campaigns. In 2017 on the island of Lamu, Kenya, using traditional dhow builders and techniques, they built the world’s very first 100% recycled plastic dhow (sailing boat) and covered it in 30,000 multicoloured flip flops, which is how they got their name. In 2018 they completed our first ground-breaking expedition, sailing the Flipflopi over 500km from Lamu, Kenya to Zanzibar, Tanzania, stopping at 12 communities along the way...and they continue sailing, with the hope that people around the world are inspired to fight the growing tide of plastic pollution.

Contact: <https://www.theflipflopi.com/our-story>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Foru Solution Floating Oil Recovery Unit (Oil Spill Response Solutions)

Activities: The FORU is a patented maritime solution developed in the Netherlands and it functions as a floating oil recovery hoover. The FORU freely floats on the water and sucks the oil of the water surface through a 360 degrees adjustable inlet opening. It is a robust, 100 % mechanical equipment, which is hydraulically driven by a power pack (HPU). It can be combined with existing conventional solutions to increase the total output of the current arsenal of oil spill response solutions.

They motivate their activities as under:

They currently offer two robust oil spill solutions equipment: FORU-340 is the bigger solution (weight 500 kg, 1,50 m high) with a capacity of 340 m3 per hour. The smaller FORU-70 is a lightweight (only 75 kg) with a capacity of 70 m3 per hour. The FORU USP's are: (i) Robust and easy to operate oil skimmer (ii) Relatively light and easy to deploy equipment (iii) Self and unaided stabilizing capabilities (iv)Unparalleled efficiency in high wave environment (v) Combines a high efficiency with a high capacity (vi)Easy to maintain and to clean (vii) Floating independently. The only serious oil spill equipment for any oil spill.

They develop preventive measures against pollution of oceans, seas and lakes worldwide. This prevents subsequent damage to maritime flora and fauna, thus enabling us to pass it on in good condition to our future generations.

Functions in rough water: The smart buoy design in combination with the position of the center of gravity, makes the FORU stick to the waves, maintaining its high efficiency.

High capacity: The FORU can recover up to 340 m3/h (90,000 US GPH) with an oil recovery ratio of 75 – 100%.

Easy to operate:

* The FORU can be operated with only little instruction.
* The FORU systems are easy to maintain. Because of smart design only a few bolts need to be loosened for applying maintenance.
* The FORU can be operated fail-safe in combination with their hydraulic power units

Contact; <https://foru-solution.com/>

### \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### \_Gjenge Makers Limited (Recycled Plastic/Waste into Bricks/Construction Materials)

Activities:

Gjenge Makers is a social enterprise whose goal is to provide strong, beautiful and durable construction products made from cement and polymer concrete. In addition to tackling the prevailing plastic waste pollution in Kenya and Africa at large by converting the waste plastic into alternative building products. Gjenge offers an array of elegant, state of the art paving bricks. Made from recycled plastic, they offer durability, strength and aesthetic range. Gjenge paving bricks come in an array of colours, including but not limited to red, blue, brown and green. They are claimed to be incredibly strong, tested to hold twice the weight threshold of the concrete blocks

Contact: <https://gjenge.co.ke/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Got Bag (Backpacks Out of Ocean Plastic Waste)

Activities: GOT BAG’s story started on a long road trip through the Alps, when the founders and water-sport enthusiasts Benny & Roman talked about the devastating impressions of plastic crowded beaches in Thailand. With the idea of turning plastic waste into something useful, they started developing the world’s first backpacks made of ocean plastic and founded GOT BAG. What has been a passion project of two good friends from school is now a dedication and a fast-emerging movement. "Plastic pollution, climate change, and overfishing hit our oceans hard and affect marine life. Sea birds, whales, and other marine animals die every second because their stomachs are filled with plastic!" They have a team member who is actively engaged on the north shore of Java, Indonesia, where he manages their clean-up activities to gradually clear the sea of plastic. In order to create a real impact and a truly sustainable product, it was important for them to have full control over every single step of their production chain - starting where the problem is the biggest. Their own network of 1,500 fishermen collects ocean plastic as by-catch, which is then carefully separated and cleaned before processed. For each GOT BAG, they recover up to 9 lb of ocean plastic. The PET share of the recycled plastic is fed into their production chain, while all other unusable parts are discarded according to the right recycling chain. The raw material “ocean plastic” turns step by step into a high-quality yarn. Each production step conserves resources and follows the highest requirements for fair and social work conditions, including job safety and certifications.

Contact: <https://us.got-bag.com/pages/who-we-are#story>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Great Bubble Barrier

Activities: The Great Bubble Barrier is a smart solution to plastic pollution. Every minute, the equivalent of one full garbage truck of plastic trash is dumped in the sea. That is 1440 trucks per 24 hours and in total 8 billion kilos per year. With 80% of those plastics coming directly from land, the Great Bubble Barrier® creates a barrier stopping plastics from flowing past, but it also allows fish and ships to pass through the barrier unimpeded.

Animal friendly: The Bubble Barrier forms a barrier for plastics, but allows fish to pass.

Ship friendly: The Bubble Barrier has no effect on passing ships.

Full range: The Bubble Barrier reaches the entire width and depth of a river or canal.

The Great Bubble Barrier® intercepts plastics in rivers and raises awareness in order to prevent more plastic pollution. They aim for a total solution that can permanently decrease the amount of plastics entering our oceans. Their goal is to protect the global ecosystem from plastic pollution and to sustain and improve the quality of life on earth.

* A smart solution to river pollution
* Cleaning rivers and canals with The Great Bubble Barrier
* Research and monitor plastic pollution
* Increase public awareness
* Connect to a circular chain for the re-use of plastics

Contact: <https://thegreatbubblebarrier.com/en/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Hoola One Technologies (Plastic Pollution Removal Device Solutions)

Activities: Hoola One provides innovative and effective ways to clean plastic polluted areas that could not be cleaned before.

It is a customizable and innovative solution for:

* Ecosystem restoration
* Attractive beaches
* Safer environment

What Kind Of Beach Cleaning Experience To Expect?

The benefits:

* Keep organic matter on the beach
* Collect micro and macroplastic
* Access hard-to-reach places
* Work on rugged terrain
* High operation capacity
* Work on dry and wet sand

They motivate their activities as under:

Waste mismanagement and over production of plastic has led to a world-wide problem that we can no longer ignore. Major actions and innovative solutions are needed to address this problem that threatens wildlife as well as human life.

* 1 Million Number of sea birds dying from plastic pollution every year.
* 5 X Plastic production expected by 2050.
* Every 60 seconds: it's the equivalent of truckload of plastic that is being dumped into the ocean.

**Customized solution**

Hoola One is designed to fit their customers’ needs regarding several aspect :

* Matter separator
* (plastic, organic, matter, rock, sand)
* Micro and macroplastic collection
* Modular machine with a precise vacuum end
* (rugged terrains, remote areas)
* High treatment capacity

Contact: <https://hoolaone.com/home/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ichthion (Ocean and River Waste Collection Technology Innovation)

Activities: Ichthion was born in London in 2017 and nowadays lives between there, Quito and Ecuador.. It has developed an award-winning technology that is able to remove big volumes of plastic for rivers and oceans. This idea was born in London’s Imperial College with the goal to create a system that is energy-generative and can be installed in rivers, coastal areas and oceans. They have won the global “Cutting River Plastic Waste” competition sponsored by the Benioff Ocean Initiative and Coca-Cola Foundation.

They have developed three types of technology streams, Azure, Cobalt and Ultramarine. These operate in different environments to prevent macro and micro plastics entering into the phytoplankton growth areas in coastal zones, and also for the reclamation of plastics in the ocean. Their technologies also have been designed to provide data of the plastic that they extract, which is used to inform governments about strategies of circular economy that can effectively reduce the pollution entering the waterstreams. The potential of their energy-generative systems to tackle the global problem of plastic pollution has been recognised by several prominent organisations through several awards and grants. For example, the Scalable Business Award by Imperial College London, three grants from Climate-KIC, the EU’s main climate innovation initiative, the Hawley Award from the Worshipful Company of Engineers, and in September 2018 they were awarded a grant of £600,000 grant by Innovate UK, as part of the competition “Plastics Innovation: Towards zero waste”

Over the last three years, Ichthion has filed a number of international PCT applications related to the Azure, Cobalt and Ultramarine technology propositions. The first is for the Cobalt and Ultramarine systems and the second application is for the Azure river system.

**Azure** – macro plastics in rivers: This system is an enhanced barrier designed for deployment in rivers to prevent plastic waste from reaching marine environments. It can collect up to 80 tonnes of plastic per day from any river. Considering its collection capacity and the value of the upcycled plastic, Azure is a commercially-feasible solution that allows the deployment of new recycling technologies in deprived areas across developing economies and provides a return of investment within three years. For this reason, Azure systems aim to integrate with the latest recycling technologies (they have a partnership with several companies developing cutting-edge technology for recycling or repurposing the waste). It is currently in Technology Readiness Level (TRL) 5 (Pilot Scale).

**Cobalt** – micro and plastic particles in rivers and coastal areas: A self-cleaning system that utilises the relative motion of its host infrastructure to extract plastic pollution from fluvial and marine environments in a scalable and financially viable approach. The device built is a self-cleaning, ducted turbomachinery unit that can be installed either as a power-generating turbine or modified to be installed into a ship. When used as a turbine, water enters the system due to tidal flow and the turbine blades extract energy from the water; when in drive format, water is drawn in and forced out of the back by impellers. In both cases, as water passes through the system, material is trapped during its passage by a series of staged membranes. Rotating armatures clean these membranes by sweeping material off and pushing it outwards radially, where it is extracted out of the system by a series of no return valves. Cobalt is in TRL 4 (Bench Scale Research).

**Ultramarine** – Dynamic system for ships: Through combining the scale and efficiency of ram filter feeders with a secondary sorting stage, the system is able to collect large volumes of plastic whilst preventing high marine collateral. The system is designed to be retrofitted or built into large shipping vessels based on the high travel volumes and overlap with the coastal regions thought to be critical to countering ocean plastics. Ultramarine is in TRL2 (Invention and Research).

Contact: <http://ichthion.com/technology/> https://ichthion.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Integrated Ocean Tracking Solutions (Oil Spill/Marine Pollution Solutions)

Activities: IOTS constitutes a joint effort from experts in oil spill preparedness and response, satellite remote sensing and ocean modelling delivering beyond-state-of-the-art Marine Pollution Geointelligence to support the Oil & Gas Industry. They use state-of-the-art hydrodynamic and oil weathering models towards providing decisive answers in all spill conditions. Oil spill surveillance, preparedness & response has experienced a low level of innovation in the last decade, relying on traditional monitoring and modelling tools. False alarms, traditional monitoring and “ghost spills” imply high operational costs while technology-driven limitations pose a risk to an efficient environmental performance. Deep-tech solutions offer unprecedented capabilities to promote a new era in the prevention and management of pollution events. To develop cost effective deep tech solutions for the World Ocean, inland seas and large lakes, to better manage marine and maritime activities towards sustainability. IOTS is driving an industry revolution, providing timely and accurate information to responders, optimizing decision making and environmental performance.

Contact: <https://iots-consortium.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### IRIS SRL (Floating Waterway and Marine Litter Vessel Solutions)

Activities: IRIS and two other partners, the French company Subsea Tech and the University of Dubrovnik -Croatia-, are developing together a self-driving vessel capable of identifying floating waste in coastal and river areas, collecting and treating them in place. For waste on land they have a Mobile plasma waste treatment unit for contaminating wastes and isolated communities that need to treat the undifferentiated fraction.

WATER TREATMENTS: HiNaPEF technology is a New Advanced Oxidation Process (AOP) similar to Pulsed Electric Field (PEF) technology but based on low frequency and high voltage nano-pulses. It is fully patented. It delivers effective reduction of all microorganisms: abatement of up to 99% on liquids. It can be configured to treat on water non-biodegradable organic pollutants including emerging contaminants and recalcitrant organic pollutants such as pesticides, pharmaceuticals, dyes.

They motivate their activities as under:

Both waste and water treatments are small scale treatments. Green Plasma is compact and mobile. Additionally, we can cover the energy process needs with the treated wastes. HINAPEF (water treatment) has low electric energy consumption: 0,01 kWh/m3, excluding the efficiency of the pulse generator (-30% vs existing PEF technologies). Additionally, its fully customizable according to the characteristics of the effluent, suitable for Point-of-Use (POU) applications and it does not heat the treated liquid. The device is compact and portable. Due to their industrial business projection, they expect to expand their projects and customer base (laser treatments) and to start selling HINAPEF technology (plasma water treatment).

Sustainable impact on blue economy: their system will allow them to collect floating marine litter in coastal areas. Each boat can collect up to 100kg/day. That means 10 tons each year per boat. In the Mediterranean area, more than 50000 tons each year are dispersed in the sea.

Contact: [www.irissrl.eu](http://www.irissrl.eu); http://www.unidu.hr/index\_eng.php;

https://www.subsea-tech.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Jospa Tug Ocean Plastics Harvester

Activities: The Jospa tug is powered by waves Jospa’ s Ocean Plastics Harvester provides the ideal solution to keeping oceans clean from plastic. Two Tugs make a Vee shape, towing a special ’beach’. The Vee’s wide-open mouth moves into the waste, and shepherds it onto the beach. It is then washed over into a net or tube behind the beach. Each Harvester cuts a swathe up to 1 km wide through the waste, moving at ideal collection speed.

They motivate their activities as under:

Statistics outlining the problem include: there are 150 to 200 million tonnes of plastic debris in our oceans: 8 to 10 million tonnes enter the oceans every year, and it is growing. A plastic bottle takes up to 450 years to degrade in the ocean: plastic kills more than a million seabirds and 100,000 marine mammals yearly: our oceans now have close to 500 dead zones, covering more than 245,000 km2. Worst of all, plastics particles are confirmed to have widely entered the human food-chain. The dream solution – very wide sweep area to capture widely-scattered waste plastics and fishing gear, incredibly low running cost - no oil-burning ocean-going tug required, and cleans 24/7.

* 500 Dead zones 245,00+ km2
* 150-200+ Million Tons of Plastic

No one knows exactly how much plastic is currently in the ocean today, but best estimates place the amount around 150 million tons. If we continue with business as usual, by 2025 the amount will increase to the point that for every three tons of fish in the sea there will be one ton of plastic. To look at this a different way: total marine capture (total amount of seafood harvested) in 2014 was estimated at roughly 82 million tons of fish. This would imply that for every ten tons of fish that we harvest each year, we replace it with one ton of plastic bottles and wrappers.

5 main ocean waste 'gyres': Much of the waste gathers in the 5 main ocean waste ’gyres’’ Efforts are being made to reduce this pollution at source, but no practical economic solution has been found to clean the gyres, which are still growing, Nobody can say with any certainty how much waste they contain and up to 50% of it is dumped fishing gear. This problem must be solved: now it can be. The oceans comprise 70% of the world surface and 90% of our habitat. ‘Now that dramatically low-cost cleaning is arrived, all our oceans can be continuously cleaned.’

Plastics harvester-beach: A purposed ship takes away the collected waste from an array of the Harvesters. As the Harvester’s controls can move it forward and backward, there is no need for expensive, polluting, tugs. Benefits: Costs, effective, pollution-free

**Zero Fuel Costs and Zero Pollution from Fuel**

Moving the Jospa Tug onto the ocean will require fuel. From then, The Jospa Tug does not require any fossil fuel, as PV panels + battery back-up, centred on the pilot tug, provide communications and control power.

**Remote Unmanned Operation**

Designed to be remote- controlled, there will not be any crew. In its first years groups or arrays of tugs may be operated by local service vessels. When the IMO (International Marine Organisation) permit fully autonomous operation, the tug will be operated via satellite.

**Jospa Tug – Core Technology**

Flowing from its Research and Development into wave power to produce electricity - WECs “Wave Energy Convertors” - Jospa’ s founders invented a wave-powered ocean-going tug with strong ‘bollard pull’. Inexpensive to build and maintain, it is a disruptive invention. It arrives when world shipping is under massive commercial and compliance pressures on costs and emissions. “Wave orbital motion”, at bottom, drives fins forward or backward depending on their position wrto the wave crest at any moment, and enables use of either horizontal or vertical fins as suits the application

**Waves Orbital Motion**

Orbital Motion has been known about for some time, but such a tug was not conceived of before now as there are a number of essential requirements, discovered by Jospa, without which the Orbital Motion could not be effective. As it is wave-powered, costly fuel and emissions do not arise: as it is unmanned (remote-guided), the costs of a crew are also saved. At some time soon “autonomous” – unmanned, remote- controlled via e.g. satellite, -operation, as is also now being planned for autonomous cars, will be permitted. The “Jospa Tug” concept has been proven (and advanced to “TRL4” in technical terms), protected by European and US patents. The tug potentially competes in all ocean-shipping modes. Initially it must prove itself in applications where its slow speed is desirable.

Contact: https://jospa.vercel.app/oceanplasticharvester

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Madiba and Nature Ecoboat (Recycling Plastic into Boats)

Activities: Africa, like most other parts of the world, is battling a spiralling plastic pollution crisis. In Cameroon, one non-profit company is helping to keep waste plastic out of the ocean while also improving livelihoods and inspiring entrepreneurs in communities across the country. Madiba & Nature's 'ecoboats' - made out of discarded plastic bottles - are helping fishermen while also creating jobs in the recycling industry, promoting ecotourism and raising awareness of the circular economy.

https://madibanature.com/

Contact: https://www.weforum.org/agenda/2020/10/q-a-madiba-nature-entrepreneur-plastic-waste-boats/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Matter Captures (Plastic Microfibre and Pollution Solutions)

Activities: Plastic microfibers in our water are one of the greatest dangers to human and environmental health. All plastic particles they capture are returned to the circular economy which is now critical to the sustainable future of us all. They are an innovation company, pioneering plastic capture for the good of the planet. ‘Through brilliant design thinking, powerful partners, and an impatience to make what we do matter, our mission is to stop this pollution at source’.

Contact: <https://www.mattercaptures.com/who-we-are>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Mobius (Create Biodegradable Material, Biofuel & Renewable Chemicals from Lignin/Waste)

Activities: Mobius create renewable chemicals, materials, and energy from waste starting with biodegradable plastics made from lignin. Petroleum-based plastic plant containers are non-recyclable and often wind up in the waste stream — and our oceans. They are partnering with plant container manufacturers to use their strong, biodegradable plastic alternative, which will decompose in the ground into carbon dioxide, water, and organic compost.

**Their Technology:**

**Lignin:** Lignin is received from Paper Mills and Biorefineries

**Process:** Lignin is added to other biopolymers in their proprietary process

**Compound:** Pelletized resin is produced from their process; the currency of the polymer industry

**Convert:** The resin is converted into products like pots and films, using existing equipment

**Biodegrade:** When the material is done being used, it will breakdown into: water, compost, and CO2

Contact: https://www.mobius.co/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Mr Trash Wheel

Activities: Clearwater Mills LLC designs, manufactures and operates equipment that removes trash and debris from stormwater and waterways. The company is best known for its Trash Wheels, which have been hailed as one of the most effective systems for stopping plastics pollution flowing from rivers into the world’s oceans.

Using the power of nature to clean the oceans:

Mr. Trash Wheel is a semi-autonomous trash interceptor that is placed at the end of a river, stream or other outfall. Far too lazy to chase trash around the ocean, Mr. Trash Wheel stays put and waits for the waste to flow to him. Sustainably powered and built to withstand the biggest storms, Mr. Trash Wheel uses a unique blend of solar and hydro power to pull hundreds of tons of trash out of the water each year.

STEP 1: FUNNEL THE TRASH

Using containment booms, trash flowing down the river is funnelled into Mr. Trash Wheel’s gaping mouth. The booms have a 2-foot skirt that allows them to capture trash floating beneath the surface. The trash booms also help stop oil slicks from polluting the water.

STEP 2: RAKE AND CONVEY

Powered by the sun and the current of the river, Mr. Trash Wheel’s rake lifts litter out of the water and onto his conveyor belt. The conveyor belt moves very slowly but is strong enough to lift anything that comes down the river including tires, mattress, and even trees.

STEP 3: FEEL THE CHURN

Mr. Trash Wheel’s giant, 14-foot, water wheel is the engine that powers his rakes and conveyor. When there is not enough water current, solar panels’ power pumps that pump water on to the wheel to keep it churning.

Mr. Trash Wheel can operate in tidal waterways, which means he keeps churning even if the river is flowing upstream!

STEP 4: INTO THE DUMPSTER

When trash reaches the top of the conveyor belt it falls into a dumpster sitting on a separate floating barge. Once the dumpster fills it is towed away and replaced with an empty dumpster. Ideally, the plastic Mr. Trash Wheel picks up gets recycled, but current sorting technologies are unable to separate the plastics from all the other trash. For the time being, the best alternative is to incinerate the trash to create electricity.

Contact: <https://www.mrtrashwheel.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Numix Materials (Removing Metal Contamination from Waterways via Water Treatment Processes)

Activities: Numix materials is developing an industrial water treatment product to remove and recover heavy metals from water systems. Their product is capable of recovering metal contamination from water in a way that renders pollutants ready to return into a useful life. This approach leaves water cleaner while producing sources of crucial metals that don’t require mining.

Treat water better: Numix Materials is developing sorbents to harvest dissolved critical metals from contaminated process streams. This platform of unique materials enables recovery of valuable metals while minimizing chemical requirements, simplifying operations, and reducing hazardous waste disposal costs. By using our unique sorbent technology, customers can reduce the concentration of toxic and precious metals in water ten times more efficiently than competing technology.

Want to minimize chemical additives and cut waste residuals? The efficiency gain from Numix Materials' high-capacity sorbents enables metal harvesting and reduces toxic and precious metals returned to the earth as hazardous waste. The inorganic sorbent works quickly to extract dissolved metals from diverse solutions, regardless of pH and without pH adjustments, so you can meet process and regulatory limits quickly, independent of initial water chemistry. With broad applicability, their customers have the opportunity to simplify water treatment systems, reclaim contamination as value, and save money and water.’ Interested in seeing if this technology can save you time and money? It's easy to set up a screening test’.

Contact: https://www.numixmaterials.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Nu Oceans (Recycled Sandals and Footwear from Ocean Plastic/Waste)

Activities: Ocean plastic pollution is killing our seas. Nu Oceans offer 100% recycled & recyclable sandals made from ocean plastics: cleaning the oceans, one pair at a time! NuOceans is a team of dedicated people with one goal in mind: clean, plastic free oceans! ‘Have you ever heard someone say: By 2050 there will be more plastic in the oceans than fish?’ They are bringing to you a whole new brand of ocean inspired footwear that will contribute to emptying our oceans of plastic. Every pair they produce will be made entirely of ocean recycled plastics and renewable materials!

Contact: https://nuoceans.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Bottle (Reusable Plastic Based Products)

Activities: Ocean Bottle makes reusable products that save our seas. Each bottle purchased funds collection equivalent to 1000 ocean-bound plastic bottles. Smart chip activated, these products are stopping ocean plastic at the largest sources, setting up long-term recycling infrastructure for plastic collection and alleviating poverty by empowering collectors to earn a higher income in coastal areas with high levels of pollution. The company is a signatory of the UN Ocean Action Platform and recent recipient of the Green Product Award 2020, Red Dot Design Award 2020, Mayor of London's Environmental Impact Award 2020 and Forbes 30 under 30.

Contact: https:/theoceanbottle.com

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Bound Plastic Certifications

Activities: Ocean Bound Plastic Certifications have developed 4 Standards that can be used by 3 types of Organizations.

OBP Neutrality Subprogram:

1) Plastic Conscious Companies willing to compensate their plastic footprint by purchasing Neutralization Certificates to produce Plastic Neutral Products.

2) NGOs, Cooperatives or Companies involved in environmental cleaning to collect and treat Non Recyclable Ocean Bound Plastic and emit Neutralization Certificates for the job done.

OBP Recycling Subprogram

3) Plastic Recycling and Plastic Goods and Packaging Companies willing to sell Raw or Transformed recyclable/recycled ocean bound plastic, or to incorporate ocean bound plastic in their products.

4) NGOs, Cooperatives or Companies involved in environmental cleaning to collect and sell recyclable ocean bound plastic for its recycling.

**For Plastic Conscious Companies**

You are investing to limit the contamination of our Oceans by plastics by buying Neutralization Certificates from an organization collecting OCEAN BOUND PLASTIC. They certify the neutrality of your products of production according to what you have chosen to compensate.

**For Abandoned Plastic Waste Collectors and Managers**

They certify your organization as an Ocean Bound Plastic Certificate Holder so that you can sell certified recyclable OBP or sell Neutralization Certificates for having collected and treated non recyclable OBP.

**For the Recycling Industry and Plastic Products Manufacturers**

They certify your Recycling, Transformation or production chain so that you can either sell Certified Recyclable/Recycled Ocean Bound Plastic or claim the content of Recycled OBP in your B2B or B2C Products.

What Is Certified?

The Auditors will certify the amount of plastic used for your products or production (your choice) and that you have compensated it by buying Neutralization Certificates.

What Is The Cost?

Like most certifications you will need to pay for the cost of the auditor to come and perform the audit (travel cost, if required and time). They expect the audit to last not more than a day so the cost is reasonable. A quotation will be made when you contact the Audit Company The NGO Zero Plastic Oceans who developed and maintains the certification scheme charges a variable fee depending on your organization size to cover its running costs.

How Do I Compensate My Plastic Footprint?

First you shall determine the scope that you want to compensate. Then you will buy from certified organizations Neutralization Certificates up to the amount of plastic used by the scope you have chosen.

They update the list of organization supplying neutralization certificates as they get certified. Check the OBP Neutrality section to find providers for that service. If you need another provider they will help you set up the operation.

What are my benefits?

The certification gives you the opportunity to market your product as Plastic Neutral or Ocean Bound Plastic Neutral. It also gives you the assurance that the removal of non-recyclable OBP and its treatment has been effectively and properly done as each Certificate is controlled by the Certification Body.

Contact: https://zeroplasticoceans.org/ocean\_bound\_plastic\_certifications/ www.obpcert.org

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Cleaner Technology (Catamaran Ocean Waste Cleaning Solutions)

Activities: The OC-TECH cleaning multitask catamaran vessels have a patented cleaning system under the deck, so can work and clean as Swiss army knives: 1) As a work vessel, the OC-TECH is perfect for transporting people or cargo, placing barriers or supplying ships. 2) As a cleaning vessel, the OC-TECH is equipped to collect oil spills, microalgae or microplastics and remove any floating marine litter such as plastic waste and packaging, as well as store the pollutants and litter collected from the sea separately and continuously with the OCT-Ecobarriers new products.

They motivate their activities as under:

The business focus must foresee the segments where the key features of OCT products will add value, such as: 1) a vessel capable to transport up to 12 people and loads up to 1,000kg/m2 and cleaning activities at real maritime conditions; 2) Cleaning Efficiency (waste output rate of several tons/hour and continuous work), 3) Innovative multi-purpose design and flexible functionality for non-cleaning operations. OCT's products present outstanding USPs at a competitive price: Their products (OC-Tech, OCT-ecobarrier and OC-Tec ECO) will economically benefit the users because they will use the same vessel for different cleaning-up activities and in different locations. Several clients from different sectors have already shown a strong interest in the development of their technologies, such as public authorities related to environmental protection, as they represent an interesting opportunity for the sector that will provide higher efficiency and effectiveness than current competitive solutions that are limited to specific operations. Also, some regions of the world, such as the Caribbean, are struggling with the removal of the Sargasso. During 2019, the Sargasso blooms caused loss in the Riviera Maya of over 12M, and in Cancun and Puerto Morelos, the losses are estimated between 10 and 11M OCT's technologies will help to alleviate such ocean, coastal and fluvial environmental problems. They have already proven the interest and the success of their technology, (proving excellent collection-effectiveness, correct waste separation and the storage-capacity for various types of floating waste including microalgae), with the sales of 2 OC-Tech cleaning multitask vessels to the Government of the Canary Islands.

After successfully constructing the OC-Tech vessel and making some real test with cleaning microalgae bloom in Tenerife coastal, the company is looking for investment to open and develop their huge international market. Although they have successfully validated the OC-Tech cleaning multitask vessel, they have realized that the OCT-Ecobarrier system integrated into the vessel must be improved to exploit its capacity and performance (to be able to collect macro marine litter continuously). This will also help Ocean Cleaner Technology to become a more versatile technology and to reach wider market possibilities. To do so, the OCT-Ecobarrier will be optimized and validated, both in-house and in real conditions (focusing on testing the OCT-Ecobarriers in the Caribbean for the removal of the Sargasso).

**Sustainable impact on blue economy:**

OC-Tech cleaning multipurpose vessel fosters circular economy by transforming marine & fluvial marine litter into a multitask OCT Ecobarrier. It is impossible to predict the nature, place, time and magnitude of an accident. Pollution control equipment must be permanently available while being put to profitable use in the periods between cleanup operations. Even though there have been several attempts none of them has successfully mixed the automatized cleaning performance with the nautical versatility in terms of stable sailing performance, optimum output rate in the extracted mass of pollution, and multi-purpose focus of the vessel that enables other port-related operations. After successfully constructing the OC-Tech vessel to solve the aforementioned problems, the OCT-ecobarriers are a new maritime and coastline patented product designed to continually collect the floating macro waste to foment and develop the sustainable use of floating macro waste as a useful final product with utility for the ocean and that will fit with the parameters of a circular economy.

Ocean Cleaner Technology’s original recovery and storage systems provide the recovery sector with a more profitable vessel than existing alternatives because of its better adaptability to a wide range of tasks; efficiency; excellent response time and simple equipment, which needs no time consuming calibration for optimal use. Additionally, for the investor, the system´s simplicity, compared to existing options, offers further advantages as smaller crews are necessary and crew members require less training and specialization. Down-time is also reduced to a minimum during crew changeovers. El OC-Tech offers a large deck area, which can be used for secondary and complimentary tasks, such as the transport of persons and equipment or as a platform for maintenance work related to port and bunkering services, as well as deployment of buoys and containment booms, demarcation floats or environmental investigations such as sampling. The vessel has a high-pressure hose system which can be used in inshore clean-up operations, for the removal of contaminants from rocks, beaches and other areas with difficult access. Contaminants removed with the hose can then be directed towards the vessel´s tunnel for collection using the unique propulsion system. Additional filters can be fitted to further purify collected water and prevent eutrophication in enclosed waters.

Contact: https://www.oceancleaner.es/oc-tech/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Clean Up

Activities: The Ocean Cleanup is a non-profit organization developing advanced technologies to rid the oceans of plastic. To achieve this objective, we have to work on a combination of closing the source and cleaning up what has already accumulated in the ocean and doesn’t go away by itself. Over 5 trillion pieces of plastic currently litter the ocean. Trash accumulates in five ocean garbage patches, the largest one being the Great Pacific Garbage Patch, located between Hawaii and California. If left to circulate, the plastic will impact our ecosystems, health, and economies. Solving it requires a combination of closing the source, and cleaning up what has already accumulated in the ocean.

Cleaning up the Great Pacific Garbage Patch using conventional methods – vessels and nets – would take thousands of years and tens of billions of dollars to complete. Their passive systems are estimated to remove 50% of the Great Pacific Garbage patch in just five years, and at a fraction of the cost.

**Create a coastline where there is none:**

The challenge of cleaning up the gyres is that plastic pollution is spread across millions of square kilometres and travels in all directions. Their cleanup technology has been designed to do the hard job of concentrating the plastic first, before it can be effectively removed from the ocean. The system consists of a long floater that sits at the surface of the water and skirt that hangs beneath it. The floater provides buoyancy to the entire system, while the skirt prevents debris from escaping underneath and leads it into the retention system, or cod end. A cork line above the skirt prevents overtopping and keeps the skirt afloat.

**Take advantage of natural oceanic forces:**

For an area of this size, active cleanup methods would be too energy-intensive; this is why they have chosen a passive design. The cleanup systems rely on natural forces to navigate the patches – a feature that also increases its survivability in the harsh ocean environment. Both the plastic and system are being carried by the wind, waves, and current. However, to catch plastics there needs to be a difference in speed between the system and the plastics. Using a sea anchor to slow down the system, plastic can be retained and captured. The combination of natural forces and a sea anchor create a drag, which makes the system move consistently slower than the plastic, while allowing the plastic to be captured.

* Step1: capture
* step2: accumulation
* step3: extraction

**Expected impact**

Their floating systems are designed to capture plastics ranging from small pieces just millimetres in size, up to large debris, including massive discarded fishing nets (ghost nets), which can be tens of meters wide. Models show that a full-scale cleanup system roll-out could clean 50% of the Great Pacific Garbage Patch in just five years. After fleets of systems are deployed into every ocean gyre, combined with source reduction, The Ocean Cleanup projects to be able to remove 90% of ocean plastic by 2040.

**Sunglasses**: their sunglasses are made from plastic they removed from the Great Pacific Garbage Patch during their operations in 2019. Designed in California by Yves Béhar and made in Italy by Safilo – this is probably the most stylish way you can help rid the oceans of plastic. And, should the time come, they’ve been designed to be easily recycled.

The Ocean Cleanup is developing a passive cleanup method, which uses the natural oceanic forces to rapidly and cost-effectively clean up the plastic already in the oceans. With a full fleet of cleanup systems in the Great Pacific Garbage Patch, they aim to clean up 50% of its plastic every five years.

Contact: <https://theoceancleanup.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Currency International (Recycled Plastic Products, Vessels & Reward “Currency”/Other Initiatives for Marine Plastic Pollution & the Circular Economy)

Activities: Ocean Currency International (OCI) is a pioneer in Direct-Social-Action Development. Their mission is to transform the world’s islands, waterways and beach communities into sustainable Waste-Free Impact Zones and improve the quality of life of each global island community. Island nations face disproportionately high rates of urban municipal solid waste due to tourism and the high cost of exporting recyclable materials. The waste’s impact on nature, human health and quality of life in turn affects the tourism industry that the island depends on. While everyone now understands the problem of plastic in our ocean, most people disengage as they feel their individual actions do not make a difference. OCI engages and enables ocean-loving corporate employees and individual consumers through aspirational purchase-based funding to give them a way to make a direct, tangible physical difference in creating plastics-free water, better air quality, and a healthier, cleaner world.

Contact: <http://www.oceancurrency.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Eye (Payment Platform for Marine Protected Areas Compensated for Ecosystem Services)

Activities: Ocean Eye is a financial technology company specialized in ecosystem service payments for communities and conservation. Their solution is designed for the marine tourism industry, enabling dive centers and other marine tourism operators to report sightings of charismatic species. These reports are linked to small payments from tourists that go directly to coastal communities in order to incentivize the protection of these species. Rather than receiving income only when harvesting marine life, the platform allows communities to instead be paid for conservation. The idea is that the operators who take the tourists out – be they a ranger, other MPA staff, or a private sector player – will operate the app. That ensures a good scientific standard of identifying animals, and means the data can be put into good use for management. Operators can also view their own sightings data and trends over time, which they can then use to sell and promote their activities.

For the time being, the payments will rely on visitors being there and being willing to pay for the ecosystem services, i.e., the animals. They have some plans for when they expand to regions like Antarctica that lack local communities, in which payments could be collected and then channelled to communities elsewhere – perhaps places that are critical and have communities but receive no visitors. They are open to ideas, and want this to work in as many situations as possible. They are running the Morotai pilot in the last half of 2020 and will make sure everything is working well. Then they will be ready to expand more globally at the start of 2021. Even if international tourism is still slow at that point, there are many places where domestic tourism can be making a stronger conservation and community impact already.

Contact: https://oceaneye.io/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean-I (Designer Recycled Ocean Plastic Furniture and Cigarette Butt Collection)

Activities: Two new innovations are coming ...You can help us recycle and save our oceans and rivers from plastic pollution! Ocean-i-(mpact) - designer recycled plastic furniture, and cigarette butt collection services that have a direct measurable impact on land-borne ocean-bound plastic & cigarette butt pollution at source

Contact: https://www.facebook.com/oceaniafrica/about/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Shapers (Gamification Platform for Ocean Waste Reduction)

Activities: Ocean Shapers is an environment impact startup developing a digital platform that transforms the activity of removing ocean-bound plastic waste into a joyful, progressive, video game-like activity, with the fusion of virtual reality and eco-friendly shopping.

The Ocean Shapers (O.S.) Impact Package was designed to be easily replicated to be suitable for scalability. The package currently includes a so-called Impact Picture the helps the contributor envision the impact that is created via the ocean-bound plastic waste collection where the majority of his/her purchase is channelled to and empowers the person as he/she can clearly see what can be achieved. In addition, the contributor receives a so-called Process Picture for envisioning the process of how plastic is collected and recycled to have higher engagement by developing a better overview of the actual collection activity. The Impact Picture is created in the Philippines, they are the original products of Ocean Shapers, while the Process Picture is taken by the external waste mgmt. partner, the Plastic Flamingo. O.S. works as a retailer of this picture, and Plastic Flamingo promises to collect and recycle a specific amount of ocean plastic in the Philippines after each picture sales.

They motivate their activities as under:

In the future, for Ocean Shapers, as a high-tech fusion startup aiming to focus on fusing gamified video game development, virtual reality, e-commerce as well as environmental advocacy and externally catalyzed ocean-bound plastic waste collection & recycling, the primary product is planned to be the IT platform, which would be the first to provide an addictive virtual immersion into the ocean cleanup activity via integrating a recurring purchasing behaviour. There is currently no similar platform on the market. Naturally, the development of such IT platform would be resource-intensive, however, in contrast with typical IT startups, Ocean Shapers unconventionally has a secured secondary income channel for mitigating the investment risks, from the first day, in the form of real-life ocean plastic collection that comes with the offered impact package.

As Ocean Shapers fuses the elements of tech, IT and product businesses with traditional social entrepreneurship, as well as the impact created on the ocean which is externally handled via Plastic Flamingo, a corporate partner in the Philippines, there is a solution available for scalability and localisation issues via automation and innovation, while retaining the social ability of engaging communities.

Sustainable impact on blue economy: Gamification unlocks the receptiveness of the person and thus impact creation can be integrated into the daily behaviour as an incentivised, recurring behaviour, resulting in sustainable, incremental social-environmental impact. Ocean Shapers (OS) is aimed to be a cross pillar platform that deeply focuses on human empowerment as a core to catalyse impact creation. The platform is strengthened to be more inclusive for diverse partners and facilitate the creation of pervasive, long-lasting, sustainable impact. It is not asking for a contribution. O.S. integrates customer education to help create people who are entrepreneurial and understand the impact that can be harnessed from developing local, collaborative communities which further evolve in an exponential rate into a decentralised, growing organisation of ocean impact-makers. Exponential impact is achieved as empowered customers who are incentivised to create further leaders who also activate interest that brings stable growth.

Contact: <https://www.youtube.com/watch?v=VPigZXQ9HKw>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### ORBITAL EOS (Marine Oil Pollution Tracking Solutions from Space)

Activities: Orbital EOS detects and characterizes marine oil pollution from space. They work with companies and agencies that want to guarantee secure and environmentally friendly operations at Sea. They state they can reduce the cost of monitoring by a factor of 10, increasing the surveillance capacity by a factor of 100. After having worked 12 years in aerial remote sensing for the Spanish Maritime Safety & Rescue Agency (SASEMAR), they decided to embrace new technologies and fly higher. Now we use Space Technologies + AI to foster a privileged vision of maritime data. Their solutions are supported by years of hands-on experience in the field. Their mission is to democratise access to satellite-based maritime intelligence. Their vision is to monitor the health of oceans and save lives.

Contact: <https://www.orbitaleos.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Parley for the Oceans (Recycled Textiles, Apparel and Supporting Ocean Plastic Cleanups)

Activities:

Recycled plastic is still a very important approach in fashion,” says Cyrill Gutsch, the founder of Parley for the Oceans, which revolutionized ocean plastic clothing and accessories in 2011. Parley’s ongoing collaboration with Adidas has produced tens of millions of sneakers made from Parley Ocean Plastic, and Stella McCartney has used it for shoes and activewear. “There’s no excuse to make new plastic anymore—everyone should be using recycled materials. Parley for the Oceans addresses major threats towards our oceans, the most important ecosystem of our planet. They believe the power for change lies in the hands of the consumer – given we all have a choice – and the power to shape this new consumer mindset lies in the hands of the creative industries. Artists, musicians, actors, filmmakers, fashion designers, journalists, architects, product inventors, and scientists have the tools to mold the reality we live in and to develop alternative business models and ecologically sensible products to give us earthlings an alternative choice, an everyday option to change something.

To succeed, we need to find ways to synchronize the economic system of humankind with the ecosystem of nature. And make environmental protection fiscally lucrative for pacesetting major companies. Parley has been created to accelerate a process of change that is already in progress. No other big movement in the history of humankind has developed faster than the environmental cause. We want to make sure we are fast enough to meet the ultimate deadline and turn the ship around before we lose a treasure we have only just started to explore and still don’t fully understand: the fantastic blue universe beneath us — The Oceans.

Contact: <https://shop.parley.tv/collections/all-products>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Pharem (Enzyme Based Micropollutant and Wastewater Treatment Solutions)

Activities: PFS offers a highly efficient solution for removing organic micropollutants (e.g. pharmaceuticals, pesticides, plastic derivatives) for a much lower cost than existing technologies. It has also minimal energy consumption and offers no additional safety concerns. The technology is based on novel biotechnology.

They have a low CAPEX (as little as 10% of competitors); Low OPEX (50-75% of competitors). It is safe to use (Big challenge with other technologies) Minimal energy consumption and low CO2 production.

Technology readiness level:

The project has been verified by a Horizon 2020 SME instrument Phase 2 project and is currently in the early stages of commercialization. A few customer projects are initiated and the plan is to increase the customer projects internationally the next year to quickly reach break-even.

Sustainable impact on blue economy:

Pharem offers affordable solutions to some of the most complex pollutants found in water today.

Contact: https://www.pharem.se/technology/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### River Cleaning (System to Intercept River Waste).

Activities: River Cleaning was born in 2018 in Italy’s northern region, Veneto, with the mission to prevent plastic waste from reaching the seas/oceans. After creating and testing different tools, they’ve found a solution that has an almost non-existent environmental impact. The River Cleaning System, as it has been named, consists of a diagonal line of floating devices that move along the course of the river to intercept waste. During coronavirus, the team has expanded its team with 3 new hires.

**River Cleaning System**

The river cleaning system is made up of a series of floating devices, positioned diagonally on the course of the river; thus positioned, they allow to intercept plastic waste and transport it to the river bank, in a special storage area.

Why revolutionize everything?

* Zero impact
* Totally self-powered
* Autonomous 24/7
* Allows navigability

The devices are 100% scalable. Depending on the size of the river, the strength of the current and other eventualities, it is possible to study the correct sizing for the best possible performance. They have studied its structure to make it solid and to be able to come into contact with boats of all types. The structure of the River Cleaning System devices allows it to divert waste by transferring it from one device to another, until it reaches the storage area beside the river. Its constant and incessant functionality allows it to intercept waste in full efficiency and safety. The River Cleaning System collects energy directly from the river current. It does not need auxiliary power, and does not produce any type of waste. It is designed to have zero impact on the ecosystem. It only does good! The anchoring system and the structure of the River Cleaning System allow it to behave exactly as if they were a series of normal buoys. In this way, when they come into contact with the boats they let themselves be dragged along the edges, and then return to the starting position.

Contact: <https://rivercleaning.com/river-cleaning-system/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sulapac (Straws, Packaging and Other Alternatives to Ocean Plastic Products)

Activities: The Sulapac® Straw is ocean safe as it biodegrades fully into CO2, water and biomass in marine environment within a similar time frame as tree leaves in nature. As the Sulapac straw and biological materials fully biodegrade in nature, they do not accumulate and thus are not capable to collect harmful chemicals or pathogens that can enrich along the food chain..

They motivate their activities as under:

It is even more difficult to clean up the ocean of microplastics than of visible litter. Fully biodegradable materials do not yield microplastics, as these will be assimilated by naturally occurring microorganisms. The process of biodegradation depends on the environmental conditions, which influence it (e.g. temperature, inoculum, humidity, etc.) and on the material or application itself. To claim a product’s biodegradability, the ambient conditions have to be specified and a timeframe for biodegradation must be set in order to make claims measurable and comparable. . For most fossil plastics there are no naturally occurring organisms which could metabolize them. Thus, if traditional plastic ends up in nature, either in the form of microplastics or visible litter, it’s very persistent and stays there for hundreds of years. In the course of time this means accumulation. Biodegradable materials do not contribute to plastics accumulation in nature as they are fully assimilated in a specific time frame leaving behind no traces.

KEY FEATURE: OCEAN SAFE

Several test methods for biodegradation of materials in marine environments exist. As open sea water (without sediment) is regarded as the most difficult environment for biodegradation, they have chosen ASTM D6691 “Standard Test Method for Determining Aerobic Biodegradation of Plastic Materials in the Marine Environment by a Defined Microbial Consortium or Natural Sea Water Inoculum” as the test method for the biodegradation of the Sulapac Straw. In this test the sample is in powdered form in natural sea water and the CO2 production during biodegradation is measured as a function of time. It thus indicates the molecular level degradation of the material into CO2, H2O and biomass. [In addition to ASTM D6691, they have performed field tests in open sea water. In the field tests the mass loss and visual changes of the material are measured.

