MUSICA

"WHAT IS MULTI-USE AT SEA? AND HOW CAN IT PAVE THE WAY FOR A MORE SUSTAINABLE AND COST-EFFECTIVE APPROACH TO THE USE OF OCEAN RESOURCES"

Workshop

June 4th, 2024

European Union's Horizon 2020
Research and Innovation Programme
under grant no 862252

"What is multi-use at sea? And how can it pave the way for a more sustainable and cost-effective approach to the use of ocean resources"

MUSICA

MUSICA Project

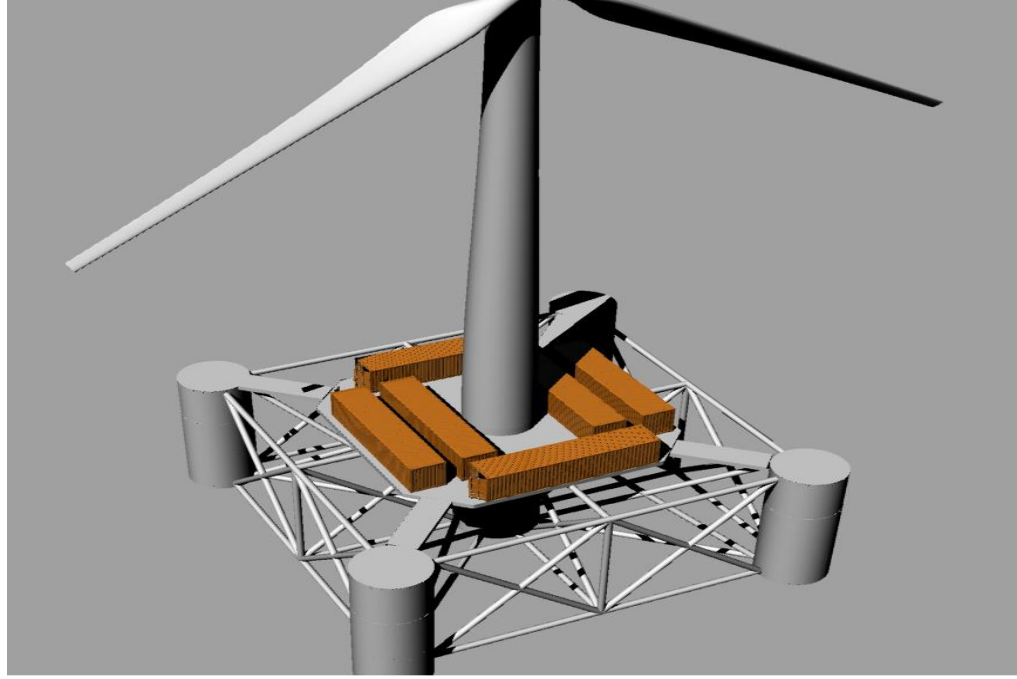
Theodore Lilas, Nikitas Nikitakos, Leyne Kevin, Athanasios Vatistas

Workshop

June 4th, 2024

European Union's Horizon 2020 Research and Innovation Programme under grant no 862252

Multiple Use of Space for Island Clean Autonomy



MUSICA

Partners

Multidisciplinary teams
Utilize diverse knowledge
Many synergies
Stakeholders involvement
Long term vision for
Environmentally friendly solutions

- AQUABIOTECH
- CORAL PIRAEUS
- DAFNI
- ECOWINDWATER
- FORKYS
- FULGOR
- HERIOT-WATT UNIVERSITY
- ICoRSA
- INNOSEA
- INSB
- MUNICIPALITY OF CHIOS
- MUNICIPALITY OF OINOUSSES
- NEODYNE LIMITED
- OPTIMUS PRIME LIMITED
- PLOCAN
- SINN POWER
- UNIVERSITY COLLEGE CORK
- UNIVERSITY OF MALTA
- *UNIVERSITY OF THE AEGEAN*

MUSICA Project: Bringing Sustainability to Small Islands
What is MUSICA?

Unique System: Provides clean energy, drinking water, and supports sustainable aquaculture.

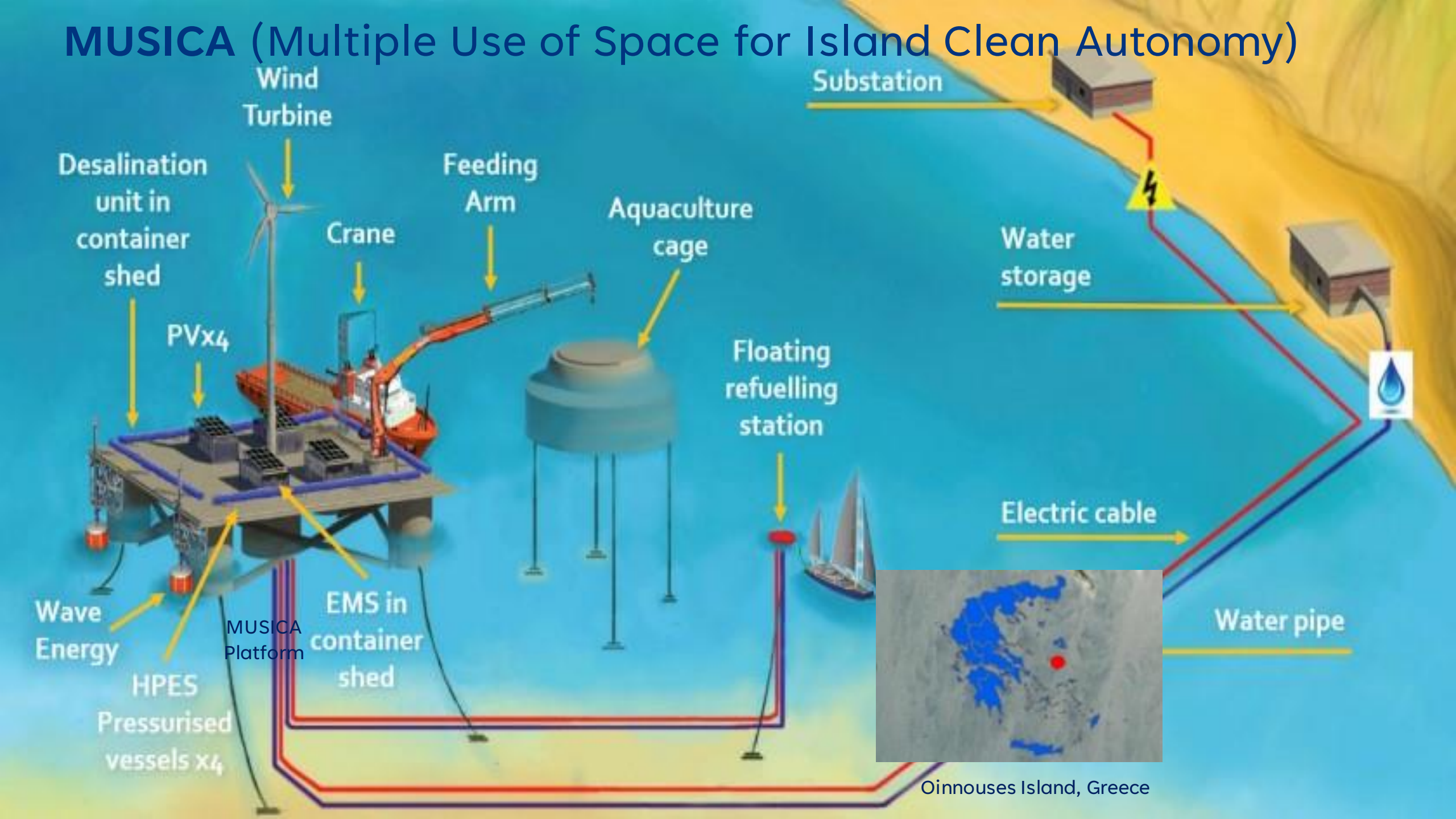
Multi-Use Platform (MUP): Combines these functions, promoting efficient use of ocean space.

