

Pioneering adaptation solution for vulnerable island and coastal territories:
symbiotic and biophilic Smart Open-sea Ecosystem

INDIGO CIVILIZATION

01/2026

SUMMARY

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In a few words...

Pioneering a regenerative open-sea blue economy

1.

A public-interest initiative bringing together two pioneering players to co-construct a model of sustainable development and adaptation dedicated to coastal and island vulnerable territories.

Indigo Civilization x Bora Bora

2.

A sustainable development strategy to transform the constraints of island and coastal territories into opportunities: adaptation to climate change, preservation of natural heritage, economic diversification, regenerative tourism, food and energy self-sufficiency, socio-cultural resilience.

Regenerative open-sea Blue Economy

3.

An offshore regenerative spatial and functional ecosystem model allowing interdependent co-activities and biophilic synergies that benefit all stakeholders: local community and biodiversity, economic actors and tourists.

Smart Open-sea Ecosystem

1.

GLOBAL CONTEXT

CHALLENGES OF THE FUTURE

Future global challenges

In 2050…

Scarcity of land and depletion of resources: the world's population would grow by 26%. The need for accommodation would increase accordingly and 50% of the population would be concentrated within 100 km of the coast.

Rising waters and floods: 1 billion people would see their terrestrial environment flooded and would be forced to migrate. Most of SIDS are particularly threatened (overall 65 million individuals).

Lack of drinking water: 52% of humans would suffer from chronic water stress in their environment and a lack of access to drinking water.

Food challenge: using the current intensive techniques of agriculture, an additional 22 million km^2 of arable land would be needed to feed the population, the equivalent of North America. According to the UN and Nature Journal, global demand for food and seafood would roughly double.

Energy challenge: global energy consumption would increase by 68%.

Pollution: CO^2 emissions would increase by 35% in countries with the highest population growth.

Loss of biodiversity: Nearly 90% of land animals could lose their habitat with current farming methods. 90% of coral reefs, home to 25% of the planet's marine biodiversity, would disappear.

Collateral threats: according to MIT, 4 societal consequences are also to be expected (famine and malnutrition, migration, conflicts / geopolitical, and diseases).



Sources: IPCC, NOAA, AIE, OMM, Growing Blue, WEF, MIT, UN, Blue21

Future Ocean challenges

2050

Projection

To address future global challenges, humanity will increasingly rely on the ocean as a "toolbox."

The Blue Economy is expected to grow by 55%, reaching $5.1 trillion, leading to more people working at sea and offshore —away from overcrowded coastal areas.

About 400 million people living on islands or coastal territories will face threats from rising sea levels.

For reasons of adaptation, work, productivity, and impact, humans will settle at sea — temporarily or permanently — transforming the ocean into a new frontier for living and working

▶ More information

Threats

Tens or hundreds of million people may be forced to migrate and leave their homeland.

The Ocean could be then perceived as the new space to be colonized and could arouse many covetousness and abuses.

Marine biodiversity could suffer even more...

Opportunities

Anticipating a new relationship Humanity – Nature.

Learning to live in symbiosis with the Ocean for a sustainable Blue Economy.

Experimenting a complementary transformative solution to rising sea level demonstrating it is not necessary to fight or flee the sea to be resilient and to adapt.

Source: IPCC, Nature, McKinsey, DNV, World Economic Forum

French Polynesia faces structural vulnerabilities

An urgency that calls for innovation

92,5%

energy dependence

377 million liters of imported hydrocarbons/year (IEOM, 2025)

90%

Food dependence

Trade deficit: 147 billion CFP francs of imports (IEOM, 2025)

20%

of 18–25-year-olds have left the Fenua

In 5 years (ISPF, 2022) Exodus of skilled youth

33%

Land threatened by rising waters

1/3 of the 118 islands of Polynesia uninhabitable in 2100 (CESEC, 2025)

99%

of the surface of the territory

5.5 million km² of ocean largely undervalued

2.

OUR TRANSFORMATIVE PROPOSITION

SUSTAINABLE DEVELOPMENT AND ADAPTATION FOR TROPICAL ISLAND OR COASTAL TERRITORIES

NOTA: the hereafter inspirational illustrations are intended to share a preliminary principle as an early intention, and not a completed project.

Indigo Civilization's mission

Inspiring a harmonious relationship between humanity and the ocean

Mission

Our goal is to anticipate the future growth of the blue economy and the anthropization of the seas by creating a symbiotic relationship with the Ocean to transform challenges into opportunities.

Our mission focuses on adapting to the impacts of climate change such as rising sea levels — without fighting or fleeing the sea — while supporting the resilience and prosperity of vulnerable coastal and island communities and marine life.

Action

We offer a forward-thinking solution initiating the sustainable development of a symbiotic offshore blue economy.

Indigo Civilization federates and leads an international network of multidisciplinary expertise to co-construct, experiment and validate viable adaptation models.

From consultation to R&D and operational execution, we bring together project stakeholders and ensure their respective interests and buy-in:

1. Territorial actors and local civil society,
2. Economic actors and investors.

Structure

Indigo Civilization is a purpose-driven entity non-profit and recognized as being of general interest, legally registered in France in 2023 under the RNA number W784011015.

Indigo Civilization has created an ecosystem of partners and complementary expertise such as oceanology and marine biology, maritime architecture and engineering, pollution and waste management, marine renewable energy, marine permaculture, economic engineering, mesology, law and governance and regenerative tourism.

Our holistic proposition: Smart Open-sea Ecosystem

Pioneering a scalable regenerative open-sea blue economy from deep waters

1.

Open-sea spatial extension of the coastal zone: regenerative climate-resilient, floating and modular, multi-use and self-sufficient.

2.

Open-sea location to alleviate environmental and anthropogenic pressures on the coastal and lagoon ecosystem.

3.

Circular multi-use ecosystem composed of synergistic and biophilic interdependent co-activities:
Energy → Freshwater → Food → Tourism → Marine research.

4.

Concept foreshadowing an opportune solution empowering local communities: adaptation to climate change, autonomy, socio-cultural resilience, economic diversification.





Preliminary inspirational concept design by Simon Nummy

VALUE CHAIN OF FUNCTIONAL SYNERGISTIC INTERACTIONS

USING DUAL ENERGETIC AND BIOGEOCHEMICAL FUNCTION OF COLD, NUTRIENT-RICH DEEP WATERS

The value of SOE does not lie solely in its ability to produce energy, water, or food at sea. It lies in its ability to create a system where economic, environmental, and social benefits reinforce each other, without the risks of one activity compromising others.This is the logic of the circular economy applied to open-sea, directly aligned with the structural needs of a territory.

OCEAN THERMAL ENERGY CONVERSION - ECOSYSTEM'S CORE

INTERRELATED CO-ACTIVITIES

- GREEN ENERGY → Self-sufficiency / decarbonated marine transport / Research on alternatives MRE, local production of H_2 & O_2
- FRESH WATER → Self-sufficiency / Hydroponics - On-board food production
- DEEP COLD (SWAC) → Air & Marine conditioning / Cooling of local data centre
- NUTRIENTS → Regenerative upwelling / Depth-cycling process bringing life to oligotrophic surface waters
- MARINE PERMACULTURE → Regenerative ecosystem / Life aggregating ecosystem / Traditional fishing
- OPEN-SEA SEAWEED CULTIVATION → Cosmetics / Nutraceuticals / Biofuels / Fibres
- REGENERATIVE TOURISM → Initial financing of the ecosystem / Polynesian soft power / Model's dissemination
- RESEARCH & EDUCATION → Polynesian stream of Excellence / Sustainable development
- COMMUNITY'S WELL-BEING → In time, with upscaling of the model: skilled jobs, territory's autonomy and youth retention