VALIDATION

Marine biodegradability tests of the first generation Sulapac straws showed 3% biodegradation in a time frame of 3.5 months in open environment conditions in the Baltic Sea, which suggests a similar biodegradation speed as that of tree leaves in nature assuming that the biodegradation of the Sulapac Straw occurs with an constant rate Combined data from the Baltic Sea and ASTM tests suggested a full biodegradation of the straw ranging from 2 to 5 years. Also, it should be noted that according to EN 13432 tests, the straw is industrially compostable and the degradation products are not ecotoxic and do not exceed the threshold values for heavy metals [12]. The Sulapac straw has passed the Daphnia magna plankton toxicity test (according to OPPTS 850.1010 & OECD 202) performed by a third-party laboratory indicating no harmful effects on the plankton in the marine ecosystem.

Currently, there is no international standard providing clear pass/fail criteria for the degradation of thermoplastic materials in sea water. To the best of their knowledge, the comparison of the biodegradation of Sulapac Straw to that of naturally occurring biological materials provides scientifically sound criteria to claim that Sulapac Straw is ocean safe. ISO TC61/SC14/WG2 is in progress of developing a standard that will specify test methods for the determination of the degree of disintegration of biodegradable plastic materials exposed to marine habitats under real field conditions.

Contact; https://www.sulapac.com/blog/key-feature/ocean-safe/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### The Beach Co-op (Data and Related Solutions to Ocean Plastic and Other Solutions)

Activities: The Beach Co-Ops’ previous work for WWF-SA, Fair Trade Tourism and similar organisations in the field assists them to find solutions by understanding how single-use plastics are perceived by consumers and the food industries, and to what extent they are being recycled. They offer data collation and analysis services for those organisations and businesses wanting up-to-date and rigorous quantitative and qualitative studies in this sector. Their work and the decisions they make as experienced researchers are scientifically based, and their partnerships and combined work experience provide rich insights into the nature of the problem

**The dirty dozen:**

There is growing concern about the amounts of plastic and other waste entering the sea. We need a practical tool to track the amounts of litter at sea, so we can tell if specific measures to address the problem are working or not. Collecting rubbish washing up on beaches is the easiest way to track litter at sea, and it helps to reduce the amounts of plastic in the environment, but it is very time-consuming to record all litter collected. The Dirty Dozen + programme offers a simple way to contribute useful data while also making a difference in terms of cleaning beaches. The Dirty Dozen are 12 types of litter selected to track different sources of marine litter.

‘If you would like to get involved in contributing to this research platform, come to a Beach Cleanup, or contact us. If you are keen to participate in hosting a beach cleanup using this methodology please download the information pack.’

The Dirty Dozen Methodology is explained here:

COOLDRINK BOTTLES: Use a reusable bottle or flask

WATER BOTTLES: Use a reusable bottle or flask

COOLDRINK LIDS: Use a reusable bottle / flask – means no disposable lids

CARRIER BAGS: Use tote bags

CHIP PACKETS: Avoid packaged food or try and buy in bulk

SWEET WRAPPERS: Encourage restaurants to serve their sweets from a sweet dispenser as opposed to individually wrapped sweets

STRAWS: Purchase a glass, bamboo, steel or copper straw

EARBUDS: Purchase bamboo, wooden or paper versions

LOLLYPOP STICKS: Purchase paper or wooden versions

CIGARETTE LIGHTERS: Get a refillable lighter

FISHING LINE: Never leave fishing tackle behind. Take it home

LIGHTSTICKS: Rather use LED lights or avoid all together

DATA COLLATION & ANALYSIS: We are developing a shared data platform that will allow those engaged in beach clean-ups to interact and share their findings. This will contribute to the understanding of beach and marine litter at the national level and help provide a robust rationale for national campaigns.

Contact: https://www.thebeachcoop.org/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### The Litterboom Project

Activities: Initiated in 2017, The Litterboom Project (TLP)- was the pilot phase of their solution to alleviating the increase in marine plastic pollution, by targeting the river systems, instead of dealing with it only at the oceans. 90% of marine plastic pollution comes from river systems and the TLP team, have therefore devoted themselves to this preventative solution. Over the past year and a half, they have successfully been able to prevent 120 000kgs of plastic from reaching the ocean through the hard work of a very small team. They believe that true intervention starts with the public citizens engaging with meaningful projects such as this, ‘be it sacrificing time to join us for clean-ups or donating to our cause’. Every little bit helps a tremendous amount.

Contact; Cameron Service CEO <https://www.thelitterboomproject.com/about>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Net Your Problem (Recycle Ghost and Other Fishing Gear)

Activities: The mission of Net Your Problem is to engage a variety of stakeholders and partners to create an economically viable pathway to recycle end of life fishing gear, improve waste management, contribute to the circular economy, and reduce energy use and greenhouse gas emissions related to virgin plastic production. They work with fishermen, recyclers and manufacturers to dispose of fishing nets by turning them into new plastic products with a great story and even better environmental footprint. They currently have operations in Alaska, California and Maine and are working on expanding globally. They rely on a list of unlikely partners that consider themselves stakeholders of the issues around waste management, recycling and plastic pollution. As of November 2020, they have recycled 880,000 lbs of fishing gear and are just getting started.

Contact; <https://www.netyourproblem.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Plastic to Bricks (Nigeria/West Africa)

Activities: Their idea attempts to solve major environmental problems in Lagos, Nigeria, resulting from large quantities of plastic wastes in the drainage systems and ocean bodies. Using a scalable business model and recycling technology, they will provide financial incentive schemes for people, especially women and youth living in urban-low communities, to sort and gather plastic waste materials for recycling. The collected waste materials will be used as a feedstock to produce Eco-bricks (a brick made of plastic as a binder) for the thriving building and construction industry in Lagos. Their solution will motivate people to properly dispose of most of the 5 million waste generated in the state annually, and also provide a conducive environment to encourage infrastructure development leading to the well-being of the citizens, especially those living in the urban-low communities.

Phase 2. Pre-Funding: Prototyping

They motivate their activities as under:

Plastic ocean pollution: It is difficult for us to disengage from plastic. We need better systems to manage waste. The current global MSW generation levels are approximately 1.2 billion tons per year and expected to increase to nearly 2.2 billion tons in 2025. Eight million tons of plastics waste ending up in the world’s oceans, landfills, and dumpsites, which pose threats to marine life and ecosystems. Nigeria generates about 74,500 tonnes of municipal waste per day, of which more than 20 percent of the wastes compose of plastic materials. Despite the government and private investment in wastes collection and disposal in Lagos, there are still a lot of untreated and illegal landfills as well as no behavioural change of the citizens towards proper disposal of waste. The need to provide sustainable solutions and contribute to the reduction of plastic in drainage systems and oceans in Lagos is the rationale behind their initiative.

Success to them means achieving all the target objectives below:

1. Introduce Eco-bricks to the building and construction industry in Lagos, Nigeria, as a means of reducing plastic pollution.

2. Design and execute the first large scale supply chain of Eco-bricks in Nigeria.

3. Scale up the project from a pilot phase to usage of 3,000 metric tons of plastic waste to produce Eco-bricks by the end of 2021, thereby reducing a portion of the 8 million tons of plastics waste ending up in the world’s oceans, landfills, and dumpsites which pose threats to the marine life and ecosystems.

4. Demonstrate the benefits of Eco-brick as a practical, viable, and sustainable method to reduce plastic pollution to government and critical stakeholders in Nigeria and the development community.

5. Design capacity building (technical training for SMEs in the building and construction industry) Initiate policy components to ensure long term sustainability.

KAMAL-DEEN KASSIM is the Solution Owner

Contact; <https://www.instagram.com/p/BpcFaZvHDeN/> https://unleash.org/news/winners-unleash-found/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Purency (Automated Microplastic Analysis Solutions)

Activities: By automating the data analysis of microplastics measurements, we enable laboratories to perform a fast, scalable and high quality analysis of microplastics to protect consumers and the environment. Purency is a young company that emerged from the TU Wien (Vienna). Years of research into microplastics and our expertise in chemical engineering as well as data analysis are bundled in our product, the Microplastics Finder. It is a powerful software tool that provides robust and comprehensible results to laboratories that analyse samples for microplastics.

Contact: https://www.purency.ai/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Bin Project (Collecting Marine Waste Innovation)

Activities: One of the goals for the Seabin Project is to provide practical and tangible solutions to reduce the plastics in our oceans which is one of the world’s greatest problems. Seabins evolved into a comprehensive research, technology, and educational initiative with global interest and reach. The world’s marinas, ports and yacht clubs are the perfect place to start helping clean our oceans. With no huge open ocean swells or storms inside the marinas, these relatively controlled environments provide the perfect locations for Seabin installations. If we can have rubbish bins on land then why not have them in the ocean? The Seabin Project team is a dynamic and dedicated group who are working towards solutions by harnessing the knowledge and power of the world’s top experts in the field. Community activation, education programs, data collection, scientific research and technology are the pillars from which we can have an influence. We need to turn off the tap first if we are ever to clean up the mess. The last 3 years have been a whirlwind, recognised through international awards for commitment to sustainability practices, product design, service, and social responsibility. They are continually striving to find solutions, whether its new technology or educational programs. Their ultimate goal is to have pollution free oceans for our future generations.

* Number of Seabins 860
* Amount captured each day 3,612.8 kg.
* Total amount captured to date 1,469,494 kg

Contact; https://seabinproject.com/about-us/our-purpose/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### The Sea Cleaners (Solutions to Removing Marine Pollution)

Activities: Sea Cleaners is a non-profit organisation with a vision to preserve New Zealand’s Coastline for the benefit of the marine life and for the enjoyment of all users. Their long term strategy is to educate people, particularly our young people, to dispose of their rubbish in eco-friendly ways, including recycling, and so not to harm the environment. They will build awareness of the project’s vision and goals, create networks of collaborators, assisting the local charities, schools, community groups, iwi and corporates to work together, and educate people of the consequences of littering and work to stamp it out. However, they acknowledge that there is a problem of litter and rubbish entering our waterways and ultimately contaminating our coastlines and the sea. Accordingly, Sea Cleaners, through sponsorship, have co-ordinated volunteers to remove rubbish from our marine environments for the past 5 years. As funding permits, the team will grow; more vessels, crews and educators will be deployed, one harbour/stretch of coastline at a time, focusing initially on those adjacent to major population centres.

* They are Results Driven
* 9.8 million Total volume in litres of rubbish removed from the coast by SEA CLEANERS Team since 2002
* 325 Total shipping containers filled with loose litter
* over 98 million Total estimated number of pieces collected
* over 160 Thousand Total volunteer hours co-ordinated

Contact: <https://seacleaners.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Shore Buddies (Toys Made From Recycled Waste)/$1 For the Ocean (Business/Social Philanthropy Network).

Activities: Shore Buddies are made from recycled plastic bottles $1 for the Ocean donated from every purchase. Stuffed Animals Made from recycled plastic bottles. By 2020, Shore Buddies has saved over 500,000 plastic bottles from entering our oceans.

Contact: https://shore-buddies.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Slick Sleuth (Oil Spill Sensor Awareness and Alert System)/InterOcean Systems

Activities: Slick Sleuth provide a range of sensor models suited to specific applications and requirements for oil spill and leak detection. Slick Sleuth oil spill monitors and detectors are used in a wide variety of industrial and environmental applications for real-time detection of oil leaks and spills on fresh, brackish, or saltwater, as well as ground and normally-dry surfaces. In the event of an oil spill or leak, Slick Sleuth provides instant detection and notification, enabling users to contain accidental spills and avert costly environmental damage, cleanup, mitigation expenses, and regulatory penalties.

* SS100 & SS100 EXd - used in tank farms and industrial sites
* SS300 & SS300 EXd - used in refineries and power plants
* SS320 & SS320 EXd - used at marine terminals

**Rig Guard:** This ruggedized early detection system was created for use on offshore platforms and rigs operated by oil companies.

* Provides continuous, remote, real-time monitoring and alerts
* Fully integrated system that includes remote sensing, wireless communication, and cameras
* Available for supply, lease, or as a service

**Slick Sleuth Offshore Slick Guard Buoy**

Their high-tech buoy is specifically designed to monitor pollution and protect the environment.

* Used at desalination plants, fish farms, and environmentally sensitive habitats
* Fully integrated system includes buoy, oil pollution sensor, autonomous power, and wireless communications
* Additional instrumentation and sensors can be added to the floating platform

Slick Sleuth Smart-Boom Boom Guard: This “Smart Boom” technology delivers essential real-time monitoring of potential oil spills.

* Integral connectors link buoy to standard containment booms
* Real-time alerts and reports for oil spill detection and response in addition to geo-fencing and orientation
* Boom deployments include remote offshore and coastal locations, terminal and piers, and fuel storage and production facilities

Solutions:

* Defence
* Environmental
* Industrial
* Offshore
* Marine Science
* Products & Services
* Oil Spill Monitoring
* Cable Handling Systems
* Mooring Release and Monitoring Systems
* Specialized Engineering Services

InterOcean Systems is a recognized leader with more than 70 years of continuous experience and product development of the highest quality offshore, defense, and environmental equipment. This long and successful history of innovation and specialized design of advanced marine systems allows InterOcean to offer the unique experience and engineering background necessary to understand and solve difficult application problems in the challenging marine environment.

**Core Expertise**

* Advanced mechanical systems design
* Integrated hydraulic, acoustic, electronic, mechanical, and control systems
* Underwater systems design and fabrication
* Oceanographic towing and lifting systems
* Pollution detection and alert

**Products and Services**

Products include oil spill monitoring systems, high-tension mooring release systems, advanced cable handling systems, and specialized engineering services. Clients in over 75 countries include government agencies, military, research institutions, shipyards, offshore energy producers, and contractors. InterOcean uses proven technologies to meet critical requirements with durable, easy to use solutions that are designed to offer long term reliability for offshore applications. InterOcean continues to innovate and adapt products to match our clients’ needs. Our experience, customer support, and dedication to quality products will provide you with confidence in any extreme environment.

**InterOcean's facilities**

InterOcean’s facilities include all phases of production, from R&D to manufacturing, engineering and systems support. Concurrent engineering and production permits optimal quality control, quick adaptation and streamlined efficiency. Our facilities include machine and welding shops, plastics fabrication, electronics assembly and testing/calibration centres. InterOcean conducts thorough and complete performance testing and calibration of all instruments and systems. Our test facilities include high-pressure test tanks for long-term underwater testing of all instruments, as well as a facility for dynamically testing winches.

Contact: <https://www.interoceansystems.com/about-us/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### TIDE Ocean Material (For Recycled Jackets, Furniture, Electronic Products and Other Goods)

Activities: TIDE’s versatile granular material is compounded with the help of solar energy – and made completely from plastic collected from the ocean and coastlines – all kinds of plastic, not just PET bottles... Switzerland doesn’t have any coastline but that doesn’t stop this Basel based startup from creating all kinds of products out of plastic trash collected from the oceans. Founded in 2018, Tide has teamed up with multiple organizations to collect and use plastic waste to create material that can be used to make sustainable products. The collected trash is processed in Switzerland and turned into a granular material that can be used for many kinds of products; from jackets, to furniture and even electronic devices. Just 2 days ago, they announced a collaboration with Oceanworks, and 1 month ago launched their subsidiary in Southeast Asia.

Contact; https://tide.earth/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### TIPA (Compostable Packaging)

Activities: TIPA® was founded in 2010 to address the challenge that flexible plastic packaging poses to the world. At TIPA, they think that our packaging should be inspired by nature’s packaging: a protective layer that decomposes back into the soil with no toxic residue, microplastics, or other pollutants. TIPA®’s vision for flexible packaging is to have the same end-of-life as organic matter while maintaining the qualities of conventional plastics that consumers and brands have come to rely on, like durability, transparency, barrier, sealability, printability, and shelf-life. TIPA®’s packaging solutions seamlessly fit with industry machinery and manufacturing practices. They believe that with the right technology, compostable packaging can meet the same performance standards as conventional plastic.

Returning to a Circular Economy: conventional flexible plastic packaging is a rapidly growing segment, an estimated 97% of which ends up in landfills and oceans. Unlike rigid plastics, flexible plastic packaging lacks a circular solution because it is often made by blending several materials, contaminated by food, and too light-weight for separation and recycling. The challenge brands and consumers face is that single-use flexible plastic is an inexpensive, light-weight, and storage-compact packaging solution. TIPA®’s solution is to create packaging that mimics these valuable qualities, but is made with materials that return safely to the biosphere. At TIPA®, they believe packaging should be part of a circular economy, where materials that are produced can be reused for another valuable purpose: their compostable packaging biodegrades into nourishing compost, leaving behind the same nutrients left by an organic waste.

**Providing Solutions for the Food and Fashion Industries**

TIPA® focuses on the food and fashion industries, two segments with a very high volume of flexible packaging.

**Food**

Over 60% of flexible plastic packaging is consumed by the food industry.. In order to provide packaging solutions that will replace conventional flexible plastic packaging, they cover a range of applications in the segment, including dry food, fresh produce, meat, spices, powders, coffee, supplements, bars, and more. Their catalogue includes home compostable one-ply films in a variety of thicknesses, and industrially compostable multi-ply laminates in a variety of thicknesses with varying barrier capabilities.

**Fashion**

An estimated 180 billion polybags are used every year for fashion, apparel, and accessories. As awareness for plastic pollution increases, brands are seeking a waste-free solution to pack their products. TIPA® provides fully compostable polybags, zipper bags, mailers, garment bags, and more. TIPA®’s provides a replacement for single-use plastic packaging in the fashion and apparel industry, and has a portfolio of fashion items.

Nature's packaging is compostable. Bio-materials have been around for more than 20 years, but they haven’t delivered on the promise of bringing the same packaging usefulness as conventional plastic while returning 100% back to nature, with no harmful impact. TIPA’s technology is about making the promise of bio-materials real, based on deep technological innovation and multiple patents, with packaging that can be returned to nature after it is used. The vision behind TIPA® was to resolve the challenge of creating sustainable, flexible packaging by creating advanced bio-materials. A key technological requirement was to ensure that their flexible bio-material is as good as conventional plastic in terms of:

* Shelf life and durability
* Transparency
* Sealing strength
* Printability
* Flexibility

Their products have the same mechanical and optical properties as most conventional plastics, serving both consumers and manufacturers. Consumers enjoy the same level of packaging functionality. Manufacturers receive bio-materials that meet all their manufacturing needs, materials that are adaptable to their current packaging and production practices.

TIPA’s IP and know-how encompass resin, multi-layer film structures, laminates and more, enabling the creation of optimal solutions for any specific application with any desired properties. TIPA’s patented technology and strong manufacturing know-how solve a variety of issues concerning the applicability of bio-materials to flexible packaging. Explore compostable packaging solutions for Fresh Produce, Dry Food and Fashion segments. The company has a strong professional team consisting of a group of researchers, doctors, professional experts in chemistry and bio-plastics, industrial experts and food engineers. ‘The TIPA® team is 100% committed to making bio-based, compostable packaging work in the real world and reach a mass of consumers’.

Contact: https://tipa-corp.com/sustainability/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Toraphene (Biodegradable Compostable Plastic Packaging)

Activities: Toraphene is a manufacturer of biodegradable packaging products. Toraphene is claim to be a developer of the ‘World's First Economically Viable Truly Compostable packaging products’ that can replace the plastics that pollute our Oceans and transform into Micro Plastics that toxify the human food chain. Building biomaterials to help end ocean plastic pollution and help our environment heal. Packaging made from nature, by nature, for nature.

Contact: <https://www.toraphene.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### United By Blue (Sustainable Textiles, Clothing Apparel Combined with Ocean Pollution Removal)

Activities: For every product purchased, United by Blue removes one pound of trash from oceans and waterways. So far there has been 3,526,525 pounds of trash removed. They organized their first community cleanup the week they sold our first t-shirt. Years later, they are still hauling old tyres, gathering plastic bottles, and picking up the bits of styrofoam (polystyrene) that litter our shorelines. Their dream is to eliminate the need for this mission one day, so their pursuit doesn’t stop at reusable trash bags. They prioritize sustainable materials and ethical manufacturing to lead the charge toward better business practices. They facilitate easy ways for their customers to generate less waste by creating products like reusable utensil kits. And they build community through our waterway cleanups, determined to spread the idea that if one business can make a difference, so can one person.

They motivate their activities as under:

Ocean pollution is undeniably one of the most pressing issues of our time. The overwhelming amount of plastic in our waterways is polluting our beaches, choking our wildlife and contaminating our drinking water. They are committed to making a tangible impact, so they confront ocean trash in the most direct way we know how: by getting their hands dirty and removing it from the waterways. By mobilizing the community to join them, they aim to not only rid our shorelines of litter, but also to inspire individuals to live less wasteful lives.

**A Measurable Impact:** Behind the 2 million pounds of trash they have removed so far, there are countless cleanups, volunteers, partners, and initiatives that got them there. ‘We publish an impact report at the end of each year so you can read how it all went down.’

**Products for a more sustainable life:** Their products are made in GOTS-certified factories from sustainably-sourced materials. They create them to last, because the best way to be a conscious consumer is to ultimately consume less. They make this attainable by designing products that facilitate new ways to generate less waste, like take-it-with-you meal kits and reusable coffee cups.

**Business for good:** At United By Blue, they believe business not only has the ability to be a part of environmental solutions, but also a moral responsibility to address them. This is the motivation behind their B Corp status, a certification they have held since 2011.

**Balancing profit with purpose:** Every day, 38,356,164 pounds of trash are dumped into our oceans. ‘Our plan is to remove all single-use plastics from our supply chain by Spring 2020. We're here to prove that fashion can be a force for good. Through our commitment to sustainable materials, ethical manufacturing, and a zero-plastic policy, we're always searching for better ways to put the planet first’.

Contact: https://unitedbyblue.com/pages/our-story

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Waste Shark/Ran Marine Technology (ASV Marine Waste Solutions)

Activities: Ran Marine Technology specializes in the design and development of industrial autonomous surface vessels (ASV’s) for ports, harbours and other marine and water environments. Ran Marine’s current products include the Waste-Shark™ range, designed and used to clear plastics, bio-waste and other debris from waterways. The data enablement of their products allows customers to closely monitor, in real time, the environment and makeup of their water and create an accurate picture of the waters DNA over time. Ran Marine products are designed to be used either manually via an onshore operator, or autonomously with online control and access.

The Waste Shark

* Designed for round-the-clock waste and data collection.
* Swim Time 10 hours
* Range 5 km Operating life 15 years
* Debris cleared in a day 500kg
* Modelled on Planet Earth’s biggest fish, the Whale Shark, their drones are designed to be efficient, long-lived, non-threatening and unobtrusive.
* With zero greenhouse emissions – their drones act as an intelligent tool to cleaning our waters.

**Tech specs**

* Autonomous waypoint mission path (4G communication)
* Radio-controlled guidance:3km (1,8 miles) range
* Onboard Lidar enabled anti-collision software
* Dimensions: L: 161cm H:46cm Width 114cm (5,2 x 1,5 x 3.7 ft)
* Weight: 72 kg
* Propulsion: 2 x electric thrusters (5.25 / 4.1 kg f / 11.6 / 9.0 lb f per thruster)
* Protection: All thrusters are mounted with Ran Marine proprietary thruster guard technology
* Autonomy: 10 h (in autonomous mode)
* Max speed: 3 km/h

Contact: <https://www.wasteshark.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 11. MARINE RENEWABLE ENERGY

List of Marine Renewable Energy Influential Stakeholders

|  |  |
| --- | --- |
| **AGENCIES** | **COMPANIES** |
| IRENA | ABB |
| Ocean Energy Europe | Aegir Dynamo |
| Ocean Energy Systems | Anaconda, |
| International Windship Association | Andritz Hydro |
| **Companies** | Archimedes Wave Swing, |
| Aqua-Buoy | Astrom, Atlantis Marine Resources |
| Aquamarine Power | Blue Energy, |
| Carnegie Wave Energy | CETO II |
| Centrepod, | DCNS |
| C Wave | Eco Wave Power, |
| GDF Suez | Eel Grass |
| Hydro Air | Energy Island Ltd; Fuma-Tech, |
| Kawasaki | Hyundai |
| Lockheed Martin, Marine Current Turbines | McCabe Wave Pump |
| Mighty Whale, Minesto | Motor Wave; MRC 1000 |
| Nautricity Ltd, Oceanus, | Osmo-Blue, Oasys Water, |
| Oceanlinx; Ocean Power Technologies, | Ocean Star, Ocean Thermal Energy Corporation |
| Open Hydro, Offshore Infrastructure Associates, | OTEC International, Oyster |
| Penguin, Pelamis Wave Power | Pentair X Flow, Porifera, |
| PS Frog, Poseidon | Pontoon Power Converter, SBM Offshore, |
| Seabased AB, Statkraft; | Surf Power, Synch Wave Power Resonator, |
| TAPCHAN, Tetron | Tidal Generation; Triton |
| Verdant Power | Voith Hydro |
| Wave berg, Wave Cat | Wave Dragon, Wave Energy Buoy, |
| Wave Roller, Wave Rider, | Wave Plane, Wave Star, |

*Source: This Study*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Accumulated Ocean Energy Inc

Activities: Accumulated Ocean Energy Inc (AOE). currently holds several patents related to Wave Energy Conversion (WEC) Renewable Energy, Seawater Desalination, Thermo Dynamic Energy Recovery, Ocean Oxygenation Systems. Jim Matei founded OE bringing together a diverse group of talents as founding share members, and has taken advantage of their experience of the related industry. They are now in the process of developing the technology and have successfully deployed the first proto-type and tested with better than expected results. Over the past 3 years AOE has worked with the West Coast Wave Initiative and the University of Victoria and the new PRIMED (Pacific Renewable Institute of Marine Energy Discovery. This Wave Energy technology is a point absorber designed for a very simple means to convert wave energy into the form of compressed air. The sequential compression provides high pressures which can be easily transported via pipelines to be further processed. AOE Accumulated Ocean Energy Inc. is an early stage alternative energy company with a proven concept to utilize the energy of ocean waves to compress air for use in multiple industries. By compressing air using a concept as simple as a bicycle pump and transferring it to shore, it eliminates the need to convert energy into electricity at sea, a major technical barrier faced by most wave energy concepts.

Target markets for AOE’s patented systems include:

1. **Water Desalination –** as climate change impacts the earth, weather patterns and rainfall have changed considerably in recent years. Lakes and rivers are running dry while other areas with traditionally limited rainfall are experiencing floods. Water desalination represents the largest immediate opportunity for the commercialization of AOE’s patented technology.

2. **Ocean Thermal Energy** – by utilizing the difference in ocean temperature from the deep sea to the surface, AOE can generate a significant amount of compressed air for use in the production of energy. This can then be used on shore to support power generation in remote locations and eliminate the use of diesel generators.

3. **Seawater Oxygenation Systems** – The dissolved oxygen levels of our oceans have been declining in many area’s of the world. The natural ocean currents move hypoxic water into local marine environments which cause devasting results to local marine life. This also affects aquaculture operations which may result in large seafood mortality. The AOE oxygenation system is designed to use ocean wave energy to provide oxygenated seawater for aquaculture operations and to provide oxygenated seawater to the ocean floor to help mother nature compost decaying matter into rich ocean floor soil to enhance marine life growth.

4. **Carbon Dioxide Sequestration** – As carbon dioxide becomes a major factor of climate change and carbon tax will be administered, AOE can provide pneumatic solutions to carbon dioxide sequestration in a wide variety of engineering devices to extract carbon dioxide from the atmosphere and compress and liquify for transportation to the oil and gas industry and for underground storage.

5. **Electrical Power Generation** – ocean wave energy can be converted into electrical power for coastal communities.

6. **Air Powered Automobiles** – AOE has developed a means to convert ocean wave energy into high pressure compressed air for the use in air cars and trucks.

Contact: <http://www.aoecanada.ca/about-us/#collapse-1>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Anaconda

Activities: Anaconda is a novel wave energy-capture device. Checkmate’s Anaconda consists of a rubber tube and, depending on the wave climate and the power required, the tube can range from 50m in length with a 3m diameter to 150 metre length with a diameter of 5m. This in turn is then filled with seawater and closed at both ends. Once anchored in the sea, with one end facing oncoming waves, ‘bulge waves’ are excited or created inside the tube as each passing outer wave squeezes the distensible tube. As the bulge wave moves down the tube the sea wave that created it runs along the outside at the same speed making the bulge wave inside grow larger. It is these series of bulge waves inside the tube that in turn feed a power-generating turbine at Anaconda’s far end. They hold patents across the World from USA to South Africa to protect this unique intellectual property.

In the early days some initial research funding was provided by the Carbon Trust, a government-supported body whose mission is to ‘accelerate the move to a low-carbon economy’. Further significant funding was provided by the company. In 2011 the Carbon Trust’s budget was cut by 40%, 35 staff were made redundant and Anaconda was one of the projects that lost its funding. By 2015 they were ready to give up on the project. But then Wave Energy Scotland came into the picture. As a result, they secured Stage 1 funding of some £300,000. Anaconda made a successful transition to Stage 2, as the results were promising, and this brought a second injection of £720,000 to further prove the technology in more detailed wave-tank testing. Since 2016 scale models of the Anaconda have been put through their paces in wave tanks at three world-class laboratories; the Kelvin laboratory in Strathclyde University, Flowave in Edinburgh University and the Lir Laboratory in University College Cork.

They were also able to demonstrate that the life expectancy of each tube in constant 24-hour operation would likely be in excess of 12 years. This was an important finding, as one of the main problems associated with more rigid structures is that they have historically found it impossible to overcome the challenge presented by long-term survivability and freak waves. The power output evidenced by the tests was excellent and a sensible cost of energy for power generation was in sight.

A number of marine-based devices have failed in the last decade and, as 2020 is upon us, only a radically new approach to exploiting the power of the sea will reap rewards. Keen observers of wave energy converter (WEC) technology will note the common features across many historical initiatives, a force generated between a wave-activated oscillating body and a second reacting body, or seabed reference, is used to drive a power take-off (PTO) system. No matter how innovators have sliced and diced this approach, the same torpedoes have sunk them. There are thousands and thousands of islands around the world, all of which have coasts on which you could install Anacondas tuned to specific wave climates. This would create local jobs, local support and maintenance opportunities. Then the diesel electric generators can be stood down and run only if they need to as an emergency standby. ‘Anaconda, the doyen of Sir James Dyson, languishes in a backwater, due to the lack of continued funding. The Anaconda technology works. We have not given up hope of persuading purses to open that will allow an Anaconda device to undergo serious open ocean trials to finally prove that the results from extensive wave tank testing can be replicated or indeed improved at sea.’

Contact: https://www.checkmateukseaenergy.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Andritz Hydro/Tidal current turbines

Activities: Energy generation based on tidal current is an important area of innovation for ANDRITZ Hydro. ANDRITZ Hydro Hammerfest represents a leading technology provider in the tidal power business capable to generate clean, renewable and predictable energy from tidal currents occurring in coastal waters.

**Tidal current turbine - HS1000**

Tidal current electricity is clean, renewable, reliable and predictable. While ocean currents move slowly relative to typical wind speeds, they carry a great deal of energy. Sea water has more than 800 times the density of air, so for the same rotor swept area, water moving at 2.5 m/s (5 knots) exerts about the same amount of force as a constant 350 km/h wind. Building on the successful prototype experiences, ANDRITZ Hydro Hammerfest’s current turbine technology is a tried-and-tested design with horizontal axis rotor, equipped with a specially designed variable-speed pitching mechanism and a nacelle yawing system allowing optimal harnessing of the tidal currents in both flood and ebb directions. Automatic control software governing a sensor-driven monitoring system adjusts the leading edge to capture optimum output from a given tidal stream environment. It is meant for among the most taxing marine currents, designed to handle flows up to and above 5m/s. Designed for water depths down to 100m the tidal turbines are deployed on the seabed and kept in position by gravity, pins or pilings depending on the seabed and tidal stream characteristics.

At the end of 2014, ANDRITZ Hydro Hammerfest received an order from the UK-based tidal development company MeyGen Ltd. to supply three 1.5 MW tidal current turbines for an array under construction in the Inner Sound of the Pentland Firth, Scotland. The order placed with ANDRITZ Hydro Hammerfest is the first commercial order worldwide to supply tidal current turbines and part of the first project phase in completion of the MeyGen tidal array, which is the largest development project worldwide for a tidal turbine array. The Inner Sound of Pentland Firth is recognized as one of the most challenging and highly active sites of tidal flow with high wave frequency and requires careful engineering, manufacturing, and assembly to ensure that the technology deployed is able to operate and perform within its environs. The ANDRITZ Hydro Hammerfest HS1000 pre-commercial tidal turbine has been successfully certified by DNV (Det Norske Veritas) in 2013.The technology had already a five-year track record in Norwegian waters as the first ever tidal current turbine with permanent connection to a public grid in 2004. This smaller prototype has demonstrated more than 17,000 hour’s production track record of which more than 9,500 hours of continuous operation.

At the end of 2014, ANDRITZ Hydro Hammerfest received an order from the UK-based tidal development company MeyGen Ltd. to supply three 1.5 MW tidal current turbines for an array under construction in the Inner Sound of the Pentland Firth, Scotland. In December 2011 ANDRITZ Hydro Hammerfest successfully deployed its 1 MW pre-commercial tidal turbine HS1000 at the European Marine Energy Centre (EMEC) in Orkney, Scotland, destined to validate the technology for commercial tidal stream array application’s and has exported more than 1GWh of electrical power to the national grid powering the equivalent of 250 households for a year.

Contact: <https://www.andritz.com/products-en/marine-offshore/products/tidal-current-turbines>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Akuo Energy (Offshore Wind Energy Solutions)

Activities: Akuo was created in 2007 by the founders of Perfect Wind, who a year earlier had sold their entire wind portfolio (600MW) to Iberdrola. Akuo has been committed to developing and operating projects that go beyond simply producing renewable power and create additional social benefits for the inhabitants of the areas in which they are located. This strategy has allowed Akuo to establish itself as one of a leading French independent producers of renewable energy in just a few short years.

* **Key figures**

1. Total group revenues as of end 2019

* 1,3 GW capacity in operation and under construction at end q3 2020
* €2.5 bn cumulative investment by the group since inception as of end 2019
* 5 GW total capacity of the Akuo project portfolio at the end of 2019

At Akuo they are convinced that their actions are right and they pursue them with passion. They have elected to take part in tackling climate change by supporting the expansion of renewable energies. Today, a good project is a project with strong roots in its location; one that produces not only green energy but also works symbiotically with its environment. As a pure player in renewable energy, Akuo has diversified both in terms of technologies (wind, solar, biomass cogeneration, hydro, marine thermal) and geographies – at the end of 2019 and a presence in over fifteen locations around the world – following a strategy that is both opportunistic and focused on niche markets .Majority-owned by its cofounder and manager, Akuo has also sought operational independence by bringing in-house all the required expertise in development, contracts, financial engineering, construction and operation of its projects, and by systematically retaining control of its assets. It is an integrated company, which has chosen to internalize all the expertise needed by a developer and operator of renewable energy projects.

Creating projects from scratch, identifying acquisitions with significant potential, designing the layout of a project, optimizing the integration of a project into its environment, holding meetings with the local community and ensuring that planning applications are properly advertised, our development teams have a very broad scope of action which draws on a wide range of skills. Teams are organized by renewable technology.

**Contracts and financial engineering:**

Involved from an early stage of project development, dedicated contract and financial engineering teams offer precious support to the development teams. For the contract teams this comes from their expertise – gained in the British Oil & Gas industry – in negotiating, unstintingly, contracts for projects, whilst in financial engineering it is based on their expertise in the area and the ability to structure projects in a way that meets the needs of financial partners. Combining all this expertise allows ‘bankable’ projects to be created, and these are housed in dedicated vehicles to allow without-recourse financing with an emphasis on attracting local financial partners.

**Construction**

Construction is a key stage for Akuo, which manages its energy projects over the long term and therefore has to ensure that its projects are built to last. As a result, Akuo is systematically involved in the construction of all of its projects, in a supervisory role at least, thus guaranteeing the quality of works, respect for the deadline and for the highest safety and environmental standards. In addition, the company now acts as the independent contractor for the construction of its solar projects.

**Operation**

Akuo is an operator. Nearly half its staff is dedicated to the management of its assets and Akuo makes the intelligent operation of its projects a core priority. The asset management function is multi-faceted – covering proprietary supervision software, a spare parts strategy, in-house maintenance of solar farms, dedicated local teams, frequent training and monitoring of technological developments – and continuously seeks to optimize the productiveness and lifespan of the group’s projects.

Contact: https://www.akuoenergy.com/en

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Aquanet Power (Offshore Wave Power and Desalination Solutions)

Activities: Aquanet are wave energy conversion technology developers and are passionate with their work to help shape a sustainable future. With a technology developed for more than 20 years and accumulated real ocean data and experience, they provide in depth field knowledge, cost-effective, end-to-end solution wave energy converter systems. The Company is now ready for demonstration to the world of the technology’s capability to produce clean energy from the ocean waves at cost levels comparable to other matured renewable energy even at the first full scale device.

* Their products and integration services go far beyond renewable energy generation
* Unique highly efficient patented air turbine.
* Versatile shallow & deep water application devices
* Plug & play power take-off system solution
* Suitable for remote island energy and fresh water supply
* Cost-efficiency comparable with the most mature renewable energy sources at 10+MW scale
* Equipment operational life designed to last 30 years
* Can act as a breakwater reducing coastal erosion and providing safe harbour

Contact: <https://www.aquanetpower.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Archimedes Wave Swing

Activities: Archimedes are currently developing an advanced utility-scale wave energy generator based on the concept of the award-winning Archimedes Wave Swing. Following extensive optimisation based on a detailed understanding of both the operating environment and their customers’ requirements they believe that their technology represents the best technical prospect for delivering commercial wave power as a reality.

**Archimedes Waveswing Submerged Wave Power Buoy: Reliable and Affordable Wave Power Solutions**

Their patented Archimedes Waveswing submerged wave power buoy is a unique device designed to provide reliable and affordable power for maritime communities and offshore applications. The Waveswing reacts to changes in sub-sea water pressure caused by passing waves and converts the resulting motion to electricity via a direct-drive generator. The system is suitable for deployment in water depths in excess of 25m and can be configured for ratings between 25kW and 250kW by selecting the appropriate scale. The technology was tested offshore Portugal in 2004 and narrowly missed a world first for delivery of offshore wave power to a national electricity grid, being beaten by Pelamis by some 6 weeks. Since that time, the Waveswing has been refined and developed to focus on customer needs in an emerging market. They intend to offer their 25kW Waveswing on a pre-commercial basis from mid-2017. Key benefits of the Waveswing technology derive from its elegant and unique operating principle, its sub-sea location and the use of direct-drive technology. These combine to produce a system that is inherently survivable and reliable whilst providing best-in-class efficiency and cost and a minimal environmental foot-print.

Contact; <http://www.awsocean.com/archimedes-waveswing.html>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Biogas Made from Fish waste -Brian Lee Chandler Barbados)

Activities:

Innovators Brian-Lee Chandler & Nikolai Holder are working to determine the potential of fish waste from our local markets. Brian Lee Chandler provided an insightful pitch on the potential of fish waste and other organic waste in the production of bio methane for energy and heating generation. The objective of this project is to determine the value and contribution to energy security of local fish waste, produced from Barbados’s Oistin’s Market and Bay Gardens. Projected benefits include reducing greenhouse gas emissions, commercial market revenue, methane production for energy and heat along with lowering operation and production costs for MSME’s, creating livelihoods for women and supporting fish vendors.

Contact: https://www.bb.undp.org/content/barbados/en/home/presscenter/pressreleases/20191/eight-pitch-innovative-solutions-to-blue-economy-challenges.html

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue-Newables (Offshore Wind and Solar Project and Technology Solutions)

Activities: BlueNewables is a technology and engineering services provider. They own a family of technologies for the offshore wind and solar markets. WIND-bos: evolved floating wind spar platform. It avoids challenges of traditional spars in a cost-effective manner. CT-bos: concrete Tension Leg Platform. The current early quotation is showing it is the cheapest technology in the market. Therefore, several important companies are witnessing development. PV-bos will become one of the first oceanic floating solar devices in the world. It is a unique, modular, cost-effective and easy to build & install device. It is oriented to markets where the soil is scarce or expensive, isolated networks, islands etc. It is also part of a project consortium researching on producing Green H2 offshore. G-bos is a self-installing gravity base platform including the Wind Turbine onshore. An important construction company is already contributing to the development of this technology.

They motivate their activities as under:

They are contributing to the Energy Transition by smartly designing new concepts, bringing the experience from the O&G with an innovative approach adapted to the specific requirements of the offshore renewable energies. Their team is fit for purpose in the development of their products, and their network and contacts consist of relevant market players.

Their under-development products: WIND-bos and CTbos (floating wind), Gbos (bottom fixed offshore wind) and PV-bos (oceanic floating solar) are receiving positive feedback from the industry.. R&D funding: as technology developers, they are aware of the national and European programs for R&D funding and their network allows them to easily create consortiums to raise funds from the European Commission. Private investment: Direct approach to potential clients. Some remarkable achievements include their early agreements with a large EPCI company to develop the Gbos. The PV-bos, the WIND-bos and CT-bos are under constant development and today are part of several proposals within the H2020 program.

Sustainable impact on blue economy: Reduces carbon emissions, Increases the use of renewable energy resources, Encourages sustainable use of maritime resources

Contact: <http://bluenewables.com/#products>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Power Synergy (Marine Renewable Energy Power, Storage and Desalination Unit Solutions)

Activities: Their top-line product is a modular system consisting out of an energy production container a technical container. For the floating option (ports, bays, marinas, rivers & lakes) a pontoon expansion pack is available. The energy production container holds 6 synchronized vertical wind turbines and 96m of PV solar panel array. Installed wind capacity: 18Kwh, installed solar capacity: 18Kwh. Tech container holds the battery storage: 48Kwh. Energy production about 200-300KWh depending on local wind & solar. When equipped with a desalination system for drinking water: production of 30 000L/day. 2 Full-scale demonstrators can be visited.

They motivate their activities as under:

The Container-based solution: Compact, mobile synergy system with multiple renewable sources incorporated, battery storage and optional water purifiers. It is a completely independent, clean solution. Easy transport & relocation. Depending on region few to no permits are required. They currently have 2 full-scale demonstrators operational tested in Port of Ostend. 2 Commercial water purification plants are in construction to be installed end 2020 to supply local community, schools & hospital of water in a humanitarian aid project. Next steps are further commercialization.

Sustainable impact on blue economy: Each unit reduces CO2 emissions with 176 Tons per year. Focus on renewable solutions for your specific needs. Their broad expertise in the whole range of renewable systems for energy production, storage and water production makes us a 1-stop-shop for your solutions.

**Energy generation:** They can provide a wide range of systems, from classics to innovative, including PV, wind, micro-hydro, tidal & wave systems.

**Water production:** Clean water solutions for drinking water, process water, agriculture etc.

**Energy storage**: For 24/7 and autonomous operations think E-storage.

‘Your personalised support, offering you solutions that fit your specific needs.’

Contact; http://blue-power-synergy.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Cal Wave Power Technologies

Activities: CalWave’s mission is unlock the vast and steady carbon-free power from ocean waves worldwide. CalWave is bringing superior power generating technology to market with a global reach. Their proprietary wave energy converter technology achieves high performance while surviving storms and extreme conditions. In 2016, CalWave spun out from UC Berkeley (Mechanical Engineering and CITRIS Foundry), graduated from Cyclotron Road and was awarded in the U.S. Department of Energy’s (DOE) U.S. Wave Energy Prize.

In 2017, CalWave received an award by the U.S. DOE to conduct an open ocean pilot and received support from Breakout Labs, Autodesk Technology Impact Program and the Sustainable Ocean Alliance.

In 2019, CalWave received two additional awards by the U.S. DOE to 1) build a commercial scale drive train in parallel to their open water demo and 2) design the next generation of their submerged pressure differential WEC and investments from High Tide Foundation and others.

In 2020, CalWave’s “xNode" was awarded the Grand Prize of the discovery stage of the Ocean Observing Prize to enable the “Ocean Internet of Things".

**Calwave xNode**

The xNode is a versatile platform for converting and storing the power of ocean waves, serving as a facilitator in the Ocean Internet of Things. An adaptable payload compartment means a standard xNode can provide reliable power at sea for a range of remote offshore consumers. For example, xNode can easily maintain an AUV docking station to increase remote inspection frequency while reducing vessel costs. In the open ocean, the xNode can accommodate any third-party scientific payload, for instance to complement the ARGO fleet of oceanographic profilers, acoustically monitor fish stocks and marine mammals, or measure CO2 above and below the sea surface.

Contact: <https://calwave.energy/>

<https://www.energy.gov/eere/articles/doe-and-noaa-announce-11-winners-powering-blue-economy-ocean-observing-prize>

<https://www.energy.gov/eere/articles/energy-department-announces-12-million-projects-advance-wave-energy>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Carnegie Clean Energy /CETO II

**Activities:** Carnegie Clean Energy Limited, formerly Carnegie Wave Energy Limited, is a wave energy technology developer and solar/battery microgrid project developer. The Company is an owner and developer of the CETO Wave Energy Technology intellectual property. Named after a Greek sea goddess, CETO offers the potential to revolutionise renewable power production globally. CETO harnesses the enormous untapped energy present in our ocean’s waves and converts it into grid-ready electricity. CETO is a unique, fully submerged, point absorber type wave energy technology. A submerged buoy sits a few metres below the surface of the ocean and moves with the ocean’s waves. This orbital motion drives a power take-off (PTO) system that converts this motion into electricity. The CETO 6 design builds on intellectual property first lodged by Carnegie in 2013, incorporating on-board power generation and multiple moorings and power take-off modules. This associated US patent, granted on 6 November 2017, confirms the additional features as state of the art. These features boost power production and unit efficiency.