Blue Growth Alignment: Supports clean energy, sustainable water, and responsible aquaculture.

Responsible Research & Innovation: Actively involves islanders, addressing their needs and concerns.

Quadruple Helix Model: Collaboration between citizens, industry, researchers, and public authorities.

MUSICA (Multiple Use of Space for Island Clean Autonomy)



Oinnouses Island, Greece

Multiple Use of Space for Island Clean Autonomy

MUSICA Key Goals

Develop & Test: Real-world implementation on Oinousses island, Greece.

Replicability: Make the system attractive and accessible for other islands.

Sustainability: Long-term solution benefiting the environment, economy, and society.

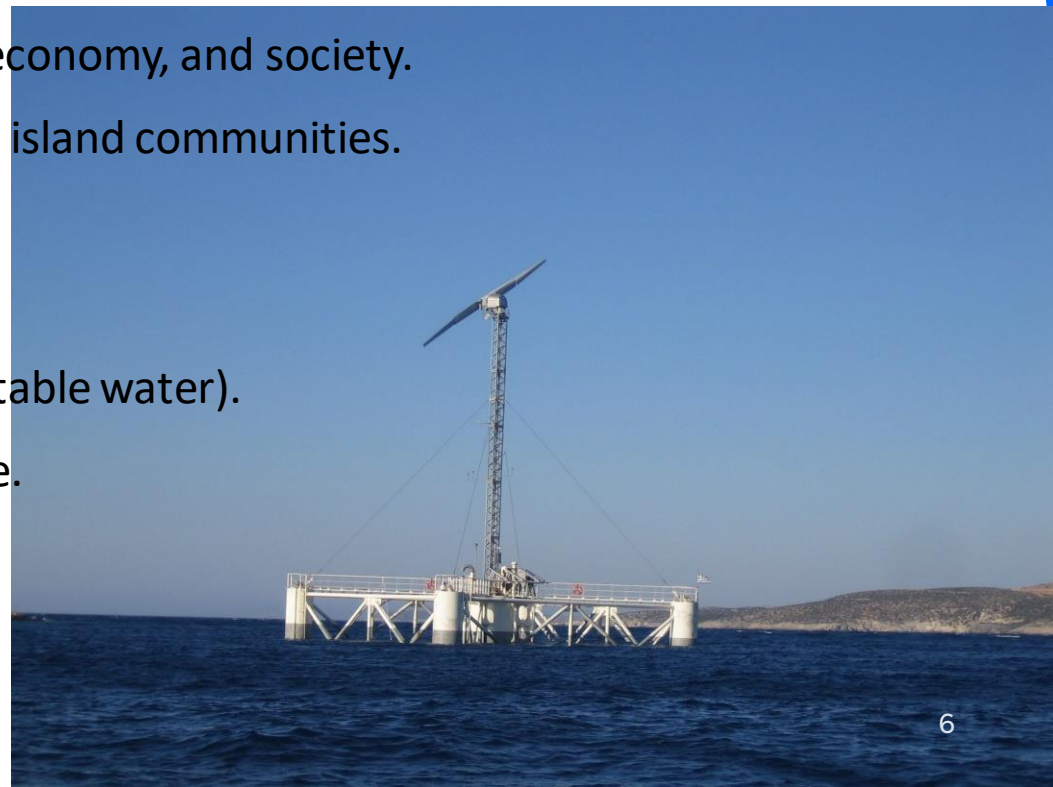
Empowerment: Enhance self-sufficiency and resilience for small island communities.

Core Technologies:

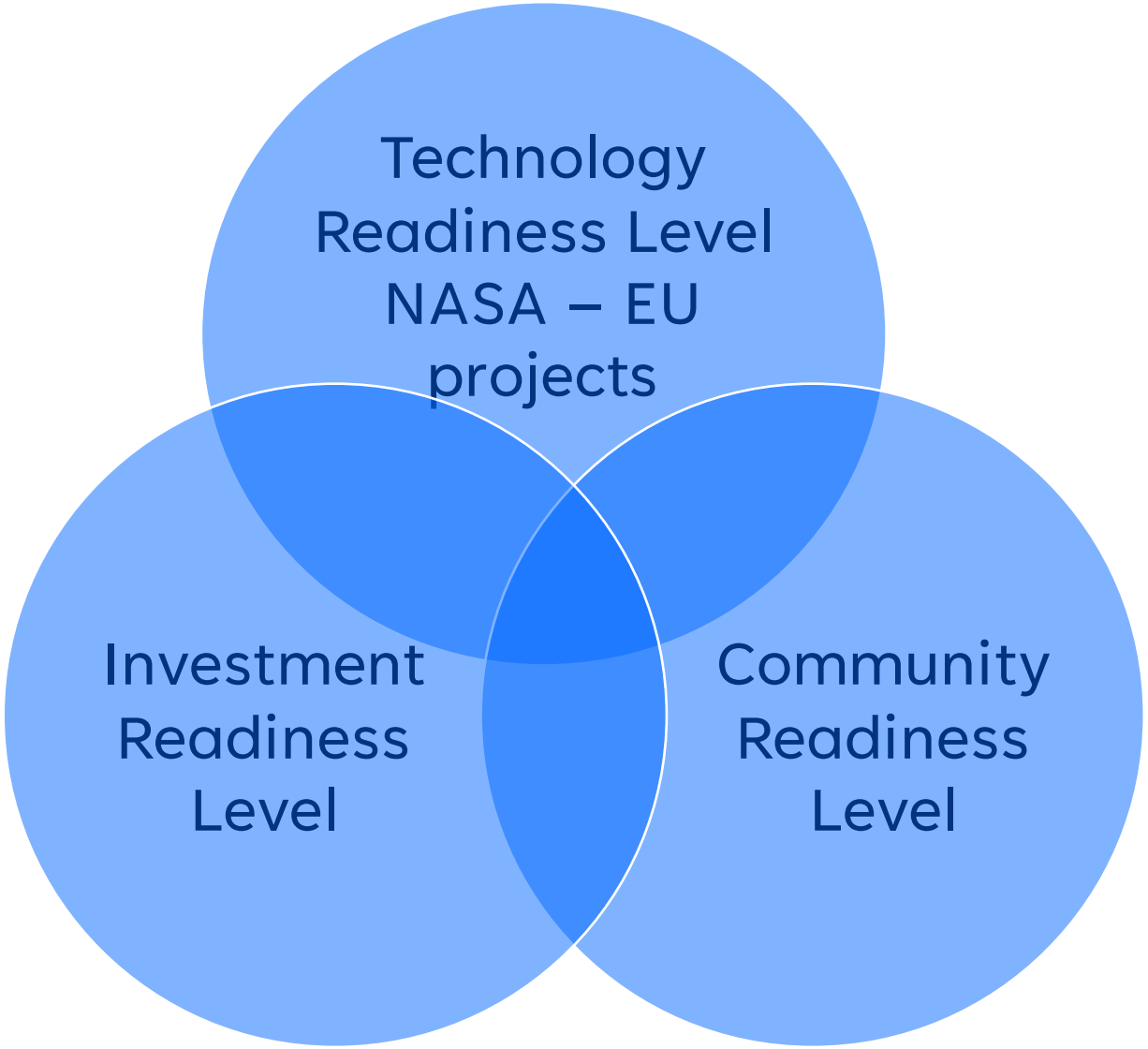
Clean Energy: Wind, solar, and wave energy generation.

