mocean energy

Green Energy for the Blue Economy

Prepared for ADB EA Webinar on MRE and Blue Economy

Cameron McNatt
Managing Director
cameron.mcnatt@mocean.energy
+44 (0)7852 328117

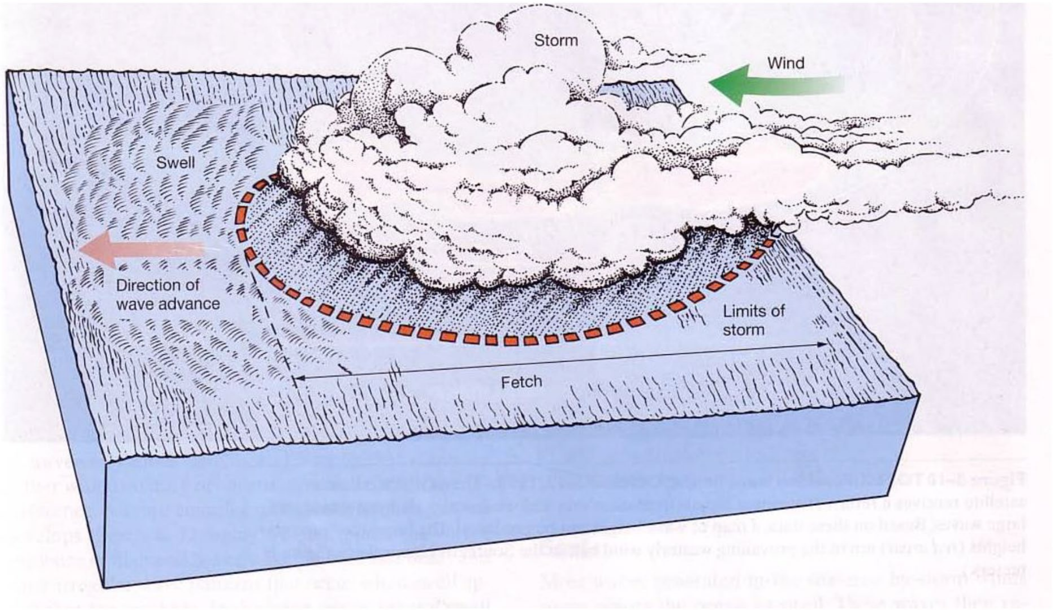
www.mocean.energy

What is Wave Energy?

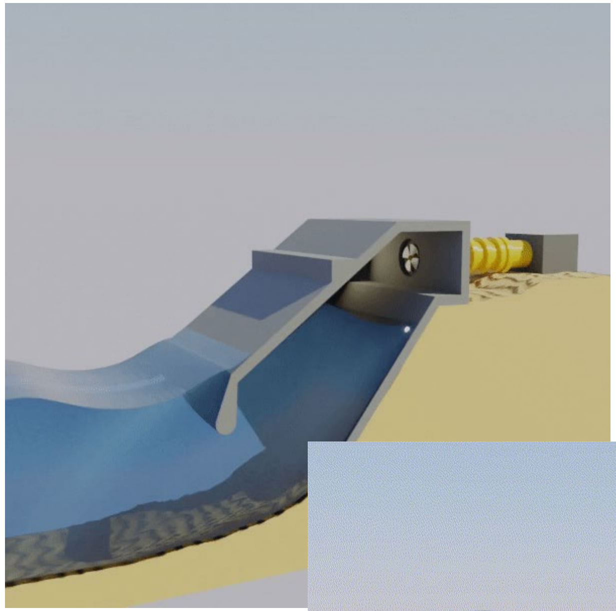
Wind blows over the surface of the water, and creates waves