**CETO Technology Characteristics**

* Converts ocean wave energy into zero-emission electricity
* Environmentally friendly, has minimal visual impact and attracts marine life
* Fully-submerged and operates in deep water, away from breaking storm waves and beach-goers
* Tens of thousands of hours of in-ocean operational testing

**CETO Advantages**

* No Visual Impact – fully submerged
* Developed & Proven – over 10 years with onshore, wave tank and tens of thousands of hours of in-ocean testing
* Flexible -operates in variety of water depths, swell directions, tides & seafloor conditions
* Storm Survivability – fully submerged & extreme wave mitigation system
* Security – provides emissions free sustainable energy and water security to countries & islands
* Scalable – modular array design
* Clean – minimal environmental impact, co-exists with marine life.
* Desalination – zero-emission freshwater co-production allows pseudo energy storage

Contact: <https://www.carnegiece.com/technology/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Cor Power Ocean (Wave Energy)

Activities: CorPower Ocean brings reliable and competitive wave energy technology to the world, unlocking one of the largest untapped sources of renewable energy - harnessing the natural power of the oceans to help us tackle climate change and achieve a sustainable low-carbon future. CorPower Ocean is a leading wave energy technology developer utilising forty years of ocean energy research to bring a new class of high efficiency Wave Energy Converters to market, enabling robust and cost-effective harvesting of electricity from ocean waves. They are headquartered in Stockholm, Sweden with offices in Norway, Scotland and Portugal. CorPower enjoys broad backing across Europe, with funders including InnoEnergy, the European Commission, the Swedish and Scottish Governments as well as private investors. End users such as Iberdrola, EDP and Simply Blue Energy have been involved through all stages of development to ensure the product meets customer demands. CorPower’s goal is to successfully introduce certified and warrantied WEC products in the market by 2023-2024, allowing their customers to build wave farms using conventional project financing. Such a bankable product, with technology risks sufficiently eliminated, will be achieved by completing the last two steps of their structured market introduction process that has been ongoing since 2012.

Contact: <https://www.corpowerocean.com/about-us/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### C Power (Wave Energy)

Activities: C·Power delivers the products the marine economy needs to change the ocean from a power desert into a power- and data-enriched environment. As a worldwide leader in wave energy systems, C·Power is developing solutions that deliver reliable, cost-effective energy generation and storage that unlock innovation in critical industries such as offshore energy, defence and security, aquaculture, science and research, and communications. C·Power’s systems are easy to transport and deployable anywhere in the world for a wide range of applications, which reduce the cost of marine operations, energy costs and greenhouse gas emissions. With headquarters in Charlottesville, Virginia, and product development based in Corvallis, Oregon, the C·Power team brings more than 150 years of successful management, operating and engineering experience from the renewable energy sector, early stage prototyping and testing, and Fortune 500 companies. Formed in 2005 by Greenlight Energy Resources, Inc., C·Power partners include the U.S. Department of Energy and U.S. Department of the Navy, with strategic investors including the Oregon Venture Fund.

Contact: <https://cpower.co/why-wave-energy/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Crestwing (Wave Energy Power and Hydrogen Producing Solution)

Activities: Crestwing consists of two rectangular pontoons connected by hinges. The two interconnected pontoons move in relation to each other. A push rod is mounted to the rear pontoon and inserted into the front. The pushrod moves a rack and pinion whereby it drives a generator. The generator acts as a brake. The energy is drawn out as the wave pulls away and the center of the plant is pulled down. This shows that it is not Archimedes principle that mainly creates the energy, but the atmospheric pressure. Wave energy will be able to give a sustainable impact on the market of blue growth by taking over the offshore oil industries facilities such as workshops, shipyards and educated staff and turning it from a black industry into a green. Crestwing plants are very large and will be able to produce hydrogen and store it for fuel to the shipping industry.

They motivate their activities as under:

They know from their first tests at sea, that they have an anchoring system that solves a good part of the anchoring challenges, that have caused difficulties during tests of other wave energy plants, such as preventing accidents and minimizing the environmental impact. Furthermore, they have developed and built a scalable mechanical PTO system that is tested onshore to have an efficiency higher than 90% of the absorbed energy to power. Regarding competing with other renewable energy solutions their main objective is to get wave energy back on the political agenda as a renewable energy solution, that in few years can be a profitable supplement to wind power, solar and biogas. Wave energy is important since our earth globe consists of 2/3 water and 1/3 land. With a plant like this, there are many options in relation to location close to land or far from land, in interaction with offshore wind farms, coastal protection, to produce hydrogen etc. Furthermore, wave energy is visually out of site.

Crestwing's wave energy converter is expected to be sold to major energy companies, pension companies, States and governments and investors who invest in renewable energy parks in a similar way to how the wind turbine farms are organized. They are founded with a small amount of money from a Swedish supply company Vattenfall in Frederikshavn. In February they are planning a political and public promotion in cooperation with the corporation The Danish Partnership for Wave energy to raise awareness and interest in wave energy.

Sustainable impact on blue economy: Reduces carbon emissions, Increases the use of renewable energy resources, Encourages sustainable use of maritime resources

In 2020 and 2021, Crestwing plans to first design and produce one plant measuring 70 X 18 m, which will be located in the North Sea. Thereafter, two more plants will be produced, making the three plants the first park of Crestwing wave energy plants.

Contact: https://crestwing.dk/home-2/tordenskiold.html

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Eco Wave Power

Activities: Eco Wave Power is the sole global inventor, owner, and developer of the unique EWP wave energy device. Due to its 100% control and ownership of the EWP technology, Eco Wave Power can cooperate through a variety of options. We have the capability to support different project structures such as: BOO (Build, Own, Operate), BOT (Build, Operate, Transfer), BOOT (Build, Own, Operate, Transfer), BLT (Build, lease, transfer), and BLOT projects (Build, lease, operate, transfer).EWP is currently in collaboration processes and is seeking collaborations with conventional and green energy companies, electric utilities, energy ministries, marinas and ports, project developers, institutes, manufacturers, engineering companies, private and public funds, and investors. Global organizations that are interested in researching, harnessing or investing in wave energy with the purpose of meeting the rising global demand for clean, renewable, and affordable electricity are also being considered. EWP is interested in selling its generated electricity in utility-scale size, grid-connected, multi-unit arrays to supply electricity for network connection and also distribute smaller-scale devices to supply designated and off-grid users.

Eco Wave Power provides its clients and partners with a convenient A to Z package of services: starting with undertaking the feasibility studies to support the validation process of wave energy projects in different geographic locations, and continuing with services of construction, installation, operation, and maintenance services to support their projects. Their core focus is on three potential main revenue streams: However, as the wave energy sector is at an early development phase, the company will continuously adapt and evolve its positioning in the value chain in line with industry maturity. As a result, they are also able to collaborate through: Joint Ventures (JV) companies, technology exclusive and non-exclusive licensing agreements, Original Equipment Manufacturer (OEM) and Operation and Maintenance agreements (O&M).

Contact: <https://www.ecowavepower.com/news-media/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Envision Energy (Wind Turbines)

Activities: Intelligent technology creates the world of beautiful energy. To solve the challenges for a sustainable future Envision is committed to creating a world of beautiful energy where everyone has access to clean, secure and affordable energy. Since 2007, they have been focusing on a new world of sustainable energy and become one of the Largest wind turbine technology company in the world. From next-generation smart wind turbine manufacturing to integrated management systems, their offerings span wind, storage and beyond. Envision has a global footprint in China, France, Mexico, Vietnam, Argentina, Montenegro, Kazakhstan and other countries and regions all over the world.

Contact; <http://www.envision-group.com/en/windfarm.html>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Esteyco SA (Alternative Offshore Wind Maintenance Tech Solutions Without Jackup Vessels)

Activities: OPEX accounts for 30% of the cost of offshore wind energy. Nearly half of this OPEX is dedicated to paying for the large jack-up vessels that are the only option to perform any so-called Large Corrective Maintenance (LCM) interventions. ATOMS project will complete the development, prototype, and full demonstration in offshore conditions of pioneering technology for turbines, which will form address the monopoly of jack-up vessels and will reduce the maintenance cost of bottom-fixed wind turbines. It will also fill the technological gap existing in floating offshore market.

They motivate their activities as under:

Key unique selling points could be summarized as Bottom-fixed offshore wind: ATOMS is the first technology to allow Large Corrective Maintenance operations with no need for scarce and expensive jack-up vessels. This makes it possible to slash the costs of these operations to 1/5 and provides a most needed solution for new markets which lack the large fleet of jack-up vessels in the North Sea. Floating offshore wind: ATOMS provides a a simple breakthrough and effective solution to a critical unresolved problem: how to perform on-site LCM operations for floating wind turbines. This will provide a significant advantage to semi-submersible floating platform, but it will be game-changer for spar or platforms.

Sustainable impact on blue economy: Reduction of CO2 emissions: 2.791 kg/day less (50,96% reduction). According to Environmental Analysis by the University of Strathclyde of Glasgow, jack-up CO2 emissions are of 5.476 kg/day. According to their tugboats & suppliers which will be used for the transportation of the ATOMS, CO2 emissions amount to 895 kg/day. Since they will need to use 3 tugboats for the operation, the total amount of CO2 emissions will result in 2,685 kg/day, approximately. It will generate jobs and improve local economy: Since construction materials can be obtained on the area (steel, cranes, platform sections, etc.) they do not need to be transported from far away areas to the construction site (except for the turbine which may need to be transported). Therefore, the environmental impact resulting from transportation is reduced to the minimum possible. 8 direct jobs (FTE) and 50 new indirect jobs will be created since Esteyco will be directly hired 15 companies to provide products or services to Esteyco including materials, cranes, vehicles renting, etc during the project. Encourage women's introduction to offshore wind energy field: there will be 8 women participating in the project which accounts for a 40%. According to IRENA Wind gender report, women account for 32% of the renewable energy workforce.

Contact: https://www.esteyco.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Evolve (Produce Hydrogen from Tap Water)

Activities: Evolve™ is an alternate polymer based electrolyser producing pure hydrogen from tap water and seawater. As a USD 200 billion market opportunity by 2023, hydrogen generation is a market that presents fantastic opportunities for the right technologies. Evolve™ technology is a ‘true disruptive innovation’ within hydrogen generation, and their next milestones sets out to finance the further development of their prototype, work with their research partners and the field testing of their technology to take them to a commercial ready technology within 2021-22. The Evolve™ technology is patented in the US & Canada, holds an EPO in 42 countries and rights to manufacture in 8 countries. Gilman is at a very exciting time with the Evolve™ technology as they are validating their electrolyser technology and reaching commercial ready prototype together with their research partners. ‘We are offering first mover opportunities for companies interested in prototype developments.’

Contact: https://gilmanindustries.com/#aboutus

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Gi-Kinetic Energy (Turbine Technology)

Activities: Their product is a novel, hydrokinetic turbine; hydrokinetic simply meaning the natural energy found in moving water. The product family is made up of a floating 25kw and 60kw unit as well as a larger, submerged 250kW tidal device. They are also conducting a feasibility study on smaller fixed turbines. While competing devices require a minimum flow speed of 2.5 metres per second (mps) in order to be viable, the GiKinetic turbine operates in flow speeds as low as 0.5mps. With average flow speeds in most bodies of flowing water in the region of 0.7 - 1.2 mps, this means their product, thanks to its unique, patented 'bluff body', can service the mass market where competing devices can't. The resulting product offering is a turbine that harnesses predictable and renewable kinetic energy from flowing water in rivers, estuaries and oceans.

They motivate their activities as under:

Their ability to generate adequate power in lower flow speeds of water is their Unique Selling Point (USP) as this is something no other hydrokinetic turbine can deliver and is a huge blocker for other developers as it cuts off the majority of available sites (or sales) to them.

Sustainable impact on blue economy: If they can successfully achieve commercialisation by 2022, they project that they will generate revenues of 244 Million in the five years following (2022 - 2027) and produce 511 GWh of carbon free electricity, while at the same time displacing 383,162 Tons of Carbon Emissions and 14,560 Tons of harmful NOx emissions. The large scale roll out of theirr turbines will not only have significant impact on reducing carbon emissions but will also contribute to waste reduction by displacing other wasteful and polluting energy alternatives such as diesel generations. Their simple, affordable solutions will increase the use of hydrokinetic turbines thus encouraging the sustainable use of one of our maritime's most precious resources, it's 100% predictable, endless source of energy. Their solution has the potential to be a truly ground-breaking contributor to the renewable energy industry. ‘Using innovative concepts and designs, sound engineering principles and a collaborative approach, we are leading the research and development of our kinetic turbine devices.’

**Low Cost**

Simple deployment systems that offer low cost operations and maintenance procedures.

**Innovative**

Their turbine’s unique design features accelerate the flow of water allowing for significant energy generation.

**Clean Energy**

Constant supply of zero carbon hydrokinetic energy which is predictable and reliable. Monitored Remote Monitoring Systems for safety and performance tracking.

Contact: https://gkinetic.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Global OTEC Resources (Ocean Thermal Energy Power)

Activities: Working to reduce tropical nations’ reliance on fossil fuels in areas that are suitable for Ocean Thermal Energy Conversion (OTEC). OTEC is an application of solar energy that exploits the heat that the ocean captures from the sun’s rays. It possesses huge environmental advantages over fossil fuels and nuclear power; avoids land-use problems associated with renewable energy technologies such as solar, wind, biomass, and hydroelectric power; and has the potential to produce far more useful and affordable energy than could be obtained from other renewable sources. Tropical islands lack space for base-load solar projects, but have an abundance of solar heat energy stored in the ocean. Global OTEC Resources converts this heat energy into clean, renewable energy, solving islands’ problems such as: unpredictable pricing and availability; need for imports and deliveries; carbon emissions and the lack of space for conventional renewables. Each system is designed bespoke for every location, from resorts to public utilities. They plan projects from idea inception all the way through to commissioning and operations. Their key focuses are:

* Cost Per Kwh: Competitive cost compared to diesel generators and fuel imports
* Supply Security 24/7 supply regardless of changes in the global markets
* Zero Emissions Baseload: No harmful exhausts interfering with the environment
* Offshore: Unlike solar, this plant won't require any land or shoreline

-

It Started as a sustainable desalination research project, and has been awarded €250,000 in RD&I grants.

-It has multiple MOUs/letters of intent for customers who want to pioneer OTEC, along with endorsement and letters of support from government's and globally recognised hotel groups and PR coverage across top trade titles and mainstream global media.

Contact: http://otecorporation.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Helio-Rec (Floating Solar Energy)

Activities: HelioRec is building a floating solar power plant with a circular economy approach. They have an innovative, sustainable and cost-effective solution of green electricity production. HelioRec is solving these global problems: High cost of the electricity, especially at remote locations; Traditional source of electricity is not a clean energy source; Land scarcity. They are developers of the cost-effective and innovative solution of electricity production and are building floating solar power plants with a circular economy approach. With theirr solution customers can spend twice less money on electricity generation, the system produces "clean" electricity and we save the land space.

They motivate their activities as under:

Unique Design - Efficiency higher on 14% - Modular System; fast installation - Cost is lower on 50% Circular Economy Approach -Lower carbon footprint using ML/AI -Parameters forecast.

Pilot project installation Next step: start selling their floating system.

Sustainable Impact On Blue Economy: They want to install the cost-effective floating solar power plant in the sea. Positive impacts: Clean electricity production (MWh depends on the site); -Installation on the water on the sea and saving the land space:; historically many people live near the water and it is wise to produce electricity there (1MW of the installed capacity ~ 10 000 m2). ‘We believe that offshore floating solar technology is the new type of industry (first was a ground-based installation, after lakes, and now offshore installation). Also, we are implementing a circular economy approach in our project and we reduce carbon footprint at manufacturing processes and transportation.’

Contact: https://heliorec.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ingine (Wave Energy)

Activities: Wave Power Generation The Long Awaited Blue Energy:

Our planet’s perpetual waves have an energy potential of 3 TW, which is more energy than the world’s annual demand. On top of that, the stronger waves that are used as energy sources can be found along every single continent and ocean around the world, proving that wave power generation has no territorial boundaries. The growing demand for electricity around the world calls for a wider range of renewable energies to supplement solar or wind power. Wave power is an option that presents fewer regional restrictions than any other energy source, as water covers 70% of the surface of the Earth. Today, the commercialization of wave energy has undeniably become a necessity. INWave TM is INGINE’s own innovative wave energy converter. This converter uses a multi-directional energy harvesting technology that allows it to be installed by the coast. The shallow waters of coastal areas act as breakwaters, weakening the strong waves coming from the open sea. (Waters less than 10 meters deep will convert large waves from the open sea into small- and medium-sized waves.) In addition, INWave TM has a significantly lower operating cost than other technologies. Since the main facilities are installed ashore, it does not require submarine transmission cables and most of the maintenance work can be performed on land.

Contact; <https://ingine.co.kr/why-wave-energy-2/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### LIFETAG D (Energy Harvesting Battery)

Activities: Energy harvesting battery for ocean IoT. Self-charging 'D' battery for remote ocean IoT with integrated power management. Designed to provide continuous powers up to 10 MW.

**LIFETAG Mini**

Miniature power converter. Small footprint power source designed for hydrodynamic and hydrokinetic energy harvesting. Nominal specifications:

* mass: 3.9 grams
* max. power: 150 mW @ 120Hz
* bandwidth: 32% @ half-power

**LIFETAG Prime**

Broadband power converter. Medium power source designed for hydrodynamic and hydrokinetic energy harvesting. Nominal specifications:

* mass: 12.6 grams
* max. power:800 mW @ 120 Hz
* bandwidth: 45% @ half-power

**LIFETAG Cassette**

High-impact power converter. Impact-driven energy harvester designed for high force excitation up to 1000 N. Built-in mechanical limiter prevents damage under large forcing.

* mass: 92.3 grams
* max. power: 5.3 W
* max. force: 1000 N

Contact: <https://www.pyro-e.com/diy>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Magallanes Renovables (Tidal Energy)

Activities: Magallanes Renovables has developed and successfully proved a floating platform that can generate high output energy at a low cost from the tidal currents that happen at the ocean. The floating system developed by the Magallanes Renovables is a steel-built ship, which incorporates a submerged mast with a nacelle 15m deep where two hydro generators are fitted. As the platform is anchored to the seabed, the current moves the blades of the mills and generates energy. There is a double redundant anchoring system, that is fixed to the bow and stern. The platform can be installed in any area in the world, no matter the depth. One of their key advantages is the easy access to the nacelle, which provides easy and quick maintenance in situ.

Tidal Energy has enormous potential, since it has a high energy-density, is constant, predictable and very strong. But currently, there is no commercial system available to exploit it since all attempts have resulted in expensive and unreliable structures. Their platform is robust, can easily reach commerciality in the short term and can harness a high output of energy at a low cost. They have proven the viability of their technology and are about to take a step to reach commercialization. Investment is needed to take this step, and create a market lead by Europe and European technology.

Sustainable impact on blue economy:

Reduces carbon emissions, Increases the use of renewable energy resources

Contact: <https://www.magallanesrenovables.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Mean Sea Level (Wave Energy Converter Technology)

Activities: Based in Hermanus, South Africa, Mean Sea Level (Pty) Ltd is piloting its patented wave energy converter design by constructing a 1MW plant under offtake agreement with their industrial partner. Having completed 5 years of R&D, MSL will implement its patented automated profiling and pre-casting construction technique. Traditionally, solar and wind power have become the go-to clean alternatives for energy generation, but Mean Sea Level is looking to add a new option to the mix by developing the world’s first truly commercially viable wave-energy technology, something that has not yet been achieved at significant scale. The cost of innovation in marine construction requires huge investment. Managing Director Marius Hugo’s family co-founded the South African abalone industry in Hermanus and has been working in aquaculture for more than 30 years. He, recognised how abalone farms could benefit hugely from a renewable energy resource, making one of the farms the perfect testing ground for Mean Sea Level’s 1MW pilot project. By building an on-shore dam higher than mean sea level, alongside the ocean, Marius and his team will capture the wild energy carried by the waves. The sloped dam wall allows waves to enter the dam over the top or via non-return valves, and then run back to the ocean with the force of gravity. The returning water generates electricity as it moves through a hydro-electric turbine.

Marius is an electronics engineer who has previously worked in the fields of aerospace and chemical engineering. Mean Sea Level’s concept has, during the last 5 years, been patented, and once the 1MW project is mastered, it will move on to a 3.5MW project, which has already been given the environmental go-ahead. Future dreams include powering other aquaculture farms, coastal cities and more isolated towns and industries that require alternatives to the national electricity grid. Although Mean Sea Level is currently constructing and testing the technology on its own, Marius hopes to get big construction companies involved once the construction technique is proven. “And then we can focus on project development and innovation,” he says.

Contact; <https://www.meansealevel.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### MHI Vestas Offshore Wind

Activities: MHI Vestas are involved in Turbines & Innovations. Their ‘gentle giants set new standards for reliability, availability and cost efficiency’. Combining tried and tested technology with a new perspective on clever power generation, their product portfolio offers interesting possibilities. Being an industry leader also means taking on responsibility for driving innovation. They are involved and committed to a number of exciting projects that demonstrate new technologies that drive our industry forward. They operate, service and maintain their turbines in collaboration with their customers. They are responsible for looking after ~3 GW of hard working, reliable and world-class machines today, ensuring optimal performance and power generation. Through their 20+ year history they have installed ~1000 turbines, equalling more than 3,200 MW. For every turbine erected, installed and commissioned, they have gained experience that adds to their unique bank of knowledge.

* V174-9.5 MW™
* V164-10.0 MW™
* V164-9.5 MW™
* V117-4.2 MW™

They offer several service packages based on yield or availability, tailored to customers’ individual needs and strategies to maximise return on investment.

* Yield-based packages
* Availability-based packages
* Time & material packages
* Project Management
* Construction and installation
* HSE Management

Contact: https://www.mhivestasoffshore.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Minas Energy (Tidal, Offshore Wind)

Activities: Minas Energy are leading in sustainable energy solutions, education and public outreach. They offer:

* A full range of project development services:
* Renewable Energy Opportunity Identification
* Business case analysis
* Policy analysis
* Municipal and Community energy strategies
* Project Management
* Project Development: Consenting, Planning, Negotiation, Community Engagement, Media, Press Releases, Hearings
* Education: E-learning, Workshop programs

**St. Croix Hydro Power Generation:**

Minas Energy owns and manages the St. Croix Hydro facility. This 5 MW generation system was built in the 1930s and still serves a nearby industrial load.

**Operations & Compliance:**

They manage all operations and compliance activities, including dam repair, refurbishment and water rights renewals.

**Minas Tidal - FORCE**

Minas Energy has worked to develop a future industry in Canada with this project. Developing the Fundy Ocean Research Centre for Energy (FORCE) which hosts multiple berths equipped to demonstrate various in-stream tidal technologies.

**Project Initiation**

The Province of Nova Scotia awarded them the contract to manage the implementation of an in-stream tidal energy facility in the Bay of Fundy. Minas used its extensive network to assemble a team of local and international researchers to assess the Bay of Fundy in search of the best location to develop the facility required to bring the electricity ashore. Relying on its vision with key skills in public engagement and project development, Minas Energy;

* led the team as it secured the Federal and Provincial Environmental Approvals,
* created the appropriate project corporate structure,
* secured the funding for the project from the Clean Energy Fund.

Thanks to the successful teamwork led by Minas, Nova Scotia now has North America's first in-stream tidal energy site and a world-class research institution.

**Kaizer Meadow Wind Project**

The Municipality of the District of Chester wanted to play an active role in decarbonizing Nova Scotia's electricity grid. Minas Energy undertook development and project management services for a 2 MW wind turbine that provides renewable energy and financial benefits to the Municipality. Minas Energy brought skill and innovation to this solution that promotes environmental stewardship and economic sustainability.

https://www.minasenergy.com/kaizer-meadow-wind-project

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Minesto (Tidal Stream and Ocean Current Energy Technology)

Activities: Minesto is a world leading developer in tidal stream and ocean current energy technology. The company is based in Sweden and the UK with a global market potential. It has developed Deep Green –Minesto’s patented and awarded ocean energy power plant.

What makes Deep Green different from other tidal energy technologies is the wing, the size of the turbine and the fact that the power plant is “flying” under water. The wing pushes the turbine through the water in an eight-shaped trajectory, sweeping a large area at a relative speed that is several times the actual speed of the underwater current. The speed has a cubic relationship to the power production. This means that when Deep Green multiplies the relative speed which the turbine is pushed through the water, the electricity produced by the power plant's generator is several hundred times greater compared to if the turbine would be stationary. By adding this step of energy conversion, Minesto expands the global ocean energy potential.

Minesto’s marine energy technology, Deep Green, generates electricity from low-flow tidal streams and ocean currents by a unique and patented principle similar to a stunt kite flying in the wind. The wing uses the hydrodynamic lift force created by the underwater current to move the kite. With an onboard control system and rudders, the kite is autonomously steered in a pre-determined figure of eight, pushing the turbine through the water. By doing so, the turbine experiences a water flow several times higher than the actual stream speed. The turbine diffuses power to the generator which outputs electricity via power cable in the tether. Seabed umbilical transfers the electricity to the onshore connection.

They motivate their activities as under:

**Market exclusivity:** ‘Deep Green is the only known technology to cost-effectively produce electricity at sites with velocities between 1.2–2.4 m/s and depths of more than 60 meters’

.

**Small in size and lightweight:** Up to 15 times less per MW than competing technologies.

**Low-cost offshore operations:** Smaller vessels and equipment are used for installation, service and maintenance. Detachable design concept enables service and maintenance on shore.

**No visual, minimal environmental impact:** Deep Green operates completely submerged below the water surface, in unison with the marine environment.

**Predictable electricity production:** Tides are generated by the relative motion of the Earth, sun and moon, which can be calculated with almost 100% accuracy. Ocean currents are nearly constant.

**Utilisation of ocean currents:** The ability to operate at low velocities makes Minesto's Deep Green the only technology to be cost-efficient in both tidal and ocean currents. Two product lines provide flexibility and increased market opportunities

|  |  |  |  |
| --- | --- | --- | --- |

|  | **Deep Green Utility** | **Deep Green Microgrid** |  |
| --- | --- | --- | --- |
| Application | Multi-megawatt grid-connected farms | Remote islands, remote/coastal communities, aquaculture |  |
| Market | Global | Global |  |
| Market driver | Adding baseload renewable energy to the energy mix | Emerging energy access, electrification of remote users |  |
| Customers | Utilities, project developers, power producers | Project developers, island economies, aquaculture developers |  |
| Rated power | 0.5–3MW | 50–250kW |  |
| Wingspan | 12–24m | 4–6m |  |
| Weight | 10–35t | 1–3t |  |
| Depth of installation | >60m | <60m |  |
| Operating stream flows | 1.2–3.0m/s | 1.2–3.0m/s |  |
| Operation & Maintenance | Surface/onshore | Surface/onshore |  |

Deep Green has been undergoing extensive ocean testing in scale model since 2013 at Minesto's test and demonstration facility in Strangford Lough, Northern Ireland, during which operational functionality and power production have been verified and gradually improved. Minesto are engaging in several projects to promote the market uptake of the Deep Green technology.

Contact; <https://minesto.com/our-technology>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Mocean Energy Blue Star Wave Energy Converter (Wave Energy)

Activities At Mocean Energy they have built an expert team combining scientific principles and real-world experience to develop new technologies which can harness the power of waves – and accelerate the transition to a zero-carbon world. Their approach utilises numerical modelling and optimisation, rapid prototyping and tank testing – allied to hard-won ocean experience – to deliver wave energy machines that produce high levels of power for their size and work in some of the world’s harshest environments. Already they have secured more than £4 million in funding support from the Scottish and UK governments and the EU and are progressing prototype plans for our two core technologies – Blue Star and Blue Horizon. Blue Star's compact design utilizes a robust power-take-off to provide reliable, continuous power and communications to a range of UUVs. As the world strives to decarbonise the way we live, travel, and work, there is an urgent need to rapidly increase the generation and use of electricity from renewable power. Today we can successfully capture energy from the sun, wind and even tides, but we have not yet succeeded commercially in harnessing one of the largest green energy sources on earth – our ocean waves. It's estimated that worldwide, there is more than two terawatts of wave power around our shores. If we could harness just one percent of that resource, we could power 50 million homes and save more than 50 million tonnes of CO2 annually.

The Blue Star wave energy converter will provide reliable, affordable renewable energy to power a range of subsea applications – from control systems to ROVs and autonomous underwater vehicles. This small-scale device is the design stage and will provide continuous communications and green power generated by waves and stored in batteries. They are also developing a much larger hinged-raft wave energy converter – known as Blue Horizon – based on the same principles as Blue Star. This machine will deliver grid-scale power and is designed to be deployed in farms off the coast. Blue Horizon design has already undergone rigorous tank testing and computational modelling – and Mocean Energy has secured £3.3 million from Wave Energy Scotland to build and deploy a scaled prototype at the European Marine Energy Centre in Orkney in 2020.

Contact: <https://www.mocean.energy/wave-energy-news/> <https://www.mocean.energy/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### NEMOS (Wave Energy Converter)

Activities: The NEMOS Wave Energy Converter is an innovative system for generating electricity from ocean waves. The incoming energy is absorbed by an elongated floating body and transmitted to a generator by a spring-loaded belt drive. Performing its motion on a curved trajectory relative to an underwater reaction structure, the systems hydro-mechanical efficiency is far above standard technology. The system can be adjusted in size to different environmental conditions so that energy output is maximized and loads are limited. The design aims for a multi-megawatt array when deployed in energy-rich locations. The 2019 Wave Energy Converter (WEC) prototype features an 8 x 2 m floater and a 16 m long substructure. The prototype is intended to be deployed in Ostend first, next to the NEMOS research tower that is installed on site to control and survey the WEC trials. The prototype design marks the latest stage of the NEMOS WEC developments. This evolved standalone floating design does not require a fixed building structure like the initial NEMOS concept and thus can be realized to competitive steel to kilowatt-hour ratio. Comprehensive tank tests are the basis of all NEMOS wave energy development activities. Under controlled conditions, the hydro-mechanical interaction between floater and waves can be investigated in order to improve control algorithms and maximize the harvested energy.

Since 2013: Scaled Tests In Nearshore Environment: The step from tank tests to real environmental conditions is a big one. The NEMOS team challenged its own technology over several years by carrying out scale tests in Denmark`s Limfjord. At 1:10 and 1:5 model scales, the NEMOS system exhibited high efficiency, robustness and automated operation. Since 2016: Full Scale Power Take-Off Tests: To analyse the efficiency of the power conversion path and gain experience in assembling and operating large components, a full scale PTO test bench was installed at the University of Duisburg-Essen. The simulation data verified the theoretical power predictions. From 2019: Large Scale Offshore Installation: Currently the team is focussing on the installation of a large scale prototype in the North Sea. With a floater displacing more than 10m³ water and a fully equipped research station on an independent structure nearby, the system will generate enough energy to supply several households with electricity.

**Wave Energy: Research**

OESA aims to accelerate the development of marine energy technologies through strategic partnerships and international collaboration The Ocean Energy Scale-up Alliance (OESA) is an accelerator project aiming to develop and deploy large scale marine energy pilots. The transnational partnership under the lead of the Dutch Marine Energy Centre combines expertise from 6 European countries from the North Sea Region. The following three goals will accommodate a larger number of technology deployments in the future:

1. To develop a transnational scale-up offer for marine energy technologies, in which the services of large European service providers in offshore and marine energy are combined.

2. To accelerate the development of five technologies, leading to the deployment of 20 MW in large scale pilots.

3. To bring together stakeholders from the offshore industry, investment business and policy makers in a stakeholder platform and show the collaborative potential of marine energy in order to secure their support for future deployments in the ocean energy sector.

Contact; https://www.nemos.org/waveenergy

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### NEREUS (Wave Energy Conversion Single Point Absorber)

Activities:

Nereus™ is a unique combination of wave energy conversion and piezoelectric technologies that consists of a Single Point Absorber (SPA). Autonomous underwater vehicles (AUVs) and unmanned underwater vehicles (UUVs) are devices that perform underwater tasks without a connection to a surface vessel and that carry instruments and sensors that monitor, inspect and survey underwater environments. Although they are a less expensive and safer alternative to traditional means of conducting such tasks, the power capacity of batteries remains a constraint that keeps their missions limited in range and duration, often to as little as a few hours. Docking and recharge stations can extend the range and duration of AUV missions by recharging their batteries at sea, as well as providing a secure platform for docking between missions. Underwater recharging of AUVs would reduce the need to recall vehicles to the surface as frequently; save time and resources; improve human safety on ships at sea; increase mission duration, range, and stealth; and lower carbon emissions.

However, underwater docking stations are not widely used because they lack a practical power generation source. Resolute Marine is developing an innovative wave-driven powering system called Nereus™ that can provide a locally generated, reliable power source for underwater docking and recharge stations. Nereus™ is a novel combination of wave energy conversion and piezoelectric technologies that consists of a Single Point Absorber (SPA) that produces electricity using a piezoelectric generator with a targeted 10 kW power rating to meet the needs of our first customer and project partner, Marauder Robotics. The goal of this project is to design, build and test a compact and self-contained wave energy converter that is easy to deploy and requires minimum maintenance to provide power for AUVs. In Phase I, the project will focus on; a) the design of a proof-of-concept Nereus™ system through modelling and optimization of the wave energy converter for operation in a broad range of sea- states; b) focused design on the piezo-electric power take-off; and c) system modelling to demonstrate the compatibility of the Nereus™ system with Marauder Robotics’ requirements. Globally, the AUV market is estimated at $2.6 billion and is expected to double by 2022. The market for underwater AUV charging stations, which includes the charging stations and associated infrastructure, is not well developed and has an unknown value but is expected to grow at a similar rate as the AUV market. Looking beyond its application for AUVs, Nereus™’s addressable market also includes powering ocean observation and navigation systems where battery life severely limits endurance and increases mission costs. The world market for navigational and survey instruments more than doubled between 2001 and 2011, from $7.5 billion to $16 billion suggesting that this is an attractive market opportunity for Nereus™ systems.

Contact; <https://www.herox.com/oceanobserving/round/562/entry/24456>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Noordzee Wind (First Netherlands Offshore Wind Farms)

Activities: The first Dutch offshore wind farm: The wind farm was built by the construction combination Egmond. This is a joint venture between Ballast Nedam and the Danish wind turbine manufacturer Vestas. Both companies have extensive experience in offshore wind energy. It starts with the wind turning the blades, or rotor blades. These rotor blades are attached to the main shaft. The rotational movement is sped up in a gearbox. The main shaft drives the generator. For the development, exploitation and eventual removal of the Offshore Windpark Egmond aan Zee (OWEZ) diverse licences are necessary. This first Dutch offshore wind farm was an important step for both companies to gain expertise in this form of renewable energy.

Contact; <https://www.noordzeewind.nl/en_nl.html>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Nova Innovations Limited

Activities: Nova is an award-winning global leader in tidal energy. They design, build and operate tidal turbines that generate electricity from the natural ebb and flow of the tide. Their underwater turbines have zero visual impact and work in harmony with the marine environment, with no barriers or barrages. In 2016, they installed the world’s first offshore tidal array – three turbines located in the Shetland Islands, Scotland. Their turbines have been generating clean electricity and exporting to the grid for over three years. In 2018, they worked with Tesla to add energy storage to their tidal technology. This created the world’s first baseload tidal power station with the ability to deliver constant, steady-state power to the grid and deliver energy on demand to meet consumer needs. Nova is currently expanding operations in North America and across Europe.

Awards:

* 2016: won the prestigious Judges Award at the Green Energy Awards
* 2017: won a Shell Springboard award for low-carbon innovation
* 2018: won the European Commission’s European SME of the year
* 2018: won ‘Outstanding Project’ at the Green Energy Awards

They motivate their activities as under:

Tidal energy can provide a new source of clean, abundant and predictable energy to many regions of the world. ELEMENT is one of a constellation of EU projects aimed at accelerating the development of technologies and infrastructure to harness this power. ELEMENT (Effective Lifetime Extension in the Marine Environment for Tidal Energy) is a €5 million project funded by the European Union’s Horizon 2020 research and innovation programme. It will show how artificial intelligence can slash the cost of tidal energy by an estimated 17 percent, bolstering the case for tidal energy as an important part of the world’s future energy mix. From mid-2019 to mid-2022, 11 academic and commercial partners will develop and demonstrate the ELEMENT control system in operation at Scotland’s Shetland Tidal Array. This site, the world’s first offshore tidal array, is home to some of the world’s leading renewable energy research projects led by tidal technology pioneers Nova Innovation.

**TIPA**

A European tidal energy consortium, led by Nova Innovation, has secured funding from the European Commission to demonstrate and validate an innovative subsystem (a direct drive power take-off (PTO) solution) for tidal turbines. The PTO subsystem is the component that transforms the mechanical power in the tidal turbine rotor into electricity that is exported into the grid system. The technology, when commercialised, will reduce the lifetime cost of tidal power by 20% and provide long term system reliability. The project will build the PTO subsystem and conduct accelerated onshore testing in Germany followed by in-sea testing in Scotland with third party validation of the design and the test results. Once complete the project deliverables and product will be used to raise market confidence in the maturing tidal energy industry and to maximise the benefit of the project to the ocean energy sector.

Contact: https://www.novainnovation.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Based Perpetual Energy

Activities: Perpetual Energy and a Clean Alternative to Fossil Fuel. Ocean Based Perpetual Energy, a revolutionary renewable energy developer, is solidifying years of scientific research that proves the viability of harnessing energy from the Florida Gulf Stream current and converting it to clean, renewable power for the nation’s power grid and other end uses. Compared with solar, wind and other alternative energy sources, the powerful Gulf Stream runs perpetually and is capable of producing continuous power. Their work has shown that the Florida Gulf Stream represents the optimal location to commercialize ocean current energy and provide clean, sustainable, renewable power 24 hours per day.

Preferred Partner With SNMREC.

The U.S. Southeast National Marine Renewable Energy Centre (SNMREC) is a U.S. Department of Energy and State of Florida-designated research and development center at Florida Atlantic University (FAU) that is focused on enabling the safe and responsible commercialization of marine renewables in Florida, the nation and around the world. Ocean Based is a renewable energy developer dedicated to bringing baseload-capable, clean, renewable energy to market. They seek to help reduce global carbon emissions by harnessing the power of the Gulf Stream and converting it to perpetual, sustainable clean energy.

**Advantages**

The powerful Gulf Stream flows north at 3 to 5 miles per hour from the Florida Straits to Cape Hatteras. Moving at 8 billion gallons of water per minute, its energy-dense Florida portion alone could yield 4 to 6 gigawatts of clean, renewable energy.

**Their Approach**

From ocean current energy converters suspended 300 ft. deep in the powerful Gulf Stream, harnessed carbon-free power is transmitted to ocean floor substations, then via cables to an onshore substation connected to the electrical grid and industrial consumers.

They motivate their activities as under:

**Why Ocean Current Energy?**

The constant flow of ocean currents creates enormous amounts of kinetic energy across the earth’s oceans. Ocean currents, with relatively constant and directional flow, represent an extraordinary sustainable and renewable energy source. Ocean water is the fuel for ocean current-derived marine energy, with no emissions to adversely affect the environment. Rigorous permitting processes, substantial marine research, and ongoing operational surveillance work together to protect the marine environment. As global energy consumption increases each year, ocean current patterns around the world provide substantial opportunity to meet increasing energy demands. Because water density is more than 800 times that of air, the potential to channel it through ocean current energy converters represents an efficient method of marine energy production.

* Sustainable Energy Source
* Environmentally Conscious
* Scalable and Efficient

Contact: https://oceanbased.energy/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Energy (Wave Energy)

Activities: Ocean Energy is a wave energy technology development company. The OE Buoy is a floating oscillating water column type device with a self-rectifying air turbine generator power take-off. This device has been developed through the TRL levels and is currently at TRL6. The device was deployed at quarter scale in the Ireland Galway Bay Test Site for three years. The current situation is that a 500kW prototype is being constructed for deployment at the US Nave Wave Energy Test Site at Oahu Island, Hawaii. This will be operated for one year from mid 2018. A follow on one year deployment, after re-powering to 1MW, will be conducted at the European Marine Energy Test Site (EMEC) from late 2019

Contact: <https://www.irishtimes.com/business/innovation/for-wave-and-tidal-potential-geography-is-definitely-on-our-side-1.3194589> ?? website

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Grazer (Ocean Renewable Energy Battery and Other Solutions)

Activities: Ocean Energy for a Sustainable Future: At Ocean Grazer, they strongly believe that going offshore is crucial to achieving the goal of renewable, clean energy, available nonstop and at any time. Their innovative solutions enable them to harvest the full power of the oceans. The Ocean Battery is a scalable, modular solution for large scale storage of electricity that is produced by renewable sources such as wind turbines and floating solar farms at sea. It is a pumped hydro system in a box that provides utility-scale energy storage of 2 – 10 MWh per unit. The mechanism is based on the technology of a hydro dam, a technology that has proven itself for over a century as highly reliable and efficient. To store potential energy, the system pumps fresh water into flexible bladders that are deflated by the pressure of the water above their battery. The Ocean Battery is suitable for both newly build and existing wind and floating solar farms. Discover the unique advantages of the Ocean Battery

**Plug & Play Energy Storage at the Source**

Their Ocean battery provides storage at the source. This way, they can reduce local peak loads in the network and optimally match supply and demand.

**Reliable & Affordable**

By applying a proven hydro dam technology, they can guarantee a long lifetime of decades and a high round-trip efficiency. Therefore, their technology is reliable and affordable.

**Eco Friendly**

Their battery is highly sustainable, and the storage medium is based on fresh water with biological additives. The construction is designed to act as an artificial coral reef to support flora and fauna.

Energy when we need it and where we need it: Producing renewable energy is crucial to achieve a climate-neutral economy. The energy transition requires a significant change in the energy system. More and more solar and wind turbine parks are being realized onshore and offshore to contribute to a sustainable society. In the coming 10 years, the offshore wind turbine parks will grow from 20 GW to a capacity of 180 GW, a massive growth! To grow to a system where renewable energy is the norm, the biggest hurdle must be solved: energy storage. ‘At Ocean Grazer, we tap into this huge potential of renewable energy.’

Contact: https://oceangrazer.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Motion Energy (AI Controlled Wave Energy Converter)

Activities: Ocean Motion is fabricating the world’s first adaptive ocean wave energy converter controlled by an advanced artificial intelligence system. APA adapts to ambient sea states for power optimization. That means not only scaling up, but also scaling down. We're pioneering an extensible technology that works at all levels of generation and storage -- from scientific instruments to grid-scale applications. It starts with getting the basics right. We started at the drawing board, figuring out how we could create a product and strategy that allows for iteration, experimentation and optimization that scales with our customers' needs. Ocean Motion is fabricating the world’s first adaptive ocean wave energy converter controlled by an advanced artificial intelligence system. APA adapts to ambient sea states for power optimization. Ocean Motion recently announced their AI Initiative to support open source innovation in machine learning in robotics, reinforcement learning, distributed training and sequence modelling. Projects support cross-industry, multi-disciplinary research that have applications in Blue Tech.

● A plug-n-play independent power unit that can be installed on most oceanographic buoys

● Specifically designed for ocean observing needs

● Unique design significantly lowers maintenance costs

Contact: https://www.oceanmotion.tech/tech.html

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Orbital Marine Power

Activities: Orbital's unique floating platform is moored via anchors in powerful tidal stream or river currents. Underwater rotors capture the dense flowing energy. With a global capacity estimate of 100 gigawatts, tidal energy harvesting has the potential to power 80 million homes. Full deployment of this resource would generate investment in equipment and services of over £300bn. Scaled down to capture power from river flow, their platform, can support off-grid demands from communities, households and electric vehicle charge points. They are passionate about their technology, and about evolving it, so that they can reach more people, communities and business with lower cost clean energy. ‘That's our goal and our vision’.

**The O2:** they claim this isThe most powerful, technologically advanced tidal turbine in the world.

**The SR2000:** The SR2000 was an industry break through and produced unrivalled performance whilst validating both the whilst validating both the engineering and conceptual benefits of Orbital’s technology.

[Contact; https://orbitalmarine.com/](file:///C:\Users\Julie\Documents\jack\Contact;%09https:\orbitalmarine.com\)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Power Technologies

Activities: Ocean Power Technologies (Nasdaq: OPTT) is a pioneer in renewable wave-energy technology that converts ocean wave energy into electricity. Information from the oceans can help us understand climate change and natural disasters while also providing sources for food and energy. Persistent, reliable and cost effective instrumentation, communication, and power sources are necessary to support the maritime activities to obtain such information. Present solutions and technologies suffer from the need for costly and repetitive maintenance as well as the rather limited electric power output they provide. The PowerBuoy® system integrates patented technologies in hydrodynamics, electronics, energy conversion, and computer control systems to extract the natural energy in ocean waves. The result is a leading edge, ocean-tested, proprietary autonomous system that turns wave power into reliable, clean, and environmentally beneficial electricity for offshore applications. Wave power is abundant in all areas of the world and its harnessing offers a dependable clean source of renewable and cost effective energy. OPT’s PowerBuoy® converts such energy to provide persistent and reliable power generation for marine applications. Current solutions for applications that require persistent, long-term operation and/or require significant power, such as batteries, solar, micro-wind and diesel, are limited and costly. The PowerBuoy® with its expandable, onboard battery system (Energy Storage System) can act as an offshore Uninterruptible Power Supply (UPS).