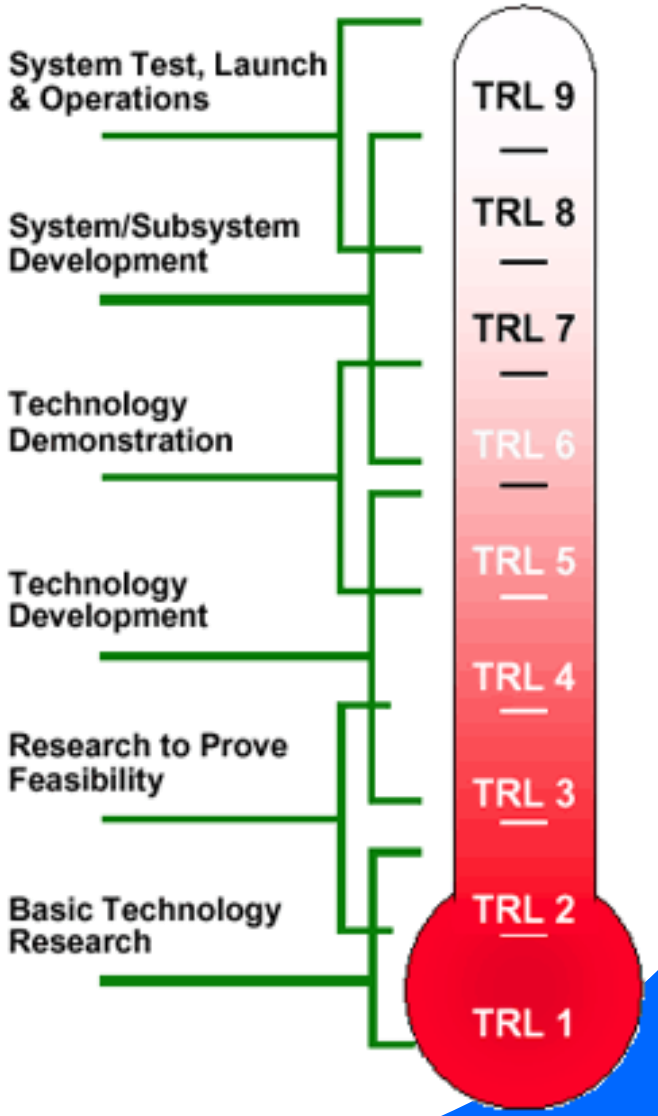
Drinking Water: Reverse osmosis desalination (seawater to potable water).

Aquaculture Support: Sustainable fish farming further offshore.