To discover the map of possible intertwined co-activities

Benefits of a Smart Open-sea Ecosystem – 1/2

Pre-analysis of benefits / risks in Appendix 4

Advantages	Analysis and strategic scope
1. Spacious and modular available space (3D)	The open sea offers considerable spatial expansion capacity, with a three-dimensional organization: surface, subsurface, and water column. It allows for the pooling of technical, productive, scientific, tourist, and residential spaces, with modularity superior to that of many terrestrial developments.
2. Reducing environmental pressures on the coasts	The shift of part of human activities to the open sea can help reduce land pressure, withdrawals, discharges, and the use of coastal and lagoon environments. This is particularly relevant in Bora Bora, where lagoon uses are already subject to restrictions and trade-offs.
3. Reduction of human-use conflicts	The open sea allows for a new spatial distribution of activities: tourism, aquaculture, research, energy production, and logistics. It can thus help relieve congestion between land and lagoon areas, without shifting conflicts of use to the marine environment.
4. Access to deep, nutrient-rich cold waters	Access to the thermal and biogeochemical resources of deep waters opens synergies around the water-energy-food nexus: OTEC, SWAC, desalination, aquaculture, algae cultivation, and biomass valorisation.
5. Resilience to certain climatic hazards	Floating infrastructure designed to monitor sea level is structurally less exposed to permanent submersion than fixed coastal infrastructure. Exposure to tsunamis in the open sea is also different from that of coastal areas, where amplification and flooding effects can be considerable.
6. New tourism opportunities	The project could give rise to a new category of ocean tourism: scientific, exploratory, regenerative, and underwater. The tourist experience also becomes a means to fund research, ecological restoration, and territorial development.

Benefits of a Smart Open-sea Ecosystem – 2/2

Pre-analysis of benefits / risks in Appendix 4

Advantages	Analysis and strategic scope
7. Research and development	The SOE serves as a full-scale experimental laboratory for marine energy, aquaculture, marine biology, marine engineering, climate adaptation, and new lifestyles in the ocean environment.
8. Participatory governance and community leadership	The model can enable local communities and indigenous populations to participate in defining uses, governance, value creation, and resource management. It can also help preserve and enhance traditional knowledge.
9. Replicable territorial adaptation model	The SOE can serve as an experimental long-term adaptation model for small island states and vulnerable coastal territories. Its modularity allows for gradual evolution according to local needs, resources, and constraints.
10. Creating a living and productive ecosystem	The development of artificial habitats, algae farming, reefs, and aquaculture activities could promote biodiversity, biological production, and certain carbon sequestration functions. This involves moving from infrastructure simply located in the ocean to infrastructure contributing to marine life creation.
11. Diversification & economic sovereignty of territories	The SOE could help reduce certain energy and food dependencies, develop new local economic sectors, create skilled jobs and research activities, retain and attract skills to island territories, and generate new export revenues from marine by-products.
12. Pooling infrastructure	The same infrastructure can host several activities sharing: energy production, pumping and water treatment systems, port and logistics infrastructures, communication and security systems, and maintenance and operational means. The value of SOE therefore lies not only in the sum of activities, but in the savings and synergies made possible by their proximity and interdependence.

Our sustainable development goals



3.

Our first pilot territory

Municipality of Bora Bora, French Polynesia

Our first pilot territory

Bora Bora, the pearl of the Pacific

Beyond the exceptional splendour of its natural environment, its favourable climatic context, and its reputation as a high-end tourist destination, this **pioneering territory** has gradually established itself, over the past twenty years, as a **real living laboratory for sustainable development for small island territories**. Bora Bora and French Polynesia illustrate many of the realities of most of vulnerable island territories, which are facing current and future environmental and socio-economic challenges, particularly in the face of climate change and sea level rises (see in Appendix 2). Besides, the Polynesian cultural heritage and the deep link that unites the People of the Sea to its ocean are assets to nourish and stimulate the collective imagination.



Our long-term collaboration, notified through a MoU signed in January 2025, is based on four pillars: preserving natural heritage, improving the well-being of communities, achieving economic autonomy and becoming an eco-exemplary model for other vulnerable territories around the world. About 600 hectares of its lagoon are now fully protected from anthropogenic activities and entail to find new ways ton collaborate with the Ocean. **Our project is a logic continuation of the sustainable development actions carried out on the island** (partially funded by the European Union as part of the IANOS / SWEET 1 & 2 projects). To watch at M. Gaston Tong Sang's video – Mayor of Bora Bora.



REGENERATIVE HIGH-END TOURISM AS A FUNDING OPPORTUNITY

INDIGO CIVILIZATION

How to finance the maturity of emerging solutions ?

Both a world's unique tourist experience and a pioneering Ocean lab





Preliminary inspirational concept design by Simon Nummy

The UN, and more specifically the World Tourism Organization (UNWTO/UN Tourism), strongly recommends tourism as a key lever for the sustainable development of Small Island Developing States (SIDS). According to UN Tourism guidelines, sustainable tourism is considered a key tool to achieve the Sustainable Development Goals (SDGs).Tourism is seen as a pragmatic way to contribute directly or indirectly to all 17 SDGs, promoting economic resilience, environmental protection and social inclusion in these territories that are particularly vulnerable to climate and economic shocks.

Tourism serves as the primary economic engine of French Polynesia, with 65% of visitors including Bora Bora in their itineraries. The island's high-end positioning presents a compelling opportunity for our innovative project: to develop a financially sustainable initiative that offers a one-of-a-kind luxury experience while serving as a living laboratory for island sustainability and climate adaptation. In essence, the revenue generated from high-end regenerative tourism is poised to both enhance Bora Bora's soft power and fund the maturation of emerging solutions that might otherwise struggle to achieve viability independently.

Contemporary meaningful high-end tourism

Immersive experience made of sustainability, inclusion, well-being & individualization

Customers' drivers

High-end travellers expect slow personalized luxury featuring meaning, wellness and spirituality. Luxury tourism is marked by a quest for emotional, sustainable, and personalized exclusive experiences, driven by innovation

80% of luxury travellers wish to travel more responsibly. For 61% of them, responsible travel means 3 pillars: protection of the planet, support for local economies and cultural preservation.

42% consider choosing a company with strong sustainability policies to be "very important" in their booking decisions.

Business trends

High-end tourism is expected to grow annually by 7,9% till 2035, driven by an increasing number of HNWIs (+ 6,3% in 2024).

Eco-responsible travel at sea is even more attractive. Luxury cruises are expected to grow at a CAGR of 8,2% to reach $22 billion. The floating hotel niche business is expected also to grow at a CAGR of 7.7% from 2026 to 2035 to reach $7.4 billion.

In response to customers' demands, many players in the luxury hospitality industry propose high-end eco-responsible offers: coastal-based resorts (Aman, Six Senses, Banyan Tree…), cruises (Ponant, Explora Journey…), private islands (Tetiaroa, Bawa Reserve, Conrad or St Regis Maldives…).

Opportunities

Designing a carbon-neutral travel offer.

Combining avant-garde technologies with traditional indigenous knowledge to create an immersive and eco-responsible smart maritime experience.

Developing both a profitable business model and a strong image lever by financing innovation and sustainable progress in vulnerable territories, thanks to a targeted strategy of socially responsible investments.

Boosting customers' memorable pride by having a true positive impact on local communities and biodiversity.

Source: Deloitte, WiseGuy, CLIA

Inspirational concept design

Illustrative example of a regenerative tourist SOE nearby Bora Bora, proposed by S. Nummy

INDIGO CIVILIZATION

Experimenting beyond the lagoon for new opportunities

Foresght 2100, responding to the challenges of the Present and anticipating those of the Future



Simulation of a 60 cm rise in sea level on Tupai Atoll according to its current topographic survey. Complementary consequences to current challenges: scarcity of resources and land area, submersion and salinization of land, exacerbated conflicts of interests. By operating beyond the immediate coastal hazard zone, an SOE aims for climate resilience while benefiting from access to oceanic resources: no coastal flooding, zero shoreline erosion, very low exposure to tsunami run-up.