The PowerBuoy® will deliver:

Reduced operational costs by eliminating frequent maintenance visits to service traditional energy sources. Real time data with enhanced density enabled by the availability of increased electrical power: Allows more effective operational decisions for improved assets utilization. Greater availability of reliable power: Enables the introduction of new technical solutions and enhanced capability. Proactive control and fault analysis of equipment through real time remote desktop user control and monitoring. OPT’s PowerBuoy® technology is designed to serve the offshore power requirements of the following markets:

* Defence & Security
* Oil & Gas
* Science & Research
* Communications

Contact: https://oceanpowertechnologies.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Renewable Power Company (Tidal Energy)

Activities: Ocean Renewable Power Company generates electricity from tidal energy. It installs turbine generator units in groups to form complete power systems that convert river and ocean energy into grid-compatible power. The company offers a RivGen power system, which generates electricity at small river sites particularly in remote communities with no centralized power grid; TidGen Power System for shallow tidal current applications; and OCGen power system for deeper tidal and ocean current applications.

It was founded in 2004 and is based in Portland, Maine.

Contact: <https://tethys.pnnl.gov/organization/ocean-renewable-power-company-orpc>;

Email [info@oceanrenewablepower.com](mailto:info@oceanrenewablepower.com); Phone Number (207)772-7707

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### ORSTED Offshore Wind

Activities: Green solutions:

Leading the change to green energy, their areas of business are within Offshore wind, Bioenergy Markets, Onshore wind as well as Solar and Storage.

Offshore wind: ‘They pioneered the world's first offshore wind farm in 1991. Today, we´ve established ourselves as the unrivalled leader within global offshore wind power production.’

Bioenergy:

Their Bioenergy capabilities ensure reliable, clean and sustainable electricity and heat production solutions.

Markets:

Using intelligent and energy-efficient methods, they handle the purchase, sale and distribution of energy.

Onshore wind:

Wind is an unlimited resource – and it has the potential to meet all our energy needs. Their flexible, cost-competitive onshore wind solutions help strengthen economies and pave the way to a greener future.

Solar and storage

The demand for solar power is growing fast. At Ørsted, they are utilising solar power to harness nature's resources and deliver clean, renewable power to homes across the world.

**Turning waste into energy**

Renescience turns unsorted municipal waste into biogas, while allowing plastics, glass and metals to be recycled

The Ørsted vision is a world that runs entirely on green energy. Ørsted develops, constructs and operates offshore and onshore wind farms, solar farms, energy storage facilities, and bioenergy plants, and provides energy products to its customers. Ørsted ranks #1 in Corporate Knights' 2020 index of the Global 100 most sustainable corporations in the world and is recognised on the CDP Climate Change A List as a global leader on climate action. Headquartered in Denmark, Ørsted employs 6,120 people. Ørsted's shares are listed on Nasdaq Copenhagen (Orsted). In 2019, the group's revenue was DKK 67.8 billion (EUR 9.1 billion)

Contact: Ørsted A/S, Kraftværksvej 53, Skærbæk, 7000 Fredericia Denmark, +45 99 55 11 11 info@orsted.com

### Ocean Thermal Energy Corporation

Activities: Ocean thermal energy corporation is a company introducing commercially viable renewable energy and potable water solutions. Ocean Thermal Energy Corporation (OTE) traces its roots to 1998 when their predecessor company began researching and developing the technologies known as Ocean Thermal Energy Conversion (OTEC) and Seawater/Lake Water Air Conditioning (SWAC). They are in the advanced planning stages for the world’s first commercial-scale OTEC plant. The Company also develops SWAC/LWAC systems. OTEC produces electricity 24/7/365 without the use of fossil fuels. An OTEC plant can be configured to produce large amounts of water for drinking, food production and economic development. OTEC technology has been established and proven at a research and development plant. Their management team has established a noteworthy pipeline of projects with several signed memoranda of understanding (MoU). They have completed and submitted renewable energy feasibility studies, designs and proposals for the Legislature of the U.S. Virgin Islands, the United States Department of Agriculture (USDA), and the United States Department of Defence (USDoD).

Their main project is designing and developing the OTEC EcoVillage, an entire community powered only by the fossil-fuel free energy produced by an OTEC plant. Fresh water for the community is also produced by OTEC. Once built, the OTEC EcoVillage will boast the world’s very first commercial grade OTEC plant. The OTEC EcoVillage project will consist of 2, 3 and 4 bedroomed homes, an EcoHotel, Village Center with stores, shops, restaurants and a pharmacy and a medical center. An adjoining employment-generating ‘Green Innovation Park’ with space for multiple businesses will make use of the OTEC desalinated water resulting in economic development, food production, aquaculture and other ideas. OTE's comprehensive plans for the future include building a global network of high-quality eco-resorts along the lines of the US Virgin Islands project. They are headquartered in Lancaster, Pennsylvania USA with an office in the US Virgin Islands

Contact; <https://otecorporation.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Penguin (Company Wello-Oy)

Activities: Wello Oy is an innovative wave energy technology developer. The skills of the international team of employees and their passion has been brought to life to the Penguin Wave Energy Converter. The Penguin is the result of the committed work, innovation and engineering skills of every member of Wello. With the Penguin, Wello presents a novel concept with a unique working principle for the conversion of energy from waves. Wello has been working for over a decade to bring one of the most efficient, environmentally neutral and cost-efficient wave energy converters on the market. Designed in the heart of Finland, Wello's Penguin wave energy converter is the result of years of development and testing providing the world most powerful direct drive wave energy converter.

The world’s climate is changing and with it there is a growing need to transition from traditional energy production to cleaner, more sustainable production methods. Renewable energy has already been slowly shaping the way forward, wind, solar, hydroelectric and now with the Penguin, wave energy, will allow all us to make a cleaner world and secure our future. Inspired by the natural movement of waves, the shape and power take of principle of The Penguin is rotation. It's simple design and operating principle means it is low maintenance while still producing huge amounts of energy. The unique asymmetrical shape of the device is designed to capture the energy in the waves from all sides of the device. As waves crash into its hull, The Penguin rotates in place, gyrating around a central point transferring and capturing the energy from the waves crashing into it. The Penguin is made to survive anything the ocean can throw at it, whilst having zero emissions and being as environmentally neutral as possible the Penguin is designed for sustainability.

**Environmentally friendly. Efficient. Affordable.**

The Penguin is towed to the site, it doesn't impact the landscape and the technology advances gets both increasingly efficient and affordable.

**Ready for deployment**

The Penguin can be manufactured in any shipyard and is built for an easy installation.

**Direct conversion to the grid**

The direct drive generator captures energy from the waves, sending it to the grid.

Contact; <https://wello.eu/the-penguin-2/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Planetary Hydrogen (Produce Hydrogen via water Electrolysis)

Activities: The patented Planetary Hydrogen Ocean Air Capture (OAC) technology uses renewable electricity to produce hydrogen via conventional electrolysis of water. They call their process SeaOH2. Their innovation is that by adding a mineral salt, they force the electrolysis cell to also create an atmosphere-scrubbing compound called mineral hydroxide as a waste product. That hydroxide actively binds with carbon dioxide, producing an “ocean antacid” very similar to baking soda. The net effect is the direct air capture and storage of CO2 while producing valuable pure hydrogen. The system can consume as much as 40kg of CO2 and permanently stores it for every 1kg of hydrogen it produces. This system accelerates “The Earth’s Natural Thermostat” which is the geological process that removes excess CO2 from the atmosphere via rock weathering that is otherwise very slow and inefficient. Excess CO2 in the atmosphere acidifies rainwater that on contact with alkaline minerals (exposed on much of the Earth’s land surface), dissolves the rock and consumes CO2, forming dissolved mineral bicarbonate which is washed into the ocean. This process is the reason that some 90% of the Earth’s surface carbon is in this form as seawater bicarbonate. While effective as a moderator of excess atmospheric CO2, it can take 100,000 yrs for the preceding process to naturally return atmospheric CO2 to “normal” levels.

Contact; <https://www.planetaryhydrogen.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Principle Power (Offshore Wind)

Activities: Principle Power is an Innovative Technology and Services Provider to the Offshore Wind Industry. Principle Power is building new partnerships and engaging in site development around the globe to harness the energy and potential of offshore wind. In addition, electricity demands are rising steadily while the challenges of fossil-fuel pollution and energy security continue. Offshore wind resource development promises to contribute vast amounts of clean renewable energy to coastal communities around the world. Offshore winds can produce more energy as they are not encumbered by topographical features such as buildings or hillsides and afford a more consistent wind profile. Although recovering energy from offshore wind is slightly more expensive, the resource provides up to 50% more energy than nearby onshore winds. Principle Power is developing and designing projects, together with customers and partners around the world, and enabling offshore wind to reach its full global potential

**3D Windfloat:** WindFloat is a floating support structure for offshore wind turbines with a simple, economic and patented design.

* Number of windfloats installed 5
* Number of windfloats under design contract 8
* Global windfloat power production 22 gwh
* Global windfloat operational hours 33,984 hrs

Contact: https://www.principlepowerinc.com/en/windfloat/key-markets-projects

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### QED (Sub Hub or Submersible Tidal Energy Platform Solutions or Interreg Tiger)

Activities: QED has established itself as a technology developer and project manager of turnkey tidal energy projects. They have developed an innovative, disruptive, self-deploying, submersible, tidal platform which delivers significant financial benefits:

• Turbine energy yield improvements averaging 48%

• Operation and Maintenance cost savings >60% Key project components are in place i.e. the site has 30MW currently consented, permissions, marine licenses and an established site with planning. Whilst the site is technology and developer agnostic, they have access to one of the world’s most established and robust turbines (Tocardo, in high flow Oosterschelde barrier for 6 years) and the tested and proven Subhub foundation system (in water for 1.5 years). They also use low risk, static, stable, seabed export cables. There is a multi-disciplined team on board (including QED - naval architecture, platform systems design; Tocardo - 50% owned, turbine developer; tbc - marine operations; PTEC - project developers; Isle of Wight Council; tbc – Hydrogen).

They motivate their activities as under:

The renewables energy market is at a turning point. The Government has completed its marine AR4 funding consultation and the industry expects its funding announcements by the start of 2021. The company has secured projects and pipeline to maximise its position and aims to start generating 20-year annual energy revenues by 2023. In preparation for maximizing its project pipeline, it acquired a well-proven, renowned turbine company to position it as an end to end solutions and technology provider. This has brought an EU base, additional pipeline (including dams and infrastructure projects globally) as well as a strategic partner. QED has developed a disruptive, self-deploying tidal energy solution that simply slashes operations costs and adds great yields through its design and proven turbines. Its strong team has: landed EU Interreg funding and a place on the showcase TIGER project; acquired Tocardo turbines as well as the world’s largest turbine array, the Netherlands OTP dam. It is about to go through Seedrs for crowdfunding, seeking £500k at a valuation of £12.5m. ‘This is a unique opportunity for us to supercharge our growth, by bringing investors on board as shareholders. This fundraising round will allow us to get going on all the incredible initiatives we have planned for the future.’

Contact: https://qednaval.co.uk/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Renewable Ocean Energy Inc

Activities: Renewable Ocean Energy Inc is devoted to providing safe, low coat hydroelectric energy through our patented Sea Electrical Energy Production system. This device uses the proven technology of a Francis reaction turbine driven by sea water and is suitable for any shoreline -both fresh and saltwater. They invented Poseidon Hydroelectric System which is the most cost-effective way to produce firm reliable electricity 24/7. Every operational hour of their 100-megawatt Poseidon system claims to reduce 50 tons of carbon emissions at less than 20% of the cost of solar. They don't use waves, tides, or ocean temperature inversion. They don't need a dam so we don't have the environmental and harmful risk factors of traditional hydro but we can produce electricity 24 hours a day, 7 days a week.

Contact: <https://gust.com/companies/renewable-ocean-energy-inc>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Seabased (Wave Energy Power)

Activities: Every location has a unique mix of resources that are stable over time. Technologies to capture the energy from these renewable resources will evolve but knowing your Hybrid Optimal Mix of Energy — HOME is a strategy with a long view. A stable grid needs a reliable power source: ocean waves. Seabased’s turnkey wave energy parks deliver the immense power of ocean waves directly to the grid, 24 hours a day, all year. Designed to scale, they can work alone or serve as a companion to renewables like offshore wind for a stable grid with no CO2 emissions.

TAPPING THE OCEANS’ POWER

Seabased has committed itself to solving the challenges standing between wave power’s tremendous potential and cost-effective implementation. Their scientists and engineers have amassed more than 313 patents and 20 PhD theses; developing and ocean testing full-scale generators in four countries, including two multi-generator grid-connected demonstration wave power parks. Extracting utility-scale renewable energy from ocean waves is a key to Earth’s future. Commercial wave power park projects are under development in Ghana, Sri Lanka, the Canary Islands and the Caribbean.

PROTECTING OCEAN ECOSYSTEMS

Seabased wave power parks were designed to be virtually invisible and require little maintenance. The materials used, and the mechanics of the parks protect the water and the creatures that live in it. In fact, the parks can be designed to attract desired species and provide both habitat and breeding ground to replenish waning species.

Contact; <https://seabased.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Turns (Wave Energy Converter)

Activities: After a phase of technical and economic feasibility studies, SEATURNS has developed and patented a breakthrough wave energy converter. Using an innovative anchoring system, a cylindrical float is rotated under the action of swell. Through the principle of the inner water pendulum, similar to an oscillating water column, an alternative airflow is generated between internal volumes. This flow rotates a turbine coupled with 1) A pump supplying a reverse osmosis unit for seawater desalination. 2) A generator for electricity production. This simple and robust system is designed to withstand hostile conditions and reduce maintenance costs. Its rated power is between 100 and 200 kW. The medium and long term market will be a large distribution market, i.e. the supply of electricity and fresh water to distribution networks. As a first step, SEATURNS will address a niche market from 2022, during the competitiveness progression phase. The system will be proposed in islands and isolated coastal areas to provide fresh water and electricity to coastal economic players (industry, tourism, agriculture) and local authorities of regions with high water demand and low resources.

They motivate their activities as under:

Beyond the lower environmental impact, the main competitive advantage of SEATURNS solution will be the low levelized cost of freshwater or electricity production. This comes from a breakthrough approach that reconciles technical and economic constraints throughout the design phase. On a technical level, the concept is distinguished by:

1) Its simplicity and robustness (compact form, very few moving parts) to withstand hostile conditions and reduce maintenance costs.

2) Its performance (direct mechanical energy transmission to the pump in freshwater production configuration).

3) Reduced dimensions (less than 10 m in length and diameter) &amp; simple architecture, the float is easy to manufacture. One major innovative aspect of SEATURNS concept is its large working spectrum. In particular, performance for the longest swells do not tend to zero and remain at a sufficient level. In this, the SEATURNS concept stands out from most other concepts operating in pitch. This specific behaviour can be attributed to the original anchoring of the concept which enables it to convert the surge forces to pitching motion. This innovation should make it possible to maintain relatively small machines (diameter: 6 m – length: 9 m) that will not have to be enlarged to be effective at the usual periods of wave energy. Another innovative aspect will be the possibility to harness wave energy for diversified applications (electricity production, but also freshwater production, cooling…) with a direct coupling between the turbine and the generator or other mechanical subsystems (pump for example).

The SEATURNS project has been awarded by several European calls: BlueInvest Readiness Assistance, MaRINET2, Marine Energy Alliance and PORTOS Project. In France it received the financial support of Nouvelle-Aquitaine region, Agence de Développement et d’Innovation Nouvelle-Aquitaine and Bpifrance. The project has also been distinguished by the Trophées de l’innovation ocean (https://trophees-innovation-ocean.com/) and the Trophée de l’avenir Europe 1.

Sustainable impact on blue economy: The main objective of SEATURNS is to meet the need for access to water and energy with a solution compatible with the climatic and environmental issues. The developed solution is meant to supply coastal activity regions such as cities, but also remote islands and archipelagos, isolated coastal areas or offshore platforms. The long-term objective is to contribute to the resolution of several issues: 1) Develop a low-carbon, robust and competitive energy or freshwater production solution from a considerable near-shore resource, close to densely populated areas; 2) Integrate renewable energy, and particularly wave energy, into the energy mix to meet the growing demand while diversifying the production methods.

Contact: http://seaturns.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Seawind Ocean Technology

Activities: Seawind Ocean Technology B.V. is a Netherlands based technology development company and OEM, developing two-bladed floating wind turbines suitable for installation in deep waters with extreme wind conditions. Seawind is dedicated to decarbonisation by redefining the global renewable energy industry. Based on original research and development work by NASA and Hamilton Standard (today UTC), their Seawind 6 and Seawind 12 floating wind turbines and integrated foundations have been patented, proven and achieved first-phase certification. ‘Compared to the current market, our solutions are exceptional.’

* Innovative design
* Lowest green energy cost
* Straightforward deployment
* Unlocking green hydrogen
* Safe maintenance
* Environmental responsibility

Contact: <https://seawindtechnology.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### SIMEC Atlantis Energy

Activities: SIMEC Atlantis Energy (“Atlantis”) is a global sustainable energy company, aiming to become the leading independent sustainable power generator in the UK. They are a global developer of renewable and sustainable energy projects with more than 1,000 megawatts of power projects in various stages of development, including the world’s largest flagship free-stream tidal power project, MeyGen. In addition to project development, the Atlantis Turbine and Engineering Services division designs, supplies and maintains world leading tidal turbines and subsea connection equipment. The Company is based in Edinburgh with offices in Bristol, Newport, London and Nigg Energy Park in Scotland. The company is listed on the AIM market of the London Stock Exchange (ticker SAE:LN) and currently employs over 100 experienced staff.

* 2014 – Atlantis listed on AIM
* ~100 – Employees working full time across the UK
* 250MW – Operational capacity targeted by 2021
* 1000MW – Projects in various stages of development
* 350m – Investment pipeline

As a leading developer of sustainable energy projects worldwide, SIMEC Atlantis Energy is involved in the design, construction, installation, testing, operation and maintenance of power projects across the globe. Their aim is to create value through greenfield development activities, coupled with sustainable, long-term revenue streams for their shareholders, whilst ensuring that all activities are underpinned by best practice in safety, operational excellence and expertise in our chosen markets. Their heritage is in tidal power generation, where they established a reputation in tidal system design, project development, construction management, financing and operation. They are passionate about tidal power and will continue to be at the forefront of project development and ownership as tidal races down the LCOE curve and becomes cheaper with every installed megawatt of capacity in operation. Given their long experience in the sector, governments and local partners are reassured by their resources, international experience and commitment to local communities. Their proven technology and successful project management skills, as demonstrated by their flagship project MeyGen, gives industry partners reassurance of their presence at each step of a project, from consent, to construction, to operation.

**Waste-to-Energy**

In 2017, they acquired the Uskmouth Power Plant following a reverse takeover of SIMEC Uskmouth Power limited, part of the GFG Alliance. The former coal powered station will be converted to use a waste-derived energy pellet as fuel and will deliver up to 220MW of baseload power to the grid. In November 2018, Heads of Terms was signed with Equitix, a leading UK infrastructure fund manager, for the sale of a 25 per cent stake in the project. The agreement implies a valuation of their stake in the project at £130million.The successful conversion of Uskmouth will provide the blueprint for other conversion projects across the world. They believe that it is a viable low-carbon energy solution for coal powered stations destined to be decommissioned. It will ensure these sites will continue to provide a valuable service, compliant with up-to-date emissions regulations and with materially lower levels of CO2 emissions. Local jobs will be secured and communities with a previous historic reliance on coal will be transformed to support a new sustainable future.

The acquisition is intended to be the first of many acquisitions involving the GFG Alliance. Through a relationship agreement, Atlantis is being provided with investment rights, by way of a right of first offer, to a pipeline of renewable power assets owned or subsequently acquired by the GFG Alliance. These currently comprise a number of operating and development assets in the UK and Australia with a total gross capacity of 680MW. In addition, where technically possible and economically feasible, they intend to sell our power internally to GFG Alliance owned facilities. Where this is not possible, they will sell the power into the grid via standard power purchase agreements or bespoke corporate power purchase agreements. Their Turbine and Engineering Services division designs, supplies and maintains world-leading tidal turbines and subsea connection equipment. In all cases, we look to work with their clients to support them at each stage of the project, both onshore and offshore with the provision of offshore and onshore construction and project management services.

Contact; <https://simecatlantis.com/about/atlantis/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Simply Blue Energy

Activities: At Simply Blue, their vision is to be the leading early stage developer of sustainable and transformative marine projects, by working with the oceans and enabling communities to benefit from blue growth. Their projects cover floating wind energy, wave energy and aquaculture.

Their mission is to raise awareness of the oceans’ potential, pioneer marine project development and collaborate with partners to build a sustainable blue economy and communities.

**What We Do**

* Pioneer marine development projects
* Advocate for offshore wind power, wave power and sustainable aquaculture
* Engage with coastal communities and support stepping-stone developments
* Collaborate with like-minded partners
* Work with people who value stakeholders, the community and the environment

**Offshore Floating Wind Business Model**

They believe that floating offshore wind (FOW) is a game changer for renewable power. Their goal is to develop floating wind projects that will make a valuable contribution to Europe’s electricity demand. Offshore floating wind: Opens access to new sites in deeper waters – 80% of Europe’s offshore wind resource is located in waters of 60m or deeper

* Accesses higher average wind speeds and allows for optimal spacing
* Increases yield and capacity factors leading to competitive Levelized Costs of Energy (LCoE)
* Minimises or eliminates the visual impact from the coastline as locations are further out to sea.

Contact: <https://simplyblueenergy.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sinn Power (Wave Power)

Activities: In-house expertise: From maritime engineering to innovative power-generating systems. SINN Power offers energy solutions to provide people living near coasts all over the world with access to clean electricity to enable sustainable development and contribute to our planet at the same time. In 2014, Dr. Philipp Sinn founded the company SINN Power based on intense years of academic research. The main goal was, and still is today, to turn the unlimited power of ocean waves into clean and cost-efficient energy that is accessible for everyone. Today, five years after SINN Power was founded, they operate fully functional prototypes at a research location in Heraklion and are on the verge of commercializing our technology Their products and services include in-house expertise from maritime engineering to innovative power-generating systems. Wave energy converters for structure mounted applications such as harbours and off-shore platforms. They offer Wave energy converter arrays for large near-shore and off-shore power supply

**Wave Energy Solutions**

* Wave energy converters for structure mounted applications such as harbours and off-shore platforms​
* ​Wave energy converter arrays for large near-shore and off-shore power supply​
* Peak shaving 4/4
* Grid and Mobility Solutions
* Small wind turbine concepts
* Hybrid renewable solutions
* Peak shaving Mobility solutions: charging stations and drive systems

**Ocean Hybrid Platform**

Active balancing and static floating platforms for applications such as:

* Floating wind farms​,
* Floating PV plants,
* Research purposes and
* As venue for leisure activities

Contact; https://www.sinnpower.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Solar Duck (Clean Offshore Solar Energy Solutions)

Solar-Duck powers the world with clean offshore solar energy. The aim is to tap into an abundant source of energy without threatening the climate. Solar-Duck has been founded in 2018 by a group of senior Dutch entrepreneurs. With a strong background in maritime and solar industry they are developing scalable, seaworthy solutions to safely mass produce electricity offshore. Offering independent electric power to megacities without any carbon emissions. It focuses on developing scalable solar energy solutions, for offshore energy and scarce land.

Contact: <https://solarduck.tech/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Solar Marine Energy (Floating Solar Power Energy Solutions)

Activities: Solar Marine Energy Ltd provides multi-disciplined technical expertise for marine, electrical and structural engineering projects. They develop hybrid marine renewable energy solutions. Their projects include design of nearshore floating solar energy plant to power water electrolysis for the production of hydrogen; Developing power optimization and integration between offshore wind and floating solar energy plants; Designing floating solar energy platforms for deployment in the nearshore and offshore environments; Providing marine design and installation technical expertise.

They motivate their activites as under:

They are developing unique marine energy solutions based on their 50 year plus practical and design experience working in the marine energy sector. Their innovative marine energy plant solutions combine both existing and new energy production technologies to create power generation and energy storage plants that are suitable for both grid connection and non-grid connection, eg. island communities. Uniquely they combine floating PV with offshore wind energy to create green hydrogen in the marine environment. Detailed engineering has been completed; they are now we are now looking for funding to move to TRLs 6 and 7 in the next year.

Sustainable impact on blue economy: Their projects deliver realistic and sustainable hybrid energy plant solutions for the marine environment. Through integrating and optimizing the power generated by existing offshore and onshore renewable energy plants with floating solar and hydrogen production solutions they create synergies to boost production and in doing so they increase the power density for marine projects.

Contact: http://solarmarinenergy.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Tidal Lagoon Power (Tidal Energy)

Activities: Tidal Lagoons offer the UK an opportunity to embrace a new infrastructure class at the outset of its development to regenerate South Wales’ and the UK’s historic industrial heartlands through the building of a UK centric manufacturing legacy focused on a programme of UK Lagoons with export potential. Lagoons are also unique infrastructure assets which, due to their extensive maritime footprint, can be so much more than an ‘environmentally friendly’ electricity generation plant. A tidal lagoon is a multi-functional infrastructure asset, capable of delivering and enabling a range of significant regional and local economic, social and environmental benefits. As illustrated by the Tidal Lagoon Swansea Bay project, tidal lagoons are a good example of infrastructure assets that can meet energy sector demands whilst simultaneously adding value through significant contribution to other infrastructure sectors such as flood defence and transport, as well as potentially contributing to the maritime economy, regeneration of coastal communities, and providing tourism and recreation facilities. With the right vision, Lagoons provide the opportunity to plan positively for the future and build a lasting legacy that will help attract tourism, underpin new and existing local businesses, provide regeneration and gentrification opportunities and directly benefit the local community. With the right partnerships and funding, that is what Tidal Lagoon Power (TLP) aim to deliver.

**International ambitions**:

Academic studies have identified over 300GW of potential tidal range capacity globally. Following on from their proposed pathfinder project in the UK, their international teams have looked closely at the opportunities in many countries and their development teams are actively assessing the sites for deployment in Canada, France, India and Mexico. The UK has one of the best tidal range resources in the world. The Tidal Lagoon Power team has spent a long time looking at potential commercially viable sites of which six have been taken forward into their development programme to date. After their project at Swansea Bay, their proposals for five full-scale lagoons begin with Cardiff – currently the most advanced of the full-scale projects and for which they are working towards a planning application in 2018/2019. At their other proposed sites, teams have engaged with stakeholders on the early phases of development work, iterating conceptual designs that have been created to test the feasibility of lagoons to deliver optimum power output and minimise environmental impacts. They understand that lagoons are located in dynamic and sensitive environments and more detailed work will be required before the programme can be developed in full. Their work to date has ensured that their plans for a future fleet of lagoons are informed by real world data, active input from key stakeholders and local views from the outset. They remain confident that each lagoon could be a significant addition to the UK’s energy infrastructure. Visit each lagoon’s project page to find out more.

Contact: http://www.tidallagoonpower.com/projects/international/; email [info@tidallagoonpower.com](mailto:info@tidallagoonpower.com)

### US Wind Inc.

Activities: US Wind was founded in 2011 and is fully owned by Renexia S.p.A., a leader in renewable energy development in Italy and a subsidiary of Toto Holding Group. Toto Holding Group has more than 40 years of experience specializing in large infrastructure construction projects, rail transportation and aviation. In 2014, US Wind bid on and was awarded two leases offshore of Ocean City, Maryland by the Bureau of Ocean Energy Management (BOEM). Combined, the leases cover more than 85,000 acres and provide enough renewable wind energy to generate more than 1300MW of offshore wind electricity, powering more than 500,000 Maryland homes. The Maryland project involves a total investment of $2.5 billion and is part of the comprehensive Climate Action Plan to create American jobs, develop domestic clean energy resources and cut carbon pollution. US Winds has responded to a Call for Information and Nominations to acquire commercial wind leases in four areas offshore South Carolina. US Wind holds the lease for a significant off-shore wind project 17 miles from the coast from Ocean City. With an investment of approximately $1.5 billion, the Maryland project is among the largest offshore wind farm projects in the United States. The project will leverage US Wind’s extensive international experience to create a local sustainable footprint in Maryland’s economic base. Plans call for installing 32 turbines in 20-30 meters of water, 17 miles offshore. A substation will collect the energy from the turbines and transmit the electricity to the shore using underwater cables.

The Maryland project is expected to produce approximately 270 MW of power, which will help meet Maryland’s off-shore wind renewable energy goals. This is enough power for more than +/- 76,000 Maryland homes. The project is anticipated to come online in early 2023, with an operational life expectancy of more than 25 years. Over its lifetime the project will support hundreds of highly skilled jobs in engineering, construction and operation. For more information about the Maryland off shore wind project, see [www.boem.gov/Maryland](http://www.boem.gov/Maryland). Exact photographic rendering of the eventual view of US Wind’s planned offshore wind farm project including 32 wind turbines—the “MarWin” project—roughly 17 to 20 miles from the coast of Ocean City. US Wind Inc. has secured the Federal leasing rights to establish an offshore wind farm 17 miles from the shoreline of Ocean City, Maryland. The project will produce approximately 270 MW of energy. Construction will begin in 2019 and the wind farm will be operational in 2023. It will contribute to economic development, jobs, and environmental sustainability.

Contact; http://www.uswindinc.com/about-us/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Verdant Power (Tidal Energy Power)

Activities: Founded in 2000, Verdant Power’s mission is to help build sustainable communities through a holistic approach focused on clean energy generation, as well as advancing partnerships and hybrid platforms to make significant impacts at the water-energy nexus. They develop technologies and projects that generate village and utility scale energy from the free-flowing currents of tides, rivers and canals referred to as marine and hydrokinetic (MHK) energy. Marine energy systems are next generation clean energy technologies that can provide electricity in a predictable manner for populations near water currents. Through its Roosevelt Island Tidal Energy (RITE) project in the East River of new York City, and other initiatives world-wide, Verdant has developed industry leading capabilities in the areas of marine energy systems, design and operations, water resource assessment and site feasibility analysis, and environmental monitoring and project licensing. Verdant has been a trailblazer in marine energy since the company’s inception. As part of the industry’s first active participants, Verdant has evaluated and conducted in-water testing of various marine energy systems over the past 2 decades, gaining a level of hands-on experience and depth of knowledge which it claims are unmatched today. The experience has lead the company to advance its free flow system to the current 5th generation commercial class. In 2005 Verdant Power sought permission from the Federal Energy Regulatory Commission (FERC) to test a 6 turbine free-flow system array at the RITE project site in the East Channel of the East River. In a precedent setting- declaratory order, referred to as the ‘Verdant Order’, FERC ruled that this activity could proceed in order to demonstrate the technology and gather data necessary to apply for a commercial license. Under this ruling, Verdant operated the world’s first array of tidal turbines, which generated and delivered electricity from the currents of the East River to 2 commercial end users. Based on operational and environmental data gathered during the demonstration at RITE, Verdant Power and applied for, in 2012, and received the first commercial license for a tidal power project in the United States. .

Contact: <https://www.verdantpower.com/press>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Wav EC

WavEC offers marine renewable energy specialising in waves, offshore aquaculture and ocean engineering solutions. They promote the development of marine renewable energy supported by R&D, innovation and transfer of knowledge. Based on our expert knowledge of complex systems and power take off mechanisms, we help clients to design efficient and robust devices. We work across many sectors and we support our clients through all stages of device and technology development.

• Site screening

• Support on licensing process

• Regulator and stakeholder liaison

• Resource assessment

• Constraints mapping and metocean data analysis

• Feasibility studies

• Layout design

• Field testing and onsite support

• Planning and conduction of public/ local communities consultation events

• Instrumentation and data acquisition

• Power production and performance evaluation

• Logistics and O&M planning & Optimization

• Cost assessment

• Procurement and Tender support

Contact: <https://www.wavec.org/en/services>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Wave Piston (Wave Powered Energy and Desalination Solutions)

Activities: Wave Piston have a turn-key solution for electricity production and desalination (potable water) based on a renewable energy source (waves). In the first step, they focus on small islands and coastal communities replacing diesel generators as main power supply being able both to produce electricity and potable water. It is a Non-intrusive system (does not spoil the view, low environment impact), competitive cost of energy and water based on renewable energy, scalable solution, turn-key package with both electricity and desalination. They have two demonstration projects for the next 2 years including preparing their commercialisation with the first commercial projects. The first commercial project is expected in 2023. Several locations/customers are being involved and analysed.

Sustainable impact on blue economy: Reduces carbon emissions, Increases the use of renewable energy resources, Encourages sustainable use of maritime resources

Contact: https://www.wavepiston.dk/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Wave Swell Energy

Activities: Wave Swell Energy Ltd (WSE) is an unlisted Australian public company. WSE has developed a world leading proprietary technology that converts wave energy into electrical energy. The WSE technology produces clean, sustainable electricity without the use of any oil or other contaminants. There are no moving parts in the water. The devices can be re-floated and towed to another location. This is an exciting development as waves are predictable, reliable and a naturally occurring infinite resource.

Contact; <https://www.waveswell.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Weptos (Wave Energy Converter)

Activities: Wave Swell Energy Ltd (WSE) is an unlisted Australian public company. WSE has developed a world l WEPTOS WEC (Wave Energy Converter) employs a well known and effective method to extract wave energy in a completely new and innovative way. Through its floating angular construction, the Wave Energy Converter can regulate the wave energy input and reduce the impact during harsh weather conditions. The V-shaped structure absorbs the wave energy through a line of rotors, which each of them transmits energy to a common axle, directly attached to a generator. This way, an even energy generation throughout the wave duration follows, enabling for other known generator solutions to be applied.

Weptos technology is entering TRL 8 and protected by 22 issued patents globally. It is calculated to produce electricity with an LCOE = 35/MWh. For the next 24 months the growth effort will solely focus on investments into the development of the commercial version of the technology and hereby reach the base for business scaling up. Sustainable impact on blue economy: Weptos can reach a recycle rate close to 100% and produce electricity far cheaper than existing renewable offshore wind turbines. LCOE = 35/MWh. The potential is more than three times the global use of electricity.

Contact; <http://www.weptos.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Wunder Hexicon (Floating Offshore Wind Solutions)

Activities: MULTIPLAT2 is a unique multi turbine floating offshore wind technology which offers compared to current solutions: -up to 70% more generated electricity per area; less environmental impact as seabed area per platform is reduced and a ton of steel per MW; a reliable wind energy system with an LCOE of 0.098/kWh, which is lower than the current technologies and lower than the target stated in the Declaration of SET-Plan of the offshore wind. The WH's multi turbine platform with title turrets aligns with the wind, resulting in a significant increase in energy capacity per area at sea while at the same time reducing weight and platform size and seabed impact. This platform will also benefit from WH's modular design and patented novel construction techniques to lowering the LCOE. These platforms will allow obtaining energy generation even from isolated areas of the world, providing a cost-effective solution that will support to lower carbon dependence and its environmental impact to be. They result in:

45% less of cable, 50% transport reduction, 51% LCoE reduction, 35 % Capex reduction, 16% OPEX reduction.

The project is producing a sustainable impact on the blue economy by producing and using natural offshore resources such as wind, which has greater power far from land. The dimensions of the floating platform make it feasible to hybridize the platform with other solutions such as energy storage (hydrogen) or aquaculture, which can even make more impact in the blue economy than just energy production. Wunder Hexicon specializes in the Spanish and Portuguese markets for offshore wind power production. They develop floating offshore wind projects using the technology developed by Hexicon AB which offers up to 75 % more generated electricity per area and 45 % less cable compared to solutions with one wind turbine per platform.

**Complementary technologies**

* Different industries can be integrated with their floating platforms, such as:
* Other Renewable Energies
* Energy Storage
* Aquaculture
* Desalination
* Measurement Equipment
* Etc

Contact: <https://www.wunderhexicon.es/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### X1: Wind

Activities: X1 Wind is a disruptive floating wind system with the potential to make a step change in offshore wind. Based on more than 10 years of experience of the founding team in offshore renewables, X1 Wind has been designed to benefit from the “offshore” environment to drive costs down. The design drivers have been weight reduction, simplified installation with a quick connection system, elimination of unnecessary systems to reduce maintenance and scalability. X1 Wind is developing a disruptive floating system to change the paradigm of the wind energy industry. Unlike other solutions, which use “marinized” onshore wind turbines on the top of adapted oil and gas platforms designs, they have designed an integrated system to take advantage of the offshore environment, resulting in a cost competitive concept. Their technology has been proven, and a prototype will be in waters of the Canary Islands by beginning of 2021 (reaching TRL 7). They are now accelerating to prepare a commercial pilot unit (reaching TRL 9) with partners and investors willing to bring a disruptive technology to the market, that will make floating offshore wind cost competitive.

They motivate their activities as under:

The floating wind industry is currently facing several challenges to become commercially competitive. Current platform designs (e.g., spar and semi-submersible) require large mass causing high CAPEX and use of catenary mooring systems, which are expensive and cause large environmental footprints on the seabed, and tend to have complex & expensive installation & maintenance processes. X1 Wind offers disruptive innovative solutions that solves these problems by reducing the weight (by 80- 25%) compare to current floating platforms, by introducing PivotBuoy (a TLP single point mooring system) that allows the platform to orientate itself passively with the wind, which results in a more efficient design. The PivotBuoy system requires less moorings and space on the seabed, hence substantially reducing the impact in the underwater and seabed environment. The PivotBuoy system also provides easier, faster, cheaper installation and can be pre-installed at port before being towed to site. X1 Wind aims to contribute to the goals of reaching climate neutrality.

In late 2017, X1 Wind put in place a structured and ambitious technology development roadmap. The first milestone to develop a proof of concept was achieved in 2018 (TLR 1-4), and the second milestone of validation in a relevant environment was completed 2019 (TLR 4-5). During this short time X1 Wind has secured 6M€ in public and private funding, and established collaboration with potential clients such as utilities and EPCI companies. The third milestone of a demonstration project in an operational environment is currently ongoing and is to be deployed during Q1 2021 (TLR 5-7). X1 Wind has so far been able to accomplish all the milestones successfully on time & reach TLR 7 in 3.5 year, compared to competitors who took 7-10 years to reach the same level. The next milestone is to obtain a certification for a commercial scale design, fabricate, install and commission a first commercial size unit (6MW), going from TRL 7-9.

Sustainable impact on blue economy: Marine renewable energy can present a great opportunity to a green recovery, given the coronavirus pandemic negative affect on the blue economy (tourism, fisheries, aquaculture). X1 Wind believes that floating offshore wind can contribute to this green recovery by providing an innovative, cost effective floating concept, with environmentally friendly mooring system. This would increase the activities related to port and shipyards on the coast regions. Since X1 Wind’s unique design allows for simple and cheap installation procedures (compared to the expensive heavy-lift vessels used by competitors), where local vessels and infrastructure can be utilised, contributing to local job creations.

Contact: http://www.x1wind.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 12 OCEAN OXYGENATION SOLUTIONS

### Messer’s FARMOX (For Aquaculture)

Activities: Their aim is to farm more fish faster with FARMOX™, aquaculture's best-in-class supplemental oxygenation solutions. Aquaculture farms are the key to meeting the rising global demand for fish and seafood—and the key to maximizing aquaculture production is the ability to control and supplement the oxygen level in your water. Messer’s pioneering FARMOX™ oxygenation solutions give you that control. Deeply versatile, scalable and customizable for your specific use case, FARMOX™ systems are easy to deploy in most any operational scenario, from Recirculating Aquaculture Systems (RAS) to sea cages to transport trucks. Moreover, FARMOX™ is unaffected by salinity, and can enrich the environmental quality for any species of farmed fish (and most aquatic plants) in fresh, brackish, or salt water.

What can FARMOX™ do for you?

* Higher stocking densities
* Lower fish mortality
* Faster growth rates
* Higher feed conversion ratios, leading to feed cost reductions of up to 20%.

Contact: <https://www.messer-us.com/chemistry/aquaculture>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Based Climate Solutions (Wave Energy Powered Oxygenation and Upwelling)

Activities: This is a spin-out of Atmocean, Inc., focusing on its OxygenatorTM technology which uses wave energy for upwelling and downwelling. The Oxygenator is designed to address the problem of declining ocean oxygen content using natural ocean upwelling physical processes, powered entirely by ocean waves. Extending from just below the surface to several hundred metres deep, the upwelling function delivers nutrients trapped beneath the thermocline to the upper ocean sunlit zone, triggering primary production (phytoplankton). To metabolize the upwelled nutrients, phytoplankton absorb dissolved CO2 and give off oxygen. They are the base of the ocean food chain and get eaten by zooplankton, which in turn support small fish and higher trophic levels. Particulates, including faecal matter containing high levels of carbon, are excreted and begin sinking due to their higher density relative to seawater. Much of this is re-mineralised by microbes naturally existing in the mid and deep ocean – accounting for the higher level of C:N:P found below the thermocline. (Redfield Ratio).

Contact: <http://www.ocean-based.com/technology/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 13. OTHER OCEAN/BLUE ECONOMY TECHNOLOGY AND INNOVATIVE SOLUTIONS INCLUDING MARITIME COMMUNICATION

### Arviem (End to End Online Supply Chain and Cargo Monitoring Platform Solutions)

Activities: Arviem solves the challenges of obtaining visible and intelligent trade by offering real-time end-to-end cargo monitoring services. As the only full service provider for real-time cargo monitoring on the market, Arviem provides exceptionally accurate location and quality condition monitoring of cargo throughout the global supply chain. Arviem helps manufacturers, exporters and importers to reveal inefficiencies in their supply chains, to get back in control and to start to actively manage their supply chains instead of experiencing it. The smart insights provided by Arviem’s real-time cargo monitoring service empower supply chain professionals to improve their trade management and supply chain operations while avoiding the costs of developing their own solution or the need to invest in devices, hardware, software and staff.

They give you the data and the tools to optimize your supply chain. They provide multimodal in-transit supply chain visibility allowing their customers to understand what’s happening throughout their extended supply chain. With their actionable insights, clients can develop cost-saving strategies, optimize their supply chain, assess performance, and identify bottlenecks. Their analytics dashboards provide intelligence to improve strategic decision making and daily operations. Unlike competitors offering supply chain visibility services on the market, they guarantee a minimum of 150% ROI on their cargo monitoring and supply chain visibility services.

* Develop cost-saving strategies
* Decrease logistics costs
* Improve inventory management
* Optimize working capital
* Prioritize cargo inspections
* Reveal cargo mishandling hotspots
* Reduce demurrage costs
* Assess Logistics Service Providers
* Optimize Logistics Processes
* Reduce Inventory Levels
* Increase Cargo Security
* Monitor Cargo Condition & Quality

Cargo monitoring in real-time to collect reliable data: They collect data and uncover supply chain blind spots by installing automated locating and sensing technology on multimodal containers and cargo. They provide real-time, carrier independent data on the location and condition of cargo during the whole journey of the goods from the point of manufacture to the point of delivery. They offer cargo monitoring as a fully managed service, including cargo monitoring devices, access to their data analytics platform, and device logistics and maintenance.

* Real-time location and predictive ETA
* Geozone entry/exit
* Temperature and humidity
* Door opening and light intrusion
* Shock
* Real-Time Cargo Monitoring Dashboard, Cargo Monitoring Device, Data collection
* Data Enabled Service, Working Capital Optimization, Financing Capital Dashboard
* Data enabled services

Working Capital Financing: End-to-end transparency paves the way for significant working capital optimization. First, safety stocks can be reduced and work-in-process inventories allocated efficiently among the supply chain. Second, Arviem’s innovative supply chain finance services for goods-in-transit can be accessed.

Contact: <https://arviem.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Link Ocean (Virginia Tech/Maritime Communications)

Activities: They will empower continuous data collection in the ocean and high-bandwidth data transmission from ocean to shore. We will empower continuous data collection in the ocean and high-bandwidth data transmission from ocean to shore. Bluelink, a platform developed by CSIRO and partners, is used to model the dynamic and sparsely observed ocean. It improves understanding of ocean dynamics for the benefit of the Australian community.The challenge

• Complex ocean conditions can be difficult to predict

• Variable ocean conditions present a significant challenge to maritime and naval industries.

• These coastal and ocean-based industries rely on ocean forecasts.

But sparse data makes it difficult to access reliable information on ocean conditions. This results in risk and uncertainty.