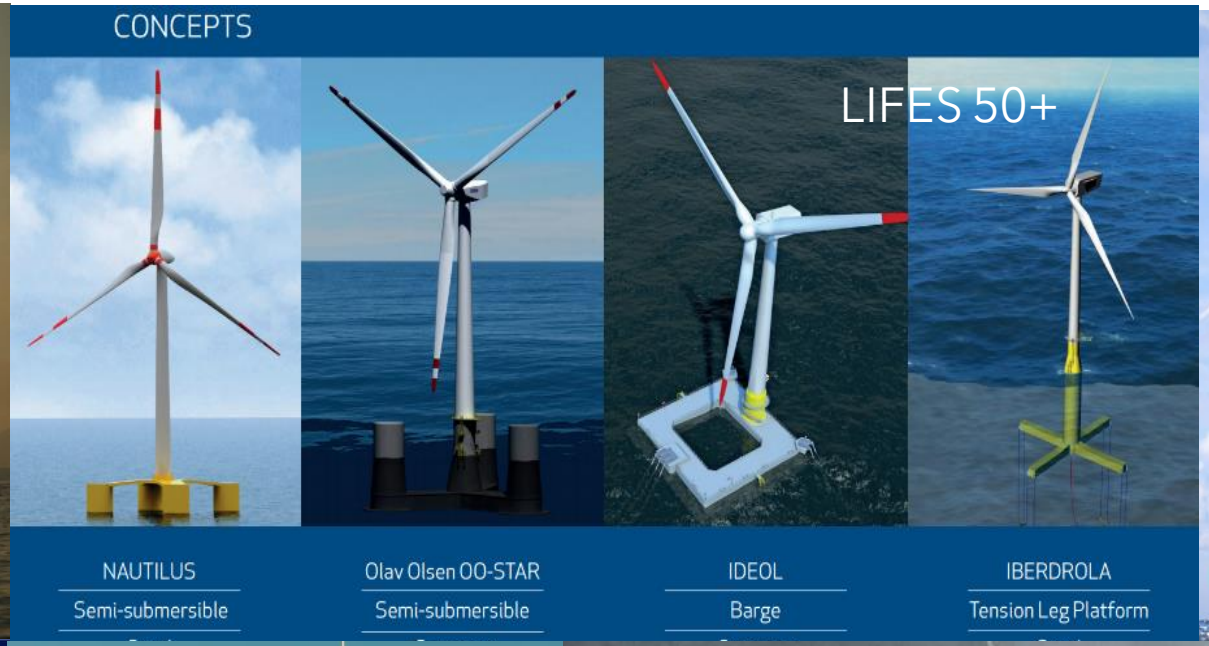


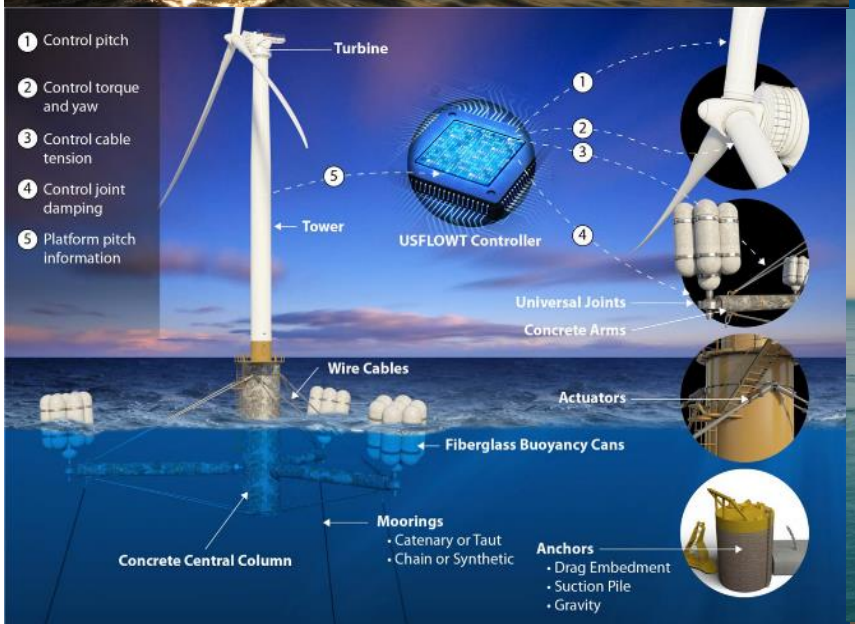
Technological innovation

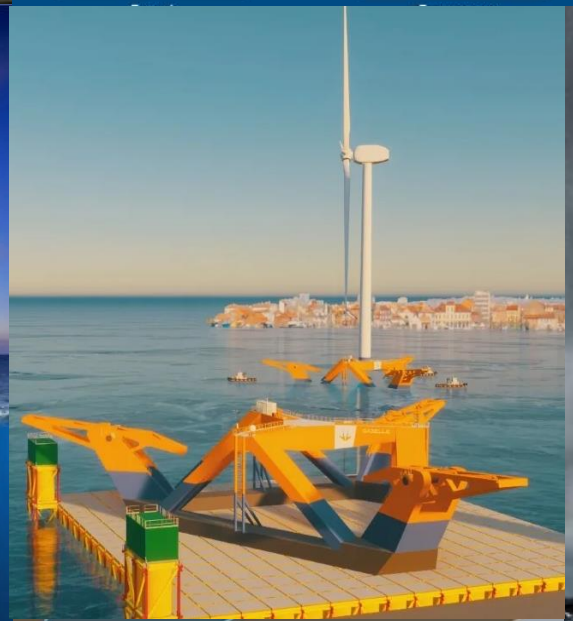




State of the art concepts and Background







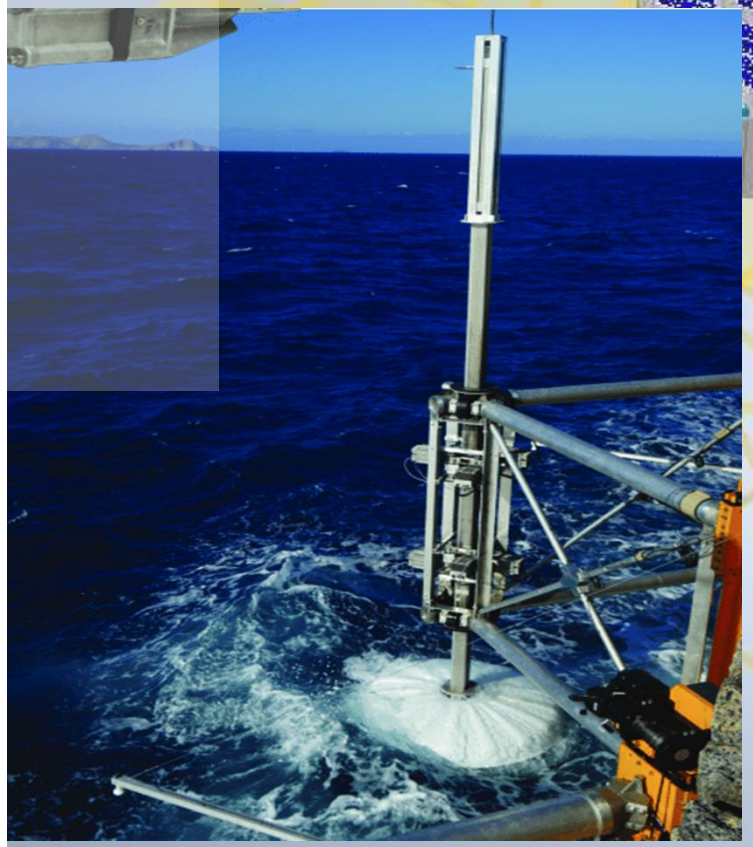
MUSICA: Revolutionizing Resource Access for Small Islands

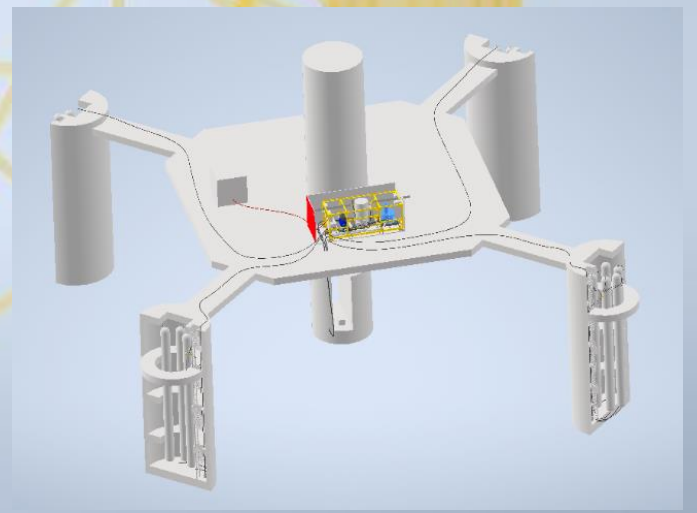
Pushing Technological Boundaries

- First Large Scale Multi-Use Platform: Delivers clean electricity, water, and food for small islands
- Innovative Integration: Combining diverse technologies for technical and economic viability.
- Advanced Autonomous Control: Sophisticated energy management, demand-side control, and SCADA system.
- 100% Renewable Desalination: Eco-friendly drinking water production.
- Hydro-Pneumatic Energy Storage: Reliable power alongside battery storage.
- Unique Energy Mix: Integrating wave, wind, and solar energy.
- Blue Growth Fusion: Merging renewable energy with offshore aquaculture.

Multi-Use, Modular configuration

- Wind turbine
- High-efficiency PV panels
- Wave energy
- Energy storage
- Desalination
- Offshore
- Aquaculture