PILOT OF A SCALABLE REGENERATIVE OPEN-SEA BLUE ECONOMY

A SELF-SUFFICIENT BOUTIQUE HOTEL ALLOWING THE MATURATION OF EMERGING TECHNOLOGIES

BREAKWATER

- Floating dissipative infrastructure made of bio concrete
- Integrated wave oscillating column
- Floating mangrove
- ⦰ 150 meters

HOSPITALITY MODULES

- Floating TPL platforms
- Interconnected low-lying modules
- High-end hotel (70 guests)
- Underwater spaces
- Diving centre
- Back office and maintenance

ENERGY & WATER CENTRE

- Ocean Thermal Energy Conversion
- Sea Water Air Conditioning
- Desalination by reverse osmosis



RESEARCH CENTRE

- Renewable marine energies & biofuels from algae and green H_2
- Seaweed fibres and co-products
- Adaptation & resilience
- Autonomous life at sea
- Deep-sea (mesophotic corals)
- Upcycling – waste-to-wealth

MARINE PERMACULTURE

- Open-sea seaweed cultivation
- Artificial reef, anchored life aggregating ecosystem, opportune for traditional fishing
- Integrated Multitrophic Aquaculture

FLOATING FARM

- Hydroponics
- Aquaponics
- Pearl cultivation

SYMBIOTIC PHILOSOPHY

INTEGRATED - REGENERATIVE - FACILITATING A NEW INCREMENTAL TROPHIC WEB IN OLIGOTROPHIC SURFACE WATERS





The modular floating infrastructures of the Smart Open-sea Ecosystem aim not only to be as minimally invasive as possible, but to be conducive to the development of a new marine trophic web and an artificial reef. Located beyond the lagoon and the reef of the neighbouring island, the SOE acts as a key spatial extension.

Maritime philosophy

Safe & comfortable – modular – reliable & adaptable to open-sea environment





Low-lying TLP platforms designed for deep waters (up to 1,500m but expected to be anchored at 7-800m), featuring biomaterials such as basalt fiber-reinforced structures, manufactured onshore in Polynesia and then towed to sea for assembly or maintenance. Capable of withstanding cyclones (⊳ cat. 4) and 10 m swell (API standards), they are surrounded by a floating circular infrastructure that accommodates mangroves and can absorb wave energy by 50%. Thanks to a hydraulic and/or pneumatic telescopic system, the platforms can adjust their height according to sea conditions from 3 to exceptionally 10 m.

TOURIST PHILOSOPHY

REGENERATIVE – MEANINGFUL – UNIQUE EXPERIENCE



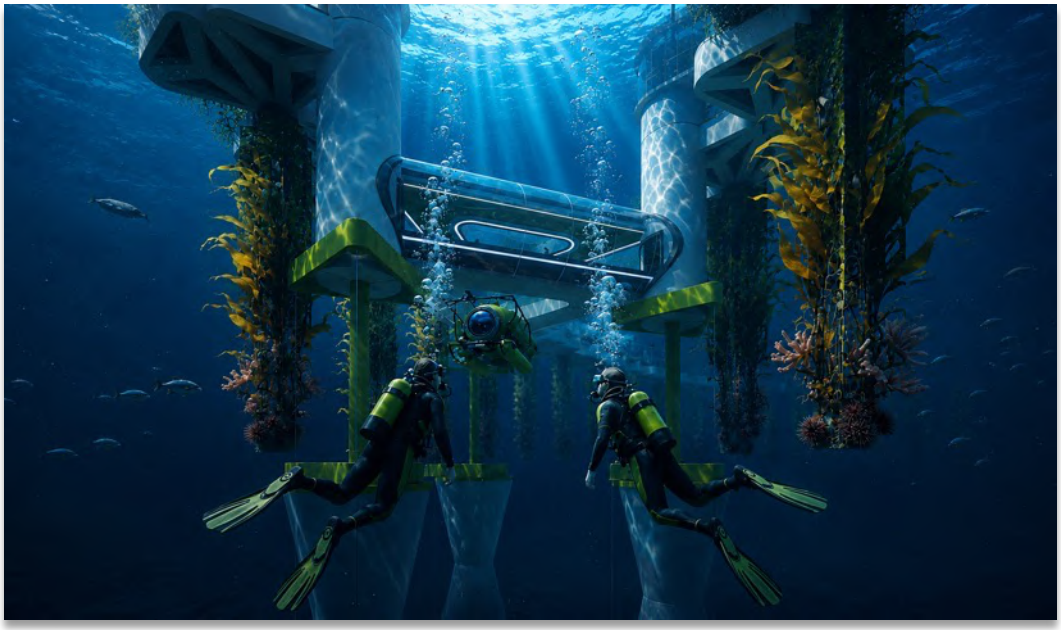


Taking advantage of Bora Bora's tourist attraction and positioning to finance progress and experimentation with new models of sustainable collaboration with the Ocean. Living a comfortable, rewarding, immersive and meaningful experience in a marine and underwater environment that is unique in the world. In collaboration with scientists and researchers, guests are invited to learn, contribute and become true ambassadors of our approach.

UNDERWATER EXPERIENCE

EXPLORATION – IMMERSION - DISCOVERY





Understanding the fascinating interaction between the biophilic infrastructure, the artificial reef and the food web that has been created around it to create a real ecosystem conducive to both the hosts and the traditional fishermen of the island. Living Captain Nemo's Dream and discover the wonderful marine world in a safe and comfortable way.

Marine research and education hub

Awakening – Inclusivity – Marine science – Polynesian stream of excellence





Inspiring a promising future in harmony with the ocean, and to consider great professional opportunities to nurture a Polynesian sector of excellence dedicated to the symbiotic blue economy: energy and marine food, co-products, shipbuilding, Académie Bleue – graduate school of regenerative tourism management. Observing, studying, testing and experimenting in place viable and replicable preservation and adaptation solutions.

Marine and underwater architecture

Central Hub: exploded Axonometric



Roof Terrace

- Sunset Bar and Restaurant
- Pool and Jacuzzi

Guest Suites

- 6# Corner Suites (140m2)
- 6# Loft Suites (120m2)

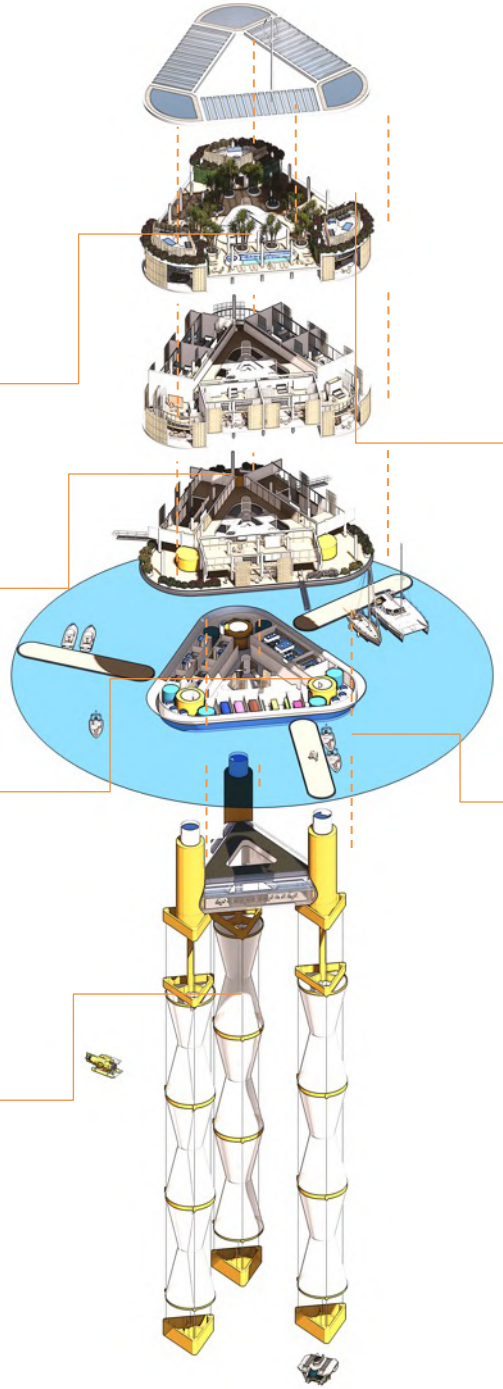
Reception

- Reception and Offices
- Restaurant
- Spa and Gym

Floating Spar Structure

Excellent stability and low motions (especially heave/pitch/roll) in deep water.