Our response

Ocean forecasts to guide operations and improve maritime safety

Bluelink : Accurate ocean forecasts are crucial for decision-making in marine industries and Defence applications. The CSIRO Bluelink team develops these ocean forecasting capabilities together with Bluelink partners. Bluelink, a platform developed by CSIRO and partners, produces a comprehensive suite of ocean forecasts. It is used by maritime industries to predict marine scenarios ranging from local beach conditions to regional currents and waves, and oceanic circulation on a global scale. Bluelink predictions are high in accuracy, which is a result of access to a range of data. It uses ocean observations from the sea (via moored sensors, ships, robotic gliders and Argo floats) and from space (via satellite). These datasets are processed and interpreted to create accurate, near-real time models and forecasts. With Bluelink partners, CSIRO provides scientific services, delivered via: a Relocatable Ocean Atmosphere Model (ROAM) system, a fine resolution prediction system at regional scales, and The Bluelink ReANalysis (BRAN), a global ocean hindcast that is the key to understanding ocean circulation.

Contact: <https://www.herox.com/oceanobserving/round/562/entry/24500>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Beach Necessities (Striving for Sustainable Beach Related Products Online Marketplace)

Activities: BeachNecessities.com forges the online shopping experience for the $15B+ US beach goods market with a focus on sustainability, both in the products they carry as well as protecting the health of the ocean, and human race, given the impacts from climate change and plastic waste. They help people get ready to relax and have fun, as well as help fund beach and ocean conservation initiatives to protect the resources we enjoy so much. They are developing expertise, establishing and growing a loyal customer base as well as with the BigCommerce SaaS eCommerce platform. While many people equate the beach with the ocean, for others this could be a favourite lake, pond or river so they define beach as any place you can dig your toes in some sand, go for a swim and just enjoy yourself. It is their intention to ensure that the beaches and ocean, where their products are used, will be there for future generations to enjoy. ‘To enable this, we are a member of 1% for the Planet, 1% For the Planet Member, founded by Yvon Chouinard of Patagonia, which commits us to investing 1%+ of our annual revenues in environmental non-profits.’

Contact: <https://www.beachnecessities.com/about-beachnecessities-com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Tribe (Software Aiming to Improve Prediction of Floods and Natural Disasters for Coastal Management)

Activities: Blue Tribe is an enterprise software company using machine learning to predict natural disasters for the insurance, engineering, and security markets. Floods are the most frequently occurring and most expensive natural disaster. Blue Tribe's global mission is to save lives and help protect trillions of dollars in resources and property.

Coastal intelligence: predictive analytics at street and neighbourhood levels that enhance the accuracy and recency of existing models and forecasts, to allow decision-makers to get ahead of high frequency coastal disasters including flooding, beach loss, and sea level rise.

Contact: <http://www.thebluetribe.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Equiseas (Pre IPO Ocean/Blue Economy Stock Exchange)

Activities: Equiseas is just an idea at the moment, which Dimitris Servis, the solution owner, is discussing with relevant people. The problem he sees is that investment towards the Ocean Economy is currently limited. Ocean startups and innovators can mainly turn to accelerators for seeding and larger corporations for funding. Oftentimes this stifles innovation and concentrates effort and funds in very specific operational areas in shipping. Also, a lot of the startups are never going to reach the J-shaped growth curves that VCs desire. However that does not mean that they are not viable and worthwhile businesses worth investing in. The idea of Equiseas is to create a pre-IPO stock market for ocean economy startups using ICOs or STOs in order to offer real stakes to individual and institutional investors and a platform where these assets can be traded. The aim would be to make financing, at a relevant scale, more available to researchers, entrepreneurs, innovators to seed and further finance their startups as well as to allow the broader market decide on how and where to source funds and how individual startups are performing relative to their goals.

Phase: 1. Pre-Funding: Ideation Integrated technologies.

Operating region: Global.

Success would mean that there is a stable platform with enough investors and projects to be funded; ongoing engagement from individuals, groups, communities, corporations; low concentration in specific thematic areas - good spread of projects; successful exits and IPOs.

Contact: https://uplink.weforum.org/uplink/s/uplink-contribution/a012o00001G7kcBAAR/equiseas

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Fortuna Cools/Coconut Coolers

Activities: Fortuna Cools are replacing plastic foam insulation once and for all. In its place, they use coconut fibre, a leftover waste product of the enormous coconut meat industry. Nine billion coconut husks are burned as garbage every year in the Philippines alone. Fortuna’s coconut fibre insulation avoids CO2 emissions from incineration and provides extra income for impoverished coconut farmers. Fortuna partners with rural communities in the Philippines to build coolers that last for years, not millennia. Impact is built into every Fortuna Cooler we sell.

Contact: <https://www.fortunacools.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Live Wire (Wave Energy to Power Ocean Observations)

Activities: Livewire: wave energy to power ocean monitoring. Built on their successful ocean-wave-powered vehicle, the Wirewalker, Livewire is an onboard wave-energy-converter to power observations. Through field test measurements, Livewire has shown potential for power to be generated from surface ocean waves independent of batteries.

Contact: <https://www.herox.com/oceanobserving/round/562/entry/23872>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Mission Unlimited UUV Station

Activities: Mission Unlimited UUV Station provides scalable energy harvesting, charging, and data transfer to extend the endurance and utility of UUVs. Underwater missions share a common challenge: they’re constrained by the amount of stored energy they can carry onboard, which limits mission range and duration, as well as undersea sensor operating times. Additionally, the task of recharging them, particularly rechargeable autonomous systems, remains complex and daunting. . Seatrec has invented a family of energy-harvesting products that extract energy from the ocean's thermal gradient — the difference in temperature between warmer mixed water near the surface and colder water below — and convert it to electricity.

<https://www.northropgrumman.com/what-we-do/sea/mission-unlimited-inventing-autonomous-recharging-of-unmanned-underwater-vehicles/>

Contact: <https://www.herox.com/oceanobserving/round/562/entry/24484>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Sonics (Digital Hydrophone and Maritime Communication Solutions)

Activities: icListen Smart Hydrophones are the world's first digital hydrophone. Use the icListen for real-time listening and event detection, or as an acoustic recorder. icListen internal processing capabilities saves you time and provides you with the most accurate data possible, without the need for onerous gain settings.

* Small enough to carry in one hand, allowing you to deploy with smaller craft, or deploy on autonomous vessels.
* Powerful enough to be combined into simple or complex digital hydrophone arrays.
* ‘icListen is the most reliable and user-friendly hydrophone available. Understanding ocean sound has never been easier.’

Contact: https://oceansonics.com/product-types/iclisten-smart-hydrophones/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Searoutes (Optimising Greener Searoutes/Discover Searoutes)

Activities: Searoutes’ mission is to make freight transportation become greener by optimizing routes. Searoutes is an API first company which brings accurate data to empower current supply chain solutions. Maritime at first sight, they began their business making accurate sea routing from Automatic Identification System (AIS) data available to all. AIS data provides a unique source of information for understanding and monitoring maritime traffic. They have partnered with researchers and engineers to implement calculation methods and machine learning algorithms to calculate the real sea distances by combining historical and actual data, weather data and ship performance.

Contact: https://discover.searoutes.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### SINAY –Maritime Data Solution

Activities: Maritime data-driven modules that solve real problems. SINAY collect and gather tons of data from various sources such as vessel position, weather, currents, wildlife, and much more. Thanks to their AI algorithms based on advanced machine learning, they can compute, combine & analyze to get the key performance indicators out of the data. Their AI algorithms only get better with time and constantly improve their performance. You just have to click to easily consult your real-time or historical data and reports in the SINAY Hub which gives you access to all modules directly through your browser, among which: air quality, water quality, aerial noises, underwater acoustics, or ETA.

* **Air module:** Monitor air quality in real-time, be alerted when a threshold is reached & easily comply with regulation thanks to the automated reports.
* **Route module:** Predict the best maritime route to optimize fleet rounds & fuel consumption.
* **Data module:** Retrieve all data related to your activities and discover other additional data from various sources that might be useful for your business.
* **Water module:** Monitor water quality in real-time, predict and avoid water pollution & comply with regulations thanks to the automated reports.
* **Aerial Noise:** Control in real-time aerial noises and prevent them thanks to alerting systems.
* **GIS module:** Visualize as layers key geographical information among maritime data to consolidate them.
* **ETA module: Accurately predict the ship arrivals**at the port to save money, better allocate resources, and optimize operational efficiency.
* **Underwater Acoustics:** Map underwater noise and prevent human impacts on cetaceans and fisheries resources.

https://sinay.ai/en/about-us/

## Wave Sub/Wind Sub.

MPS is developing the WaveSub wave energy converter to exploit the abundant, global, wave energy resource. WaveSub is a class-leading wave energy converter that can generate high levels of consistent, low cost power. WaveSub benefits from all the generic advantages of our platform technology and has its own unique advantages when it comes to harnessing wave energy. WindSub is a floating wind turbine that can be stably anchored in deep water, allowing wind turbines to be cost effectively installed at sites that are too deep for fixed foundations (depths greater than around 60 metred).

<https://www.herox.com/oceanobserving/round/562/entry/24256> <https://twitter.com/wavesub>

<https://www.marinepowersystems.co.uk/windsub/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 14. PORTS/LOGISTICS

### Cargo-X (Blockchain Linked Bill of Lading)

Activities: A Smart B/L (or smart BL or smartBL) is an electronic bill of lading, sent through the CargoX Platform for Blockchain Document Transfer (BDT) or any other electronic platform. A smart B/L can be uploaded in the form of PDF (or any other type of document). It can also be created as a structured data document and then sent or transferred on the platform. Ownership of the smart B/L document is unequivocally transacted to the new owner, who can legally claim ownership rights. Digitalize your trade documents processes with Blockchain Document Transfer. The CargoX Platform gives you the world’s easiest way to upload documents and provides the tools for their secure and instant transaction. What is new is that you can also transfer ownership of documents.

Contact: <https://cargox.io/platform>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### C-Log (Blockchain Maritime Platform for Secure Stakeholder Integration and Data Exchange)

Activities: C-LOG provides a blockchain-enabled platform for secure identification (DID). The platform enables cross-industry data collaboration, linking stakeholders from the entire maritime value chain in a trust system. Addressing fundamental administrative, operational and security challenges, the platform enables secure and transparent industry-wide ID & credential management leveraging Blockchain and AI. The Maritime industry being part of critical infrastructure is at high risk and a severity for cyberattack. C-LOG is a paradigm shift to handling ID and data-privacy governed data. As part of handling data-privacy and lowering the risk for cyber-attacks through social engineering, the platform is digitising several paper-processes made possible by a trusted universal ID.

Contact: https://c-log.io/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### ECOncrete™ (Sustainable Port/other Eco-friendly Concrete)

Activities: ECOncrete™ technologies provides an innovative series of bio-enhancing concrete admixtures and designs that enhance the ecological value of coastal and urban infrastructure, while increasing their structural strength and longevity .The Company provides A to Z services from tailored designs, site specific science based solutions, product development, manufacturing of mold system and admixtures, supervision of field execution, as well as post installation biological monitoring and reporting. ECOncrete (R)'s unique biological traits, encouraging biogenic buildup, also provide substantial structural and economic advantages in terms of increased stability, longevity as well as reduction in maintenance costs. The Company's products are adapted to specific environments with their typical fauna and flora. ECOncrete maintains ongoing research and development activities for expanding the company's product range, addressing needs of new geographical locations, and optimizing product structural and biological performance. ECOncrete's experts closely cooperate with landscape architects, engineers and policy makers in the design of new coastal and marine infrastructures as well as in retrofitting existing structures for optimal biological productivity and ecological efficiency.

Contact; https://econcretetech.com/about-econcrete/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Nautix (Maritime Ship to Shore Collaborator and Communication Interface Solutions)

Activities: At Nautix, their mission is to make the shipping industry safer and more efficient.

Seafarers plan and perform complex operations every day on ships. The workforce of the 21st century relies on their training, experience, and management tools, which have not kept up with the changing times. These tools are inefficient in minimizing human error. As a consequence – people are injured, equipment damaged, the environment suffers, and our industry bleeds billions of dollars year on year. Nautix’s application makes planning and execution of operations easy and simplifies complex safety processes for the 21st-century workforce. When at home, they can predict when to start driving with google predictions – why not provide the same level of sophistication to their often risky tasks? AI-powered prediction offers an unprecedented level of input in planning and risk mitigation, thereby improving operational performance. This approach influences user behavior toward proactive safety, human error reduction, and increasing compliance. Nautix Technologies is uniquely placed through its IP, expertise, and its technical capability to build a comprehensive solution for ship operation management. Leading companies in the industry have identified them as a much-needed and long-awaited step towards improving safety and business efficiencies

Nautix wants to make the lives of seafarers easier and safer – they believe in the collaborative future of humans and technology, enabling the shipping world to be safer and smarter – with a friendly and simple experience that is more the norm than the exception in today’s tech-savvy world. Nautix’s solution is made by mariners, for mariners. Their CEO and Co-Founder Tarang Valecha has have lived through these challenges and knows their users’ strengths and capabilities. These challenges are vital opportunities for their design: they know the pain-points, and are eliminating them, one at a time. With experience from ship, shore & software they are ‘building a holistic solution with heart.”

Nautix enables more than just chat, so you and your team can get things done efficiently.

* Stay informed with all your work related conversations, files and people in one place
* Break silos and communicate better as a team – whether on board or ashore
* Bring context to conversations with team chat - discuss relevant issues and take informed actions

Want to see it live? Book a demo with one of their experts or sign up for our Early Adopter program,

SHIP WIKI.

* Find answers to all your questions easily
* Tap into a collective knowledge base and get the right information at the right time on any device from on board or ashore.
* Everyone in your company can work faster and smarter with information at their fingertips
* Narrow your search and make informed decisions without initiating repetitive email chains
* Empower your team to share and access best working practices in a central location

Contact: <https://www.nautixtech.com/about>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### NAVIER (Sensor Communication on Ocean Assets)

Activities: REEF® (Real-time Edge Execution Framework) is an intelligent sensor data platform with a built-in internet gateway that enables seamless sensor connection on ocean assets.

Impact: REEF® will streamline information gathering and sharing for all maritime stakeholders to take responsible actions. For example, researchers and ocean professionals run their algorithm on the edge of the platform for furthering research and scientific studies on ocean health.

Founders: Sampriti Bhattacharyya, Soya Seo

Location: San Mateo, California, USA

Contact; https://www.crunchbase.com/organization/onet-global

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Secur-Space (Online Trucking/Logistics Parking and Storage Solutions On Demand Marketplace)

Activities: SecūrSpace is an online marketplace and software platform that connects companies looking for parking and storage options to those with dedicated or excess capacity. Their platform was built to combat issues caused by the lack of adequate space in and near major transportation hubs. Motor carriers, shippers and forwarders all contend with this issue on a daily basis – solving this problem is their specialty.

Find the right fit: Search for available parking and storage space with the security, visibility and access that meet your needs.

Flexible Arrangements: Reserve and pay only for the capacity you need; no more long term commitments.

* Growing National Network
* Access a growing network of locations in every major transportation hub.
* Explore Secure Storage Spaces
* SecūrSpace is adding new partners across the country
* Find out how you can monetize your extra parking and storage space today.

Contact: https://secur.space/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Trade Lens (Blockchain Based Digital Solution).

Activities: digitizing the global supply chain**,** TradeLens is an open and neutral supply chain platform underpinned by blockchain technology. They are enabling true information sharing and collaboration across supply chains, thereby increasing industry innovation, reducing trade friction and ultimately promoting more global trade. The TradeLens platform has been jointly developed by IBM and GTD Solution Inc. Together each partner works to ensure the product and business model is aligned to meeting the needs of the shippers and supply chain operators around the world.

Contact: <https://www.tradelens.com/about>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 15: SEASTEADING /ARTIFICIAL AND ALTERNATIVE FLOATING/UNDERWATER HABITATS)

### Ocean Builders (Seapod Homes, Seasteading Communities and Floating Cruise Ship for Entrepreneurs)

Activities: Life above the waves**:** Ocean Builders’ homes allow for a comfortable living experience while the boats around you are pitching and swaying in the waves. Their shallow water version will be close to shore so you can experience all of the modern conveniences of living on land while enjoying your 360 degree ocean views.

**Smart Luxury**

The SeaPod will come equipped with an assortment of modern technology with the goal of self-sustainability from water catchment, fresh water maker to your own energy system to power your home. They will be adding smart home technology to modernise the various systems in your home and give you up to date information on your phone any time of day. Combining luxury, technology and sustainability, their homes are one of a kind.

Could working from a converted cruise ship docked in the tropics be the future of office life? ‘Seasteading’ pioneer, Ocean Builders, seems to think so, and plan to convert luxury cruise liners into ocean communities of digital nomads, crypto-enthusiasts and entrepreneurs. The first wave of cabins is up for auction aboard MS Satoshi. The 804ft ship is being prepared to set sail from the Mediterranean and anchor in the Gulf of Panama where it will welcome its first residents in early 2021. MS Satoshi, aka the Crypto Cruise Ship, houses 777 cabins (tentatively priced between US$25,000 to US$50,000) with a capacity of 2,020 people plus crew and crew quarters. Facilities include multiple restaurants, a theatre, casino, gym and wellness areas. The ship will be used for tourism, home residence, research and office space and aims to become an incubator for innovation and entrepreneurship. The aim is to create a floating community for the advancement of ocean technology, engineering, sustainable living and experimentation, working together in a blockchain and non-blockchain crypto-friendly environment. Bitcoin, US. dollars and other forms of payment are accepted. The seasteading movement is a libertarian group dedicated to building independent floating cities on the high seas. The point has been emphasised by the Coronavirus, as living out on the ocean might be helpful for these situations. Their goal is to figure out how to live sustainably on the sea and chart new waters in this new frontier. Ocean Builders hopes that entrepreneurs will come on board to run restaurants, events, fitness classes, and other businesses and is calling on the elites of London, San Francisco and New York to join them on their floating office.

Residents will pay an ongoing fee for the upkeep of the ship and amenities. Ocean Builders is able to assist residents with acquiring permanent residency in Panama if they want to live in the country full time. To complement life on board MS Satoshi, Ocean Builders recently began construction of its floating, off-grid SeaPod homes on the Caribbean side of Panama. They plan on housing employees on the ship as they begin building on the Pacific side.

Contact: <https://ocean.builders/seapod/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Stem (Self-Contained Autonomous Mobile Sea Surface Habitat)

Activities: SEA STEM is an ambitious concept that imagines a completely self-sustaining habitat with minimal environmental impact, which would initially be stationed 7.5 miles from Palavas port in the south of France. The project is in response to rising sea levels and receding coastlines. Visitors take part in various activities such as kitesurfing and foiling, which help to collect environmental data via onboard sensors

SEA STEM is conceived to be 100% autonomous on energy by harnessing solar, wind and wave power; 100% autonomous on food production through permaculture and aquaculture; 100% autonomous on water management by rainwater harvesting and desalination; and 100% autonomous on waste management thanks to food waste reuse. In addition, the habitat proposes to help regenerate sea life by means of an artificial reef. 30m above sea level, the dome hosts a protected permaculture garden. As a visitor, you will be engaged in gardening activities to contribute towards local food production. The project is also conceived to be 100% funded through a mixed-use program of eco-tourism and scientific research. In 50 meter-deep water, SEA STEM’s artificial reef provides a place for marine life to grow safely and a platform for scientific research. It also serves as a way for visitors to discover and learn about sea life. Diving will help maintain the artificial reef structure and thinktanks and workshops will contribute towards developing future ideas for the evolution of SEA STEM. An onboard restaurant cooks meals exclusively from local permaculture crops and aquaculture. Any food waste is then used for biomass energy production and ground fertilizer. With its variable geometry, the artificial reef provides safe habitats for local species. Rainwater harvested in the dome irrigates the permaculture garden and is stocked in reservoirs beneath.

Ccontact: https://www.designboom.com/architecture/sea-stem-mobile-habitat-autonomous-living-at-sea-11-05-2020/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ventive Floathouse (Ventive Sea Tech)

Activities: The Ventive Floathouse mission is to build permanent ocean communities for the masses, using modular structures designed to make ocean living safe, comfortable, and affordable. “*We’re building new types of floating-structures capable of flourishing at sea permanently, to organize them into floating communities and ultimately into independent cities in international waters*.”

What is a Floathouse? A floathouse is a new kind of floating home designed to do one thing better than any other floating structure: to stay in one place, comfortably and securely, on the ocean. The Floathouse is a finished home, ready to move in. It is a basic building-block of our more advanced structures. It is designed to be a year-round home for individuals or a family. The round hull of this structure makes it extremely comfortable for passengers when rolling side to side. Compared to boats you may have been on before with different hull shapes which roll very quickly and tend to make many people seasick, the round hull rolls very slowly and tends not to produce seasickness. When this structure is built into some of our other configurations, like the Maran or Bermuda configurations, roll can be reduced even more.

Uses:

* House
* Office space
* Restaurant
* Doctor’s office
* And more

Contact; https://ventivefloathouse.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 16 SHIPBUILDING, MAINTENANCE AND REPAIR

### Action Tracker Solutions (Fault Detection/Risk Management and Maintenance Solutions)

Activities: Their comprehensive fault detection system is effective in case of:

FIRE

Event alerted the authorities of the port for your boat receiving assistance immediately and precisely.

FLOOD

Detect any road or water leak in time to avoid disastrous consequences.

VANDALISM AND THEFT

While vacationing alone you will enjoy your boat. They are effective in case of vandalism and theft.

ENGINE FAILURE

They monitor the signals from the sensors installed on your boat, and even engine. They can perform preventive and corrective maintenance, avoiding major consequences.

PROACTIVE MAINTENANCE

Through remote monitoring system, they can perform proactive maintenance. In addition to preventive maintenance, they can help you by suggesting performing routine tasks in your absence: refuelling, filling and emptying containers, level control, equipment reviews and engine. You get greater enjoyment of your boat. ACTIONTRACKER is the solution from our team of expert engineers and marine professionals. It has been designed and implemented, harnessing new technologies for your comfort and tranquillity. Get away from your boat, and you will not lose sleep, since all active sensor systems monitored remotely allow them to monitor your boat in your absence. Timely action against small incidents is always the way to prevent them from becoming a great loss. Also, allows remote control of your boat, by monitoring critical parameters and variables for your comfort and safety.

They motivate their activities as under:

They believe in prevention. Your accommodation on the mainland has surveillance systems that ensure your peace of mind. Similarly they think it is important that you can feel just as safe and secure against the most common incidents and critical accidents that can happen in your boat. ACTIONTRACKER is the solution. Fire, vandalism, theft or collapse are common facts that demonstrate how vulnerable vessels are. Swift action against them prevents the economic loss and prevents events that are not compensable by any insurance policy taken. Mechanical problems can also be detected quickly and efficiently by connecting to the network ACTIONTRACKER existing sensors on your boat, and even the engine via CAN bus, thus optimizing the actions and interventions of technical equipment. They can manage emergencies in the boat, efficiently transmitting emergency equipment and rescue at sea.

Sustainable impact on blue economy:

With regard to the merchant recreational ship sector, the solutions they propose allow the 1. traceability of ballast tanks, to avoid contamination and invasion of foreign species, 2. optimization of engine chamber environmental conditions for less consumption by ships, 3. optimal trimming, for less resistance to navigation, 4. proactive maintenance to reduce environmental impact, 5. information exchange 24/7 connectivity with stakeholders and authorities to track compliance and emissions.

Contact: https://actiontracker.es/?lang=en

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Closelink \*Online Cloud/Digital Marketplace Solution for Marine Lubricants)

Activities: Closelink helps customers to find the right offer for their lubricant demand by providing the first cloud-based marketplace for marine lubricants. They are bringing together global and local operating suppliers to ensure the best result for their customers. No matter if major or minor port, main or side route. They enable a reliable and cost-effective procurement of marine lubricants by digitising existing processes and building the groundwork for the world of tomorrow. Closelink was founded in Hamburg (Germany) by three founders Philippe Lavarde, Tobias Schumacher and Eike Lawatsch. They combine several years of experience in maritime sales, software and product development. Today they have 10 employees with diverse background ranging from design, development, sales, accounting and marketing. Their team is building a future-proof product to tackle major challenges in maritime procurement

Contact: https://www.closelink.net/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Demogate (Online Ship Recycling Solution Marketplace)

Activities: Take an educated decision in line with regulations on where to scrap your vessel, under which conditions and for what price. Demogate is an intelligence centre and trading platform for ship recycling services that furnishes owners with the knowledge required to make, implement and safeguard their demolition decisions.

**Vision:** To enhance decision making in ship recycling though provision of state of the art digital tools coupled with hands-on advice.

**Mission:** To simplify the ship recycling process for our customers by providing instant price indications, suitable recycling locations and a trading tool to enable efficient transactions.

Contact: <https://demogate.com/company/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### io-Currents (Risk Management Predictive Analytics, Fuel Optimisation and Long Term Reliability Maintenance -Marine Insights Platform)

Activities: ioCurrents is revolutionizing management and maintenance of high value maritime fleets from tug boats to bulk carriers to Panamax ships. With Marine-Insight edge AI, they have proven ability to monitor and analyse all the data from large diesel engines, generators, PLCs, tanks, cargo systems and more at sea and predict failures in real time, taking action on problems before they become critical. Predictive Analytics, real-time at sea Fuel Optimization and long-term Reliability Centred Maintenance are all driven by edge analytics on their one of a kind platform. The digital revolution in shipping is happening now, ‘and ioCurrents is leading the world in advanced AI capabilities delivered in an easy to use independent maritime-first platform.’

Contact: <https://www.iocurrents.com>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Main Deck (Drydocking Project Software Solutions)

Activities: Maindeck is modern software for dry-docking projects and ship repair. Accelerating dry-docking projects for technical ship managers, Maindeck is the next-generation planning- and project-management software for Fleet Managers and Technical Superintendents. Throughout the entire dry-docking process, from the first inspection to the final report, all information is gathered and organised in one place providing you with a complete overview of where your project stands. Their easy-to-use system captures all the critical information about your project, whether it be job specifications or progress reports and variation orders, and utilises this to help you remove cost overruns and avoid delays.

Industry leaders accelerating their dry-docking projects with Maindeck:

* Wilhelmsen Ship Management dry-docking software reference
* Sea Dream Yacht Club dry-docking software reference

Having a proper project specification, clear to all parties involved, is critical to avoiding delays and cost overruns. More information available in real-time to those involved means less delays. With Maindeck acting as a single source of truth, you have the transparency and up-to-date information in order to get on top of things. All information, from all work orders, from all changes, by all parties involved, everything is funnelled through Maindeck and available for insights, reports and proof in case of disputes. One project, one platform. A complete overview of where your dry-docking project stands at all times.

**Provide the owner with full transparency and traceability of the project at all time:**

Creating both daily reports and final reports is no longer a time consuming task. All images, updates, variation orders, text templates and summary tables are already processed and available right in front of you to drag directly into the report. Writing a daily report is done within minutes and the final report can be compiled in less than an hour.

**Generate professional reports at the click of a button**

Have everybody (crew, yard, all service companies, class) provide progress updates through the mobile app, and everything appears for you in one place as it happens. Instead of constantly chasing information, you can now start receiving information. The mobile app has full offline functionality so that you don't have to worry about an internet connection - the app will automatically synchronise once it detects a connection. The app is available for both Android and iOS users.

Contact: <https://www.maindeck.io/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Pinovo AS (Zero Emission Vessel Sandblasting Solutions)

Activities: Pinovo AS has developed technology which eliminates all emissions from surface treatment of rust and old paint (=microplastics) into the oceans. To put this into perspective, and taking just the 184 oil rigs in the North Sea, sand-blasting and water-jetting on those rigs causes microplastic emissions that are equivalent to dumping 14 million plastic bottles into the North Sea every year ‘Use of Pinovo technology would reduce that to zero.’

Phase: Launched

**We need better systems to manage plastic ocean waste: What's the problem?**

Paint is used to protect steel from corrosion, and Paint Is Plastic. Annual emission of microplastics, from marine and protective coatings, into the ocean is estimated at 60,000 tonnes globally, which is equivalent to 6 billion plastic bottles being dumped in the ocean each year! Pinovo's solution prevents microplastics entering the ocean, and grit entering the workspace. Pinovo's technology also delivers superior surface quality, lengthening the asset's life, and at a lower cost. Their impact on SDG 14 could be huge, measurable and immediate, because, using Pinovo technology, there are zero emissions of micro plastics. In addition, all blasting grit is re-used during sandblasting operations. It is Clean, Circular, Safe and Cost Efficient. ‘Pinovo AS is the new industry standard for surface preparation i.e. removal of rust and old paint from steel. It should be part of the toolbox of every fabric maintenance contractor and asset owner, and become their "go to" tool. We need to get our system on every oil rig, ship, bridge, power plant and wind turbine around the world and permanently replace all open blasting.’

Contact: https://www.pinovo.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Drone Pro (Automated Ship Hull Inspections)

Activities: Imagine automating routine hull inspections so your field teams can focus on putting their expertise to work and enabling coordinators to take quicker decisive action. Stream live video from your underwater vehicle to your remote coordinators and extend the reach of classification bodies in remote locations. No travel time, travel costs or waiting time.

**RE ACCURATE, EASIER, AND SAFER HULL INSPECTIONS**

**BETTER INSPECTION EXPERIENCE**

1. iPad Mission Planning
2. Load your ship’s general arrangement diagram.
3. Calibrate sensors relative to the ship hull.
4. Identify minimum diving depth.
5. Complete pre-dive checklist.

Contact; <https://seadronepro.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ship Support (Online Ship Supply and Electronic Commerce Marketplace)

Activities: Online maritime B2B marketplace for spare parts and consumables. ShipSupport.com is the worldwide digital eCommerce platform that opens up the maritime industry. It brings ship owners, operators, MROs and suppliers together for trading parts and sharing expertise. They offer a One-Stop-Shop with fully transparent pricing and fast global delivery. And in addition, a 'My Fleet' environment; with customer specific pricing and making sure you'll order the right part. Over 1.000.000 products can be ordered directly, without the need of issuing RFQ’s, drastically speeding up the sourcing process and reducing supplier management.

Contact: https://www.hellenicshippingnews.com/netherlands-based-maritime-e-commerce-platform-shipsupport-com-powered-by-royal-ihc-hits-another-milestone-and-offers-its-customers-1-million-products-in-collaboration-with-more-than-40-suppliers/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Techno-Carbon (Carbon Fibre Stone (Sustainable, Carbon Dioxide Reducing Vessel/Other Material)

Activities: Carbon Fibre Stone (CFS) is a high-performance building material that aims to be the first of the Carbo-Negative materials capable of replacing cement, concrete, steel, wood & aluminium. It currently possesses a carbon footprint of about 90% smaller than cement, steel, aluminium and other materials in virtually all forms of building and infrastructure projects. CO2-free manufacturing: a versatile, high-performance, revolutionary, environmentally-friendly alternative material, CFS is low carbon not only during its use but also during its manufacture: it will quickly become carbo-negative. Making Negative Carbon Growth possible is a strong positioning towards the green materials market, thanks to its attraction potential, creating the largest market for the circular economy. Techno Carbon can manufacture many applications with this family of materials to solve technical and environmental challenges. Higher quality and faster manufacturing/installation times help customer choice.

They motivate their activities as under:

Carbon Fibre Stone is a mineral-carbon alloy that harnesses the forces that formed Planet Earth and applies modern materials and process innovations to create new materials. It is corrosion-free and will cut installation times by a factor of 2 or more. Granite that bends. Railway sleepers that outlast the testing equipment. Marine Vessels that won't rust. Rooves, domes, dams, bridges and ports with biblical longevity. CFS has 10x smaller carbon footprint: 5-10-times more longevity and resilience than concrete and/or steel, 4-times more resistance to stress than aluminium or concrete, 3-times lighter than steel, 2-times less energy consumption than traditional materials. Zero-waste, zero CO2, zero fine particle emissions Zero sand, zero freshwater consumption.

TechnoCarbon just signed partnership agreements with major architecture and engineering firms. New projects will lead to certified products within 12 months. Time-to-market will depend on funds raised to increase production capacity to high throughput levels necessary to accept large orders. Market size, growth and trends point towards a fast demand increase for their products. They expect a sharp increase in both trends (new sales and media traction) as their first product sales demonstrate market traction and user satisfaction. The laboratory-proven and field-tested performance of their products will lead to the fast growth of our sales pipeline. They are already negotiating sales prices for large contracts which require investment on the order of 10-20 MEUR in 2020 in order to scale up production in 2021. Market demand is strong and rising. Rising CO2 requirements will soon eliminate competitors completely.

Sustainable Impact on the Blue Economy: Shipbuilding within offshore and seashore infrastructure entails large amounts of metals (steel and aluminium) and concrete. These 3 materials generate 20% of CO2 emissions worldwide. Sea level rise due to climate change will result in infrastructure overhaul and reinforcement projects worldwide. Thus low-carbon Blue Growth will require new materials with longer lifetime and lower carbon footprint than steel, aluminium and concrete. Furthermore, natural resources such as freshwater, sand and other sediments are becoming scarcer every day, due to climate change and/or environmental protection. Their technology solves all these issues at the global level as it has a high replacement potential up to the multi-billion tons per year scale. That's due to the availability of hard stone (90% of Earth's crust) but also because their material can be partly or made from recycled waste (if required and depending on actual cost/benefits ratio).

Contact: https://technocarbon.de/en/cfs

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Tugdock (Modular Floating Dry Dock)

Activities: TUGDOCK is a new patented modular floating dry dock. The world's first road-transportable floating drydocktugdock.com. TUGDOCK is a low cost, highly flexible drydocking solution which has none of the typical problems associated with other docking solutions. It costs less to buy, less to operate and is far simpler to use than any present dry dock system. Deck dimensions can be increased or decreased to suit the size and shape of the vessel or floating structure to be lifted. Transportable as shipping containers for cost effective global delivery. TUGDOCK has signed a worldwide partnership agreement with Unique Seaflex, a global leader in Buoyancy and Ballasting equipment and part of the Unique Group, one of the world’s leading integrated subsea and offshore solution providers. This partnership will see TUGDOCK’s modular floating dry docks being offered for rental or purchase via Unique Seaflex’s global network, whilst providing customers with a warranty on their product.

Founded in Falmouth, Cornwall, United Kingdom.

Contact: <https://tugdock.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### X-Ship (Shipbuilding, Repair and Vessel Performance Software and Data Analytic Tools)

Activities: XShip is a fantastic collection of apps for ship owners, managers to understand the performance of their ships under the varying conditions of speed, load, and weather, thereby enabling them to save money. Over 1000 ships enabled them to create a powerful algorithm and some of the leading shipowners like MSC, PIL, MTM use their app.

**IMO Data Collection System**

Ship FO consumption data collection plan (SEEMP part II)

The system for the preparation of ship fuel oil data collection plan, Monitoring and Reporting of carbon emissions, Fuel, Distance sailed etc, and Submission of Annual emission reports to flag state.

**XShip Performance**

An Online tool for ship owners & fleet managers for performance monitoring and emission control of vessel. XShip Performance uses a proprietary algorithm to analyse and predict vessel performance. This algorithm relies on the ship data. So, any vessel which has past 6 months data can start using XShip Performance using the PA Module.

Contact: http://xship.in/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 17. SHIPPING/TRANSPORT

### Air Seas (Kite Based Wind Energy Powered Propulsion Systems)

Activities: Development and sales of giant automated kites to tow ships and produce electricity.

Seawing, the automated kite that tows ships:

* Seawing exploits a free source of energy that allows to reduce the power demand on the main engines.
* Seawing is a safe choice as its savings on energy cost and gas emissions always apply.
* Seawing pilots the kite position, altitude and speed in order to provide the best thrust to the ship in a given situation.
* Seawing can be re-installed on any vessel of a fleet. This allows flexibility to operating companies that are operating ships on a rental basis.

Seawing harnesses the power of wind, a free and unlimited energy source, to aid vessel propulsion and reduce fuel consumption by up to 20%. Inherited from the Aerospace Industry, Seawing’s automation and Digital Twin technology guarantee safe and simple operation without the need for deck crew intervention. With the potential to be used on any type of vessel, the modular design facilitates vessel retrofit and is fuel agnostic. Seawing is an enabling parafoil kite technology, that assists the Maritime Shipping Industry to achieve the IMO 2050 GHG Emission Targets, facilitating the transition to Zero Emission Shipping.

They motivate their activities as under:

To-date Seawing is the only 100% automated parafoil kite solution available for the Maritime Shipping Industry. The Seawing solution is unique on the market, as Airseas have overcome major technological challenges, most notably by applying digital-twin flight control technology inherited from the Aerospace Industry to the Maritime Shipping Industry. The Airseas application assists Vessel Fleet Owners in achieving their International Environmental GHG Emissions Obligations and at the same time reduces Vessel Fuel Consumption by 20%.

Airseas has already secured 2 contracts: the first one with AIRBUS (to equipped Ro-Ro vessel), and the second one with the Japanese shipowner “K-Line” for 1 Seawing installation next year followed by 50 additional Seawing installations.

Contact; https://www.airseas.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Andritz Hydro

Activities: ANDRITZ Sea SOx Scrubbers. Designed on the basis of more than 35 years of experience in scrubber design and using the most highly developed CFD models to simulate and optimize flow distribution and SOx mass transfer the maritime scrubbers offer some decisive benefits. Remove SOx, NOx and particulates in one step! ANDRITZs unique multi filtration for exhaust gas cleaning in the maritime industry. Cleaning of exhaust gas in the shipping industry is a challenge that is perfectly compatible with the comprehensive know-how ANDRITZ has gathered from supplying and optimizing hundreds of flue gas cleaning plants worldwide. In the maritime sector, ANDRITZ offers proven and well known technologies such as the common and well known open-loop, closed loop, hybrid-ready and hybrid SeaSOx scrubbers and is consciously developing its product portfolio further in order to provide all customers with the perfect solution to meet their requirements. ANDRITZ offers Dual/Multi-Filtration exhaust gas cleaning technology for multi-pollutant control. SeaSOx Dual Filtration is used for abatement of sulphur oxides (SOx) and particulates, while SeaSOx Multi-Filtration removes nitrogen oxides (NOx) in addition. Hence, **‘**ANDRITZ is the only supplier worldwide to offer its customers both SeaSOx scrubbers (wet solution) and SeaSOx Dual/Multi-Filtration.’

• SO2 removal to achieve a 0.1% Sulphur content

• Low pressure loss in filter < 15mbar

• Less power consumption (around 90% less than a wet scrubber)

• No circulating fluids

• No dry dock required for installation (as no sea chests or overboard installation work are needed)

• No wash water

• No exhaust gas plume

• No chemical concern (NaHCO3 is also known as baking soda)

• Additional dust separation > 99%

• Exhaust gas from several sources can be cleaned at the same time

• No harmful sorbents

• Less equipment overall

Contact: https://www.andritz.com/products-en/group/environmental-solutions/air-pollution-control/seasox-exhaust-gas-cleaning

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blu-Energy Revolution (Hydrogen Energy Battery, Storage & Systems for Vessels)

Activities: BluEnergy Revolution (BER) offers Engineering, Consulting and Training services in the field of traditional and innovative energy systems, bringing research excellence in these fields and in particular all the knowledge in the nautical sector. The product that will be launched in the marine sector from its spinoff company H2Boat (H2B) is the Energy Pack, a system of storage of energy produced from renewable sources for sailing boats. The Energy Pack is a system that uses hydrogen technology to autonomous leisure boats; especially sailing boats; from the point of view of the electrical needs on board. The system consists of three parts: a fuel cell, able to produce electricity from hydrogen; an accumulation with metal hydrides, able to store large quantities of hydrogen safely at low temperatures and low pressures; an electrolyser, able to produce hydrogen from water using excess energy produced from renewable sources.

They motivate their activities as under:

Energy Storage Batteries lack the energy capacity, energy density, require the use of critical raw materials and have a poor LCA. BER wants to develop a system (Energy Pack) usable for many applications that, exploiting the hydrogen technology, is able to store and produce energy without polluting. The spinoff company H2B integrates the energy pack on board sailboats and motor yachts increasing the GHGs free electric energy, increasing comfort in a sustainable way.

Sustainable Impact on Blue Economy: The socio-cultural impact and its trend are measurable through the KPI: #companies, #employees, # research projects, # events, # publications, #products. From an environmental point of view, all the research and development activities revolve around hydrogen technology as a future solution for reducing the environmental impact of humans activities on the environment. It is possible to establish indexes for the reduction of polluting gases produced by sailing boats and motor yachts that will use the Energy Pack system, which is being standardized and which will be put on sale in 2021. Respectively for a sailing boat (10 kW) and a motor yacht (60 kW): 2.1-15 kgCO2 / h saved; 20.8-124.5 gSOx / h saved; 40-240 gNOx / h saved.

Contact: <https://bluenergyrevolution.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Blue Technology (Sustainable Maritime Transport (Zero Emission Ships and Solutions)

Activities: We need to come up with an alternative track, as future consumers, companies and eventually shippers require a more sustainable way to transport their commodities. Most of the major companies, have already committed to lower their carbon footprint, and transportation is where they will find the low hanging fruits. The market will be there for that first mover, who dares to think on a long-term sustainable way of transport. Traditionally, a ship is designed to carry a certain amount of containers, cars, people or tonnage and compromises on its efficiency and aerodynamics due to a length maximum. Liberty is designed purely for optimal performance, allowing them to go zero emissions. To demonstrate the capability of this new type of vessel, they are working on 4 case studies based on a 200 meter long wave-piercing trimaran with a width of 55 meters, two x 110 meters tall wings and a designed draft of 4.5 meters.

**PROJECT #1: Liberty Pure Car Carrier:**

Their first project is Liberty PCC, servicing the route Veracruz – Zeebrügge, with a capacity of 2.000 cars. They have an average wind speed around 8 meters/second, and believe they can offer a service that is competitive in price and transit time.

They see this as a great opportunity for the car manufactures to achieve their emission reduction goals – while not compromising on delivery times and saving money on fuel. Partners to develop the car carrier case will be involved to ensure the availability of the relevant competence related to cargo handling and port operations. The study of this PCC will be published still this year.

**PROJECT #2 Liberty CONTAINER CARRIER:**

This design has a capacity close to 1,200 TEUS and a system where containers are loaded by a reach stacker and moved inside the hull via an interior storage system.

They have no need for lashing and this system allows them to line up the containers that are to be unloaded at the next destination during the voyage. All containers are all stored inside the hull, and will not be stacked, therefore more cargo can be transported by using flat-racks. Also reefer containers can reduce their energy consumption, when transported “below deck” compared to containers on deck that are exposed to heat and sunlight.

**PROJECT #3 Liberty CARGO:**

Wind and solar energy is expected to become the major energy source of the future, and a lot of equipment needs to be transported for this to materialise. Due to its width and stability, Liberty can easily be modified to carry long items such as wings, and other windmill equipment. Transporting this equipment with zero emissions, improves the total life cycle of the future wind farms significantly. A study of this segment is planned to kick off by June next year.

**PROJECT #4 Liberty CRUISE:**

Todays cruise ships are massive polluters, purely for the pleasure of the cruise guests. They expect that the coming focus on CO2 will affect cruise tour operators negatively, unless the cruise lines can offer a zero emissions solution. LNG, HFO with scrubbers or MGO will not be part of this industry on newbuilds in a decade from now. And today’s newbuilds will need to compete with zero emission options well before they reach their twenties. Blue Technology can offer zero emission, low noise, no vibrations, excellent stability and comfort cruising, without damaging the places they visit. An initial study of the options within the cruise industry is planned by next year.

Shipping is currently focusing on autonomy, mega ships, improved engine technology, better lupe oil, LNG, scrubbers, waste heat recovery systems and installation of LED light in order to cut its overall CO2 emissions by 50% within 3 decades. Focusing on small optimizations to improve the efficiency as well as other fossils or energy intensive biofuels will not really impact the fact that shipping continuously adds 2-3% annually to its CO2 emission. ‘We need to acknowledge that today’s newbuilds are all fossil ships, that will be outmanoeuvred by sustainable ships within the next 15-20 years and they will end as stranded assets. Shipping need to have a great number of zero emission ships in service within the next decade in order to meet its own targets’.

Contact: <https://bluetechnology.dk/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Bound4Blue (Innovative Vessel Propulsion Via Foldable Wingsails)

Did you know that the sixteen largest vessels in the world generate the same amount of sulphur emission as the entire world fleet of cars? Tighter regulations are being enforced by several actors, such as the International Maritime Organisation and the European Union, to reduce the CO2, SOx and NOx pollutant emissions.

FUEL COST INCREASING

These regulations will force ship owners and operators to switch to a higher-quality but more expensive fuels such as Marine Gas Oil (MGO), thus negatively impacting shipping fuel-related OPEX. This new scenario builds up an enormous challenge for the industry.

BOUND4BLUE IS THE SOLUTION

Activities There is a clear need around technologies to protect the environment while being economically profitable and impacting positively on our society. They claim to have the solution. Bound4blue has developed a foldable and autonomous wingsail system to be integrated onto a wide range of vessels. The system has been conceived as a complementary propulsion system, which produces effective thrust from existing winds, reducing the main engine power required and, therefore, delivering fuel consumption and pollutant emissions reductions of up to 40% and it ensures a payback period under 5 years.

Contact: https://bound4blue.com/en/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Boundary Layer Technologies (Hydrofoil Container Ships 3x Faster)

Activities: This is a Marine tech startup building hydrofoil container/cargo ships, delivering ocean freight 3x faster. It is backed by Y Combinator W19. Boundary Layer Technologies is building small, fast hydrofoil cargo ships. By offering an on water speed of 2x that of normal ships, direct routing and daily services, their ships will be the successor to expensive and polluting airfreight.