Operational in open sea environment

Autonomous

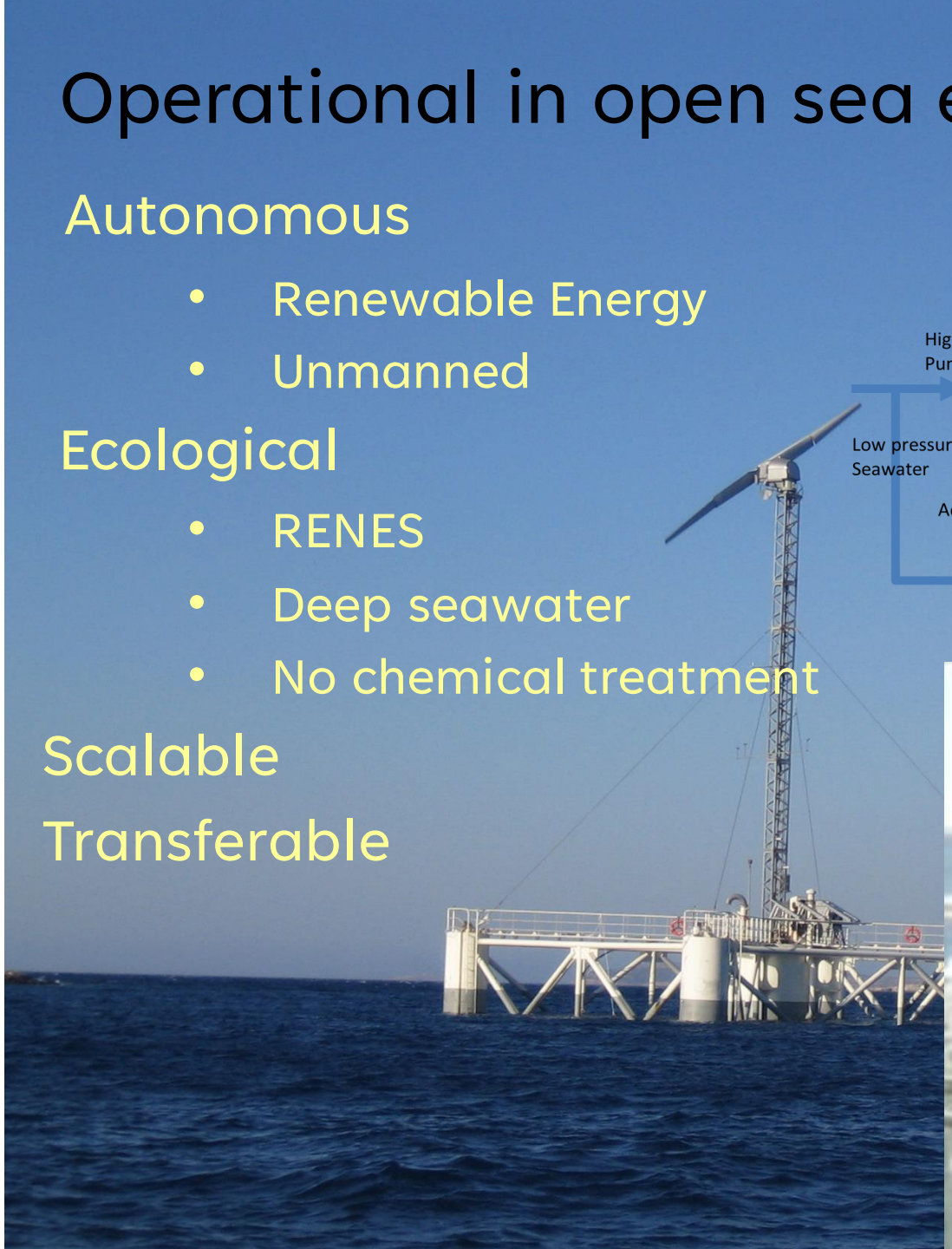
- Renewable Energy
- Unmanned

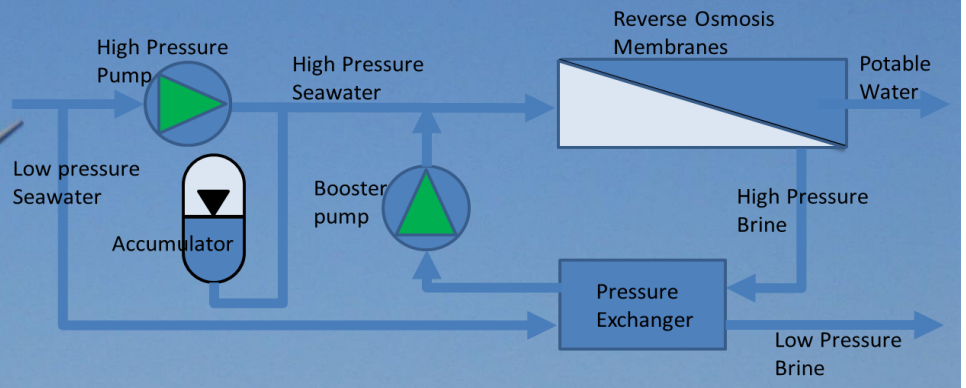
Ecological

- RENES
- Deep seawater
- No chemical treatment

Scalable

Transferable





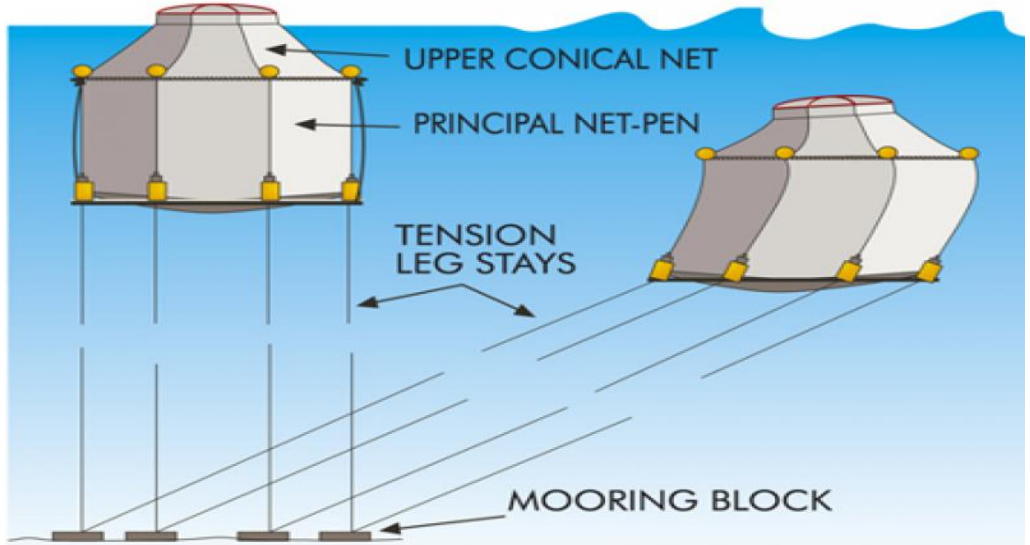
Marine environment restoration

Offshore Aquaculture challenges

Problems
- Weather conditions
- Operation difficulties
- Higher cost

Advantages
- Better conditions and quality
- Environmental impact

Multi use space reduces drawbacks



Societal Acceptance and Impact

Valuable feedback has been collected on social acceptance and social needs and the benefits of multi use of space and MUP concept have been elaborated.

The development of a MUP for island energy autonomy, potable water and aquaculture in multiple use of space is expected to have significant socio-economic impacts on sustainability of islands and remote areas.

MUP-Site Selection

Tools (ArcGIS Software) + Spatial Data:

Exclusion criteria (Legislative constraints)

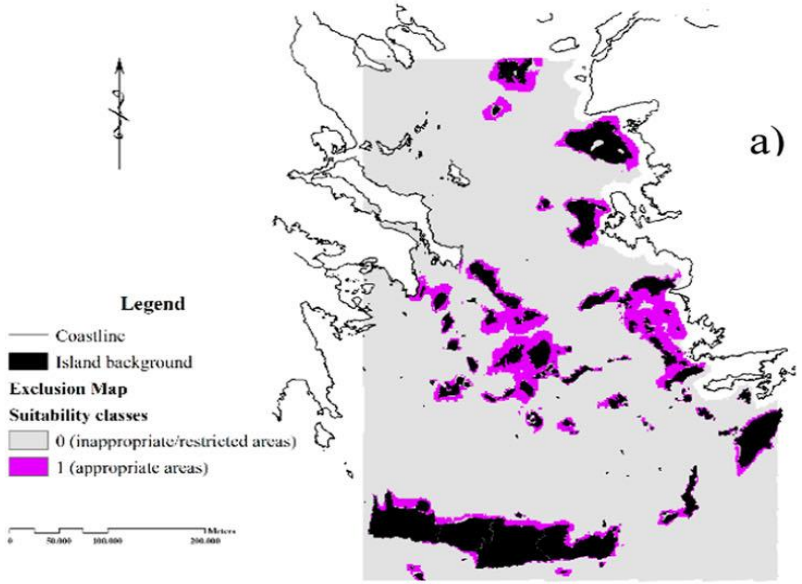
Evaluation criteria

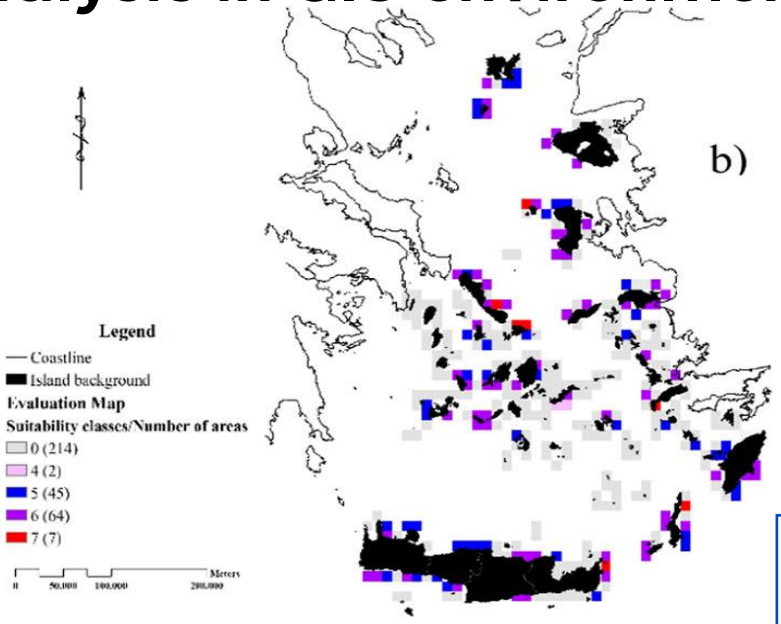
1. Wind & wave potential-WP/WaP
2. Distance from electricity grid-DFEG
3. Distance from water supply network-DFWS
4. Accessibility-ACC
5. Distance from aquaculture facilities-DFAF
6. Distance from settlements-DFS
7. Distance from areas of particular environmental interest-DFPA
8. Bathymetry-BATH
9. Sea bottom soil-SBS
10. Permissions-PER