- Underwater Restaurant
- Tension Truss (100 -200m depth)
- “Lovelock Pipes” - ETFE Fabric cylinders incorporated into the tension truss act to pump nutrient-rich deep ocean water (from below the thermocline) up to the sunlit surface.
- Hanging Ballast



Energy Roof

- PV system
- Vertical Axis Wind Turbine (VAWT)
- Solar Thermal system
- HVAC Units
- Atmospheric Water Generators (AWG)
- Solar Hot Water Storage

Platform

- Main Kitchen and Store
- Staff Quarters
- Potable Water Tanks
- Spar Technical Systems
- Freshwater Generator System
- Wastewater Treatment System
- Battery Storage
- Back-up Generator
- Floating Dock

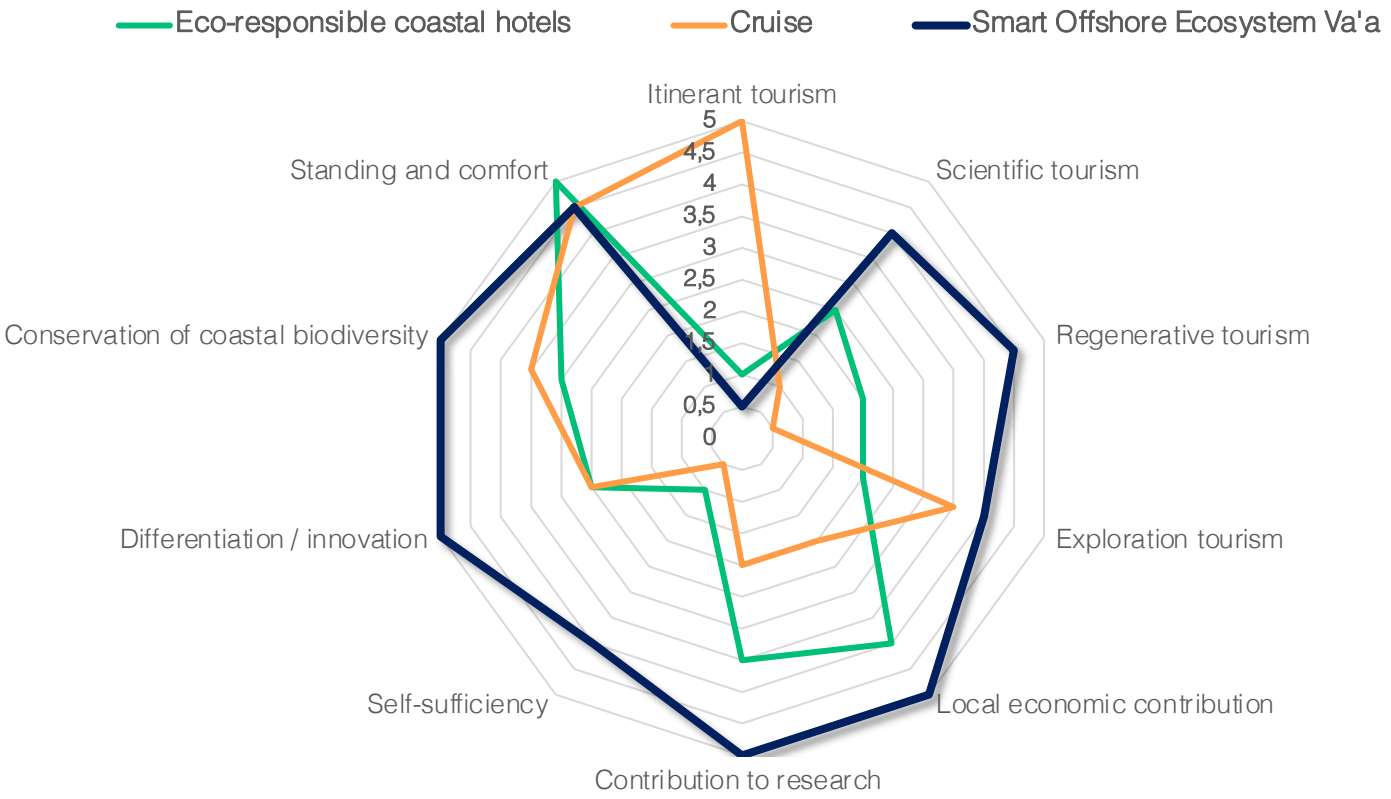
INNOVATIVE TOURISM FOR SUSTAINABLE PROGRESS

BENCHMARK OF THREE HIGH-END TOURIST MODELS IN FRENCH POLYNESIA









A VIABLE AND ATTRACTIVE MULTIPLE PROJECT

PRELIMINARY ASSUMPTIONS – AMBITIOUS BUSINESS CASE

What if…

CAPEX : 400 million €.

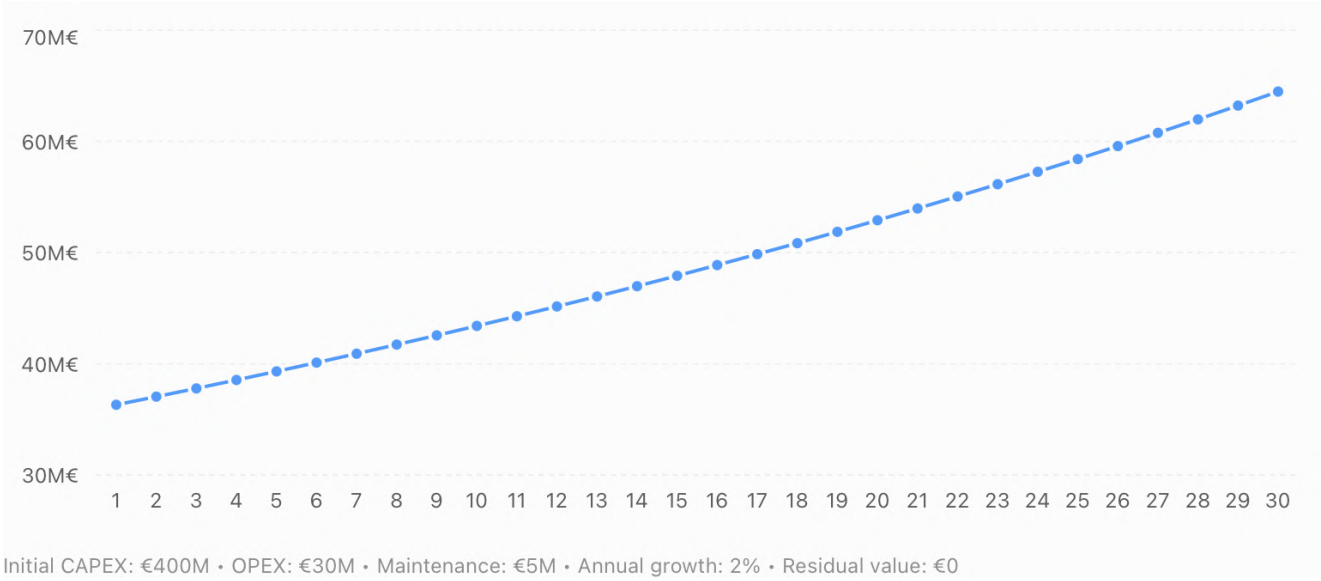
- Hospitality: 60 million.
- Offshore infrastructure: 100 million.
- Marine Energy: 45 million.
- Marine utilities and logistics: 70 million.
- Experiences, ecology, technology: 75 million.
- Engineering and contingencies: 50 million.