Contact: https://www.boundarylayer.tech/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Bunker Metric

Activities: BunkerMetric, a Denmark-based digital technology firm, is working to assist operators and bunker buyers in finding the best bunker purchasing plan with its Bunker Planner analytical tool. Before setting up BunkerMetric, co-founder Christian Plum saw that the bunkering industry was underserved with analytical tools which could create transparency, lower costs and assist planners and buyers to make good decisions faster. He believes they can help their tools stick with customers by addressing some of the real pain points. These include quickly adapting to changed market conditions; reducing the risk of bad business practices and reducing personal bias by adding more transparency to bunker purchasing and the supply chain; make shipping greener and lower fuel costs by calculating the voyage execution. BunkerMetric’s tools now focus on the existing fuel supply chains currently covering VLSFO, MGO and HFO, adding new fuel types such as LNG as their availability and market develops. BunkerPlanner assists operators and bunker buyers in finding the best bunker purchasing plan and improves voyage margins by hundreds of $/day, while considering all operational, regulatory, environmental, and commercial constraints.

BunkerPlanner can be set up very quickly, as it interfaces with your existing VMS. Their daily bunker planning digest helps you focus on the bunkering activities that are relevant today. ‘The payback period of our solution is measured in weeks.’

Contact: http://bunkermetric.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Bunker Trace

Activities: Bunker Trace offers end-to-end oversight of your marine fuel supply chain. Combining synthetic DNA tracers (tags) with blockchain technology bridges the physical and digital to create an immutable chain of custody that follows the fuel. Built with and for the maritime industry, Bunker-Trace is a turnkey solution for marine fuel traceability, providing evidence of the authenticity and quality of fuels for actionable insights and compliance. BunkerTrace is a joint venture that combines solutions and expertise from technology innovators BLOC and Forecast Technology Ltd. In 2018, BLOC’s Maritime Blockchain Labs brought together a consortium of actors consisting of LR FOBAS, Precious Shipping, IBIA, GoodFuels, BIMCO, and Heidmar to validate the concept of marine fuel assurance. In September 2018, they completed the world’s first digital end-to-end blockchain fuel transaction in the Port of Rotterdam. Yet, this collaboration demonstrated that tracing fuel in the digital world only would not be enough - they had to bridge the digital and the physical for this solution to be of value to the industry. Forecast Technology’s specialised, patented, synthetic DNA tracer technology provides the answer. This technology facilitates environmental protection initiatives and legislation and is a natural fit for monitoring marine fuels. The result is a joint venture that brings forward a solution combining both elements of DNA and Blockchain that together create fuel authenticity by enabling instant physical field inspections and results, recording transactions and providing actionable digital data insights for detection, enforcement and protection of brand reputation.

Contact: <https://bunkertrace.co/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Can-Scan (Automated Shipping Container Inspection Service)

Activities: Canscan Software and Technologies is an automated shipping container inspection service. Through machine vision and deep learning their camera based detection system instantly flags shipping container deterioration and damages. Often, as containers arrive at ports, a dedicated employee must stand at the dock and count containers, as well as record any damage to them, even when environmental conditions are particularly inhabitable. These inspections include climbing on top of containers and viewing them from all sides to record any holes, damage, or missing locks. Not only is it costly and time-consuming, but it’s also tedious for employees and highly prone to human error. Canscan tackles this problem by leveraging existing cameras, like security cameras, on-site and applying machine vision algorithms to identify damage or missing locks and dispatching an employee to examine and report the damage

Contact: <https://www.canscantech.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Cloud Fleet Manager (Hanseaticsoft) (Seafarer/Shipping Management and Resource Solutions)

Activities: Hanseaticsoft is driving digital transformation with a new approach to business applications for shipping companies. By replacing paper-based systems with digital processes like Cloud Fleet Manager created by Hanseaticsoft, shipping companies around the world are decreasing costs, reducing administration, improving efficiency, and automating tasks. Cloud-based management systems are being introduced into areas such as:

* + document management.
  + logistics and supply chain management.
  + managing crews and resources.
  + communicating with third parties; and
  + improving the wellbeing of seafarers by allowing them to communicate with friends and family while at sea for long periods of time.

From saving costs and centralised data to up-to-date reporting, the benefits of cloud-based vessel software are endless. Cloud Fleet Manager is the web-based all-in-one software solution for shipping companies. The system offers a single, cloud-based source of truth for all employees as well as the crews at sea and external partners, centralizing all information and drastically reducing the effort for data exchange. The cloud-based design of the application gives you the freedom to use it anytime, anywhere and browser-independent. Even on your smartphone you always have access to the most important information. Cloud Fleet Manager offers tailor-made applications for all different departments of the company and increases collaboration, streamlines processes and can be used intuitively.

Contact: https://hanseaticsoft.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Cubex Global (Digital Marketplace for Sea Freight)

Activities: Cubex Global – This digital marketplace for sea freight can maximize empty shipping container space while simultaneously protecting the planet with a more sustainable approach to ocean transport. Bid for spot and book online in seconds. Experience real time spot bookings without involving long and complex process It offers:

• Instant Bids and booking

• Paperwork solution

• Realtime shipment tracking

• One central dashboard

Contact <https://cubex.global/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Dolprop Fluke Tech (Vessel Sustainable and Silent Marine Propulsion System)

Activities: Dolprop is developing the world's most efficient, sustainable and silent, next generation marine propulsion system: FlukeTech. The fin based propulsion system is based on dolphin biomimicry, ‘leveraging 50 million years of nature's own R&D’. Compared with a conventional propeller, FlukeTech reduces fuel consumption and CO2 emissions by 20%, underwater noise by 90%, and is safer for marine animals. The technology can be retrofitted to engines on small pleasure boats as well as large merchant ships.

**Environment & Safety**

Today’s vessels are causing both severe air and noise pollution. The marine transportation industry itself accounts for 3-4% of the global energy-related emissions. In addition scientists point to noise pollution as a likely cause of impaired marine animal health. Connections are made between decreased reproduction and beaching among Cetaceans, and the rapidly increasing noise pollution of the oceans. Fluke propulsion technology is safer than other predominant propulsion systems of today. As the fluke consists of soft parts it can handle groundings without breaking and is safer for all creatures, on or around the device. As it is not propelled by a rotating movement, ropes and seaweed, and other items does not risk to be tangled up in the fluke drive. This further increase safety for the user and up time for the devices significantly.

**Efficiency**

Research from NTNU has predicted that the rate of efficiency for fluke drives are more than 40% higher than for conventional propulsion systems as the energy used for noise and cavitation is eliminated. The energy inserted into the system is used for propulsion, as intended. With the patented fluke drive, Dolprop thereby opens up for an opportunity to significantly reduce air pollutants such as CO, CO2, HC+ NOx, and SOx as well and noise emissions. The increased efficiency of the fluke drive also enables electric power propulsion to become a realistic option in future applications.

FlukeTech reduces fuel consumption and CO2 emissions by 20%, underwater noise by 90%, and is safer for marine animals, compared with a conventional propeller.

Contact: http://dolprop.se/en/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Eco Marine Power (Solar/Wind Power Propulsion, Fuel Optimisation, Batteries, Data Logging)

Activities: Eco Marine Power are producing Innovative Solutions for Zero Emission & Sustainable Shipping and Offshore Applications, including: Data Logging, Marine Solar Power, FOC Monitoring, Marine Batteries and Ship Renewable Energy Systems. Eco Marine Power (EMP) offers a range of sustainable shipping and offshore related products and services. Their products include renewable energy systems for ships and offshore applications, fuel oil consumption (FOC) monitoring and automated emissions logging computer systems, class-approved batteries & ship solar power solutions panels. They also offer consulting and design services including renewable energy surveys of ships for both new-builds and existing vessels.

**Aquarius MAS - Performance Data, Emissions & Fuel Consumption Monitoring & Logging.**

A compact & reliable computer platform for ships and vessels, the Aquarius Management & Automation System or Aquarius MAS™ is a marine computer system developed jointly with KEI System which can perform a variety of roles including data logging, performance monitoring and alarm management. The system can also monitor fuel oil consumption (FOC), calculate vessel emissions (CO2, NOx, SOx) and be scaled to suit most types of vessels from small passenger ferries and offshore support vessels to large ocean going bulk carriers, passenger ferries, tankers and cargo ships. This highly flexible system is pre-configured before delivery, easy to install and can be upgraded to monitor additional systems later if required. The Aquarius MAS can also be integrated with renewable energy devices such as solar panels, wind power devices and EMP's Energy Sail technology.

**Aquarius Marine Solar Power - For Ships & Offshore Applications**

Solar power systems for shipping including energy storage & MPPT charge controllers. Marine Solar by Eco Marine Power EMP offers a range of marine solar power solutions for ships integrated with and managed by their Aquarius Management & Automation System (MAS). Using solar power on ships helps reduce fuel costs and airborne emissions such as Sox, NOx & CO2. In co-operation with their partners they can also offer flexible high quality solar panels which are designed to withstand the harsh marine environment. These unique solar panels are also lightweight and thin which makes them ideal for use on ships ranging from large cargo vessels and cruise ships to smaller passenger ferries and even recreational boats such as yachts. They are also able to supply battery packs via their strategic partner - The Furukawa Battery Co, Ltd of Japan. These battery packs are integrated with and managed by the Aquarius MAS. Their integrated marine solar power systems also include MPPT charge controllers and monitoring software. In addition EMP can provide a full turn-key solution including site engineering and installation.

**Marine Batteries, Energy Storage Solutions for Shipping, Offshore and Marine**

High performance batteries for renewable energy solutions and Emergency back-up power. In co-operation with The Furukawa Battery Co. Ltd. of Japan, Eco Marine Power is able to engineer and supply a range of battery packs or energy storage solutions for use with Aquarius Marine Solar Power or Aquarius MAS + Solar solutions. These battery packs or sets include the FCP series which has a modular design for superior vibration resistance and longer life. The mounting unit has a space-saving design that reduces installation and maintenance time. A range of battery units are available ranging from 24V 220Ah (FC-38) to 48V 4000Ah (FCP Series). Other voltages and larger capacity battery packs are also available plus individual batteries for marine or UPS use can also be supplied. Furukawa Battery also manufactures batteries for auto-mobiles, motorcycles, electric powered vehicles, stationary use, trains, aircraft, portable use and solar power generation systems.

**System Design, Marine Renewable Energy Surveys and Consulting Services**

Low emission vessel concepts, system design, renewable energy surveys & technology management. Trying to work out which environmentally friendly power or propulsion system is best for a particular boat, ship, ferry or vessel etc can be a daunting task. Not only is there a wide range of options available, but the cost of these systems also varies considerably. In addition, the environmental and cost benefits of these solutions are difficult to assess and compare against similar traditional systems. Eco Marine Power can assist ship owners, shipyards, ferry operators & cruise lines to navigate through this maze of data and propose solutions that will best meet their needs. Their services include design support, installation surveys, technology management and the survey of vessels and ships to assess their suitability for renewable energy solutions. They can also help with advice on various technologies such as energy storage, solar panels and marine computer & automation systems.

**Marine Computer & Automation Systems - Flexible & Innovative**

Proven & type approved solutions. Working together with KEI System, EMP has developed a number of innovative marine computer management and automation systems which facilitate the monitoring of equipment on ships, log performance data, control equipment and manage renewable energy systems plus carry out other functions. The Aquarius Management and Automation System or Aquarius MAS is the first of these systems to be released and allows for the performance of marine renewable energy systems to be monitored along with other equipment on the ship including main engines and generators. This system and others to be released such as the EnergySail Automated Control System (ACS) are based upon the robust and reliable KEI 3240 computer platform which has proven itself on-board hundreds of ships in service today.

**Flexible Solar Panels and Frame Kits for Ships & Marine Applications**

Emissions free power. EMP is able to supply globally marine grade solar panels for shipping and marine applications. Marine solar panels are designed to withstand the harsh conditions at sea & are suitable for all vessels ranging from small pleasure craft to ocean-going passenger ferries & cargo ships. These high quality solar panels are also incorporated into their Aquarius Marine Solar Power and Aquarius MAS + Solar solutions. In co-operation with Teramoto Iron Works special marine mounting frame kits are also available for ship photovoltaic (PV) installations or for coastal PV facilities.

**Aquarius MRE® - Renewable Energy for Shipping**

Integrated wind & solar power system for shipping. Aquarius Eco Ship by Eco Marine Power. The patented Aquarius MRE® is an advanced integrated system of rigid sails, solar panels & energy storage modules that will allow ships to tap into renewable energy by harnessing the power provided by the wind and sun. The array of rigid sails will be automatically positioned to best suit the prevailing weather conditions and can be lowered and stored when not in use or in bad weather. The array of rigid sails are based on EMP's EnergySail technology and can even be used when a ship is at anchor or in harbour. It is expected this system will provide annual savings of between 10-20% on large ships and up to 40% on other ship types.

**EnergySail® - Wind & Solar Power for Sustainable Shipping**

Advanced & innovative rigid sail design with integrated computer control EnergySail rigid sail for ships. The patented EnergySail is an innovative rigid sail device being developed by Eco Marine Power linked to a computer control system which automatically positions it to suit the prevailing weather conditions. The EnergySail can be fitted with marine grade solar panels or other devices and used either as a stand-alone unit or as part of an array. The EnergySail is suitable for a wide range of ships including ferries, bulk ore carriers, oil tankers and offshore support vessels. The computer control system for the EnergySail has been developed in co-operation with KEI System of Osaka and can be integrated with other marine computer systems such as the Aquarius MAS or KEI 3240 IAS. A variation of the EnergySail can also be used on Unmanned Surface Vessels (USV's).

Contact: <https://www.ecomarinepower.com/en/products>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ecomar Propulsion (Zero Emission Marine Propulsion Systems)

Their Targets

* To reduce CO2 emissions by 1 million tonnes by 2030.
* To build the most stylish, most reliable, lightest, fastest zero emission marine engines in the world.

Activities: Ecomar Propulsion design and manufacture zero emission electric marine propulsion systems. Outboards ranging from 5- 100kW and Ship systems to 1 MW. They Turnkey, retrofit and new build engines that are specifically designed to meet the demands of commercial operators including fish farms, emergency response and short haul vessels. The product line is designed Ito allow for rapid adoption and flexibility by using modular energy systems which can adapt to the use case and not simply to maximum power ratings. They are refining the outboard prototypes for production readiness and market launch in 2021. Inboard ship systems will follow in 2022/23

Sustainable impact on blue economy: We reduce emissions from polluting engines to zero.

Contact: https://www.ecomarpropulsion.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Econowind (Autonomous Wind-Assisted Vessel Propulsion Units)

Activities: Econowind offers an innovative foldable and autonomous unit for wind-assisted ship propulsion, helping to propel a variety of coastal vessels. The Flatrack Ventifoil® unit is based on ISO-fix corners and can quickly be placed and removed. Giving a flexible solution for a variety of vessels such as general cargo vessels or other vessels. The Flatrack system has the advantage to be moved with the hatch crane of the vessel, no additional harbour equipment is needed to move the flatrack system, which provides flexibility in use.

**Retrofitted Ventifoils®**

Econowind offers and provides in the placement of Ventifoils® which are fixed to a vessel. In contrast to the Econowind-unit, where the ventifoils are placed inside a 40ft container, the sizes of the foils are not limited to a container. The Ventifoil® is a wing shaped element using modern innovations in aerodynamics creating high propelling force relative to its size. Smart suction is integrated in the wing, resulting in double the force of the Ventifoil® while reefing when needed.

Contact; https://www.econowind.nl/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### EMH Systems Limited (Marine Environment Regulation Compliance Hub Solutions)

Activities: EMHS set out in 2017 with the common goal of assisting the maritime industry in not only complying with the strict environmental regulations which govern it, but with a vision of improving our overall interaction with the seas. In today's modern world ship operators face complex environmental regulations, numerous marine protected areas, emission controlled areas, ballast regulations, and other local directives on a common basis. Since regulations can change continuously according to the ship’s position, it has become increasingly difficult for the ship’s personnel to comply at all times. In response to this challenge, a team of specialists developed the Environmental Compliance Assistance Platform or ECAP for short and the Maritime Environmental Hub. They believed the only true solution should be as dynamic as the issues they solve. Integrated together, they offer ‘the only top to bottom solution linking any major player in the regulatory process’. EMH Systems Ltd. is located in Varna, Bulgaria, one of Eastern Europe’s prominent ports and set in a region increasingly marked by growth in the IT and maritime sector.

When dealing with the global web of environmental policies regulating our industry, there must be a clear map for all. Designed for optimal simplification while maintaining a complex network, the Maritime Environmental Hub is that map. Linking any major maritime player including agencies, administrations and your own organization under one platform, the hub is set to be the most comprehensive centralized database in the industry. Access complex regulations in an easy to navigate manner with the end user in mind. ‘We understand most regulations come in the “not so easy to understand” format and maintaining them all can be a hassle in itself. We’ve changed that, and now you have the control in one place’. Additional headquarters in New York, NY has been established in early 2018.

Contact: <https://emhsystems.com/en/about-us/subnavigation_level_1.html>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ever-Tracker (Integrated Supply Chain Solution)

Activities: Ever-Tracker provide a single access to your Global Supply Chain. Multinational OEM’s already trust in their Control Tower for Global Supply Chains to optimise their production planning. Evertracker’s Control Tower for Global Supply Chains gives them a single access to their Global Supply Chain. However, it not only provides an overview over their shipments, it provides detailed information about specific items and parts. Evertracker’s Control Tower provides transparency and smart analytics on an item-level. Their customers get therefore an instant overview in a single interface over all flowing parts and items.

**Control Tower: Predictive Analytics**

Predictive analytics is one of the key functionalities of their Control Tower. It provides precise information about arrival times. They have developed algorithms that learn and understand processes, which then can predict precise arrival times at the final destination. Their unique sets of algorithms learn und understand your supply chain to enable our users to understand what will happen

**Deviation Detection**

Deviation detection is another important feature to optimise production processes. With the help of an early warning system, their international manufacturers are enabled to react faster on incidents. They can take immediate decisions to avoid running dry. Get proactive notifications about delays and process deviation to react early on incidents

**Benefits of Evertracker’s Control Tower**

If Control Towers provide predictive analytics, deviation detection throughout Global Supply, manufacturers and producers can reduce downtimes, decrease costs and free working capital. End-to-end item-level visibility enables them to precisely plan and optimise processes. It makes Global Supply Chains more robust, flexible and resilient. It will also make them more sustainability. Evertracker Control Tower for Global Supply Chain Management - Predictive Analytics, Deviation Detection and Smart Reporting Your entire logistics on one single platform. End-to-End Item-Level Predictability.

**Real-time information**: Their platform provides you with real-time information and active notifications of statuses of your shipments to take faster decisions

**Single access point**: They aggregate all data providers in a single interface and connect the strings along your supply chain, which gives you end to end visibility

**Digital processes:**  Digital information enables you to transfer manual processes to increase efficiency, reduce costs and optimise your operation.

**Current Location**: See your shipments on a map to better understand where they are and when they will arrive, and with Predictive ETAs get an overview of arrival times of your shipments by day, week or month for an optimal planning

**Smart Reporting**: Use their smart reporting to optimize your supply chain and automate processes like invoice verification. ‘We help you Understand the Yesterday. Their algorithms enable you to get digital proofs and signatures along your global logistics and supply chain. You can use our platform e.g. for invoice verification or automate proof of deliveries.’

**Predict the Future**: The unique set of algorithms constantly analyses the inflowing data and compares it to historical events. In this way, you receive predictions on what’s next. You can monitor all your containers on one sight.

Contact: <https://evertracker.io/smartest-control-tower-global-supply-chain/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### eYard (AI Software to Improve Container Terminal Operation Inefficiency)

Activities: eYARD is a cloud based software that uses AI to slash container unproductive moves in the yard. Unproductive moves generate more than € 17 billion additional costs terminal operators worldwide. By applying the most innovative technology, eYARD helps container terminal operators reduce costs and improve operational efficiency. eYard’s core product increases the efficiency of container terminals with artificial intelligence and data analytics, resulting in more reliable, cost efficient and sustainable operations. The AI- powered platform reduces the unproductive moves of containers in the yard, facilitates the automation of complex processes and provides visibility and insights with smart reporting. Ports in Europe are already benefiting from eYard’s platform reducing unproductive moves and terminal costs by 25% and yard related costs by 21%.

Contact: <https://www.eyard.io/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Flex Port (Online Customs Brokerage and Freight Forwarder Dashboard Solution)

Activities: Flexport is a licensed customs brokerage and freight forwarder built around an online dashboard. Their mission is to fix the user experience in global trade and bring the world free trade through technology. ‘Say goodbye to the black box of freight forwarding.’ Flexport delivers deep visibility and control, low and predictable supply chain costs, with faster and more reliable transit times. All from a powerful technology platform. Flexport connects all the parties in global trade – importers, exporters, trucking companies, ocean carriers, airlines, customs agencies, port terminals – through a single, secure cloud-based platform.

Contact: <https://www.flexport.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Flow Water Technologies (Carbon Neutral Water Ballast System)

Activities: Flow Water Technologies Ltd has spent the last 6 years developing environmentally friendly, energy efficient and reliable equipment for the Marine industry, aimed at solving environmental legislation now being imposed on the industry. Flow Water's modular electrochlorination Ballast Management System is unique, safe, easy-to-install, eco-friendly and will be compliant with the latest IMO and USCG regulations. The filterless system was developed specifically for the shipping industry after extensive consultation with global ship owners and operators. FlowSafe uses a combination of two methods of treatment; a low energy frequency Sea Water Condition Unit on the main ballast water fill-line, eliminating the need for filtration as well as the production of concentrated sodium hypochlorite from the sea or freshwater using high capacity electro-activation.

They motivate their activities as under:

Simplicity in installation, price and, should vessel go for scrub, the system can be removed up to 95% and be reinstalled on another vessel. They do not use filters which are very costly to maintain. Also, their system takes very little from the ship's energy. FlowSafe is specifically designed for the 'Difficult to Fit' vessel. There are no space restrictions on their design due to its modular construction. There is no invasive engineering and no need to re-route pipes. All systems are explosion-proof as standard. All systems cater for submerged installation. Can be fitted at sea or along-side reducing downtime to 10% No crossover complications. Their FlowSafe Ballast Water Management system is ‘the only recognised carbon-neutral system globally - we have academical proof of this’. It demands less work be installed and is ‘probably the only system globally that can be installed at sea while others have to go to dry dock’. The electricity it consumes is minimal and there are no filters to replace. In general, it saves the shipowner thousands, creates fewer emissions, and should the vessel go for scrub, the system will not as it can be removed and reinstalled at another vessel with some modifications.

Contact: <https://www.flowwatertechnologies.com/en>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Flux Marine (Low Emission, Silent, Low Maintenance Electric Vessel Outboard Motor)

Activities: In 2019 E-Team Princeton University created an electric outboard motor that requires little maintenance and produces faster acceleration, silent operation, and zero tailpipe emissions.

The idea behind Flux Marine was driven by an unsinkable passion for boating and the environment. Growing up, their hobby was restoring old boats and engines on Lake George, NY. Countless times motors wouldn't start, resulting in weeks of repairs and sometimes even the rest of the summer off the water. They knew there had to be a better way. Inspiration came when they saw electrification in the automotive industry. Automakers were proving that performance, reliability, and sustainability no longer had to be mutually exclusive. While studying engineering at Princeton, Ben Sorkin found the Princeton lab for electrochemical energy systems research and dove into the world of battery technology. This led him to work at Tesla, where the technology vision for a better boat motor was strengthened. The first step was to build a prototype. They built their very first proof of concept in 2015 during a summer research program at Princeton University. That prototype almost broke an electric world speed record. Several years of research followed as they worked to perfect their technology. In 2018, they officially incorporated and tirelessly worked to build additional prototypes and prove the business viability of electric propulsion in the marine industry. They won some of the nation's top business plan competitions and competitive prizes. Through a ground-up design and innovative technology suite, they developed a product that challenges the norms of electric as slow and boating unreliable and expensive. They put our 30 HP technology demonstrator on our 1961 Glasspar G3 ski boat which ran better than the old 100 HP Merc Tower of Power they restored growing up. Not only did the boat move at 25 knots, but you can actually pull a skier because of the torque. Their focus has been towards developing additional outboard models and refining them to commercial quality. Their mission is to develop marine propulsion systems characterized by performance, scalability and dependability. Their product is a complete system comprising an outboard motor, battery, and control set. Ranging in power from 15 to 70HP+,their systems are suitable for diverse applications across the boating industry.

Contact: https://www.fluxmarine.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### FreightBro

Activities: FreightBro is a digital platform specially designed for the freight forwarders to enable them to perform their daily tasks efficiently & effectively. FreightBro helps source rates faster, reduce operational inefficiencies, boost sales, make informed decisions using data analytics, thereby providing a seamless user experience to the customers.

Why FreightBro?

* Save 70 % Time Invested through Simplified Rate Distribution
* Instant Quote Generation
* Streamlined Communication
* Reduce 50 % Cost Spent on Customer Acquisition Operational Activities
* Boost 30 % Sales with Increase in Quote-to-Win Ratio Automated Rate Discovery
* Instant Booking
* 7300+TEUs Booked
* 750+Forwarders
* 3000+Active Users

Contact: https://freightbro.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Fuel Save Marine (Integrated Marine Fuel Saving Solution)

Activities: The FS MARINE + provides a patented solution to reduce fuel consumption of marine diesel-powered engines and auxiliary systems and reduce significantly emissions. FS MARINE+ solution has been field-tested on high seas, certified and approved by DNV GL as the world’s first onboard hydrogen generator and injection solution with gas & liquid injection mechanisms and processes. The proven benefits from real-life operation and lab tests are impressive and inherit the potential for further improvement by fine-tuning to the specific engines and their usage profiles. Their aim is to help ship operators to increase their profits, while reducing the impact on environment.

FUNCTION

An intelligently controlled Hydrogen syngas generator and injector combines a proprietary gas injection with other efficiency enhancement processes, like a specific water methanol injection to increase combustion efficiency, leading to a cleaner and cooler combustion, thereby reducing fuel consumption and emissions.

BENEFITS

* Savings on fuel consumption (10-15%)
* Reduce emissions (Co2 10-15%, FSN 40% , NOx 30-80%)
* Reduce maintenance and repair costs
* Reduce engine wear & tear

ADVANTAGES

* Achieved Several World Firsts
* Worldwide unique solution
* Amortization within the warranty period
* Flexible business & pricing models focused on customer ROI
* IMO Tier I & II compliant for older ships

HOW IT WORKS

By injecting an onboard-generated proprietary hydrogen-based synth gas with methanol into the engine under approved and tested security mechanisms, they improve the combustion efficiency. Due to the higher energy potential of the gas mix, the ignition takes place earlier and the fuel is being burned more completely, providing more energy with a more efficient combustion. Simultaneously the operating temperature is decreased on the heat bearing parts of the combustion process by a proprietary water methanol injection. FS MARINE+ is available as a fully packaged “plug & play” module for equipping maritime vessels for featuring the most cost-effective deployment with the least amount of work. The FS MARINE+ Container has been designed to provide ship operators with a more cost-effective, plug-in-and-play version of its engine combustion optimization and emissions abatement system. This enables shipowners to deploy the solution with minimum installation and ship preparation costs and without space constraints under deck, while enabling the system to be reusable from one ship to another. The development also facilitates the possibility of “hot-swapping” the containers in due to service and maintenance requirements without impacting the shipping schedule. The fuel additive technology, proven to improve fuel consumption by up to 25%, cut CO2 and nitrogen oxide (NOx) emissions by up to 80%, FSN and PM by 40% and slash engine maintenance costs, and can now be installed on deck in either a TEU or FEU container. The development negates the need for engine room modifications as only additional pipework is required to connect the FS MARINE+ Container to the engine and the ship (electricity, water, air, methanol tank, alarm system).

Contact: <https://fuelsave-global.com/losungen/fs-marine/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Futureproof Shipping (Integrated Zero Emission Carbon Service, Project Developer & Zero Emission Tonnage Provider).

Activities: Creating a zero-emissions shipping world. Future Proof Shipping BV provides zero-emissions marine transportation solutions. They will contribute to a future proof shipping world by accelerating the energy transition, and creating new maritime value chains to make the industry free of fossil fuels and harmful emissions. An integrated service offering comprising project development & management, technical, financial and commercial services tailored to their customers’ needs.

**Zero-emissions Tonnage Provider**

They offer zero-emissions vessels for charter, starting with inland and short-sea vessels. As technology develops further, they hope to offer zero-emissions ocean going vessels for charter as well.

Contact: <https://www.futureproofshipping.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Golden Gate Zero Emission Marine (Marine Fuel Cell Technology) including the Water Go Round Vessel

Activities: Golden Gate Zero Emission Marine has the solution to bring maritime emissions to Zero. Their mission is to partner with you to bring the benefits of zero emission hydrogen fuel cell technology to your business and the planet.

FUEL CELL TECHNOLOGY

Fuel Cell powertrains turn fuel into electricity using no moving parts, while producing no exhaust other than water so clean you can drink it. Since fuel cells require much less space for maintenance they can be arranged like server racks allowing the on-board space to be used more efficiently. Fuel Cell systems afford the same operational flexibility as diesel but with zero emissions and simpler maintenance. When launched in late 2020 the Water-Go-Round will be the first fuel cell vessel in the US and the first commercial fuel cell ferry in the world. The completion of this project represents a global paradigm shift for marine vessel power. Built by GGZEM and its partners, this vessel will serve as a demonstration to the commercial and regulatory community at large. Performance will be independently measured by Sandia National Laboratories.

Contact: https://ggzeromarine.com/projects/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Green Steam (Enhanced Vessel Efficiency and Performance Monitoring)

Activities: Green-Steam's machine learning technology makes sense of the myriad factors which interact and impact a vessel's efficiency. MARPOL Annex VI regulations will increase fuel costs from 1st Jan 2020. Implementing Green-Steam's algorithm across your shipping fleet will deliver material bottom line EBITDA benefits. Their service model is easy to adopt across your fleet and their solid track record, backed by 12 years of development and underpinned by their maritime expertise means the efficiency advice they deliver for each vessel reliably delivers bottom line benefits and reduced CO2 emissions.

Green Steam’s Intelligent Maritime platform gathers all the performance data already obtained from your vessel and uses machine learning to analyse all of it to provide the most accurate insights possible – traditional and legacy data analytics only looks at 10%. The accuracy and reliability of machine learning: Operational efficiency gains can only become a reality if the complex interactions between all the operational variables from a vessel can be identified, optimized and measured.

**Performance baseline from historical data**

The performance model is created using vessel operational data, AIS, weather and sea-state data and is the basis for how GreenSteam identifies the inefficiencies that contribute to your fuel wastage.

**Modular approach that starts with vessel data**

They provide you with either predictive advice on how to operate a vessel more efficiently, or as dynamic advice in real-time to alert the crew on the bridge.

The GreenSteam platform provides a clear picture of your fleet, identifies where your most significant fuel losses are and provides accurate, actionable advice on how to minimize them – giving you clarity and control.

CAPTURE

GreenSteam Capture reads fuel flow meters where automatic data logging is not available and is the critical tool for eliminating manually recorded errors. It generates accurate fuel consumption data enabling operators and charterers to take remedial action and improve performance in real time.

DISCOVER

Deep dive into your vessels’ performance with the Discover service. See how an individual vessel or the entire fleet is performing and make informed decisions as to which GreenSteam services you need to improve performance and reduce fuel wastage.

FOULING ANALYZER

Bringing together their unique machine learning platform with your data, Fouling Analyzer provides you with the most accurate analysis of hull condition available. All events and trends are shown clearly on graphs enabling you to make informed business decisions.

TRIM PLANNER

Gain insight into the optimum trim of a vessel with their easy to read heat-map. Improve loading cargo and adjust water ballast for the best trim, for the best fuel efficiency, for every voyage.

DYNAMIC TRIM OPTIMIZER

Enable your crew to maintain optimal vessel trim for fuel efficiency throughout a voyage. This service reacts dynamically to changes in the environment and provides accurate advice on how to best trim the vessel.

SPEED OPTIMIZER

Control your vessel’s speed profile over the entire voyage to manage your fuel needs most efficiently. It takes account of weather and sea states, the vessel’s set up and the voyage being undertaken to provide real time advice to the crew on the best speed to meet their target arrival and minimize fuel wastage.

Contact: <https://www.greensteam.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Hefring Marine (Digital Co-Pilot and Fleet Management Solution)

Activities: Hefring Marine is a connected boating telematics system that delivers real time situation guidance, monitoring and trip insights. On board it generates a suggested safe speed for operators to follow based on sea conditions, wave impacts and actual speed. It connects the vessel in real time with a fleet management system for performance monitoring and alerts. At the end of each trip, a report with insights into each trip, captain and vessel is automatically generated.

* 96% of accidents caused by human error, and 50 % of maritime accidents go unreported
* 355,000 injuries in recreational boating accidents worldwide
* Monitoring and insights
* Configurable speed and impact limits
* Location, speed and impact monitoring
* Dashboard and SMS alerts
* Engaging graphical trip reports
* Captain and vessel performance data
* Insightful and actionable data
* Rescue & Tactical; Recreational; Commercial.
* User & stakeholder benefits
* Guidance, alerts & forecasts
* Crew & passenger safety
* Trip review & incident log
* Trip & operation profiles
* Monitoring, tracking & alerts
* Setting operational procedures
* Trip, crew & vessel insights
* Safety culture & cost efficiency
* Lower claims frequency
* Customizable policies & safety incentives
* Time of accident, risk & claims data
* Customer & operator training
* Warranty, repair, & maintenance data
* Fuel consumption & efficiency data

They strive to find ways to make their services more accessible and valuable for their customers. They have been looking for solutions for high speed boat insurance and to develop and make available intelligent systems for vessel owners, operators and managers that deliver valuable insights to enhance safety, efficiency, and asset longevity.

Hefring was founded in Iceland in late 2018. The team behind the concept comes from a diverse background, from business development to mechanical engineering, boat building, education, banking, and medical devices. The idea behind Hefring developed out of their own need to measure impact forces affecting the boats that they were working on developing back when they were involved in the boat building industry. At the same time, a number of incidents occurred on high-speed boats in Iceland that resulted in serious injuries. Connecting the two problem areas, they set out to develop a concept for a system capable of providing captains with guiding information about their journey. What began as a simple screen with colour indicators, fixed to the console of a high-speed vessel, has now developed into a full-fledged intelligent guidance and fleet management system. Hefring Marine was developed to ensure that each boat trip is guided, monitored and secure. It is an intelligent and condition-adaptable speed and wave impact guidance system for boats, supported by user-friendly fleet management software with real-time monitoring and detailed trip insights and reports.

Contact: Fiskislóð 53, 101 Reykjavík Iceland

[info@hefringmarine.com](mailto:info@hefringmarine.com) +354 620 3800

<https://www.hefringmarine.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### i4Sea (Ocean and Climate Predictive Platform for Forecasting Risks to Vessels)

Activities: i4Sea present i4cast®: an intelligent decision support system, capable of diagnosing and predicting the influence of sea and weather conditions on the operations of each ship. Complete and integrated, i4cast® is ‘the only Intelligent System that gathers on a single platform all the essential tools to support decision making regarding port operations and manoeuvres.’

Contact; <https://www.i4sea.com/apresentacao-i4cast/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Inno-Tractor (DiLLaS IoT Distributed Ledger for Logistics & Supply Chain management) Blockchain Service Platform)

Activities: DiLLaS (Distributed Ledger for Logistics and Supply Chain management) is a blockchain solution which guarantees secure storage and shared access of data amongst agreed partners. In logistics the solution offers a new and unique view on shipment events data for logistics companies and their partners. Let’s take the example of end-to-end tracking of valuable parcels with fragile or perishable goods, or think about for instance medicine transport. Current track and trace solutions only measure location but cannot verify if conditions set in SLAs on humidity, temperature or fragile treatment are met. InnoTractor offers a solution where sensors are measuring the condition of the goods in the parcel and send the data to the DiLLaS blockchain. All parties in the logistics chain get access to the data and SLA adherence can be openly verified without the ability of any party to tamper with the data. Based on this information the parcel can be stopped, rerouted, parties can decline acceptance and respective parties can be held accountable for SLA violation. It also enables critical insight in logistic chain weaknesses, enables fast issue detection and resolution and increases accountability.

Contact: <https://innotractor.com/services/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Marine Construction Technologies (Underwater Noise Reducing Pile Driving Construction)

Activities: Marine Construction Technologies aim to reduce the underwater noise from Pile Driving construction.

Reinhall piles™ were designed with handling and drivability in mind to provide significant reductions in noise. A breakthrough in noise mitigation. Noise from impact pile driving is transmitted both through the water and the seabed. To be effective, a noise attenuation method must therefore restrain noise along the full length of a pile as it is being driven to its target depth. Attenuation cannot stop at the seafloor. They have developed a patented solution that uses a conventional steel pile’s outer wall to encapsulate noise along its full length. They insert a fixed or reusable inner pipe for driving purposes, in essence creating a double-walled pile. The driving hammer strikes the inner pipe. Sound waves then travel along the inner pipe while the outer pipe mitigates noise transmission. After installation, the inner pipe is either left in place or removed and used as a reusable mandrel.

* Less pile driving noise = faster permitting, smaller zones of harassment/harm, and fewer project delays Bubble curtains no longer necessary
* Permitting/monitoring burden greatly eased
* Faster project completion

"By reducing underwater noise from pile driving by 20 dB, implementation of MCT’s technology could potentially reduce the Zone of Influence and required marine mammal monitoring, expedite consultation processes with the Services, and minimize construction delays due to the proximity of marine mammals."

Cameron Fisher, Biological Lead, 48 North Solutions, Inc.

Contact: http://www.marinecontech.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### KNL Networks Maritime Connectivity and Internet of Things/ Data Solutions)

Activities: KNL Networks provides a global real time access to data. KNL Networks have simplified digitalisation of vessels by providing an end-to-end solution for maritime, where KNL can integrate into any machinery on-board and collect data in a simple way, make on-board data processing and build database as well as transfer that data real time on shore making it available for shipping companies, and their selected 3rd party providers. All this is done in a secure way. Digitalising maritime industry is a thrilling opportunity, both from business perspective, but also by providing tools to contribute on making industry more environmentally friendly. Digitalisation is often considered as expensive and slow, but with KNL digitalising the vessel and having critical data available, visualised and usable for business,’ takes less than a week and costs less than €700 per vessel’” KNL system can be installed by crew and everything is remotely manageable, making maintaining the system fast and cost efficient. KNL uses proprietary shortwave radio network to transmit data. The advantages of own transmission channel are truly global coverage from pole to pole, extremely high security and easiness of integration on board, when ship IT networks can be left as is, and KNL provided dedicated channel for business data.

They founded the company back in 2011 to re-invent almost forgotten radio spectrum and made radio communications more efficient and user friendly. When maritime industry started to look ways to improve efficiency and introduce new business models, they realised that their solution provides an excellent way to provide global real time access to data in more secure and cost-efficient way than any other solution available. All this is provided as a service model, where no upfront investment occurs. Not to forget the fact, that KNL solution is provided with military grade security making it safe solution to access business critical data.”

Contact: <https://knlnetworks.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### MVXchange (Online African Integrated Logistics/Shipping Platform Solution)

Activities: Forward-thinking logistics for African trade and energy businesses. MVXchange provides seamless ways to manage trade and energy supply chains. They are in the business of powering [energy],developing [trade] and moving [logistics]. MVXtransit organizes the flow of import, export, regional and in-country freights for African businesses. It is a digital freight booking and management platform providing convenient and seamless door-to-door freight experience.

* Door-to-door delivery
* Shipment management dashboard
* Import & export (ocean & air freight)
* Customs processes & documentation
* In-country haulage (river, rail, truck & warehouse)

MVXenergi empowers users to book and manage end-to-end energy transport logistics. They move energy freight to enable safe exploration and production of oil, gas and renewable energy to power Africa.

MVXtransit:

* Offshore support vessel charter;
* LCL, FCL & oversize/project air, sea & intermodal freight service
* BIMCO Charter Party Agreement review assistance
* Vessel & freight shipment tracking
* Vessel & shipment management dashboard

Contact: <https://www.mvxchange.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Mariquant (Maritime Data Analytics Platform Solutions including Port Congestion and ETA Monitoring)

Activities: Mid-term planning is nearly impossible for the ports operations. ETA predictions provided by the captain and/or port agent are short-term and/or unreliable. Mariquant use Machine Learning to calculate ETA based on the current location of the vessel, possible routes, en-route speed profile, other factors. They can provide ETA for any port, on the 5 day horizon and 5 hours average error.

**Port Congestion Reporting**

Most of the vessels spent 90% of the trip with the speed at least 15% above the optimal. Moreover, inefficiencies in the port operations may require vessels to queue for the significant amount of time. Port congestion reporting provides information to the ship's master on the current situation in the port for the intelligent decision on the vessel's speed. Most of the vendors approach advanced analytics as a top-down due to the complexities involved with data quality, volumes and coverage. Introduction of the fully automated, ML enchanted data-driven analytics allows scaling to the magnitude of individual cases allowing timely, accurate and measured commercial decisions. The Mariquant team combine extensive experience in physical commodities, maritime, logistics, financial services and latest technology.

**Maritime AI**

Maritime transport challenges include increasing transport volumes and more stringent environmental requirements. A shortage of skilled manpower is also a threat in the future. These challenges can be overcome by technology: this is what autonomous ships are about. Safety and efficiency are important in maritime navigation. Efficiency, however, comes only in the 4th place within the e-Navigation strategy of International Maritime Organization (IMO). The primary listed driving factor is safety: E-navigation is the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment. The ESA-funded research project is titled Artificial Intelligence / Machine Learning Sensor Fusion for Autonomous Vessel Navigation (Maritime AI-NAV) and the team will utilize the Tallink Grupp’s newest vessel Megastar for practical field tests on the Helsinki-Tallinn route on the Baltic Sea. ESA’s overall objective is to improve European know-how in the field of autonomous transports and to study how European space-based positioning and navigation infrastructure, such as Galileo and EGNOS, can contribute to enhancing scientific innovation and consequently business opportunities in this field. Maritime-AI focuses on increasing the situational awareness, and in performing system integrity monitoring. Specifically, a sensor fusion of vision, sound, radar, lidar, GNSS/IMU, and AIS signals is studied. Note that these sensors are all listed in the front-running Rolls’ Royce AAWA whitepaper for autonomous ships.

**Project Objectives and Scope**

* to integrate absolute positioning and environmental perception sensors relevant for autonomous vesselsto implement AI techniques based on data from sensors for extracting features, recognizing them, and fusing this information,
* to perform learning-data recording and concept validation campaigns,
* to sensor integrity monitoring, vessel situational awareness, and navigation safety.
* – Sensors within the scope: GNSS, INS, visual cameras, microphones, RADAR,
* LiDAR\*. External databases such as AIS, COLREGS, etc. may be utilized.
* Possible AI techniques: Neural networks, machine learning, decision trees, Bayesian methods. 3 classes of AI methods: batch supervised/ machine learning, online learning, failure detection and correction

This research project started in January 2019 and lasts for two years.

Contact: <https://mariquant.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Maritime Digital (Fuel Optimisation, Vessel Performance Management and Route Planner)

Activities: They created a ML based system for shipowners and shipping companies - Marine Digital FOS (Fuel optimization system & Vessel performance monitoring). Marine Digital System is not just WMS (Warehouse management system) or TOS (Terminal operating system), it is a platform where the functionality of any systems is available to small and medium terminals and logistics companies: our TOS is divided into modules and solve complex tasks of all supply chain participants with cloud-based solutions, that can be integrated by API with any IT system You will be able to expand the additions you need without making changes to the core of the system and without the risk of becoming dependent on narrow-profile technical specialists to develop the functionality for your individual business requirements. The system kernel stack is based on Golang, Docker, PostgreSQL, GraphQL

**Benefits of the Platform Marine Digital System**

**Online access to the system:** The connection is possible from anywhere connected to the Internet. It can be your office or home computer, tablet or smartphone. Marine Digital System solutions are delivered according to the SaaS (Soft as a Service) model: they can be placed in their or private cloud, as well as locally in the customer's IT circuit.

**Integrability:** A distinctive feature of their platform is an open API for implementing exchanges with third-party software and hardware systems, such as scales, photo cameras, and video analytics, recognition and monitoring systems, accounting and management accounting systems, banks.

**Scalability:** Serious architectural implementations are not needed to use large computing power with horizontal and vertical scaling of the system, which allows increasing the number of plug-in software modules and their users.

**Safety / security:** All data is transmitted through secure data transfer, based on the https protocol, which guarantees the security of work inside the protected perimeter without the risk of external threats and data leaks.

**Intuitive interface:** The interfaces of systems based on the Marine Digital platform are tied to specific roles and are adapted to the screen resolutions of any mobile devices, presenting only the information necessary for specific users to work. To work with the system, you do not need to undergo training and possess special knowledge and skills in working with software, it is enough to have experience working with a web browser (Internet Explorer, Chrome, Safari, Mozilla Firefox, etc.) or a smartphone on Android or iOS.