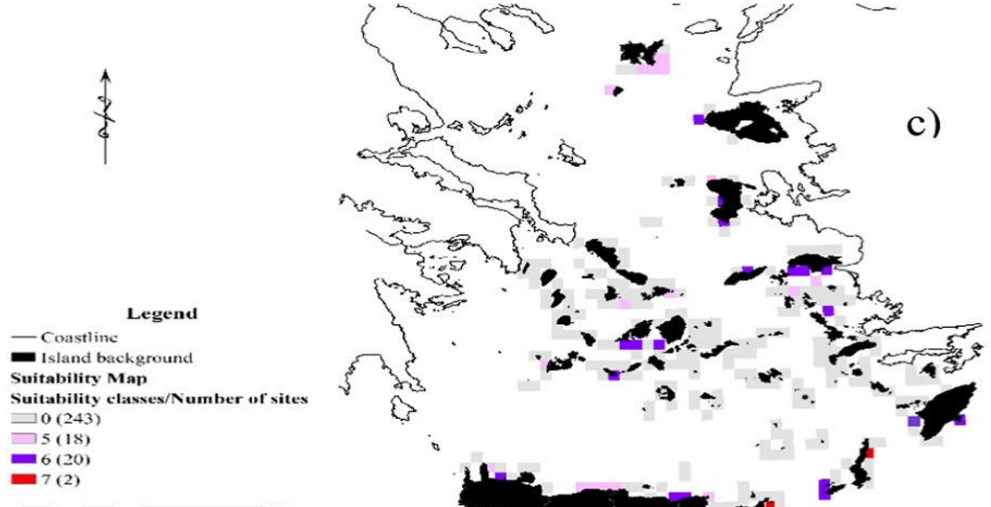
Analytic Hierarchy Process-AHP

Final Suitability Map-Site selection

Preliminary Suitability Assessment for installation of Floating Multi Use Platforms (Spatial Multi-Criteria Analysis in GIS environment)







a) **Exclusion Map**: based on legislative constraints.

b) **Evaluation Map**: based on evaluation criteria (i.e: wind & wave potential, distances from underwater cables, shipping routes, electricity grid, ports, settlements, protected areas, electricity demand).

c) **Suitability Map**: Exclusion Map x Evaluation Map

AHP Analytic hierarchy process

Overall goal

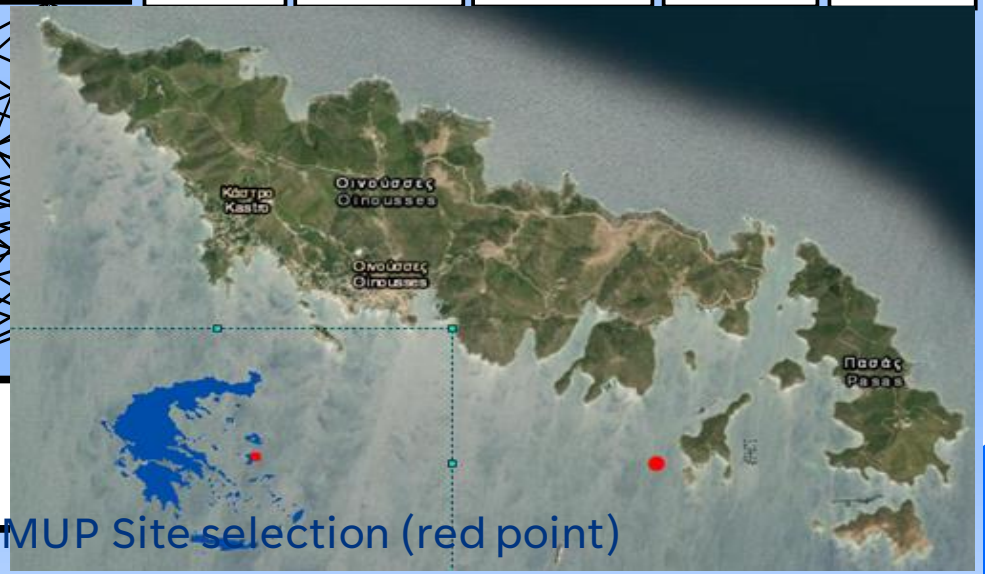
MUP Site selection

Evaluation criteria

WP | WaP | DFEG | DFWS | ACC | DFAF | DFS | DFPA | BATH | SBS | PER

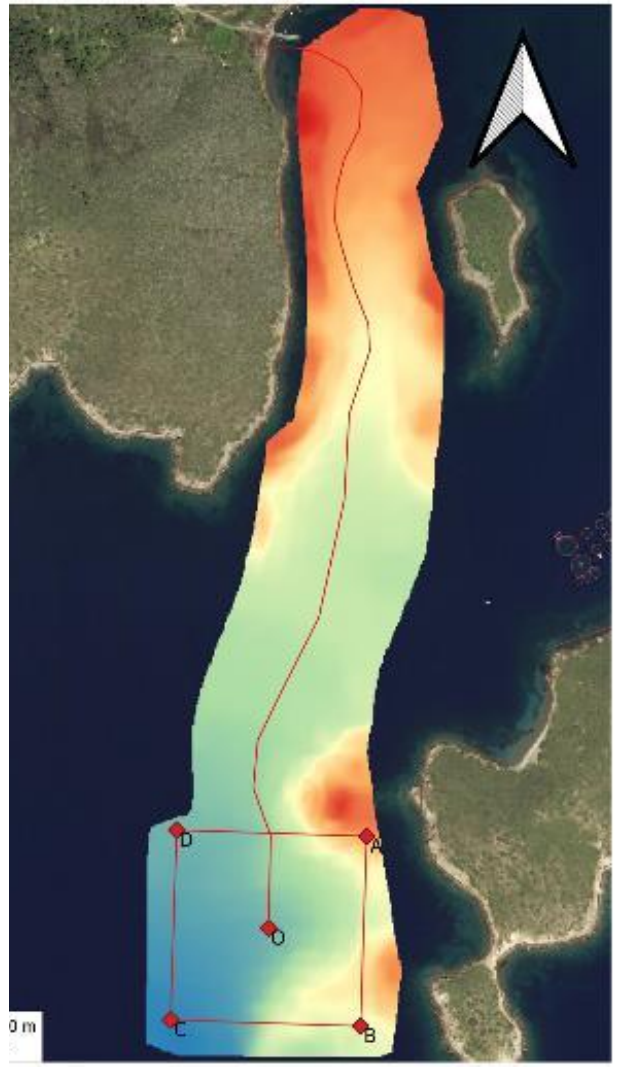
Possible sites that do not fall under any legislative restrictions

Site 1 | Site 2 | Site 3



MUP Site selection (red point)