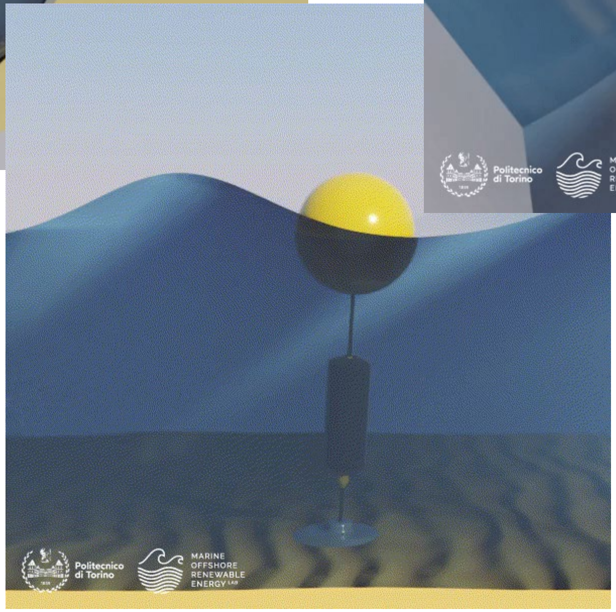
Waves are either “local wind generated”

Or “swell” – waves created somewhere else that travelled across the ocean



The “up and down” / “back and forth” motion of the fluid needs to be converted into mechanical, then electrical power.





https://morenergylab.polito.it/wec/

Problem

Ocean energy faces development challenges:

- Reaching a competitive cost of energy
- Reliability and survivability at sea
- Capital for development

Solution

Bottom-up market pull for moderate-scale technology

Denmark, a country of 6 million people, leads the world in wind power because: [4]

- Market pull for small-scale distributed projects created companies like Vestas and Siemens Gamesa
- Robust products were developed via learning-by-doing
- Top-down policy and R&D re-enforced the market and supported scaling up.

Start Small bluestar

10 or 20 kW + up to 5 kW + up to 450 kWh + Starlink, 4G, etc.

Blue Star uses **waves, solar, batteries to create an offshore renewable microgrid** supplying power, comms