OPEX + maintenance: €35 million/year
Discount rate: 5%.
Residual value: 0

Average income per night for 2 people: €5,000.
Capacity: 100 tourists / 50 suites.
Average occupancy rate: 65%.
Annual tourism revenue: €59.31 million.
Additional revenue: €12 million.

- Co-products: €9 million/year (food, energy).
- Space rental: €1 million/year.
- Subsidies and carbon credits: €2 million/year.

Total annual revenues: €71.31 million.



Positive Net Present Value (5%) of €159 million over 30 years (no residual value).
Internal Rate of Return of approximately 8,8%.
Profitability achieved in 11 years.

4.

AVANT-GARDE, NOT SCIENCE-FICTION

IT' NOT ABOUT INVENTING. IT'S ALL ABOUT COMBINING MATURE AND EMERGING SOLUTIONS

A WIDE ECOSYSTEM OF EMERGING AND MATURE SOLUTIONS

A GLIMPSE AT EXISTING SOLUTIONS…

Responsible tourism

ICRT GLOBAL

wtm world responsible tourism awards

Responsible Tourism

Floating reef & mangrove

Reef Innovations

ARC Marine

Waterstudio.NL

FLOATING REEF

Deep sea energy storage

Fraunhofer IEE

SIZABLE

SWAC / OTEC

GLOBAL OTEC

VALUE PARK

MOL Mitsui O.S.K. Lines

AIRARO

DORIS

MAKAI OCEAN ENGINEERING

Other Renewable Marine Energies

SolarinBlue

NoviOcean

SOLARDUCK

weco

OCEAN HARVESTING

ENERGYMINER

Minesto

SEATWIRL

CorPower Ocean

WAVEPISTON

HydroQuest

WavEC

Offshore infrastructure

Waterstudio.NL

blue21

DEME OFFSHORE

MARIN

OCEAN BUILDERS

PLOCAN Plataforma Oceánica de Canarias

Hydrogene from sea water

Lhyfe

HOPE

Equatic

Genuine H2

Desalination

Waterise

OceanWell

FLOCEAN

ocean oasis

E-fuels from algae

Euglena

Fuelgae

Marine biophilic materials

HOLCIM

ECONCRETE

Waste up/recycling

evac

SUEZ

WÄRTSILÄ

VEOLIA

Open Ocean Cultivation Blue carbon ecosystem

CLIMATE FOUNDATION

Underwater Gardens

PROVIDING OCEAN REGENERATIVE SOLUTIONS

nemo's garden

Ngā Punga o te Moana

CAWTHRON

AN AVAILABLE AND RICH STATE OF THE ART

A GLIMPSE AT THE RESEARCH FUNDED BY THE EU

Beyond the state-of-the-art from indigenous knowledge and decades of experience gained from cyclone proof floating platforms and wind turbines, our work will especially benefit from numerous, mature and emerging technical solutions and research programmes. Our bibliography lists a compelling selection of the available engineering research literature about ocean innovations and floating solutions.

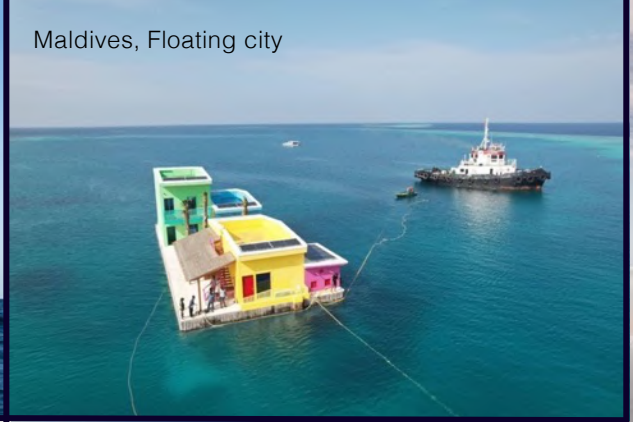
Besides, more than €70 million has been invested by the EU alone in research to study open-sea multi-use infrastructures.

- → Tropos (EU): multi-purpose floating modular offshore platforms integrating a wide range of specific activities from different sectors.
- → POMU (France): multi-purpose logistics offshore platform in French Guiana.
- → Mermaid (EU): offshore multi-use industrial platform on 4 European study sites.
- → Space@Sea (EU): sustainable and affordable workspace at sea by developing a standardised and cost-effective modular island with low ecological impact.
- → United Proiect (EU): multi-purpose offshore platform demonstrators to stimulate the blue economy.
- → Musica (UE): versatile power and freshwater generation platform using renewable wind and wave energy.
- → Plocan (UE): multi-purpose offshore platform for sustainable island autonomy in the Canary Islands.



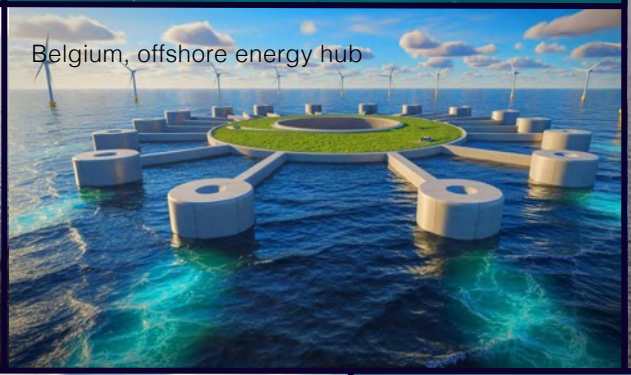


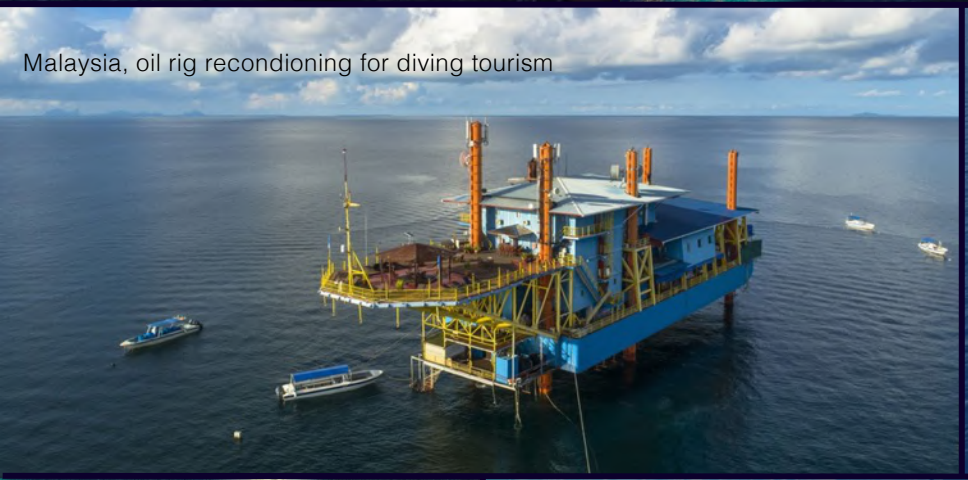

Panama, habitat


Maldives, Floating city


Danmark, Vindø Energy Island


Norway, Offshore Aquaculture


Belgium, offshore energy hub


Malaysia, oil rig recondioning for diving tourism


Spain, Canary Islands, PLOCAN


Maldives, Floating City


Dubai, The Reef project


Qatar, floating forest project


France, H_2 production

5.