**Solutions on Marine Digital System platform**

Fuel Optimization System; FOSOCR Optical Character Recognition; CRM Customer Relationship Management; WMSQMS Weight Module; Catering; Trade; Finance Port Call Warehouse Management System Queue Management System; Weight Module Catering Trade Finance; System Port Call Optimisation

Contact: https://marine-digital.com/platform

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Mayflower Autonomous Ship (Renewable Energy Powered)

Activities: The Mayflower Autonomous Ship (MAS) is named after the famous 1620 Mayflower to invoke the pioneering spirit of famous Plymouth to Plymouth, transatlantic voyage. It is powered by AI and solar energy, and is on a global voyage of discovery, designed to collect data to help safeguard the future of the ocean. The quest has since expanded to a multicultural and diverse team across 10 countries and 3 continents and has inspired the support of multiple companies and organizations all over the world. While MAS is a ship of the future designed to show the way forward for the next 400 years of marine exploration, it is important not to overlook the sensitivities connected with the name. Taking the human factor out of the Mayflower has allowed them to completely reimagine the design. Instead of thinking about eating, sleeping and sanitation, the Mayflower’s engineers were able to focus purely on the mechanics and function of the ship.

While offering the opportunity to transform oceanographic research, an unmanned research ship presents many challenges. MAS needs to understand its overall mission and destination but must be able to constantly update its route to gather the most valuable data in the short-term. Research equipment on the Mayflower needs to be light, mobile and able to operate completely autonomously, even in the middle of the ocean, where there is no connectivity to systems on land. MAS must have a high degree of fault tolerance and be robust enough able to withstand harsh ocean conditions. Sample collection methods also need to be automated, and there must be a balance between what analysis is performed by the ship at sea, and what samples are taken back to shore for analysis. Teams from ProMare and IBM are currently exploring the application of these scientific instruments and research methodologies on the Mayflower

Contact: https://mas400.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Mercado (Integrated Digital Supply Chain Management Platform Solution)

Activities: Introducing the All New Mercado Platform. Managing your orders doesn't need to be stressful. Mercado transforms the way you navigate the complexities across your supply chain. Say goodbye to complex, disconnected, and manual supply and hello to simplified, connected, and automated processes from source to store.

ONE PLATFORM TO RULE THEM ALL

Mercado connects everyone involved in your supply chain – including your own teams, business departments, suppliers, partners, and service providers – through a single platform. And with customizable dashboards and quick links, everyone can get the information they need, right at their fingertips.

ENABLE YOUR ORDERS WITH MERCADO BUY

Gain greater visibility and collaboration over your entire purchase order with Mercado Buy. From order placed to order booked, you'll have total transparency and complete predictability over your order.

* Online Ordering
* Order Management
* Order Compliance
* Network Collaboration
* Product Management
* Social Compliance

Mercado's Online Ordering solution is specifically designed to help digitalize your ordering process from creation through to delivery. Eliminating manual data entry and miscommunication with advanced features to keep your business performing at it's best. A master list shows the status of all your orders, including historic data on past orders. Coupled with robust organization tools including tags and smart grids, you always have the information you need, right at your fingertips. No more searching for documents or old versions of an order. Already use a different ordering system? No problem. Mercado integrates with many existing platforms ensuring the seamless transfer of purchase orders (POs) without the need for double entry. Alternatively, you can create orders directly within Mercado, and invite your network to view or collaborate with you, live. What's more, Mercado Order converts your POs into our patent- pending web form, eliminating manual ordering, and ensuring your order remains digital throughout the import process, with a single version of the truth. ‘With unparalleled visibility and collaboration features, tracked changes and direct communication on the order, Online Ordering really does make importing easy.’

Contact: https://mercadolabs.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Metis Marine (Maritime Virtual Assistant chatbot & other Maritime Data Solutions)

Activities: intelligence adapted for the maritime industry. Working closely with their customers they are able to turn innovative ideas into robust solutions that provide true value to the global shipping community. Based on their Mechanical & Naval Engineering expertise, their technological competence and their extensive Business know-how in shipping, they are proud to offer innovative solutions that address the core needs of a shipping company. Their promise is to provide a solid ground of intelligence for all stakeholders, based on which they will be able to accomplish their everyday tasks, plan upcoming events, diagnose problems, resolve critical issues and make evidence-based decisions.

* Past performance
* Assess present operation
* Monitor future behaviour
* Predict
* Class approved data acquisition system

At METIS Cybertech they are proud that their data acquisition service has received Type Approval Certification by Lloyd’s Register for marine, offshore and industrial applications.

**METIS-WIC-Data-Collector-2**

Their customers can be confident that they are provided with a reliable platform that conforms to recognized industry quality standards, International Conventions and Lloyd’s Register strictest testing procedures.

* Cloud based analytics platform - accessible from any device
* Real-time monitoring & powerful
* Vessel performance evaluation
* METIS - Inmarsat-3
* METIS - Voyage analysis-1
* What-If Scenario Analysis

The ultimate decision making tool for the maritime industry. Based on the actual vessel condition and on accurate weather predictions you can predict fuel consumption and ETA for any given route by altering parameters such as speed, draft, departure & destination location.

**METIS -Voyage Analysis**

Automated analysis, metrics and KPIs for every single voyage, trip and leg. All voyage related timestamps are ingested directly from the ERP — no manual user intervention required. A unique tool providing results that simplify performance assessment, accelerate the optimization of activities and supercharge decision making.

**METIS - CPA-1** CPA Monitoring

Address the challenge of continuously monitoring vessel performance while ensuring conformance to the Charter Party Agreement. Identify speed/consumption discrepancies and take corrective actions if needed. Negotiate realistic CPA terms and fend off unreasonable claims with concrete evidence.

**The First Chatbot for the Maritime Industry - Powered By A.I: METIS VIRTUAL PERSONAL ASSISTANT**

Virtual Personal Assistant, an innovative concept introduced by METIS to the Shipping Industry. Enables user interaction with METIS in plain English and instant access to any kind of information or specialized analytics. Empowered by AI, METIS provides the ultimate solution for accomplishing everyday tasks, planning upcoming events, diagnosing problems, resolving critical issues and making evidence-based decisions. The first chatbot for the shipping industry powered by artificial intelligence, Virtual Personal Assistant is helping staff from multiple departments to accomplish their everyday tasks, plan upcoming events, diagnose problems, resolve critical issues and make justified decisions.

**Live Dashboards Real-Time Monitoring**

METIS provides real-time remote monitoring and performance assessment for all critical machinery and equipment onboard a vessel.

Contact: https://www.metis.tech/metis-chatbot/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Nautilus Labs (Fleet Dashboard)

Activities: Nautilus is building artificial intelligence to advance the efficiency of ocean commerce. They deliver technology to help shipping companies minimize fuel consumption, maximize operational efficiency, and optimize fleet performance. By arming ship owners and operators with real-time predictive decision support, Nautilus is reducing greenhouse gas emissions and making global trade sustainable.

Fleet Dashboard: a single view for all your vessels. With Fleet Dashboard, Nautilus Platform enables users to compare vessel metrics and make quicker decisions at the fleet and vessel levels for voyage optimization, maintenance events, noon verification, and overall performance changes:

* Apply deeper analyses to your data
* Reach each platform module in one click
* Display and collaborate across commercial, operations, and technical teams
* Triage and maintain the vessels that need the most attention, in real time

Contact; <https://nautiluslabs.com/fleet-dashboard-a-single-view-for-all-vessels/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Nav-Alt (Solar and Electric Boats)

Activities: The only firm in India with experience of building large solar passenger ferries. Apart from pure solar with no fuel on board, for applications that need higher speed, longer range, or heavier cargo they have hybrid solutions. The first tourism double-deck ferry, 100 passenger capacity, with air conditioning is under construction and expected to be delivered end of 2020. Founded in 2013, NavAlt Solar & Electric Boats Pvt. Ltd. is based in Kochi, India. NavAlt’s vision is to make marine transport more efficient by drastically reducing the energy and resources needed for building and operation. Working towards this vision, they have designed boats and ferries combining advancements in Electric Vehicle technology, marine design and Photovoltaics. NavAlt is a result of three experts coming together, along with their respective ventures – Navgathi Marine Design & Construction Pvt. Ltd. (India), AltEn Systems (France) and EVE Systems (France).

Conventional diesel ferry boats cause air & water pollution that lead to climate change; the noise and vibration is tiring for passengers and crew; the smell of fuel is uncomfortable; and it has high operating cost. Their solar ferry has none of these problems and the operating cost is extremely low – 2.5$ compared to 110$ for diesel ferry. Currently their initial cost is 20% higher, but still has a three year break-even with close to $35,000 in diesel savings every year. They have completed one commercial ferry and with scale this difference will be very less. Their commercial ferry, ADITYA, India’s first solar ferry, completed one year of operation in Jan, 2018. In this year it transported 500,000 people across the backwaters of Kerala, travelled 20,000 km without a single drop of fuel and saved 35,000 litres of diesel that translates to 94 tonnes of CO2 and 8 tonnes of harmful emissions. They are currently building three more boats for India and many more this year for all over the world. Having demonstrated success of ADITYA there is no reason for anyone to build diesel ferries. ‘We want to transform water transport the way Tesla has done on roads.’

Contact: https://navaltboats.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Nedstack (Marine and Port Related Fuel Cell, Emission Reducing Technology Solutions)

Activities: Zero-Emission-Shipping applications require high power profiles for both propulsion and hotel load and absolute reliability, availability and safety. Hence, the right fit with their PemGen portfolio strategy. To tune their solutions for the maritime industry they accommodate a Maritime Application team that safeguards compliancy to IMO rules and class rules as applicable. Their Application Support Package helps you adopt our PemGen Maritime Fuel Cell Power Installations in a professional manner. Within the Ports & Maritime industry fuel cell applications are virtually endless and in many of these applications the use of hydrogen as an energy vector and fuel cells as a means of power conversion would qualify as the best zero-emission alternative:

* Ferries;
* Cruise ships (power at port and limited range);
* Yachting;
* Dredging;
* Power barges;
* Fishing barges;
* Inland navigation.

**Let's Navigate towards Zero-Emission-Shipping**

Where land based mobility alternatives suffer strong competition from conventional battery solutions, the maritime industry requires a combination of long endurance at sea and high power requirements. For such applications zero-emission enablers with a far better power density are required. The combination of hydrogen as an energy vector and PEM fuel cells as a means of power conversion enables the transition towards zero-emission shipping without compromising too significantly on range, endurance at sea, vessel turn-around times and weather sensitivity.

The introduction of fuel cell power installations in the maritime industry affect the whole energy system; affecting all flows and transformations. They help you take the helicopter view and understand the forthcoming changes needed to address your supply chain and operations to accommodate for such change. They also guide you through the different alternative arrangements in a way you can comprehend how this much needed energy transition will affect your business operations.

**PemGen Installations in context**

Their signature PemGen Maritime Fuel Cell Power Installations are at the heart of your Zero-Emission Application. Nonetheless, they are only part of a much larger energy transition puzzle. They support you in identifying the right interfaces between the different sub-systems and attributing the right safety goals to each of the building blocks.

**Application Support & Compliance**

Fundamental to adopting fuel cell technology in the maritime industry is to safeguard compliancy to the strict framework of IMO rules and addtional rules administered by Class Societies and flag states. At Nedstack they not only observe the development of these standards, but also try to actively involve you in taking away such roadblocks to adopting much needed innovation. They help you understand the framework of applicable rules and - in absence of the IGF code Chapter E (IMO hydrogen rules) - help you along the way through the alternative design process.

Their Maritime Application Support Package provides for - amongst others - the following services:

* Feasibility assessment of fuel cell transition possibilities;
* Sizing support of PemGen fuel cell power installation;
* Single line diagram review and recommendations;
* General Arrangement review and recommendations;
* Producing Mass & Energy balances and forthcoming sizing recommendations;
* Review interfacing system specifications;
* Provide recommended safety concepts;
* Participation in Risk Based Design studies;
* Power Management system integration support;

Contact: <https://nedstack.com/en/application-support/maritime-ports>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Norse Power (Auxiliary Wind Propulsion Sail Systems)

Activities: Norsepower was founded in late 2012 with a mission to reduce the environmental impact of shipping by providing efficient, easy to use, and reliable auxiliary wind propulsion for ships through its Rotor Sail Solution technology. Norsepower's vision is to set the standard in bringing sails back to ocean transportation, and empower shipping towards reaching the goal of zero carbon emissions. Norsepower Rotor Sails provide a reliable and easy-to-operate auxiliary wind propulsion system with a proven savings record. Norsepower Rotor Sails can typically reduce fuel consumption of a ship by 5-20%. Norsepower is ‘the market leader on the emerging market of mechanical sails for large ships’. Norsepower Rotor Sail technology is suitable for most vessel types: tankers, bulkers, cruise vessels, RoRos, RoPax vessels, general cargo vessels, and ferries. The solution has been tested in co-operation with leading classification societies to ensure that it is robust, durable and safe to use.

Various third-party measurement campaigns have proven the savings potential of Norsepower Rotor Sails. Norsepower is currently scaling up it business by through increased sales and further investments on European and Asian production hubs.

**Sustainable impact on blue economy:** The fuel savings and related emissions reductions by Rotor Sails can be measured on board the target ship.

Contact: <https://www.norsepower.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Optimiz (Cargo Claim Recovery Solution Platform for Cargo Underwriters and Shipping)

Activities: Digital cargo damage inspection and claims automation. Industry first all-in-one platform for cargo claims resolution. In the future, all your cargo claims will be Optimized Optimiz ‘provides the very first platform for cargo claims resolution that brings the cargo owners, cargo insurers and cargo carriers together to achieve unprecedented speed and accuracy in the cargo claims arena.’

**Digital Cargo Damage Survey**

Collect relevant evidence at the most relevant times and eliminate opportunities for fraud.

**Predictive Claims Resolution**

No need to be a maritime law expert. Using a combination of data sets, they make it easy to handle what has before now been considered complex claims.

**Recovery Agent Management**

Ever wondered how your recovery agent is performing against others in the market? Now you can know!

Contact: <http://optimiz.claims/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Power Cell (Hydrogen Fuel Cell Zero Emission Power Sources

Activities: Fuel cells generate pure electricity without noise, vibration or emissions, which is of great value for vulnerable maritime environments. The marine industry is a segment in which the capacity to deliver electricity without emissions is extremely important. The fuel cell systems entail high potential for reducing not only energy consumption but also emissions such as CO2 and particles. Their fuel cell systems are modular and can accommodate large power needs – free from vibration, noise and air pollution. The world class power density makes PowerCell’s systems easy to integrate and the products are designed to withstand harsh conditions at sea. Their products are constructed of industrial components and are thus reliable, have a high uptime and a long lifetime. Solutions such as remote monitoring and proactive service scheduling are among the offered service solutions.

**PowerCell’s systems for marine applications**

PowerCell’s systems are designed to meet needs such as main propulsion, range extenders (REX), auxiliary (AUX) and cold ironing. Since the systems are modular and light weight, PowerCell can tailor-make solutions for a range of applications within the marine industry:

* Large scale power supply for ships, ferries and supply vessels
* Smaller vessels such as supply boats, channel vessels and commuting ferries
* Power solutions in harbour from shore to ship
* Leisure boats
* Off shore power supply

Contact: https://www.powercell.se/en/markets/marine/

### Open Tug (Digital Brokerage Platform for Marine Assets)

Activities OpenTug is a digital brokerage platform for Marine Assets that seeks to decrease the cost of customer acquisition while providing clients with a seamless and convenient solution to getting connected with marine providers. Additionally, OpenTug helps marine service companies reduce deadweight loss and improve utilization by connecting empty assets to driven customers, all for less than the cost of traditional brokers. OpenTug was founded in Seattle, Washington in 2019 with the goal of making the marine service industry more accessible to customers by delivering transportation solutions at the click of a button. By lowering the barrier of entry for marine logistics services through a centralized marketplace and managed marketing solutions, they will increase provider utilization and customer satisfaction. This results in lower acquisition cost for providers and more competitive pricing for customers, decreasing deadweight loss and optimizing the market as a whole.

Contact: <https://opentug.com/about-opentug/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### ORCA AI (AI Based Vessel Collision Avoidance/Safety System)

Activities: Orca AI provides smart insights for Captains and Fleet Managers, increasing the safety of the entire fleet.

**Technology**

By combining AI and data generated from multiple sources, they create a powerful awareness system that provides predictions and alerts on hazards, reduces collisions and saves lives.

**Vision**

* high-resolution & thermal cameras
* Integration with existing sensors
* GPU computing power
* AI & Deep Learning

ORCA for the Ship: An AI-based collision avoidance platform that prevents human error and allows the crew to make informed decisions.

**Vision in Low-Visibility**

High-resolution and thermal cameras are detecting hidden objects and increasing the awareness of hazards in ports or congested waterways, in all weather conditions. Continuous data monitoring and the utilization of AI models allow ranking every passing ship according to its collision potential and responding optimally to any event. The platform provides life-saving alerts when there is a potential for contact, collision, grounding in shallow water, and more.

* Smart Alarms
* Risk Assessment

Contact: https://www.orca-ai.io/solutions

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Port-Xchange (Optimising Port Call Software/Platform)

Activities: PortXchange develops software to optimize port calls in ports worldwide leading to more efficiency, lower costs and less emissions. Digital collaboration is the future of the shipping industry. PortXchange provides a centralized platform for sharing real-time data to align all players in the maritime logistics chain during a port call. It allows to avoid delays and make port calls more predictable, efficient, and sustainable.

Contact: https://port-xchange.com

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Protea Marine Emissions Solutions

Activities The continuous monitoring of ship emissions is a critical measurement in global goals of lowering the environmental impact of all industries. With shipping contributing 2.5% of global GHG emissions, vessel operators, owners and clients have an increasing understanding of the needs to control and reduce emissions produced. The introduction of new regulations to limit emissions and of new technologies to help to remove emissions all require the use of accurate, robust and proven on-board emissions analysers. Protea is a UK-based technology leader in emissions monitoring for both land and marine based applications with their range of instrument incorporating various technologies to measure stack emissions. Since 2017 they have developed their Marine Emissions analyser brand based around the well-proven in-situ IR photometer, adding new features and technologies to increase the performance and widen the suitability for today’s ever expanded marine emissions market.

Contact: <https://www.marineemissions.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Quay Chain App (A Platform to Automate Bunkering in the Marine Industry Sector)

Activities: Quaychain is an end to end digital platform designed to automate the bunker management process from sourcing through to settlement and everything in between. Born in the cloud, Quaychain uses artificial intelligence, IoT and blockchain technology to manage the process you know and love, but at a fraction of the cost and without any of the hassle.

https://www.quaychain.app/

**Quay Chain (Digital Infrastructure for Smart Industrial/Transport Hubs)**

QuayChain also builds digital infrastructure in multi-user industrial locations to create Smart Industrial Hubs. QuayChain is a platform for applications & data-driven solutions for all the stakeholders who serve and drive the global supply chain. Smart Industrial Hubs are the connector that will enable the true digital supply chain, converting what have been black-holes for data and connectivity in Ports, Airports and the multi-user industrial hubs into the central hub of the digital supply chains. QuayChain combines private LTE wireless solutions with Industrial IOT to power solutions that have never before been achievable. High-speed and low-latency solutions through Private LTE combined with fiber and a variety of other propriety wireless solutions gives QuayChain access to IIOT devices and data in the harshest industrial locations. The connectivity layer with Private LTE is the foundation the network of IIOT devices that feed the QuayChain platform. QuayChain provides solutions and services securely to all industrial users regardless of their size.

* Infrastructure
* Geographic sensor data collection providing visibility and accessibility for users in public locations.
* Single IOT Platform collection, analytics and applications.
* Platform collection, analytics and applications.
* In Vehicle connecting the driver with QuayChain applications
* Two way high speed-data exchange for transportation operators
* Products / Goods
* Giving importers and exporters the ability to connect directly with their goods.
* Low power, long life durable sensors with multi-RF capabilities
* Equipment
* Chassis, rail cards and terminal equipment connected to improve performance and drive down costs and maintenance.

QUAYCHAIN CUSTOMERS

* Ports
* Terminals, Shipping Lines, Drayage operators and Chassis providers.
* Icon Image
* Airports
* Ground handling, Airlines and Air Cargo and runway operational support
* Public Agencies: Cities, Counties and local public services
* Utilities: Public or Privately owned services industrial areas. Fibre providers is a utility
* Public Safety: Serving and protecting all of the Smart Industrial Hub
* Rail Yards: Rail Cars, Locomotive IOT, Goods management and safety uses.
* Landlords, Owners of buildings and infrastructure
* Multi-modal hubs: Linking equipment and various transportation services.
* Intermediaries: 3PL’s, Forwarder, Brokers and service providers
* Banking: Providing financial tools to the Smart Industrial Hub
* Business & Industry: Retailers, Distributors, Manufactures and all business with goods
* Insurance: Managing Risk in the Smart Industrial Hub
* Transportation: Trucks, Rail, Shipping Lines, Airlines and parcel companies

Contact: https://www.quaychain.app/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Bubbles (Hovering Electric Water Taxis)

Activities: 100% electric, the Bubble is autonomous during its rides and is charging while people are getting in and out, while stationed at the Dock. People can enter from the side door, with the help of a hostess, and take their seats into the Bubble. Once the doors are closed and the Bubble secured, it will get out of the Dock and start moving. When reaching 12 km/h (7.5 mph), the Bubble will start flying above the water, preventing from any seasickness, sudden movements or waves rolling. Once the ride is over, the bubble slowly comes back to the water level to reach the Dock, letting its passengers out and waiting until the next ones are ready to board.

VISION:

They believe that pollution and global gridlock are not only threatening our welfare, but are ultimately threatening people’s freedom of mobility. Because in 2050, there will be 4 billion cars in the streets, and even if they are all powered by clean energies, it will still create a massive traffic jam. They believe that the future of mobility will rise from the water, a natural, historic path in the cities that has been underrated for a long time.

WHAT THEY DO:

They open waterways for everybody, all around the world, by creating a new way to move people on waterways at car speed, for the price of a regular cab, with no impact on the environment nor on the cities’ infrastructure. It is the only zero-impact transportation ecosystem ready for the present. Think James Bond car, available for everybody, but with zero wave, zero noise, zero CO2 emission.

<http://www.seabubbles.fr/en/bubble>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Shone (Digital Co-Pilot Solution)

Activities: Shone are making the ocean safer and friendlier, for the people who foster our global economy. Seafarer is one of the most hazardous jobs on Earth. Despite this, every day, men and women sail at sea to ship 80% of our consumer goods. They believe that Artificial Intelligence is the key to provide better work conditions to the amazing people who support the world's trade and prosperity.

**Safer**

Your crew augmented with AI: Their AI assists your crew to make sure that they always operate at peak performance and deliver the value your fleet deserves. They collect and process huge amounts of data from multiple sources to help your crew always take the best decision. This relieves the stress from your bridge teams and makes your ships safer.

**01 Sense**

Their algorithms use raw video to instantly detect targets up to 10nm all around your vessel. Night and day. Their cameras are the perfect lookout for your officer of the watch.

https://www.shone.com/

**Solid Water Ship Propeller (Fuel Saving, More Eco-Sustainable Propulsion)**

They have invented and developed the SolidWater™ Propulsion System is so named because traditional propellers tear the water apart into gasses creating a turbulent, foamy discharge, wasting huge amounts of energy and making the water unstable to push or pull upon. The SolidWater™ Device gives a laminar discharge and makes the propeller behave like it is pushing on a solid, giving it amazing traction. This technology is a major breakthrough in fluid dynamics. The technology offers a number of other virtues including that the technology is durable and reliable at sea. They expect to get 80% of the commercial ship market in eight years which will reduce atmospheric pollution by 6% which is sufficient to reverse global warming. The technology has other applications as a pump and fan as well.

**Phase: 3. Seed Funding** Next step is to have prototype #13 go through Carderock Naval testing labs.

[**Restoring, Protecting and Investing in the Ocean**](https://uplink.weforum.org/uplink/s/uplink-issue/a002o00000vOm4fAAC)

Investing in nature-based solutions for the blue economy. ‘14 commercial tankers produce more atmospheric pollution than All the cars in the world!’ At any time there are 130,000 of this class of tanker puffing and spewing their crud all around the world. The thousands of symptoms of this problem have become serious secondary problems from sea-level rise to species extinction to mass migration to disease progression to mass depression and suicides. The Solid water Prop aims to solve all these situations. The fan embodiment of this technology will dramatically address methane recovery, fires, and new air-conditioning demands further reducing greenhouse gas emissions and speeding a solution to the warming situation. SolidWater™ Propulsion System is so named because traditional propellers tear the water apart into gasses creating a turbulent, foamy discharge, wasting huge amounts of energy and making the water unstable to push or pull upon. The SolidWater™ Device gives a laminar discharge and makes the propeller behave like it is pushing on a solid, giving it amazing traction.

The technology takes advantage of a breakthrough in fluid dynamics from Inventor David Horrigan. The technology makes the fluid flowing over both the high and low pressure side of the blade move at exactly the same speed eliminating Bernoulli Effect. The technology offers a number of desirable features, however most significant is a 80% savings on fuel costs. For example an 80 million gallon tanker which uses 25 million dollars-worth of fuel, using their technology will reduce that to 5 million dollars per year. Their technology can conservatively save $2-20 million dollars per engine per year. With a fleet of 1000 or 1500 vessels the market need is quite clear. Of course other desirable characteristics expand markets and improve market reception and these include: precision ship control, reduced cost for engines and gears, silent operation, non-turbulent discharge, multi-axis thrust and the technology is durable and reliable at sea.

.

Contact:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### SPBES (Energy Storage for Electric and Hybrid Powered Vessels)

Activities: Sterling PlanB Energy Solution provides energy storage solutions to optimize or replace diesel in marine, grid and heavy industrial applications. PlanB batteries have been specifically designed for marine and industrial applications: applications where safety, reliability and cost are the most important aspects of a battery system. PlanB battery systems are used to power hybrid and fully electric ferries, offshore supply vessels, large hybrid yachts, industrial machinery and in land-based grid energy projects. Over 17MWh of installed systems. PlanB energy storage systems power the world's largest electric ferries, workboats and industrial machinery. PlanB CellCool liquid cooling precisely manages internal cell and battery temperature to provide greater safety and best in class cycle life. Integral fire prevention is in every PlanB battery. Maintaining low cell temperature at high power cycling or in a fault scenario is the key to lithium-ion safety. PlanB CellSwap - replace only the cells at end of system life instead of the whole system. Lower battery cost, reduced size and performance guaranteed for life.

**Industry Leading Innovations & Safety**

30 % Of Liquid Cooling Litres of liquid cooling flows through the system per minute, reducing the risk thermal runaway and drastically increasing lifespan and safety.

**Smaller Systems**

With CellSwap replace only the cells of the battery system to reduce total lifetime cost of a system.

Contact: https://spbes.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Swiftly.com (Africa Online Shipping Marketplace)

Activities: An online marketplace for shipping, leveraging technology and data to optimize Freight forwarding for their clients worldwide.

⮞ Via their online platform we make it is easy and less expensive to ship your packages worldwide.

⮞ Swiftly was started as a solution to the stress, inefficiency and unnecessary high costs associated with shipping

⮞ They have experts that understand customs, ship/airline regulations and provide you the best advice regarding transporting your packages

⮞ Their unique share shipping space and share cost model is a game changer and allows our clients to enjoy the price benefits and practice eco-friendly transportation

⮞ Their process is easy and our webapp works seamlessly on mobile phones or from a desktop browser

⮞Simply sign up and post your package requirements no matter the size or weight, you’ll receive instant quotes and bids from their global network of freight forwarders for you to compare and choose the best quote depending on your needs

⮞ The Freight forwarder you approve comes to pick up your items and the shipping is done!

⮞ Comparing prices from different companies ensures that users save money and obtain optimum results

⮞ They have an agile team on standby to attend to their customer needs rapidly,

Contact: <https://swiftly.global/about>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### TEQPLAY (Shipping Applications Platform)

Activities Teqplay is a context broker that provides information and applications to empower the shipping industry to make smarter and better-informed decisions in both planning and execution. Digital intelligence: know & adapt in real-time. Digitization and real-time information open the next level in decision making and create new opportunities. Leverage the power of AI and analytics on the data in the context of your business. Improve asset utilization, reduce waste on labour and fuel and spot new opportunities in real-time. Teqplay creates the insight and tools to collaborate and compete in the maritime industry.

**Terminals:** In control and pro-active terminal operations. Visual planning, active monitoring, notifications and real time insight in KPI's.

**Agents & Service Providers:** In control and pro-active in your port calls, from arrival to departure. Insight and overview in status and progress of port call operations.

**Shipping Lines:** Fleet planning and monitoring. Attract the right cargo: insight in port call performance, risks on delay, demurrage and port congestion.

**Port Authorities:** A digital twin of your port providing insight in port operations and performance. Creating digital building blocks for the port of the future.

**Reporting:** Get instant access to predictive and real-time information on all your port calls. ‘With flexible alerts and personal updates related to your port calls, we help to have the overview and be able to manage by exception. Stop wasting time looking for information. Make it come to you’.

Contact: https://teqplay.nl/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### TOTE INC (LNG Fuel Powered Containerships)

Activities: TOTE brings ‘the world’s first natural gas-powered containerships’. Their Marlin-class vessels ‘are the most advanced, environmentally responsible vessels of their kind – while providing safe, reliable cargo deliveries that keep communities moving’. The two Marlin-class vessels were built at the General Dynamics NASSCO shipyard in San Diego. These American-made ships were delivered in late 2015 and early 2016, and operate between Jacksonville, Florida and San Juan, Puerto Rico. This investment demonstrates their commitment to the people of Puerto Rico and the environment. These vessels mark a new age of shipping, using the best technology in the world.

* Sustained more than 600 American shipyard jobs during construction
* Over $350 million capital commitment from TOTE
* First Marlin ship entered service in late 2015; second ship in early 2016
* Purpose-built for the Puerto Rico trade
* Marlins accommodate 2.5x more 53’ containers than previous vessels
* Bunker (fueling) in Jacksonville, Florida

**Partners:**

General Dynamics NASSCO constructed the Marlins at their shipyard in San Diego, CA

Daewoo Ship Engineering Company (DSEC) part of Daewoo Shipbuilding and Marine Engineering (DSME) provided the vessel design

TOTE is the launch customer of MAN‘s innovative ME-GI engine design

Main and Auxiliary Engines manufactured by Doosan

Pivotal LNG, Inc., a part of Southern Company Gas, a wholly owned subsidiary of Southern Company (NYSE: SO), and WesPac Midstream LLC (WesPac) will supply LNG in Jacksonville, FL. The Marlin-class earned the Next Generation Shipping Award at the 2013 Nor-Shipping Conference, making TOTE the first U.S. company to take home this prestigious award.

**Converting Their Fleet To LNG**

TOTE is not just ‘the first in the nation to build LNG ships’, but they are also first to convert their existing fleet to run on natural gas. Two Orca Class vessels, operated by TOTE Maritime Alaska, will be converted with minimal time out of service during conversion, and return as the most environmentally advanced ships in the nation.

Conversion to LNG will reduce emissions well below the world’s most stringent environmental standards. TOTE Services, one of the leading ship management companies in the U.S., supported the new construction of the Marlins and will supervise the conversion of the TOTE Maritime Alaska fleet to LNG propulsion. Their experience in LNG propulsion systems is among the most extensive in the industry.

Contact: <http://www.toteinc.com/about/lng/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Vessel Bot (Vessel Fleet Decision Support System, Digital Charterer Marketplace)

Activities: VesselBot offers a digital chartering marketplace which brings Charterers and Vessel Owners together in the Bulk Maritime industry. Their use of technology is unprecedented in the Shipping Industry and is ‘what will change the chartering process forever.’ VesselBot’s digital chartering marketplace provides strategic operating and financially efficient benefits for Charterers and Vessel Owners by enabling them, through its platform, to instantaneously identify the best possible counterparty whilst utilizing the least possible company resources at a significantly lower cost than the traditional chartering houses. Their dedicated team of dry cargo chartering brokers is on call 24 hours a day, 365 days a year, to personally deal with any problem that may arise between parties from the initiation to the completion of all shipments arranged via their platform.

Moreover, they undertake the execution of dry cargo chartering deals on behalf of their clients for their account. They provide you, on request, with an advisory service which offers market insights, route freight rate indications, negotiation facilitation, charter party terms and post fixing operations etc. for both Charterers and Vessel Owners. The “Smart-Shipping” model focuses on the transport performance of the company/fleet as a whole, rather than a collection of individual ships, resulting in wide reaching improvements in transport productivity; safety; personnel development; and logistics.

They motivate their activities as under:

Ship owners and charterers wishing to charter a vessel presently have to go through the complex and time-consuming manual process of reviewing thousands of emails with offers from Shipbrokers in order to identify prospective matches. Currently ship owners and charterers rely extensively on the information provided by the brokers with whom they cooperate regarding the prevailing market hire rates at given ports. Choosing the right Charterer / Ship Owner to cooperate with, is a very sensitive process which needs to be executed in a very timely manner. The manual way in which chartering is currently processed and the number of different mediums used makes it a very tedious process for both parties and does not allow either to effectively make the best possible informed decision.

**The VesselBot Marketplace:**

For Vessel Owners, Vessel Charterers

* Higher Net Voyage
* Low Commission Cost
* Less Resources Utilized
* Informed Decision Making
* Rating Mechanism

Vessel owners are able to gain access to a medium to promote their vessels to a broader spectrum of Charterers.

**Vessel Bot Decision Support System Voyage: TCE Optimization Decision Support System**

Their system helps owners, managers and operators to optimize their TCE per voyage. VesselBot’s TCE Optimization decision support system identifies the optimal and feasible route via sea from location A to location B, suggests the optimal speed/rpm and estimates the ETA for each vessel by taking into consideration commercial and other terms in order to optimize TCE performance for each voyage.

They have gathered millions of historic data related to market conditions, Bunker prices, Weather conditions, Vessel particulars, AIS data, Hire rates and a number of other factors. Combining these and advanced AI models we have developed a decision support system that allows us to propose to Operation team’s actions that will enabled them to increase voyage profitability.

Fleet monitoring dashboard:

Make optimal bunker procurement decisions based on real time data,

Improve fleet vessel performance,

Enable your vessel to choose the optimal speed and direction based on current weather conditions,

Make the right decisions and keep your P&L in the black,

Reduce GHG emissions and make a positive environmental impact.

“Not a weather routing tool - Our TCE Optimization tool is much more than that.”

Weather is merely a small factor we take into consideration along other parameters. The solution is a Voyage Optimization Tool that enables you at the Operations departments to decide via data and technology which is the optimal route, speed/rpm etc in order to satisfy commercial conditions and increase TCE results. You will achieve to reduce Bunker consumption and GHG emissions while at the same time maintaining the duration of the trip at the lowest possible point.

Contact: [info@vesselbot.com](mailto:info@vesselbot.com); <https://www.vesselbot.com/marketplace>

Increase your TCE and reduce GHG emissions.

190 Siggrou Av.,17671

Kallithea, Athens, Greece

Erasmus Center of Entrepreneurship

3029 AK Rotterdam, Netherlands

+30 211 4016 523

info@vesselbot.com; [chartering@vesselbot.com](mailto:chartering@vesselbot.com); support@vesselbot.com

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Vessel Performance Solutions

Activities: Their Software, VESPER supplies the shipping world with performance analysis and operational solutions.

The software is being continuously developed in close cooperation with their clients, ensuring that their requirements from operational perspective are met. The broad web interface of VESPER provides daily monitoring of individual vessels as well as long-term trends and benchmarking overview among the whole fleet. You can set up your own dashboard on the web tool and track your vessels in your office. Most of the analytical data can also be retrieved through excel and API. Furthermore, selected results are available directly in a (secure access) database from your own Business Intelligence tool. Running the service requires your vessels’ data feed, either delivered directly from the vessels (e.g. by email), through a data upload (using sFTP) or using an API.

Performance Tracking of Hull & Propeller:

Having a clean hull, with low friction, is the key to having a well performing vessel. Many factors affect the hull condition, but the most important factors are listed below:

* Underwater Paint Type Quality
* Dry Docking Interval
* Dry Docking Treatment (Spot vs Full blast)
* Operational Pattern (idling, 'hot' sea water, etc)
* Paint Thickness (too much or too little is not good...)
* Repeated Hull Cleanings

In their opinion, the only way to ensure a well performing vessel is through condition based monitoring. Proper analysis of data, combined with inspections (and hull cleanings) ensures a promising propulsion performance. On the basis of their baselines for a specific vessel, VESPER provides different performance indicators using different methods and data sources. The history of performance indicators are evaluated and visualized based on instantaneous trend calculation of the vessel since the last event. You can also get an overview of the average performance decay of your whole fleet and also the performance of individual vessels compared to that average. Moreover, overall performance evaluation can also be assessed from paint types perspective.

Main Engine Performance

A well-tuned and balanced engine plays a significant role in efficiency of vessel operation. Having a well functioning calibrated torque meter along with accurate fuel consumption measurement is one of the options for monitoring of engine efficiency through the Specific Fuel Oil Consumption (SFOC). In addition, many operators use monthly (dedicated) performance tests of the main (and auxiliary) engine(s) in order to get detailed measurements on compression and combustion pressures, as well as the engine balance. VESPER has a report for monitoring the daily SFOC of the main engine. The main engine shop test results are used to create proper baselines. Benchmarking of sister vessels which have the same engine installed can be assessed in this report. Basis the principle of a ‘parent’ engine, all engines are supposed to be able to perform according to the (best/parent) engine in the group.

Contact: <https://www.vpsolutions.dk/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Vessel Insight (Vessel Data to Cloud and Performance Solution

Activities: Vessel Insight is a SaaS based solution that provides vessel-to-cloud data infrastructure capturing and aggregating quality data in a cost effective and secure way. The solution provides instant and easy access to fleet overview, vessel specific dashboards and data analysis tools. In addition, through Kognifai Marketplace, customers have access to a large range of applications and services that can turn their data into business value.

Contact: https://www.kongsberg.com/digital/solutions/vessel-insight/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Xeneta (Ocean and Air Freight Price Benchmarking and Market Intelligence Platform)

Activities: Powered by big data analytics, the Xeneta platform provides unprecedented transparency changing the underlying business processes of the industry, which up until Xeneta's grand entrance, have been suffering from the scarcity of proper business intelligence, market rates and metrics. The containerized freight logistics industry has been static, disconnected, outdated, and sadly, somewhat untouched by modern software technology with zero to no visibility.

Xeneta is ‘the leading ocean- and air-freight price benchmarking and market intelligence platform transforming the shipping and logistics industry’. Xeneta’s turnkey yet powerful reporting and analytic platform provides shippers and freight forwarders the data they need in real time to compare their shipping prices against the world's largest database of contracted rates. Xeneta reports in real time on market average and low/high movements with over 110 million short and long-term contracted rates in its database covering over 160,000 global trade routes. Xeneta helps make informed decisions with actionable intelligence optimizing companies’ logistics procurement. They are enabling smarter decisions based on facts. In the end, it’s all about enlightening the people running the business, and ultimately positively affecting the global economy. Are you sure you are paying the right freight rates? ‘We can help you discover savings potential in real time.’

Contact: https://www.xeneta.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### XOcean (USV Vessels as Ocean Data Solutions)

Activities: Ocean data, delivered. Using Uncrewed Surface Vessels (USVs), XOCEAN provides turnkey data collection services to surveyors, companies and agencies. From mapping the seabed to environmental monitoring, their platform offers a safe, economic and carbon neutral solution to collecting ocean data. OCEAN’s USVs offer full uncrewed Over The Horizon operations using satellite communications. Each USV sends real time images and situational awareness data to XOCEAN’s Operations Centre where a team of qualified USV Pilots keep watch and control the vessels 24/7. XOCEAN’s USV Pilots are responsible for collision avoidance. XOCEAN’s USV system is designed to comply with the requirements of existing IMO instruments.

Our Services

• Bathymetry

• Integrity Inspection

• Data Harvesting

• Fisheries

• Environmental

• Coastal Survey

Contact: https://xocean.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Zeabuz (ZERO EMISSION AUTONOMOUS URBAN & COASTAL MOBILITY FERRIES)

Activities: Zeabuz aims to revitalize urban waterways in smart cities through autonomous electric passenger ferries. Zeabuz will deliver a new service for urban, emission free, autonomous ferries. Their ferries will operate on-demand, 24/7, be easy to use, emission free, smart and green. They invest in development and testing together with strong industry and regulatory experts to ensure they meet the highest safety standards

Urban Waterways……A Challenge and an Opportunity:

* By 2050 nearly 70 % of the world population will be living in cities, up from 50 % today
* City growth is limited by existing transport infrastructure
* Most cities are founded on or near waterways that separate districts and inhibit traffic flow
* Bridges and tunnels are costly, non-scalable and leave a large and lasting footprint
* Moving passenger flow onto urban waterways is a sustainable, efficient and compelling solution for cities and citizens
* The Zeabuz solution is aligned with the UN sustainable development goals

Contact; <https://zeabuz.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Z Ships (Zero Fuel Zero Emissions, 100% Renewable Energy Ships)

Activities: ZShips International CCC Ltd. (ZShips) is changing the conversation to zero-fuel, zero-emissions, 100% fuel cost saving retrofits for commercial vessels. By replacing fossil fuels with renewable energy, electricity and storage for propulsion and auxiliary power, ZShips will be instrumental in helping the maritime industry keep air and waters clean and healthy at ports and at high seas. They are inviting investors and partners to join them.

Zero Fuel, Zero Fuel Costs, Zero Emissions, 100% renewable energy commercial vessel retrofits and new builds. At Z Ships they believe that carbon neutral and carbon negative growth is possible in global marine transportation. ZShips is changing the fuel conversation for commercial vessels and fleets. By operating zero emissions ships with zero ongoing fuel costs, the maritime industry will transition from the polluting fossil fuel-powered ships of today into the clean energy ships of tomorrow and it will set the industry on a steady path toward emission elimination and positive economic and environmental impact. Their technology is suitable for low speed, displacement hulled vessels of 30 meters (98.4 ft) long and over. The longer the ship the more area they have to work with and the more power they can produce. Superyachts, Ferries, Research, Fishing, Handysize, Handymax, Panamax, Neo-Panamax, all are excellent candidates to become Zero Emissions Vessels. ZShips is going straight to zero avoiding expensive incrementalism, replacing conventional (fossil) and alternative liquid or gaseous fuels with renewable energy, electricity, and storage to provide 100% fuel cost savings, unlimited range travel with ZERO EMISSIONS, cutting underwater noise and vibrations reducing harm to marine life and environment. ZShips will be instrumental in helping the maritime transportation industry keep air and waters clean and healthy at ports and high seas.

Contact: <https://upgyres.org/z-ships/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 18. TOURISM

### Envjoy (AI and VR Sustainable Coastal and Marine, COVID Free Tourism)

Activities: Envjoy provides technological solutions for environmental conservation and sustainable tourism. Combining the power of augmented reality and artificial intelligence with biological knowledge, Envjoy allows you to reinvent the visit to museums and natural spaces (either marine or on-land). Augmenting the visit, Envjoy lets the visitors live a unique, funny and personal experience. The users ‘have a biologist always in their pocket’ allowing them to explore according to their own curiosity, promoting sustainable habits and increasing awareness. The technological platform developed by Envjoy is also helping marine biologists – who need to identify living organisms to protect the environment and assess its status – to work faster and more efficiently, to preserve the memory and knowledge of senior researchers, and to train more efficiently the future generations.

They motivate their activities as under:

Envjoy creates beautiful immersive experiences and is an innovative tool allowing marine biologists to better monitor and protect the environment, and the visitors of museums and parks to reconnect with nature in a more interesting and effective way, retaining more information and increasing awareness toward environmental conservation.

Their two product lines (one for professionals who study environmental quality and one for people visiting natural spaces or natural collections) are highly scalable in terms of users and geographic areas. Their goal is to reach 4 museums/parks by the end of 2020 and 10 facilities in 2021. They have also spoken already with 125 early-adopter marine biologists, with the objective to have 50 clients by the end of 2020 and 150 by the end of 2021.

Sustainable impact on blue economy: Encourages sustainable use of maritime resources, Increases the use of renewable energy resources, Increases awareness and fosters sustainable habits

Contact: <https://www.envjoy.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Notilo Plus (Personal Marine, Coastal, Dive, Tourism and Other Drones)

Activities: Their mission is the knowledge and protection of the underwater world. They have therefore developed a complete and integrated solution for data collection and exploitation in underwater environments. It includes an underwater drone, a control app, and a data processing platform, all powered by artificial intelligence. Their solution provides two value components: better monitoring of client assets through the ability to inspect them more easily and quickly, and immediate savings, by optimizing asset operation or reducing inspection costs. They provide easy access to underwater data for all types of customers.

Sustainable impact on blue economy: Their product contributes to carbon emissions decrease by allowing better monitoring of ship hull and biofouling deposit on it. It can also be used to identify all kind of marine pollution thanks to computer vision (for example scooters in rivers, battery in harbours, etc). It can be useful for remote inspection of offshore assets like wind farms, thus increasing their lifespan and competitiveness. Last, it can prevent genetic depletion of wildlife, by facilitating inspection of aquaculture nets and preventing escaping of fishes.

**Autonomous. Wireless. Smart:**

iBubble evo is the first wireless, entirely autonomous underwater drone. Turn it on, put it in the water, choose your integrated movement scenario and let iBubble evo take care of the filming. Thanks to its cutting-edge and patented acoustic technology, the drone will automatically avoid obstacles and follow you everywhere you go to capture your underwater adventures in a truly unique way. With iBubble evo you can fully enjoy your diving experience and share it with everyone.