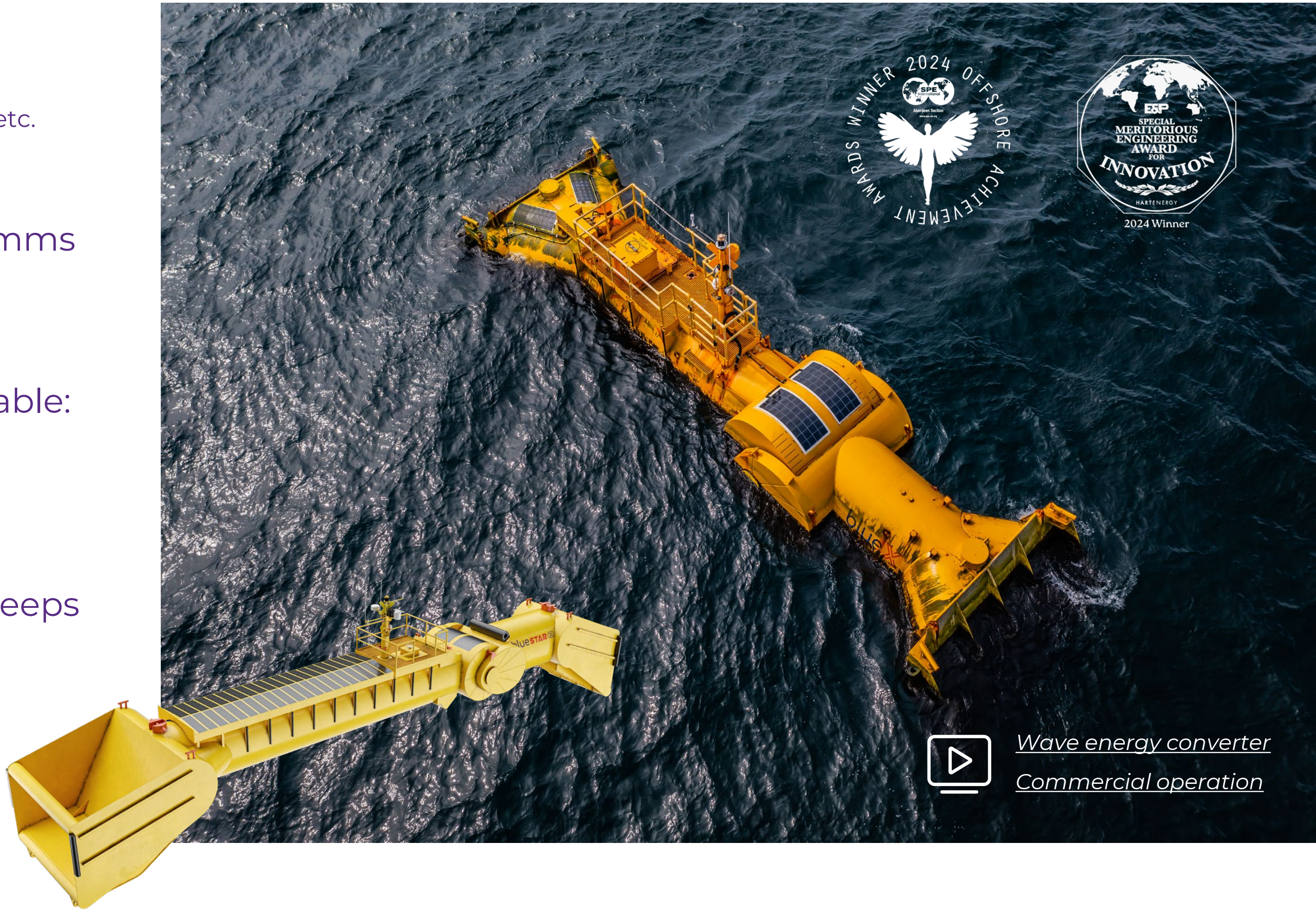
Market focus: O&G and CCS subsea systems

e.g. Compared to 30 km power and comms cable:

- Saves 40% lifetime costs [5]
- Saves 20,000 TCO2 [6]

e.g. As “back-up generator” for failed cables, keeps production online, mitigating £millions in lost revenues.

Technology is TRL 8. 18m+ months testing at sea over two campaigns with Blue X demonstrator including integration with subsea equipment.



Go Big!

blue HORIZON

100 kW – 1 MW	+	Up to 100 kW	+	TBD	+	Wired and wireless.

Power for the Blue Economy – larger power ocean-based renewable microgrids

- Applications like ports, aquaculture, subsea data centers, direct water CO2 capture

Islands

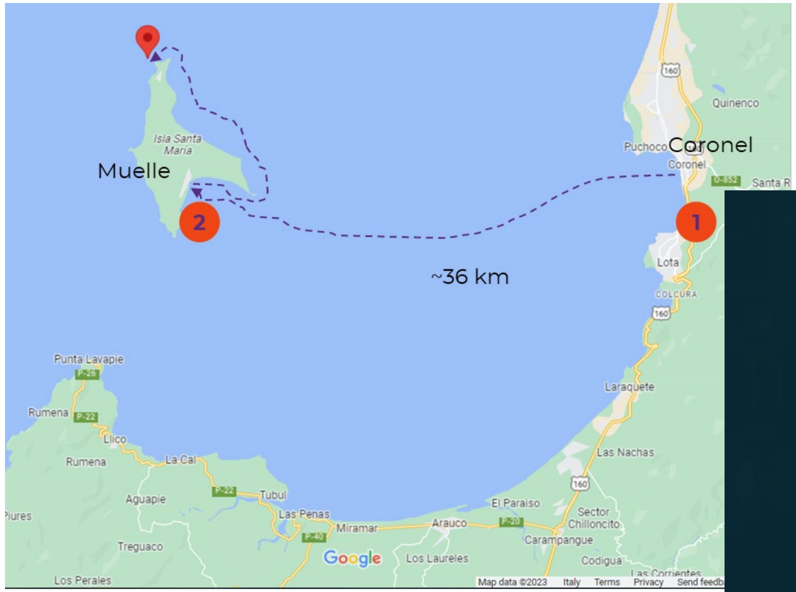
- Only 16% decarbonised [7] – wind, solar will not meet all needs
- Early project LCOE: ~280 £/MWh [8]