PROCESS OF DEVELOPMENT

PROJECT EVALUATION AND TRANSDISCIPLINARY CO-CONSTRUCTION

Recommended de-risked gradual process

Phase 1

18 months

Frame the project:
economics, social and environment

Co-construction of possible future models based on the state of the art, our vision and prospective scenarios: stakeholders from Bora Bora / French Polynesia and the Indigo Civilization research consortium.

Consultation of society and commitment of the Youth of Bora Bora through the animation of a collective of young ambassadors and the establishment of a creative and forward-looking competition.

TRL 2
Budget:105 K€ (cf. Appendix 8)

Validation of the general interest
Project scoping

Phase 2

36 months

Transdisciplinary R&D phase

Location definition,
Design & engineering orientations,
Technical feasibility assessment,
Investments and timeline assessment,
Legal / certification / insurance guidelines,
Socio-economic model & business plan,
Benefits / risks assessment,
Physical & digital demonstrators,
Operational & maintenance framework,
Public consultation & approval.

Expected TRL 5/6
Budget according to Phase 1
(ex. Appendix 9)

Social acceptance & project validation
Private / public collaboration

Phase 3

Lead time according to Phase 2

Preparation and construction of the pilot:

Optimisation and integration phase,
Technical finalization & subcontracting,
Ordering of materials & equipment,
Onshore construction of the modules,
Offshore assembling of the modules,
Training of the construction crew,
Testing phases.

Continuous follow-up ensures that social, economic, environmental and technical stakeholders are properly aligned, and that the project specifications and vision are fully respected.

Expected TRL 9
Budget according to Phase 2

Operational release of the SOE

PHASE 1: ENGAGEMENT OF LOCAL STAKEHOLDERS

VALIDATING THE GENERAL INTEREST, THEN IMAGINING AND CO-CONSTRUCTING AN EXEMPLARY FUTURE

1.

Consultation of civil society in Bora Bora via a representative panel (30-40 individual interviews)



2.

Animation of a Youth Council of Young Ambassadors from Bora Bora, Polynesia and the main ocean basins of the world



3.

Youth Creative Contest 12-18, "Architects of an exemplary future", sponsored by J. Rougerie



4.

Seminar "Foresight & Co-construction" inviting academic, scientific and public local stakeholders



WIN-WIN COLLABORATION

MAIN STAKEHOLDERS' OPPORTUNITIES

	BORA BORA, FRENCH POLYNESIA	INVESTORS LOCAL ECONOMIC ACTORS	INDIGO CIVILIZATION
MEDIUM TERM	Proof of concept for an effective model of sustainable development and a sustainable and inclusive Polynesian maritime economy.	A future driver of growth, funded by revenue from exceptional responsible tourism in a buoyant market, and the by-products generated by the SOE – notably energy and food.	Widespread public uptake and social acceptance through the validated proof of concept of an integrated symbiotic solution showcasing pioneering open-sea spatial planning.
LONG-TERM	The strength of the SOE model lies in a circular economy approach applied to the offshore sector, directly aligned with the structural needs of a territory that currently imports 90% of its food and 92.5% of its energy, yet possesses an exceptional natural marine heritage — a vast oceanic resource that remains largely undervalued.	An opportunity to develop a fair, yet profitable and sustainable business model through the international roll-out of an SOE network.	Scalability of the concept to support the resilience and adaptation of other vulnerable island and coastal communities, as well as biodiversity.



In accordance with our Code of Conduct, our process applies the IFC Performance Standards – World Bank

WORLD BANK ENVIRONMENTAL AND SOCIAL FRAMEWORK

OUR PRIORITY COMMITMENT

Indigo Civilization commits to apply the **Environmental and Social Standards (ESS)** defined by the World Bank as guiding principles of our overall process. This framework has the following **key objectives**:

- **Protect people and the environment** by ensuring that project does not harm communities or ecosystems.
- **Promote sustainable development** by integrating environmental and social considerations into project design and implementation.
- **Strengthen project outcomes** by ensuring that environmental and social risks are managed effectively.