* Size: 60cm x 45cm x 35cm / 24in x 18in x 14in
* Weight: 9 kg / 19 lbs
* Max. depth: 60 m / 200 ft
* Speed: 1.5 m/s - 3.3 ft/s
* Battery life: 1h30, interchangeable, Li-ion (<100 Wh)
* Motors: 7 - Enhanced mobility
* Smart transmitter: Scenario display, recording start/stop, lights switch, max. depth, distance control

Since 2016, Notilo Plus is dedicated to the knowledge and protection of our ocean. After creating the first entirely autonomous compact underwater drone, they started developing the Seasam ecosystem. Seasam comes from an ongoing exchange with major actors from different industries. To respond to their specific needs, they designed an adaptable underwater solution that leverages the latest innovation in AI and self-learning technologies. Their goal is to provide professionals with a comprehensive and smart solution that will assist them in their mission. The Seasam ecosystem is divided into 4 components that all work in symbiosis and can all be tailored to your specific need.

Contact: <https://ibubble.camera/> https://www.notiloplus.com/

### Peace Boat Eco-Ship (Most Sustainable Cruise Ship -Marine Tourism/Shipping Solution)

Activities Peace Boat's Ecoship Project is a transformational programme to construct the planet's most environmentally sustainable cruise ship.

The cruise industry is booming, but cruise ships are not sustainable – the average cruise ship carrying 3,000 passengers and crew generates 80,000 litres of sewage a day, according to the Environmental Protection Agency (EPA) and many cruise lines use out-dated filter systems, resulting in minimally treated sewage being dumped into the water. Most large ocean liners use bunker fuel to power their engines. This is the heavy, residual oil left over after gasoline and diesel have been extracted from crude oil and can emit dangerous levels of sulphur dioxide. The Ecoship Project aims to challenge the status-quo and has set itself a radical set of targets to demonstrate what is possible, and necessary for the industry to exist in a sustainable world. In order to meet these goals they have worked with experts from a diverse range of fields and every element of the ship from its hull to its engines to its onboard programmes needs to work together. They therefore took a whole-system integrated design approach to the project; a concept derived from the belief that elements of a system work best when they are specifically designed to complement, rather than to compensate for each other. In April 2014, they gathered world experts on naval architecture, marine engineering, renewable energy, energy efficiency, maritime law, biomimicry, and biophilia, for an Ecoship design charrette in Hamburg, Germany. This multi-disciplinary charrette approach had never before been applied to the cruise industry and the innovative outcomes formed the basis of their Ecoship specifications.

* Radical energy efficiency
* 20% cut of propulsion energy
* 50% cuts on electricity load
* Integrated heat recovery and reuse system
* Fuel adaptability and future readiness
* Boundary defying technology
* 10 retractable wind generators
* 10 retractable photovoltaic sails
* 6,000 m2 / 750
* power generation
* Kinetic floors
* Nature-inspired technology
* Aerodynamic shape and hydrodynamic hull inspired by the whale (Biomimicry)
* Air bubble hull lubrication system
* Natural ventilation
* Biophilic design for comfort and inspiration
* Real ecosystems onboard
* Onboard plant kingdom and vertical farming
* Closed loop water system
* Zero discharge / zero waste operation

Contact: http://ecoship-pb.com/

## Trilobis (Hydrogen Powered Yacht With Underwater Observation Dome) Company Semi-Sub Generation

Also specialists in semi-submerged architecture and eco-yachts. SemiSubGeneration is the first brand in the world specializing in promotion and development of a new generation of semisubmerged architecture, innovative homes and tourist eco-yachts. We create unique, cutting-edge products, highly innovative in design and technologies used. Futuristic projects for the future to live in an environmentally friendly way with style, elegance and exclusivity. Until now the shipbuilding and hospitality industries have always proposed floating or submerged projects but the partially submerged dimension is still unexplored and this is where operate with our team of designers and technicians to offer the best solutions in the last frontier of extra-luxury tourism. SemiSubGeneration is a new reality born from important partnerships with suppliers, companies in the shipbuilding industry and architecture and engineering studios that are among the most innovative on the market. SemiSubGeneration welcomes you into our world with a series of sensational products such as: Trilobis, the first environmentally friendly yacht with hydrogen engines and underwater viewports; Jelly-Fish, floating residence with underwater viewports; and Neptus, innovative cliff house; all designed to live the semi submerged experience with exclusivity.

**Eco-yacht on four levels**

The Trilobis is a 20-meter long yacht for six people. It is divided into four levels which are internally connected by a spiral staircase. The upper level is 3.5 meters above sea level. This is where the bridge is located, where the yacht is steered. It is possible to rotate 360 degrees around its axis very quickly. Photovoltaic panels on the upper side capture solar energy needed for the instruments in the control room. The electric motors are powered by hydrogen fuel cells that only produce clean drinking water as a waste material.

**Transparent underwater observation dome**

The cabin is on the second level, which is 1.4 meters above the water. There is also the (small) deck here that is secured with a railing. At a level of eighty centimeters below sea level, half under water, are the sleeping cabins and wash area. This is also where the engine room is.Three meters below sea level (completely under water) is a transparent observation dome. It is made of high-quality acrylic and has room for six seats. Thanks to the shape of Trilobis, several modular units can form a ring that creates floating colonies.

https://www.semisubgeneration.com/about/

https://innovationorigins.com/eco-yacht-and-the-return-of-the-sea-trilobite/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 19. UNDERWATER/OCEAN OBSERVATION TECHNOLOGY AND EXPLORATION

### ANB Sensors’ pH Calibration Free Sensor Solutions

Activities: ANB Sensors design and develop the next generation of calibration-free, solid state pH sensors used for measuring pH in all industries. The problem with existing pH Sensors, Existing pH technology, the glass electrode, has been around for almost 100 years. Millions of glass electrodes are sold each year to meet the need for measuring pH in fields such as pharmaceutical, water management, food & beverage, environmental & ocean monitoring. While the glass electrode is the accepted go to sensor for pH measurement, it suffers from a fundamental operating issue, the need for manual calibration because of reference electrode drift. Reference electrode drift reduces the accuracy of the sensor and adds up to 70% of the operating cost of the sensor. They have developed a new electrochemical sensor technology which uses the market accepted, ubiquitous glass electrode, but provides for autonomous, in-situ, calibration of the electrode. This lack of manual calibration provides the following value proposition:

* is at least 70% cheaper to operate and maintain.
* can be deployed for extended periods of time for autonomous sensing.
* can be deployed in an autonomous sensor network, extending use to new fields.

**Ocean Acidification**

For millions of years the pH of the oceans has remained constant, allowing marine life to evolve and be tailored to the chemical balance. However, the oceans are estimated to have absorbed about 30 per cent of the emitted carbon dioxide from human activities since pre-industrial times. The carbon dioxide is contained in the upper 10 per cent of oceans (less than 1000 metres depth) because of slow ocean mixing processes. As CO2 is absorbed the concentration of hydrogen ions is increased and the pH decreased. A decline of 0.1 from pre-industrial times has already been recorded in the pH of the oceans, corresponding to a 26% increase in acidity. However, despite the evidence behind ocean acidification, the data are limited in both coverage and quality and there is a need to develop complete sensor suites to monitor the oceans carbonate cycle, pH being the key parameter.

**Ocean Alkalinity**

This is exemplified by the fact that global ocean climate datasets like the World Ocean Circulation Experiment (WOCE), Hawaii Ocean Time-series (HOT), and Bermuda Atlantic Time-series (BATS) have only included carbon variables since the late 1980s. Typically large-scale sampling efforts and long-term time series have mostly concentrated on the open ocean. Not unsurprisingly coastal shallow water experience higher variation in pH and represent 10–20% of the oceanic CO2 sink.

**Impact**

Ocean acidiﬁcation reduces the concentration of carbonate ions having an extreme impact on the Oceans Health. Carbonate ions are the building blocks for many marine animals such as corals, oysters, clams, sea urchins, molluscs, crustaceans and echinoderms, helping them to produce shells and skeletons, as the concentration of carbonate ions reduces, their health decreases. Indeed, reef development is thought to cease at pH 7.8. This environmental impact on foundational species like coral, phytoplankton, and shellﬁsh will have cascading effects on community structure, food, biogeochemical cycling, and commercial ﬁsheries. Ocean acidification is forecast to cost the global economy around $1 trillion annually by 2100[1] through negative impacts on ecosystem services. Coral reefs provide a global economic value of $30 billion per year and the loss of them through ocean acidification is projected to cost tens of billions of dollars annually (or 0.18% of global GDP) by 2100.[2]

Contact: <http://www.anbsensors.com/>

### Automar (Ocean Buoy -Waveco)

**Activities:** Waveco is a technology innovator dedicated to contributing to the global transformation of green energy. We do this by adapting the proven principle of wind turbines to the ocean space under the waves. Air and water are both liquids and follow the same physical laws. But water is much denser. While the wind turbine blades sweep over a diameter of up to 200 meters, the diameter of the Subwave turbine will probably never be more than 20 metres. The Subwave turbine operates under the active wave zone, safely away from the harsh surface environment, with storms and marine growth. Turbines hang in cables from buoys on the surface and wave energy is transmitted to them via these cables. Automar is an anchorless Unmoored, station-holding, ocean observation surface buoy that can stay on position for years by means of electric thrusters powered by a Subwave turbine. This will be the first product planned by Waveco based on the Subwave turbine. Automar will stay in position without being anchored, using GPS-controlled electric motors. The Subwave turbine provides power to keep the battery in the Automar charged at any time. The battery supplies power to the motors and to equipment on board. Sensors and communication equipment are tailored to the customer's need.

Anchored observation buoys are used for long-term observations from fixed positions. But moorings are expensive and the cost increases with depth. Observation of deep ocean areas is now mainly covered by drifting buoys, underwater gliders and subsea drifters. Drifting buoys must be replenished continuously with hundreds of new units per year. Long-term observations from fixed positions are therefore nearly non-existent from deep ocean areas, which covers most of the world's ocean areas. This will change with Automar. Automar will also give a greater surplus of energy for scientific sensors and communication equipment than any other type of autonomous ocean observing platform. Automat will be useful for any company or institution that needs a stationary observation post at deep sea sites.

* Oceanography
* Meteorology
* Marine Biology
* Climate
* Environment
* Fisheries
* Navigation
* Communication
* Naval Defence

<https://www.herox.com/oceanobserving/round/562/entry/24464>

<https://www.waveco.no/automar.html>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Bedrock Ocean Exploration (Seafloor Data Platform and Solutions)

Activities: Rethinking the way to the world collects and uses seafloor data to lay the foundation to fully map, image, & classify the secrets of the sea. Bedrock provides more efficient, reliable, high-resolution marine surveys, including Geophysical, Hydrographic, and UXO. Their fleet of portable AUVs supports missions in water depths less than 300m and/or 90km from shore.

**Data Services**

A single place for organizations to access, manage, and share seafloor data, which they call Mosaic™. Automatically track and convert your data into open formats. Use their API to leverage scalable cloud infrastructure and integrate with existing workflows.

**Their Mission**

Bedrock is committed to providing the world with a free, publicly available map of our world’s oceans, over 50x more detailed than the current best map available. Understanding our oceans is critical for more accurate climate models, improved weather predictions, ocean safety, submarine communications infrastructure, and sustainable ocean exploration. Bedrock is aiming to connect the experts from the marine survey and technology industries.

**Mosaic™ — Seafloor data in the cloud.**

Bedrock offers a new cloud-native platform, Mosaic™, to solve for the big data problems of ocean exploration and revolutionize seafloor data management.

Contact: https://www.bedrockocean.com/mosaic

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Curious and Energetic Buoys

The research buoy drifter for collecting and transmitting information about the ocean recharges its battery due to energy of sea waves.

* Wave energy converter is a plastic turbine in a narrow cross channel.
* Automatic recharging allows to reduce battery weight, size and cost of the buoy.
* Adequate electrical supply allows continuous echolocation and transmission of radio signals.
* The buoys in transport containers can be dropped from an airplane by parachute.
* Service life of a drifter with the wave energy converter is at least 3 years.

Contact: https://www.herox.com/oceanobserving/round/562/entry/24519

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Eelume (Self Propelled Robotic Arms)

Activities: Eelume is a disruptive technology for subsea inspection, maintenance and repair (IMR). Eelume vehicles are basically self-propelled robotic arms whose slender and flexible body can transit over long distances and carry out IMR in confined spaces not accessible by conventional underwater vehicles. Their vehicles are engineered to live permanently under water, where they can be mobilized 24/7 regardless of weather conditions. A continuous IMR capability near the subsea installations without the need for surface vessels means greener, safer and less costly subsea operations.

Contact: <https://eelume.com/#the-eelume-concept>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Green Power For Persistent Ocean Observation Buoys/Sensors (Blueprint Subsea)

Activities: SeaTrac thermal energy harvesting technology enables floats to last indefinitely, sample more frequently, with more sensors to open horizons. Introducing the SeaTrac range of acoustic positioning USBL beacons, transponders and data modems:

**Product Catalogue:**

* X150 USBL Beacon
* X110 Modem Beacon
* SeaTrac Range

For data exchange, remote telemetry, positioning or underwater navigation, their range of SeaTrac acoustic beacons provides a cost effective solution. SeaTrac beacons use robust spread-spectrum acoustic communications and the latest advances in low-cost high-speed signal processing to deliver outstanding performance in a small form factor. Piloting ROV's to waypoints, tracking the progress of AUV's and monitoring Divers is made simple due to the interactive and customisable displays of the SeaTrac PinPoint software application. The simple and feature rich ASCII serial command interface of SeaTrac Beacons makes them ideal for OEM's, Academics and Developers to quickly integrate into their own applications.

Contact: https://www.blueprintsubsea.com/seatrac/index.php

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Hydro-Surv (USV’s for Hydrographic/Environmental/Geophysical Surveys)

Activities: HydroSurv™ is a designer, builder and operator of Unmanned Surface Vehicles (USVs) for hydrographic, geophysical and environmental surveys in inland, coastal and nearshore environments. A future where all inland and coastal data acquisition is delivered by low-impact, economic autonomous vessels.

Contact: <https://www.hydro-surv.com/?page_id=1490>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Mobile Observing Observation Network

Activities: The MOON concept will transform marine ecosystem and fisheries monitoring studies into a science more consistent with ocean observing. A MOON composed of a fleet of Wave Gliders can improve the synoptic nature as well as the spatial and temporal coverage of fisheries and oceanographic data collection. Its goal is to advance wave- and solar-powered vehicle technology to transform marine ecosystem and fisheries investigations into a science more consistent with ocean observing.

Contact: <https://www.herox.com/oceanobserving/round/562/entry/24383>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### OCG Data Ocergy (Zero Emission Ocean Monitoring Buoy)

Activities: The OCG-data is a zero-emission buoy that monitors metocean, chemistry, environment, bio-diversity & ocean farming for offshore developers.

* Develop a zero-emission buoy with excellent motion characteristics
* 100% renewable powered
* Wind Wave and solar energy
* Battery storage for intermittence
* Operate high power equipment including multiple radars
* 1.5 KW power need
* **Key Features**
* Slender columns buoy
* Single line mooring
* Flexibility
* Transportable by container
* Install with small tugs

Contact: <https://www.herox.com/oceanobserving/round/562/entry/24472>

https://www.ocergy.com/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Paralenz (Underwater Dive Camera)

Activities: With a rich history of creating award winning products, the co-founders of Paralenz wanted to create something dear to their hearts - a true dive camera made for a life underwater. A Kickstarter campaign set their dream to life, and the Paralenz camera was further shaped and developed in association with alpha testers all over the world: 250 divers from 38 countries. The first underwater camera with a mission – designed for Ocean lovers. Dive undistracted. Groundbreaking new features: OLED display, rough design, marine grade aluminium. 3.5 hours battery life, Free Shipping and with depth Colour Correction.

Contact: <https://paralenz.com/about>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### P.A.Zolutions (Wave Powered Buoy Strips)

Activities: They will cover the base of a buoy with small piezoelectric strips. These strips “swim” in the waves, and this motion produces power.

* The first underwater technology that enables communication and sensing at **near-zero power**
* PAB is a **battery-less** sensor that can collect the ocean’s temperature, pressure and pH
* PAB nodes harvest energy from acoustic signals using piezoelectric interfaces and communicate by modulating the piezoelectric impedance
* Deploying a network of these nodes can enable underwater **localization** and **navigation** at minimum power

Contact: <https://www.herox.com/oceanobserving/round/562/entry/24466>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Pulse of the Oceans (Underwater Backscatter -Maritime Communications)

Activities: Pulse of the Oceans present underwater backscatter, a new technology that reduces the power consumption of underwater communication by one million times.

Contact: <https://www.herox.com/oceanobserving/round/562/entry/24498>

<https://www.facebook.com/51320424738/posts/team-pulse-of-the-ocean-comprising-signal-kinetics-group-members-reza-ghaffariva/10158703818389739/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Project Blu-Eyes(High tech Buoy Solution for Marine Protected Areas)

Activities: Project BluEyes is a tangible and digital solution/platform in the form of a specialized high-tech buoy(s), named ‘Obelisk Blue’, that will provide significantly greater transparency across Marine Protected Areas. Project BluEyes is necessary to reverse (increasing) over-exploitation of coastal resources and loss of marine ecosystem services. The buoy will act as a permanent (AI-supported) floating watchtower with at least 15 km visual range, as well as an enhanced fish aggregation device (FAD) with an electrical artificial reef (i.e. BlueNest) on the underside of the buoy. The intention is to monitor, control and survey fishing activity within the area in real-time as well as to catalyse growth of fish and coral population. They envision a network of Obelisk Blues that will facilitate and catalyse an observable growth in fisheries stock within the next 7 years. This would be achieved by countering IUU fishing at all levels in Seychelles’ EEZ and beyond.

Phase1. Pre-Funding: Ideation

With a team of 20 experts, they are beyond the ideation phase, finalizing preparations to have a proof-of-concept. They have obtained the attention and support of several maritime stakeholders in Seychelles, such as Seychelles Fishing Authority and SeyCCAT.

Targeted Challenges and Focus Areas: Restoring, protecting and investing in the ocean. Technology supporting Marine Protected Areas

Andry Accouche: Solution Owner

Operating Region: Africa, The pilot location of this Project will be in Seychelles, particularly in one identified Marine Protected Area (MPA). With success and growth, they will expand to all of the MPAs in Seychelles, followed by regional and international implementation.

Contact: <https://uplink.weforum.org/uplink/s/uplink-contribution/a012o00001OSm1YAAT/project-blueyes>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Rev Ocean (Ocean Research Expedition Vessel and Research)

Activities: Established in Fornebu, Norway in 2017, REV Ocean will enable a new generation of ocean solutions and raise awareness of global impacts on the marine environment. Four interconnected initiatives are being developed: the REV Ocean Research Expedition Vessel (REV Ocean), the World Ocean Headquarters (WOH), the Ocean Data Foundation (ODP) and Plastic REVolution. Norwegian businessman Kjell Inge Røkke has launched these initiatives with a clear vision ‘to go further than anyone has before’, and has tapped CEO Nina Jensen (former WWF Norway Secretary General) to champion REV Ocean and implement the goal of going ‘from Curiosity to Understanding to Solutions’. The initiative was started as a result of Røkke signing the Giving Pledge campaign in 2017, vowing to give away more than 50% of his fortune to philanthropic causes.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### REV Ocean Strategy (Private Research Vessel Exploration/Tourism)

Activities REV Ocean is a game-changing initiative that has an ambitious yet simple goal – to ensure ‘One Healthy Ocean’. The ocean is a dynamic, interconnected global ecosystem that can recover if the negative pressures currently affecting the oceans are dealt with effectively. To do that, we need to improve our understanding of the ocean, get key stakeholders – decision-makers, researchers, business and civil society – aligned with that understanding and turn that knowledge into concrete solutions. REV Ocean shall contribute to exactly that, through a focused strategy addressing ocean challenges in 3 focal areas:

Plastic pollution,

Climate change and ocean acidification,

Overfishing and environmental impacts of fishing

Contact: https://www.revocean.org/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### RIB WEC (Wave Energy Powered Breakwater to Shelter/Power UUV’s).

Activities: Integrate a rapidly installed breakwater into a WEC that would generate power for UUV charging while creating a sheltered area for docking. Navatek proposes to integrate the rapidly installed breakwater (RIB) structure into an attenuating wave energy converter (WEC) that would generate power for UUV charging while simultaneously creating a sheltered area for improved surface docking

Contact: <https://www.herox.com/oceanobserving/round/562/entry/24494>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Machines Robotics (Vessel Sensors, Situational Awareness, Navigation Control and Related Solutions)

Activities: The SM300 is a vessel intelligence system providing “operator-in-the loop” autonomous command and control, plus direct remote-control operation via wireless belt pack. It is ideal for survey vessels, patrol boats, ferries and other workboats. The flagship SM300 integrates with existing vessel systems and sensors to manage pre-planned and dynamically charted missions through:

* A point-and-go user interface
* Pilot-by-wire propulsion and steering control
* Certified embedded ENCs
* Situational awareness via ENC, ARPA and AIS data
* Obstacle and traffic avoidance
* Remote communications via wireless IP radio, 4G and satellite
* Real-time data feed to remote operator
* Condition monitoring of hull and machinery
* Remote payload control
* Retrofit or OEM install

**SM200**

* For tugboats, fireboats, target boats, ferries, utility craft and other workboats
* The SM200 provides fully integrated, line-of-sight and remote-helm control for collaborative vessel operations.
* Industrial-grade, remote-helm control system for minimally manned or unmanned operations
* Includes payload interface for pumps/winches
* Increases workboat and commercial surface vessels’ capability, predictability and amplified safety, as well as operators’ peace of mind
* Retrofit or OEM install

**SM400 For merchant and cruise ships – Available soon**

* An Artificial Intelligence (A.I.)-powered situational awareness system for container ships
* Utilizes computer vision, Light Detection and Ranging (LiDAR) and perception software
* TALOS technology provides an intuitive remote monitoring and data recording platform
* Improves at-sea situational awareness, object identification and tracking capabilities

Contact: https://sea-machines.com/products

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea-Net

Activities: Sea Net is a self-powered mesh networking & telemetry system based on low-power, wide-area networking (LPWAN) and wave energy harvesting.

* Mesh Network
* Self-powered
* Scalable
* Long Range

Contact: <https://www.herox.com/oceanobserving/round/562/entry/24410>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Super Radio AS (5G Maritime Communications Solutions)

Activities: Super Radio AS, a high-tech startup founded in 2014 in Oslo, is the maritime 5G pioneer for ocean digitalization and autonomous ship. It provides professional maritime land-based broadband solutions, radio channel measurement/channel sounding solutions and related consultant services. Since 2016, Super Radio AS is leading the world’s first 5G Maritime communication project “LTE, WIFI and 5G Massive MIMO Communications in Maritime Propagation Environments (MAMIME)” funded by the Norwegian Research council. In 2017, World's first maritime 5G massive MIMO channel measurement campaign with a research vessel for autonomous operations was successfully performed in MAMIME project in Trondheim fjord. In 2019, it become the 5G test solution provider for the small-version Yara Birkeland, which is ‘the world's first fully electric and autonomous container ship.’

Contact: <http://www.superradio.no/a/about/> address：Toftes Gate 2, 0556, Oslo, Norway

Tel No.：+47 97431020

Email：info@superradio.no

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Virtual-Dive

Activities: TeleVirtuality is the mobile, all-terrain, hands-free and multi-camera extension of your videoconferences, webinars, MOOCs or webcasts. Your connected communities will be able to live by proxy, interact and immerse themselves virtually in the heart of your events, in real time. Offers the following services.Their WEB TV platform is the gateway to virtual television. Their platform integrates various functionalities allowing them to offer their community the maximum of interactions with professionals during live events or during deferred consultations:

**Videoconferencing and Live Stream**

* Google Map mapping, YouTube video gallery, Facebook discussion thread, News & Events, Community network
* A real community hub
* Their platform provides information on the geolocation of events and media (photos and videos) on a map basis. The platform also offers exchanges and interactions between Internet users, members of the community and the professionals who produce and carry out the events.

This platform integrates the best of social networks around a geolocation feature of data and events based on map access. This platform brings together, in one place, your main social networks to become THE social hub dedicated to sports and tourism activities.

**Multi-viewpoint live streaming**

A professional videoconferencing solution makes it possible to consult live 3D Virtual Reality and augmented 2D broadcasts without latency in order to offer real interactions between Internet users and professionals, producers of live events.

**Professionals: discover the back office**

Create your WEB.TV with your brand: The platform, offered in SaaS mode, can be adapted as a white label and become a “community” extension of your website. You will be able to centralize your information and Facebook and YouTube pages, geolocate your media and events on a single website whatever your sporting or tourist activity. Discover the back-office features

**TV.BOX: all-terrain action computers**

Their devices, true mobile control rooms, are designed as versatile and open systems that can integrate different types of peripherals and sensors. They can be integrated into several types of media depending on the use (underwater, on the surface of the water, on land, in the air, etc.). Their computers can either allow shooting in the first person in FPV (First Person View) by placing, for example, the camera on the user's helmet and thus freeing the hands or to film the action remotely . Virtual Reality, shared by internet, can finally be used on the move in all areas.

* Mobile videoconferencing without latency
* Enhanced 2D retransmission
* 3D Virtual Reality broadcast
* Geolocation of events
* Recording for delayed replay

**TeleVirtuality Box**

Mobile videoconferencing and collaboration solution enabling high quality real-time hands-free video communication to a dedicated videoconferencing and webcast platform. It includes a rugged PC, a 3D camera module and the ability to connect several other cameras (webcam, infra-red, endoscopic, microscopic) as well as other USB and audio peripherals.

**Dolphyn**

Underwater version of their solution, the Dolphyn, a product patented by Virtual-Dive, is an underwater computer dedicated to the retransmission of live underwater videos via the Internet. The Dolphyn integrates a PC, a 10-inch screen, a 3D HD camera and control joysticks. Wi-Fi / 4G and a GPS are deported in a surface buoy.

**Mobile control room:** Allows the retransmission of HD video in real time. The user can for example fix the 3D camera module on his helmet. The remote cameras are ideal for tasks where the user needs hands-free operation during videoconferencing (outdoor activities such as sports, travel, adventure, etc.). The control room is equipped with GPS and can be controlled with any type of smartphone via Bluetooth.

**Wireless network:** Their solution uses Wi-Fi or LTE (3G / 4G) networks to increase coverage, video quality and quality of service. A dual SIM card can be installed to ensure stable and reliable communication and to avoid a potential fall of one of the operators.

**Hands-free and wireless audio support:** The device works with wireless ( Bluetooth) or wired headsets .

**PC**: Allows live, 2D or 3DVR broadcasting of underwater explorations and access to applications, on-board software and online content and services (when the console is connected via Wi-Fi or 3G / 4G ). The screen located at the bottom of a dark room, allows you to view video feedback, geolocation and other on-board information.

**HD Cameras:** Allow you to shoot underwater scenes and, if the console is connected, broadcast the images live over the Internet.

**Connected buoy:** Allows you to share underwater exploration on the web by WiFi or LTE (3G / 4G). The integrated GPS makes it possible to position the diver in the aquatic environment, to geolocate the videos and to trigger the display of information in Augmented Reality of the various points of interest (POI) previously geo-positioned on the cartographic editing platform.

Contact: <http://virtualdive.com/about-us-2/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sea Cras (Earth Satellite Data Analytics)

Activities: SeaCras is Earth Observation data analytics-based company oriented to marine sector.

**Applications**

* Processing satellite imagery
* Derive water quality products
* Provide monitoring services
* Build and validate forecasting models
* Physico-chemical numerical modelling

**Coastal waters monitoring**

With an accelerated degree of coastal urbanization comes a large variety of stressors. Adequate large-scale surveillance systems are needed to ensure the security of intense marine trade and transport, to meet the criteria in public health, and to preserve the vital marine ecosystems. Satellite imagery and its adaptivity represents a perfect match for the task.

**Monitoring inland water bodies**

Unlike oceans and seas, inland water bodies have significantly lower auto-purification properties. Due to the high anthropogenic impact, such as wastewater discharge or minerals and nutrients inflow by nearby agriculture, many inland water bodies are dealing with severe eutrophication. Earth Observation data provide systematic spatial-temporal analysis of the water quality over a large number of rivers, lakes and drinking water reservoirs.

**Aquaculture**

Aquaculture is a fast-growing field in food production. Its efficiency relies heavily on the status of aquatic systems where the farms are located. Monitoring and maintaining the high quality of water is thus of the paramount importance. Remote sensing is readily coupled with sampling and forecasting techniques to provide a timely estimate of relevant water constituents.

**Tourism**

With the majority of worlds tourism being directed towards the coastal areas, the great challenge for the sustainability of this branch of the economy is to ensure the high quality of water. Earth Observation provides means for the frequent monitoring of water quality on large scale while minimizing the expenses.

**Bathymetry**

Satellite-based bathymetry represents the latest tool to map the depth of shallow waters. Compared to other techniques, the costs of creating truncated bathymetric charts of shallow waters with the resolution of 10 m (or with even higher resolution) are substantially lower. Satellite-based bathymetry is especially useful in the study of crystal-clear coastal waters such as Adriatic or Ionian Seas.

Contact: <https://seacras.com/en/applications/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Teledyne Caris (Cloud Computing Marine Hydrography Solution)

Activities: Teledyne CARIS received Canada’s Ocean Supercluster award through the Accelerated Ocean Solutions Program. The CARIS Cloud Technology Project will break down technical barriers to entry for hydrographic processing and charting in support of remote operations CARIS, a Teledyne Technologies [NYSE:TDY] company, received significant funding from Canada’s Ocean Supercluster award to develop software for remote operations survey processing. This is in alignment with the company’s leading AI strategy.

Teledyne CARIS’ project aims at three targeted deliverables:

* The enhancement of its desktop-based product line to leverage the cloud to deliver consistent access for global users in every possible circumstance
* Support for remote mapping operations to underpin advancements in ocean robotics
* Infusing its passion for future ocean mappers with access to virtual training through the CARIS Cloud Platform.

Contact: <https://www.teledynecaris.com/en/news/newsroom/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Wave Powered Oceanographic Gliders

Activities: This is a System using wave energy to cheaply power ocean gliders and drift buoys; It integrates onboard power generation and advanced energy storage. They will accomplish this through a) integration of onboard power generation and b) integration of advanced energy storage. They have designed a 50W wave energy converter, designed an energy storage system, and have identified a glider architecture to house it. These innovations will improve device lifetime, sensor power budget, deployment and recovery costs, enabling more research, cheaper.

Contact: https://www.herox.com/oceanobserving/round/562/entry/24486

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### The Sea Opportunities (Renewable Energy Powered Underwater Technology Solutions)

Activities: They aim to make the oceans better for the future. The Sea Opportunities srl provides R&D, Production and Sale of new Underwater Technologies, Robotics, Sensors and dedicated Software, with the best value for money, powered by Renewable Energy Sources, intended to be used mainly in the underwater industry. Subsea technologies for everyone: means constantly work on social inclusion on more level in the underwater industry. The Company is capable to supply subsea services with our ROVs for: Aquaculture, Aqueducts & Dams, Blue Economy, Defence, Environmental pollution, Marine Biology, Ocean Sustainability, Offshore Energy, Oil & Gas, Recreation & Discovery, Search & Rescue, Shipping, Submerged Infrastructure, Underwater Archaeology, War Reclamation, and more. The Sea Opportunities offer his know-how and consulting for underwater engineering, feasibility studies, software & hardware development, customized underwater robotics development.

They motivate their activities as under:

Their underwater technology is produced with 100% recyclable materials and powered by Renewable Energy Sources. The majority of their partners and providers are Italian. They are very aware of quality and price of their products. 30% growth in the Aquaculture sector. 30% growth in the Technology Wind Farm sector. 20% growth in the Environmental monitoring sector. 20% growth in the War Reclamation sector. Exact quantification of product/service sales request per sector cannot be currently provided.

Sustainable impact on blue economy: Their Underwater Technology can track the health of seas and oceans: It will improve the quality of workers and will help to track the health conditions of the fish in the aquaculture systems. Real-time data useful for the European Community for monitoring the ocean sustainability.

Contact: https://www.theseaopportunities.com/rov-opportunity-remtech-expo-2018-2/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 20. WATER SECURITY/WATER QUALITY/DESALINATION

### Desolenator

Activities: Desolenator uses solar energy in a new way to create high-quality water at scale. The impact goes beyond water provisioning, to create resilient communities and businesses. A frontier technology for evolved water provisioning. In a fast changing world, water is the foundation for all life to thrive, yet the way that we make and move water today is detrimental to our planet and the bottom line. Desolenator has a new approach to water supply: decentralised, regenerative, ocean-safe and 100% solar-powered. Measurable impact, evolved. A solution for forward-thinking companies seeking reliable water, and the communities that nurture them. A sustainable business, evolved.

Contact: <https://www.desolenator.com/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Graphene Water Technologies (Membrane Tech to Reduce Water Loss from Desalination)

Activities: More than 300 million people consume more than 86 million m3 of desalinated water every day. As water scarcity grows, the outlook for the desalination industry is good with an increasing need to provide clean and safe water. The main concerns among the circa 150 countries now using a desalination process is that desalinated water production is energy-intensive and expensive. In fact, 50% of the cost of the water is energy costs. Now, the economics of delivering desalinated water could be radically changed with the introduction of G2O graphene oxide-coated membranes to a plant. The membrane’s surface design means:

* It takes less energy than traditional membranes to produce the same amount of water.
* More water can be processed before cleaning is needed, making the desalination process more efficient.
* Preferential transportation of water between the graphene oxide planes results in high salt rejection.

By adopting the G2O graphene oxide-coated membrane, desalination plant operators have the potential to build smaller and more efficient units and increase their ability to improve water supply to cities and remote locations.

Contact: https://g2owatertech.com/solutions/desalination/

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### H20K Innovations

Activities: An IoT-enabled contaminant management platform helping water-dependent businesses and communities optimize water quality and treatment through predictive diagnostics. They strive to create the world's largest database on real-time environmental information. They run business development, sales, and strategy. A Techstars backed company.

Contact: Website: www.h2okinnovations.com

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Impact Free Water

Activities: Remember when Cape Town was experiencing its devastating drought and we couldn’t understand how a coastal city could not have sufficient water? Turns out that gaining potable water from the ocean is usually a very costly and environmentally destructive process that requires vast amounts of electricity. Simon Wijnberg, the founder and CEO of Impact-Free Water, has seen this problem present itself around the world as his passion for diving and a professional career in the marine environment have taken him to many seaside communities that have no access to clean water. There are health and sanitation consequences when clean water is not available. This is why Impact-Free Water has been developing a cost-effective, eco-friendly solution to turn seawater into drinking water by harnessing the power of waves in a non-intrusive way. Wave energy is used to pump ocean water to shore through an underwater pipeline, where it feeds and drives a reverse osmosis process to produce fresh water. Electricity (produced from the wave pressure) becomes a useful by-product of this innovative system. Current projects include one in Saldanha, where Impact-Free Water is working with the local community to eventually get water to places that need it most, as well as a pilot semi-commercial plant in Coega, near Port Elizabeth, where it is aiming to supply 160 kilolitres of fresh water per day to a mariculture farm. It is also putting wave-powered desalination to the test at the University of Namibia’s Sam Nujoma campus in Henties Bay, supplying drinking water and electricity to the campus. Wave Energy R&D: “This year we are testing the WEROP (Wave Energy Reverse Osmosis Pump) in the third series of sea trials to establish the efficiency of the system, and demonstrate the technology to potential investors. This is the first year we are operating the R&D full time, since its inception in 2002, thanks to funding from the TIA (Technology Innovation Agency)”.

Contact:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Ocean Oasis (Wave Powered Desalination Solutions)

Activities: Ocean Oasis utilizes the power of waves to deliver desalinated water to shore where needed in a flexible, efficient way and without emissions.

ROBUST

Their desalination plant is designed for robustness. Hydrodynamic model tests have been carried out by Marintek (now Sintef Ocean) in 2011, including a third party concept evaluation

MOBILE

The floating platform can be towed and moored using standard systems. By being mobile, rapid deployment will be possible in locations where building onshore is risky, slow and complex.

SUSTAINABLE

They offer an alternative to polluting diesel driven desalination and support countries’ decarbonization efforts. Environmental impact is minimized by offshore desalination and brine disposal.

Contact: <https://www.oceanoasis.co/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Resolute Marine Energy (Wave Powered Desalination Solutions)

Activities: A Wave2OTM system deployment typically employs several wave energy converters (WECs) that pressurize seawater which is piped ashore to directly drive a seawater reverse-osmosis (RO) desalination system. Wave2OTM systems include several proprietary innovations including:

* a system and process for rapid and safe WEC deployments in remote areas;
* a system design that is easy to maintain which enables long-term reliable operation;
* an efficient RO process that eliminates two energy conversion steps.

Wave2OTM systems are readily scalable which enables “just in time” adjustments to production capacity. This is because the entire Wave2OTM system is packaged in standard marine containers and can be installed in a matter of days which allows water resource managers to more precisely match supply with demand without the need for massive infrastructure investments in pipelines, canals, and electrical production and transmission assets.

Contact: <https://www.resolutemarine.com/technology/>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 21. UNDERWATER NOISE AND ACOUSTIC SOLUTIONS

### Quiet Oceans

Activities: Quiet-Oceans provides state-of-the-art risk assessment tools and management capabilities to help the offshore renewable energy industry to secure their projects. They support the industry with shaped and pragmatic methodologies and integrated tools adapted to the level of risk and to each stage of the life cycle of the project. With an international portfolio they are well recognized in Europe and in the United States. Regularly consulted by governments from various countries, they are also actively involved in noise regulation, especially by participating with the European Commission Technical Group on Underwater Noise and inputs of other forms of energy.

Developing human activity at sea opens up new possibilities for the global economy, but increases environmental pressures. However, developing use of the sea in harmony with marine ecosystems is a major challenge. Quiet-Oceans meets that challenge by providing manufacturers, environmental research consultancies, public bodies and marine mammal protection organizations, with solutions for ocean noise forecasting, monitoring and reducing anthropogenic noise impact.

Quiet-Oceans works in partnership with the research community to help develop understanding of the impact of underwater anthropogenic noise on aquatic life.

Arctivities LOGOArctivities is an innovative operational service allowing to display indicators in the Artic marine activities.

Arctivities is an operational service developed in partnership with Noveltis to characterize the risk indicators indices related to the safety of activities at sea (transport, fishing, aquaculture, renewable energies) as well as ‘ their environmental impact’ on biodiversity in terms of noise pollution. Quiet-Oceans has contributed to noise modeling, by computing, thanks to Quonops, an estimate of spatio-temporal distribution of anthropic noise levels.

Labège, France, 15th November 2019

Quiet-Oceans is proud to have been awarded at the the Ocean Innovation Award from ADECAN, in partnership with Institut océanographique, Fondation Albert Ier, Prince de Monaco, Energy of the sea and Cluster Maritime Français for the developpement of Quonops Online Services, the first Global Online Prediction System for Ocean Noise.

Quonops Online Services is generated using E.U Copernicus Marine service information.

Contact:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Sub-Acoustic Tech

Activities: Their services are designed around the needs and objectives of their clients. Their understanding of the regulatory expectations in the regions that they operate in, along with a deep knowledge of the latest scientific advances, ensures they maintain excellence. As a scientific and engineering consultancy, they have a range of professional capabilities offered in support of their specialist services including project management, project scoping and design, expert witness, and regulatory advice and support. They undertake the following activities: following sections outline our capabilities in more detail.

**Underwater Noise Modelling and Environmental Impact Assessments**

Underwater acoustic propagation modelling is an essential component of many marine EIAs. Many marine protected species and commercially significant fish species are highly sensitive to underwater noise and as such, careful management of noise generating activities is a regulatory requirement for most marine developments. They have a range of different modelling techniques that can be used according to the severity of the noise, complexity of the environment and proximity to sensitive receptors.

**Detailed Numerical Modelling**

Their detailed modelling uses a complete set of environmental parameters and advanced solvers to estimate noise propagation with range, depth and frequency. Combining Subacoustech’s own empirical source level modelling with appropriate third-party solvers (Parabolic Equation, Ray Tracing and Normal Modes), highly detailed outputs can be obtained with a high degree of confidence.

**INSPIRE**

A range dependent, semi-empirical broadband noise propagation model developed by Subacoustech and refined over 10 years using hundreds of datasets from field studies. Due to the nature of the data used to formulate and validate INSPIRE, it has shown a good level of accuracy for piling events in the waters similar to the North Sea and UK continental shelf.

**Source Level Modelling**

Estimation of the acoustic source level is a critical parameter as small discrepancies can be magnified significantly during modelling. Their substantial library of underwater noise measurements, particularly of impact piling has been used to compile an advanced noise source level model. This uses the pile diameter, blow energy and water depth to estimate the apparent source level.

**SPEAR** – Simple Propagation Estimation and Ranking.

A simple geometric spreading model that uses measured source level data and ranks underwater noise sources according to the likely magnitude of effect.

**INSPIRE Light**

A low resolution version of INSPIRE that has been adapted to run very quickly for use in multi-disciplinary workshop settings. Clients have found INSPIRE Light workshops to be a very useful tool for reducing risk and cost in the consenting process by identifying problematic scenarios at a very early stage. For all our modelling approaches, they have an ongoing program of validation and refinement as their library of field measurements expands. Where data falls within a range of values (as is frequently the case) they use levels at the upper bounds of the data to ensure that estimates are conservative and potential impacts are not under-predicted in a way that would lead to later compliance issues.

**Underwater Noise Measurements**

Field measurements are a critical aspect to all that they do. First-hand experience of noise generating activities and the noise levels that might be expected adds value to all their services. Their measurement services utilise a range of fully calibrated, instrumentation grade hydrophones and recording equipment covering every scenario. They have the capacity to undertake long-term ambient noise monitoring, piling or blasting monitoring, passive acoustic monitoring (PAM) systems or Sound Source Verification (SSV).

**Fully attended monitoring**

This is their preferred approach wherever possible. It ensures the most reliable data collection as data quality is verified at the time and measurements can be repeated if quality issues are detected. Where time allows, measurements are taken over a wide area and at different depths to determine spatial variation. In addition, this can be combined with fixed position monitoring to provide temporal variation.

Suitable for:

* Inshore construction noise monitoring
* Combined underwater noise and seabed vibration studies
* Sound Source Verification (SSV) of static sources

**Short-term autonomous monitoring**

Monitors are configured to continuously record high-quality noise measurements for periods of 72 hours or more at sampling rates of up to 500 kHz. If required, real-time monitoring over a wireless connection can also be configured. Suitable for: Single event monitoring such as blasting; Sound Source Verification (SSV) of mobile sources.

**Long-term autonomous monitoring**

For longer periods, their solutions continuously process and store noise levels in terms of 1/3 octave band levels (or linear frequency bands) while simultaneously recording raw audio recording data according to a defined duty cycle to optimise use of storage. This low power solution enables continuous recording for 3 months or more. Suitable for: Baseline noise monitoring; Campaign monitoring (before, during and after a campaign) and sound waves.

**Passive Acoustic Monitoring**

They can supply a range of PAM equipment along with operators, and JNCC and BOEM-approved marine mammal and protected species observers (MMO and PSO). PAM equipment interfacing with the industry standard PAMGuard software can be provided in configurations including single “dipped” hydrophones, vertical and towed arrays. For long-term detection of mid and high frequency cetaceans, they are experienced in the deployment and analysis of C-Pod click detectors. Suitable for:

* Coastal, shore-based monitoring
* Vessel-based attended (dipped hydrophone) monitoring
* Vessel-based vertical or towed array

**Developing Bespoke Solutions**

While they have a range of solutions ready to deploy at short notice, they have particular expertise in developing bespoke solutions for deployment in challenging environments, such as fast flowing rivers or very deep water with different options for seabed frames, surface buoys or acoustic releases.

In addition to acoustic monitoring, they can combine our monitoring solutions with other environmental monitoring in a single deployment, offering significant savings on separate mobilisations. Previous deployments have included turbidity monitoring at the seabed and mid-water and C-Pod marine mammal click detectors.

**Airborne Environmental Noise Monitoring**

In addition to their expertise in underwater acoustics, they also have considerable expertise in airborne noise studies as many of their staff have worked for years in traditional acoustic consultancy. As such, they offer cost effective airborne environmental noise monitoring solutions to BS4142 using fully calibrated Type 1 sound level meters as well as offshore airborne noise sampling. Their environmental noise monitoring solution can monitor continuously for up to 8 days (or 4 days with continuous 4G data upload) or indefinitely with the addition of mains or solar power.

**Consultancy and Engineering**

Subacoustech has a long history of undertaking challenging and innovative development projects. They invest significantly in research and development in order to enhance their services and meet the needs of their clients. Development projects may be undertaken in-house or with their specialist partners. Their expertise includes:

**Systems engineering:** Analogue electronics and signal processing; Bulk data management and analysis; Systems automation and integration.

**Physical engineering**: Subsea housing design; Mooring design; Solar power solutions.

**Signal Processing:** Data analysis and signal processing using Python and Matlab.

Contact: +44 (0) 2380 236330 info@subacoustech.com Unit 2 Muira Ind. Est., Southampton, SO14 5QH, UK

https://www.subacoustech.com/services