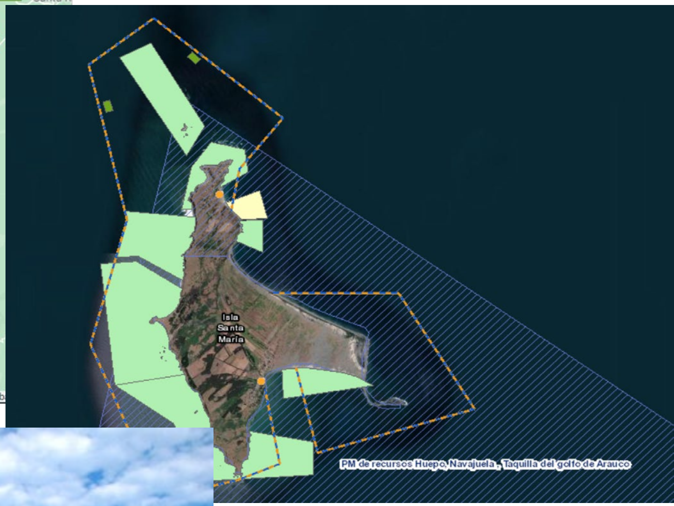
Combined offshore energy parks

- Space and infrastructure efficiency, meet demand with less energy storage and lower LCOE
- Established tech LCOE <90 £/MWh [9]

Isla Santa María, Chile

- 2,000 inhabitants
- Rely on diesel generators
- Energy prices highly volatile €635 (2020) – €1,240 (2022) /MWh
- Energy consumption: 942 MWh (2020), estimated to double by 2030
- Solar and wind projects had been explored on the island but never pursued – concerns about solidity of soil for wind
- 36 km from nearest major harbor, Coronel
- Mocean worked with regional partner MERIC, and designed a project on paper:
  - 1 MW installed capacity
  - Estimated LCOE of €595 / MWh





Isla Santa María, Chile

- Mocean visited the island
  - With reps from MERIC, the local government, and other stakeholders
  - Presented to residents
- Concerns from residents
  - Interference with fishing, which is major source of income
  - Slow / start-stop engagement of projects – people come, but nothing happens
- Other challenges
  - Mocean's technology at this scale is not ready for market
  - Access to infrastructure, O&M of equipment
  - Marine growth, ecological impacts
  - Access to finance