Priority n°1

Evaluation of environmental and social risks

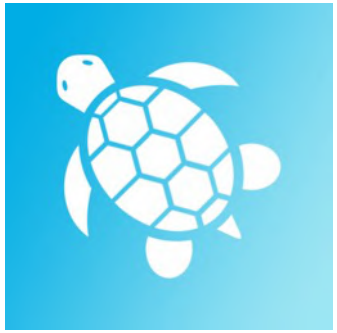
ESS 1



Priority n°2

Stakeholder and community engagement

ESS 7 & 10



Priority n°3

Biodiversity conservation Sustainable management of living resources

ESS 6



Priority n°4

Community Health and Safety

ESS 4



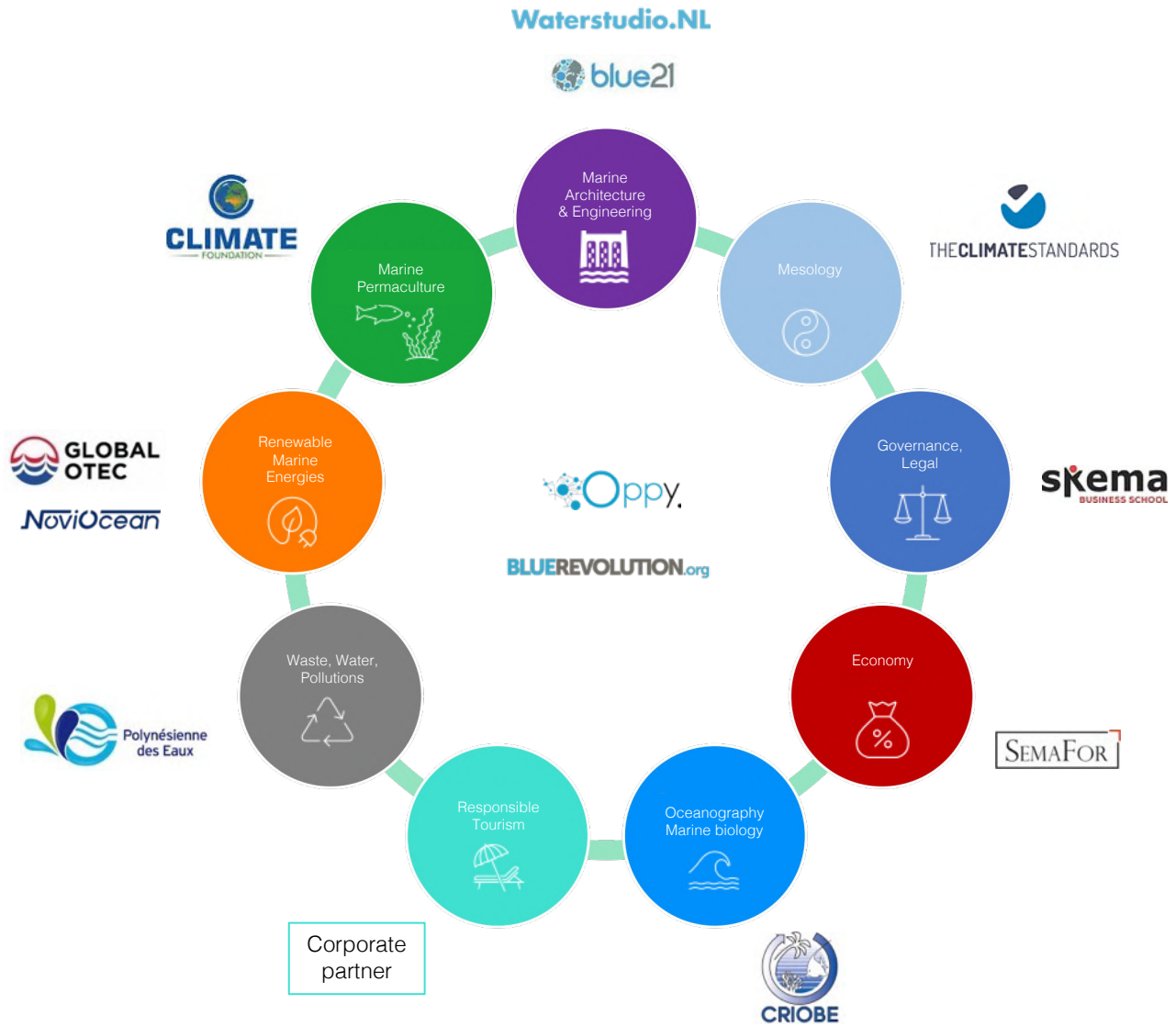
Priority n°5

Resource efficiency and pollution prevention

ESS3

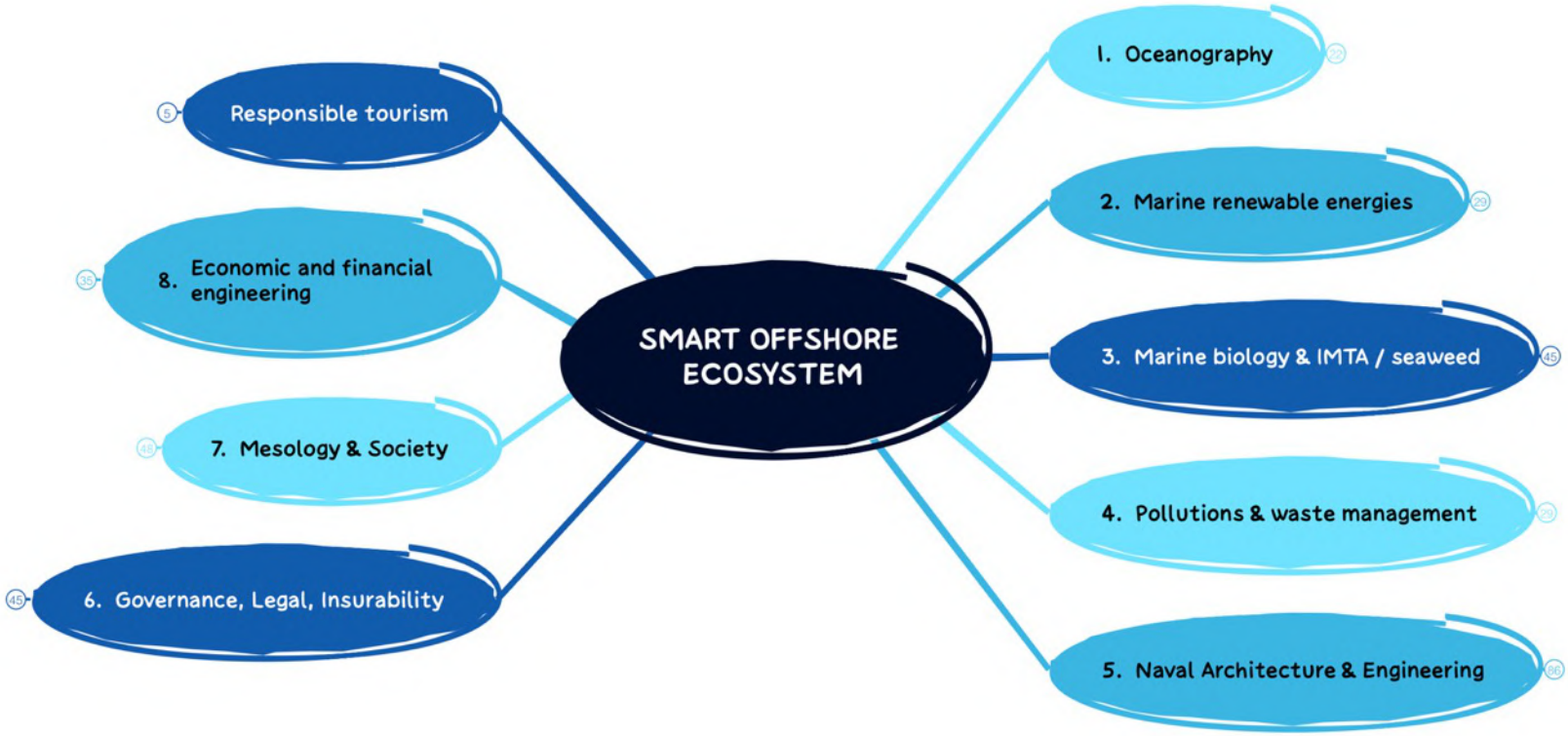
PHASE 2: A TRANSDISCIPLINARY R&D PROCESS

APPLIED RESEARCH CONSORTIUM



GLOBAL PROJECT MAPPING

TRANSDISCIPLINARY CO-CREATED INNOVATION



▶ To enlarge and consult the details of the project map
(password: BoraBora)

PHASE 2: METHODOLOGY

COLLECTIVE ALIGNMENT, IDEATION AND INTEGRATION

ORGANIZATIONAL PRINCIPLES	MAIN MILESTONES
1. Inclusive participatory process bringing together all stakeholders, whether public, economic, ecological or technical. 2. Double Diamond process management, facilitating clarity, liberty and cocreation for a wide range of competencies and participants. 3. Transdisciplinary design integration, making sure open-ended research finds its way to intentional development.	▪ Initial consultation of local stakeholders to understand threats and opportunities : public authorities, civil society, economic actors. ▪ The stage 1 (Discover) unfolds the vision and objectives (Brief v1) in a multidisciplinary collection of scenarios, enabling multidisciplinary team to learn from all the possible perspectives on the project. ▪ The stage 2 (Define) brings the various scenarios together in an integrated multifunctional Smart Open-sea Ecosystem (Brief v2). ▪ The stage 3 (Develop) allows all specialists to develop their particular solution meeting the common purpose and objectives (Brief v3). ▪ The stage 4 (Deliver) will bring all this together in an integrated theoretical functional design that is modelled to check the environmental, technical, economic and social relevance of the SOE with stakeholders. ▪ Final consultation to evaluate the relevance to go ahead.

TRANSDISCIPLINARY PROCESS

SUMMARY OF THE OBJECTIVES OF EACH WORKING GROUP (PHASES 1 & 2)

THECLIMATESTANDARDS



DISCIPLINE	QUESTION	OBJECTIVES
Mesology / Society	How can an SOE contribute to redefining a symbiotic human-Nature relationship, a true model of societal progress and a source of Polynesian pride? How may the SOE favour the community on a socio-cultural plan?	• Ensure respect for Polynesian and local culture. • Engage and federate all Bora Bora stakeholders in the co-construction of the SOE model. • Define the sine qua non conditions for the acceptability, desirability and pride of the Bora Bora community regarding the SOE. ▶ To consult the details and KPIs of this Work Package

Damien Serre, Charlotte Heinzlef, Emmanuelle Thénot & Loïs Bastide

TRANSDISCIPLINARY PROCESS

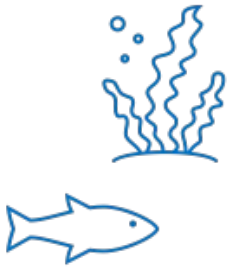
SUMMARY OF THE OBJECTIVES OF EACH WORKING GROUP (PHASE 2)



DISCIPLINE	QUESTION	OBJECTIVES
Oceanography Marine Biology	Where can we envisage, beyond the lagoon, between Tupai and Bora Bora, the experimentation of a viable, biophilic and climate-resilient SOE, given the synergistic objectives sought by its interdependent co-activities: science, energy, food, freshwater, tourism, biotechnologies?	• Spatial data collection, mapping and modelling: bathymetry, currents, waves, winds, water temperatures, biodiversity (25 km2). • Define the best study location to ensure the safety, sustainability and efficiency of the ecosystem and its co-activities given maritime, climatic and environmental constraints. • Create a floating artificial reef (blue carbon), in sustainable synergy with the other co-activities. • Ensure the biophilic nature of all SOE co-activities. ▶ To consult the details of the WP Oceanography & Marine Biology