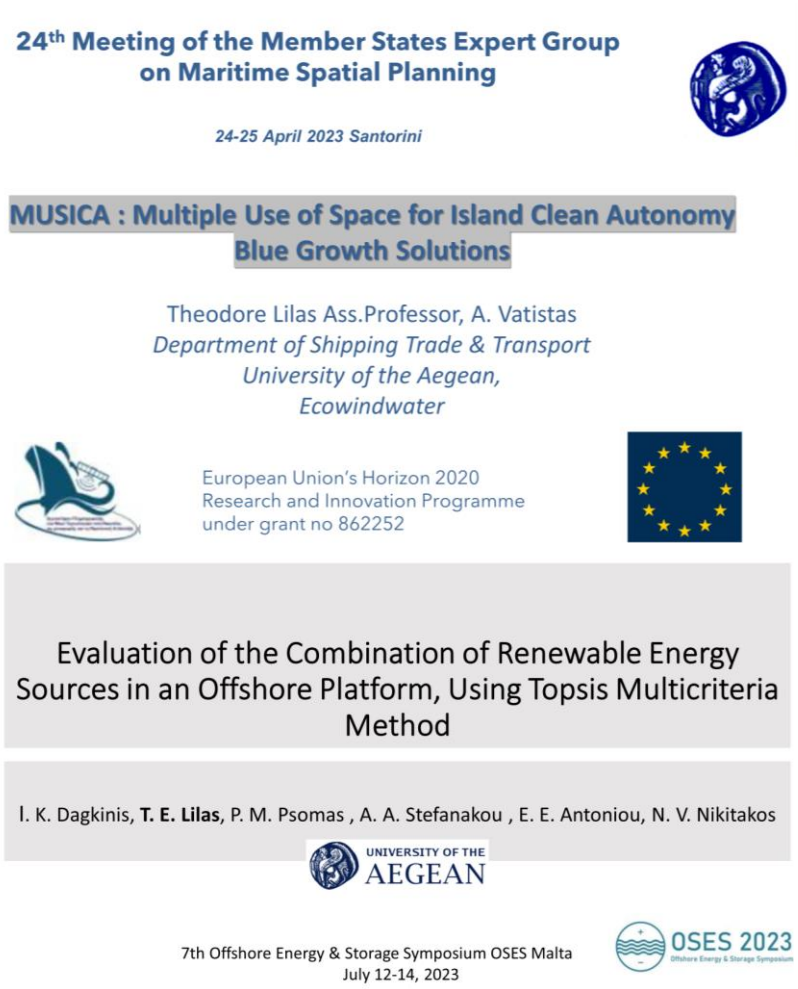
ROV survey and geophysical investigation



ROV Inspection

Communication and feedback

- Local Community
- Conferences



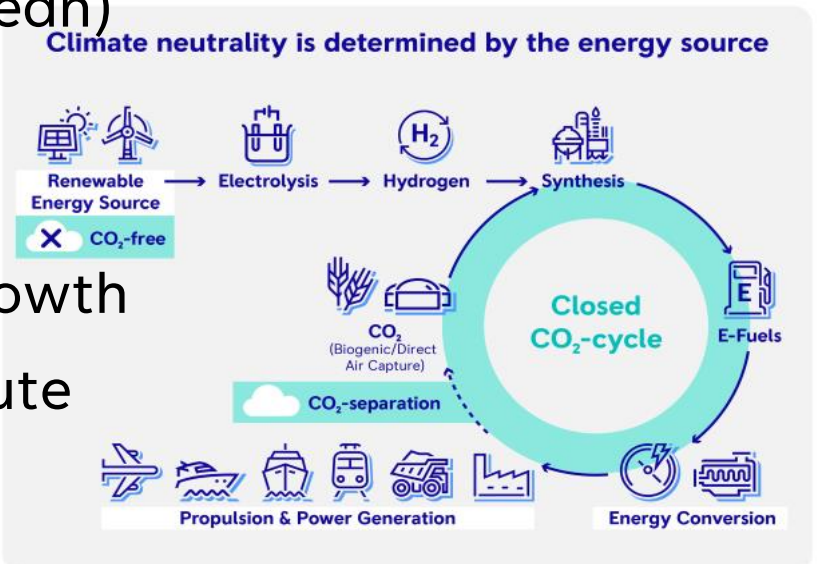
Elementary & High Schools Marine Academy

Exploitation Ecosystem

Strategy for economically viable replication of the MUSICA smart MUP solution through Exploitation and Sustainability Plans. This includes additional to techno-economic studies, market surveys, and addressing budget constraints amid global economic challenges, to develop cooperations and also work on the regulatory framework.

Current work in several directions shows several opportunities and promising potential.

- Energy community (MoChios, MoOinousses, UoAegean)
- Blue Growth Lab Chios
- Spinoffs (UM, UoAegean)
- Innovation Centre with shiprepair yards for Blue Growth
- MoU and CMMI – Cyprus Marine & Maritime Institute
- Innovation accelerator in Blue Growth



Multi Use Platform as a hub for blue innovation accelerator

MUSICA project aims to accelerate Technology Readiness Level of its Multi-Use Platform (MUP) and Multi-use of Space for small islands and to be a decarbonizing solution for islands embracing their marine initiatives (Blue Growth) and ecosystems. The objective is a configurable product that can easily incorporate innovations that improve its performance, or that enable additional applications to share parts of the existing infrastructure and the existing marine space in which MUSICA is installed.

This addresses challenges in offshore energy, aquaculture, and environmental monitoring offering space, permits, and infrastructure for trials, especially in islands with weak or saturated power networks. MUSICA also acts as a hub for new innovative technological systems. Its energy storage methods combined with fresh water production ensure utilization of energy from pilot systems even when the network cannot absorb it. Its adaptable electrical and control systems facilitate these functions, positioning this system as an innovation accelerator.