Yuquot, Canada

Mowachat Muchalaht First Nation (MMFN) territory

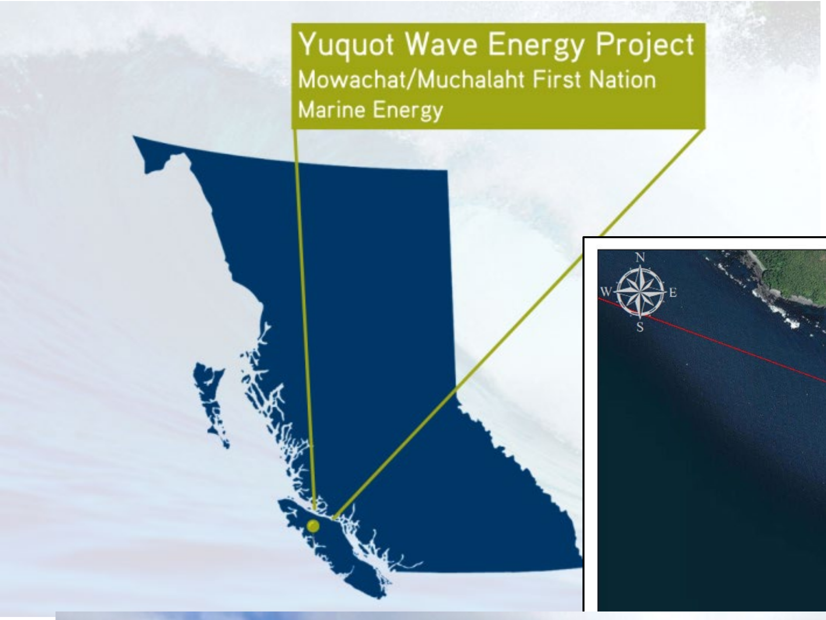
Yuquot

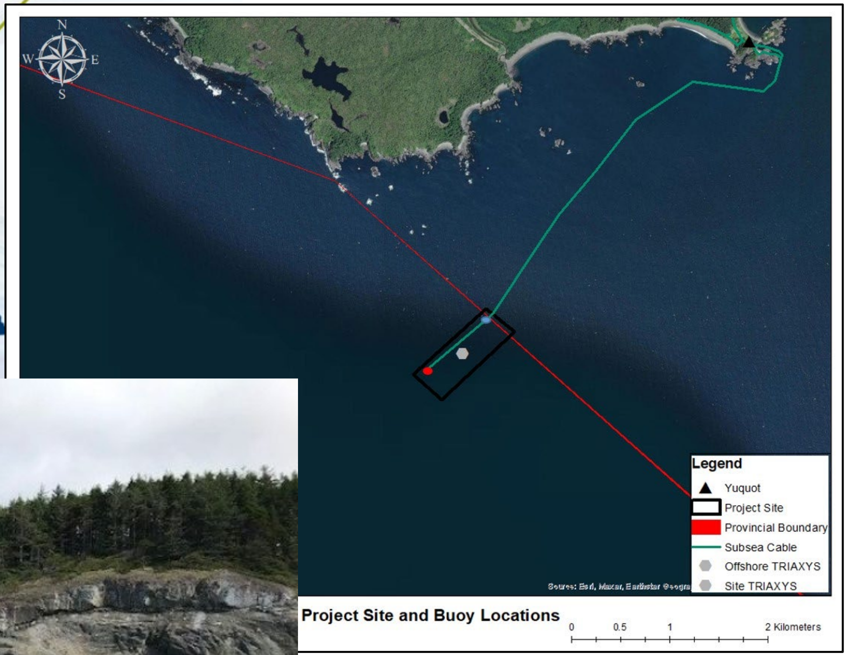
- “where the wind blows from many directions.”
- Historical village, not currently inhabited year round, but MMFN want to re-establish stronger presence use for tourism / economic development

No grid connection.

Interested in using wave energy alongside solar and battery storage

Project investigation and development supported by Barkley Project Group (project developer) and Pacific Regional Institute for Marine Energy Discovery (PRIMED) (research group at University of Victoria)





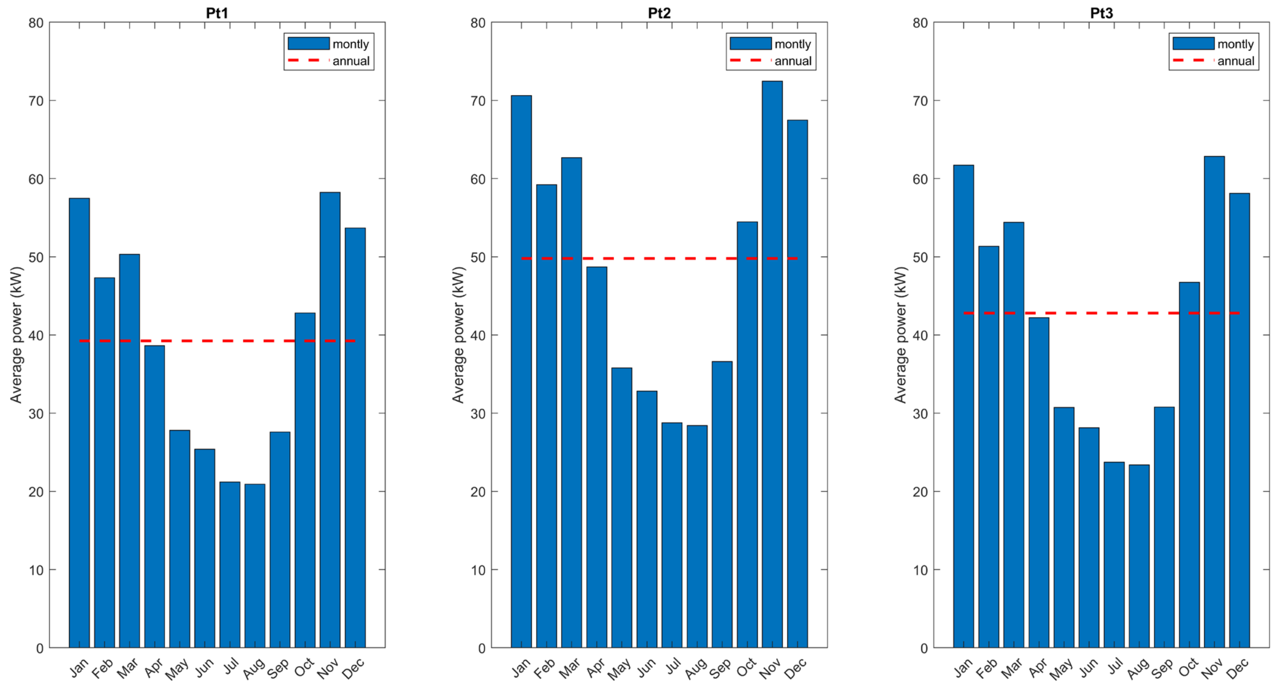
Yuquot, Canada

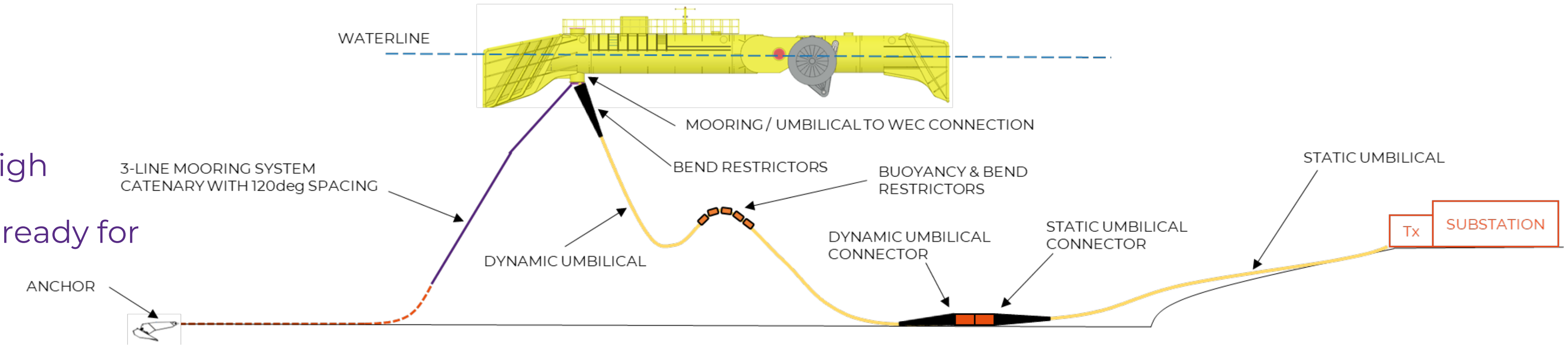
Mocean Energy carried out a feasibility study for PRIMED, considering

- Power capture from wave and solar
- Survivability
- Power cable connection
- Mooring and anchor system
- Installation and O&M
- Environmental impact
- Costs

Challenges

- First-of-a-kind costs are high
- Technology is still not yet ready for the market.