Monitoring Sensors

Meteorological station

- Wind speed-direction, temperature, humidity

Energy production

- Windturbine, PV, Wave energy, Batteries

Sea water

- Temperature, Salinity, Oxygen, hydrophone

Potable water

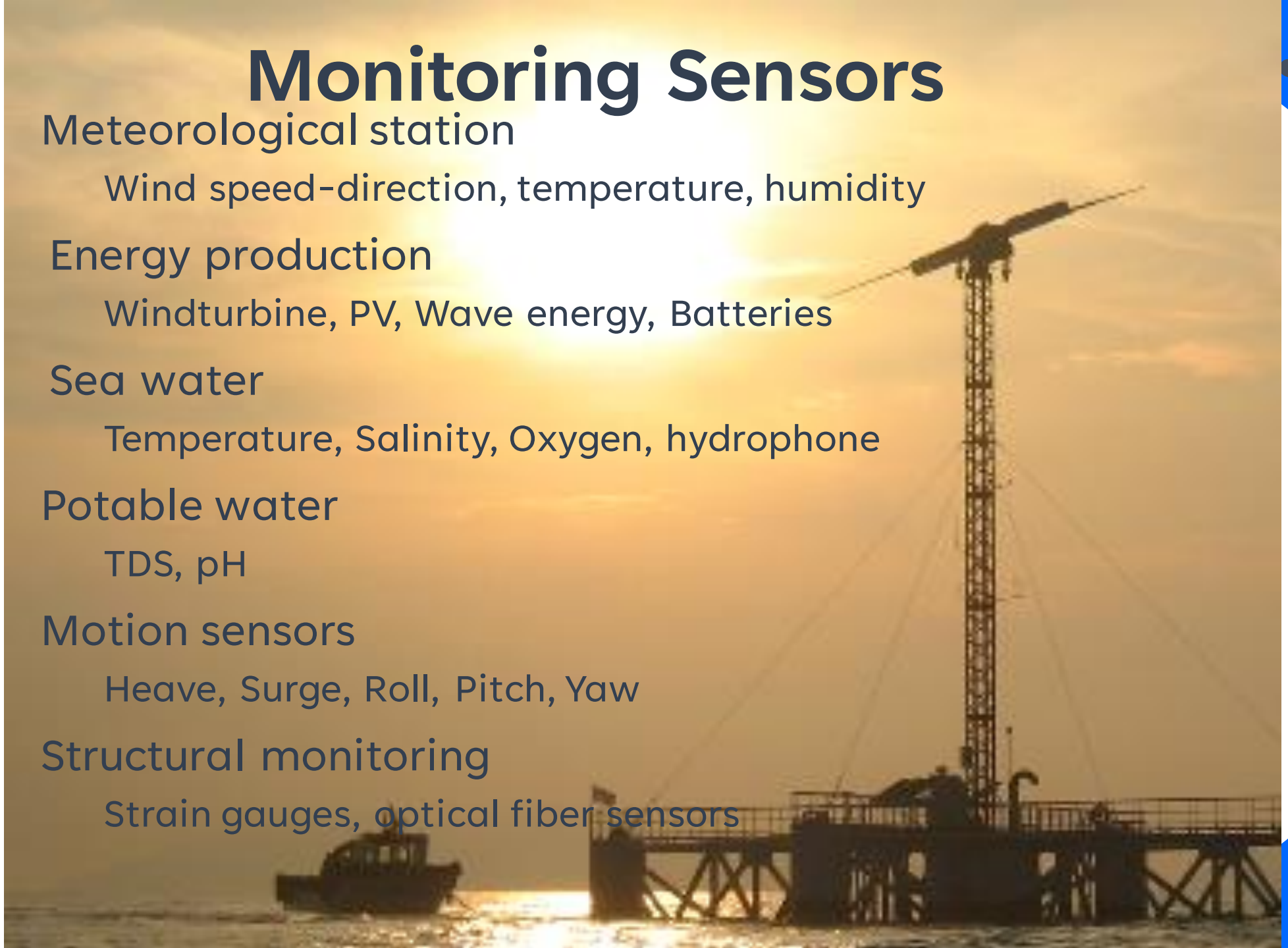
- TDS, pH

Motion sensors

- Heave, Surge, Roll, Pitch, Yaw

Structural monitoring

- Strain gauges, optical fiber sensors



Multi Use Potential

Many synergies and significant cooperation potential

Multidisciplinary teams

Stakeholders involvement

Utilize diverse knowledge

Environmental friendly solutions

Despite several advantages and solving technical difficulties

Financial and permitting issues hinder progress

MUSICA's Vision: A sustainable, equitable future for small islands.

Transformative Potential: Revolutionizing essential resource access.

Questions & Answers:

Is it possible ?

Is it difficult ?

Will we succeed ?

Thank you for your attention

YDRIADA Floating wind powered desalination

MUSICA

https://youtu.be/RrYxe2ocR1Y

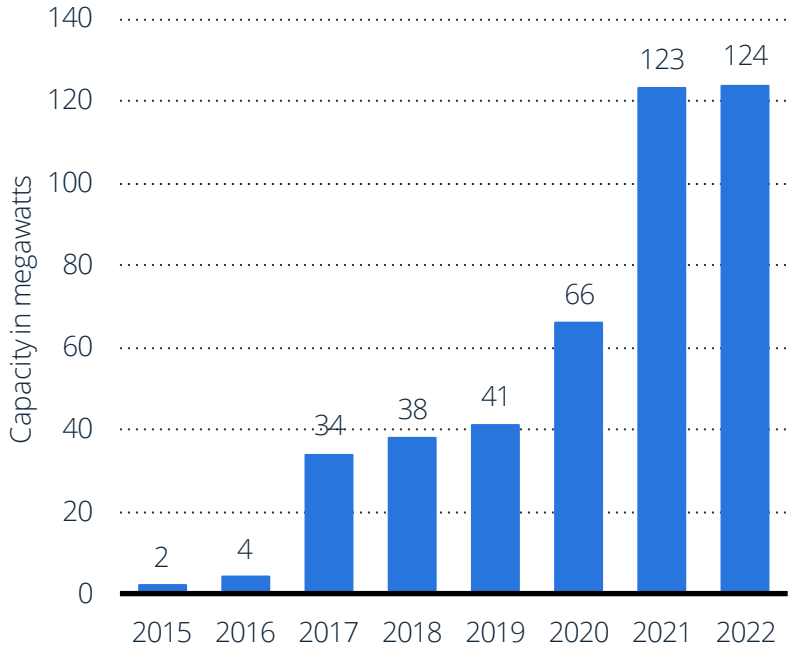
FLOATING AUTONOMOUS ENVIRONMENTAL FRIENDLY AND EFFICIENT DESALINATION UNIT

Integration of desalination unit with windpower:

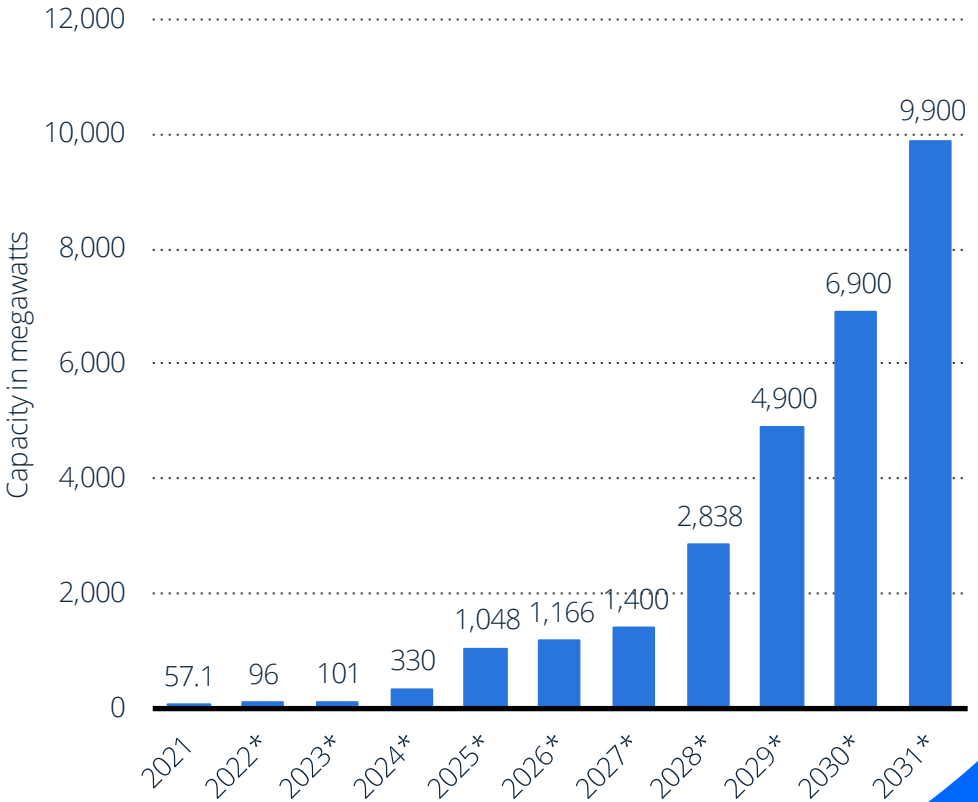
- Close coupling between generation and consumption.
- Ability of installation far from populated areas
- Minimize optical disturbance and noise
- Ability to move the unit in different areas and install it quickly

Financial Environment

- Environmental, Social, and Governance (ESG) Financing
- Poseidon Principles



Cumulative floating offshore wind energy capacity globally 2015-2022



Offshore floating wind capacity worldwide in 2021, forecast until 2031