Conclusion

mocean energy

There is strong interest from communities and islands in wave power

The technologies needed for these projects are not quite ready for the market

The technology needs to be co-designed with islands in mind. i.e. through case studies, and proven in demonstration projects.

References

[1] For example: EVOLVE Consortium (2023) "The system benefits of ocean energy to islanded power systems,". Available online: https://evolveenergy.eu/project-outputs/

[2] G. Reikard, B. Robertson and J.-R. Bidlot, "Combining wave energy with wind and solar: Short-term forecasting," Renewable Energy, vol. 81, pp. 442 - 456, 2015.

For more on [1] and [2], see: Mocean Energy Ltd, 2024. "Ocean Energy Value Proposition", MOE-COM-000-R0014

[3] 1,700 GW = 1,400 GW of offshore wind + 300 GW of marine energy.

- 1,400 GW of offshore wind: Global Wind Energy Council, OREAC Vision for offshore wind.
- 300 GW of marine energy: Ocean Energy Systems (2023). "Ocean Energy and Net Zero: An International Roadmap to Develop 300GW of Ocean Energy by 2050".

[3] con't: £5tril = 1,700 GW * £2.9B / GW

- £2.9B / GW is based on: "Guide to an offshore wind farm" commissioned by UK's Crown Estate and Offshore Renewable Energy Catapult, which for a typical nearshore UK wind farm is £2.37B / GW in 2019 GBP, which is inflated to £2.9B / GW in 2023 GBP.

[3] con't: 12% global electricity = 10% from 1,400 GW of offshore wind (https://gwec.net/oreac/) + 2% from 300 GW of marine energy

[4] Araújo, K.M. (2018) Low Carbon Energy Transitions. Oxford University Press, New York.

[5] Based on Mocean's costing and confidential customer report.

[6] Internal estimates based on data from: Pale Blue Dot (2018). "Tieback of the Future". Prepared for OGTC. 10320OGTC-Rep-01-01

[7] 16% decarbonized based on: IRENA, 2023. "Regional Profiles". SIDS Lighthouses. https://islands.irena.org/Re-Progress/Regional-profiles

[8] Mocean Energy Ltd, 2023. "Metrics & LCOE – Final Report", MOE=EWV-R0061. Bemuda site, assume 0.83 £:€.

[9] Assumes 70% cost reduction in ~15 years, i.e. by 2040-45, following trend by UK offshore wind - ORE Catapult. 2024. Tidal Stream Technology Roadmap.

[10] Mocean Energy Ltd, 2024. "Blue Star O&G and CCS Market Analysis", MOE-COM-000-R0016

[11] 200 GW of wave energy – our estimate based on e.g. Ocean Energy Systems (2023). "Ocean Energy and Net Zero: An International Roadmap to Develop 300GW of Ocean Energy by 2050".

£680B = 200 GW * £3.5B / GW, where £3.5B / GW cost per GW for wave, extrapolated from "Guide to an offshore wind farm" and own estimates.

[12] OECD (2016). The Ocean Economy in 2030 $3 tril USD converted to £2.5 tril GBP

[13] J. Hodges, J. Henderson, L. Ruedy, M. Soede, J. Weber, P. Ruiz-Minguela, H. Jeffrey, E. Bannon, R. Maciver, D. Hume, J.-L. Villate and T. Ramsey, "An International Evaluation and Guidance Framework for Ocean Energy Technology. 2nd Edition.," IEA-OES, 2023.

[14] 6 stage gates = 3 stage-gates in Wave Energy Scotland program + 3 stage gates in EuropeWave