TRANSDISCIPLINARY PROCESS

SUMMARY OF THE OBJECTIVES OF EACH WORKING GROUP (PHASE 2)



DISCIPLINE	QUESTION	OBJECTIVES
Marine permaculture Integrated Multitrophic Aquaculture Seaweed cultivation	How can a new trophic web, a true circular ecosystem (IMTA) be created considering the environmental context and the SOE's envisioned co-activities, particularly in the energy sector?	• Deploy and evaluate a 100 m^2 Marine Permaculture test system in Phase 1, generating empirical data to inform system design, ecological performance, and scalability. • Assess the potential for scaling the system in subsequent phases, ensuring broader impact and alignment with the SOE vision. • To contribute to the food self-sufficiency of the SOE in the short term, and, in a subsequent phase, to that of the island of Bora Bora. • Develop and validate profitable, sustainable, and integrated marine food production techniques capable of scaling to support coastal populations. • Develop virtuous synergies with other SOE activities, particularly marine renewable energy, to support a resilient and circular blue economy model.

TRANSDISCIPLINARY PROCESS

SUMMARY OF THE OBJECTIVES OF EACH WORKING GROUP (PHASE 2)

Waterstudio.NL



DISCIPLINE	QUESTION	OBJECTIVES
Naval Engineering and Architecture	How can we design, model and simulate a modular, safe, biophilic, attractive and multi-purpose floating maritime infrastructure that is cost-effective and located offshore given environmental and socio-cultural constraints?	• Develop a SOE pilot project that is agile and modular enough to allow different co-activities to be hosted and interacting. • Define the required technical solutions: bathymetry, waves and swell, currents, winds and tropical storms, seakeeping, safety and stability, anchoring, longevity and maintenance. • Technically model and evaluate the feasibility and costs of such scalable infrastructures. • Design an integrated beautiful and harmonious architectural project, capable of generating positive emotional valence and pride. ▶ To consult the details and KPIs of this Work Package

TRANSDISCIPLINARY PROCESS

SUMMARY OF THE OBJECTIVES OF EACH WORKING GROUP (PHASE 2)



DISCIPLINE	QUESTION	OBJECTIVES
Renewable Marine Energies	How can reliable synergies be developed and made reliable from cold nutrients-rich deep-sea waters: how can Ocean Thermal Energy Conversion be the starting point for a cascade of co-activities such as: production of e-fuel (H_2) + fresh water + promotion of a thriving biodiversity around the SOE?	• Ensure the energy self-sufficiency of the SOE in the short term, then the island of Bora Bora in the mid-term. • Deploy profitable, sustainable and integrated techniques to scale up to help provide coastal populations with energy and other benefits. • Develop virtuous synergies with other activities. ▶ To consult the details and KPIs of this Work Package

TRANSDISCIPLINARY PROCESS

SUMMARY OF THE OBJECTIVES OF EACH WORKING GROUP (PHASE 2)



DISCIPLINE	QUESTIONS	OBJECTIVES
Water cycle Pollutions Waste management	How can it at least be self-sufficient in fresh water, synonymous with life? How can the SOE be 0 pollution and recover its waste and the nutrients produced on the island of Bora Bora?	• Anticipate and prevent any pollution related to marine and submarine infrastructure, and to the anthropogenic activities of the SOE: solid, liquid, gaseous, noise. • Value the nutrients produced by the SOE and the island of Bora Bora to feed the natural ecosystem of the SOE. • To optimize the water cycle of the SOE and its co-activities, and to contribute in the long term to the freshwater self-sufficiency of the island of Bora Bora. ▶ To consult the details and KPIs of this Work Package

TRANSDISCIPLINARY PROCESS

SUMMARY OF THE OBJECTIVES OF EACH WORKING GROUP (PHASE 2)



DISCIPLINE	QUESTION	OBJECTIVES
Legal (governance, insurance)	The project is primarily designed as a high-end hospitality establishment situated in an offshore marine environment, incorporating complementary infrastructure and activities relating to energy production, regenerative aquaculture, scientific research and the conservation of biodiversity. The hotel operation constitutes the project's main economic activity. These complementary activities contribute to the project's operational self-sufficiency, enhance the quality of the visitor experience, reduce its environmental footprint and generate scientific and economic value for the region. hat certification, legal framework and governance can be envisioned for this shared infrastructure in Bora Bora?	• Design the necessary marine / maritime legal framework to ensure especially a proper insurability of the SOE. • Describe the management style and the organizational framework to be established. • Identify the roles and responsibilities of the multiple actors in order to ensure the proper functioning, sustainability and insurability of the SOE ▶ To consult the details and KPIs of this Work Package

TRANSDISCIPLINARY PROCESS

SUMMARY OF THE OBJECTIVES OF EACH WORKING GROUP (PHASE 2)



DISCIPLINE	QUESTIONS	OBJECTIVES
Regenerative tourism	• Under what conditions can an offshore hospitality infrastructure generate a net positive ecological impact on its marine environment? • How can the economic model of luxury tourism sustainably finance ecosystem restoration and scientific research? • How can an offshore infrastructure contribute to the resilience and prosperity of an island territory, beyond its own operational perimeter?	• Design an exceptional, profitable tourism model in line with the positioning of Bora Bora, given its environment and its dual function (living laboratory). • Finance science, innovation and facilitating sustainable progress that fuels incomes of tourism. • Make avant-garde techniques and technologies mature gradually. • Raise awareness in Polynesia and internationally. • Contribute to the development of a Polynesian sector of excellence: higher education – symbiotic blue economy and tourism.

TRANSDISCIPLINARY PROCESS

SUMMARY OF THE OBJECTIVES OF EACH WORKING GROUP (PHASE 2)



DISCIPLINE	QUESTION	OBJECTIVES
Economic engineering and financial (economic viability)	How can the SOE be profitable in the medium term and benefit all its stakeholders?	• Setting up a shared, viable and synergistic multiple business model. • Ensure global economic performance of the SOE in the long-term. • Transform a multifunctional economic, touritic and scientific hub into an attractive model for all economic stakeholders: local community, investors, operators, tourists… ▶ To consult the details and KPIs of this Work Package

APPENDIX 1

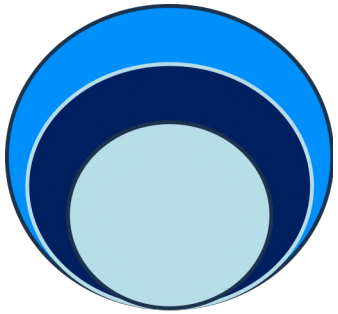
INDIGO CIVILIZATION: ORGANISATION & TEAM

To consult our Code of Conduct and our Status

INDIGO CIVILIZATION

What sustainable development model should be considered?

Towards a strong to very strong sustainability (Boutaud)



Techno-economic approach

Philosophy: "no environmental protection, no social protection without a strong economic base »

Priority: economic
Target: short-term

Weak sustainability

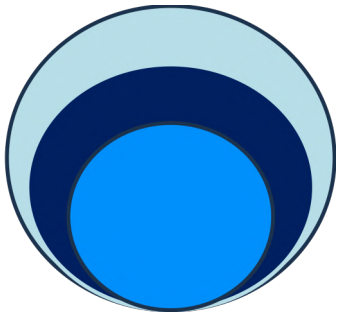


Consensus approach

Philosophy: "Reconciling environmental protection, social equity and economic growth »

Priority: balance
Target: medium term

Strong Sustainability



Ecosystem approach

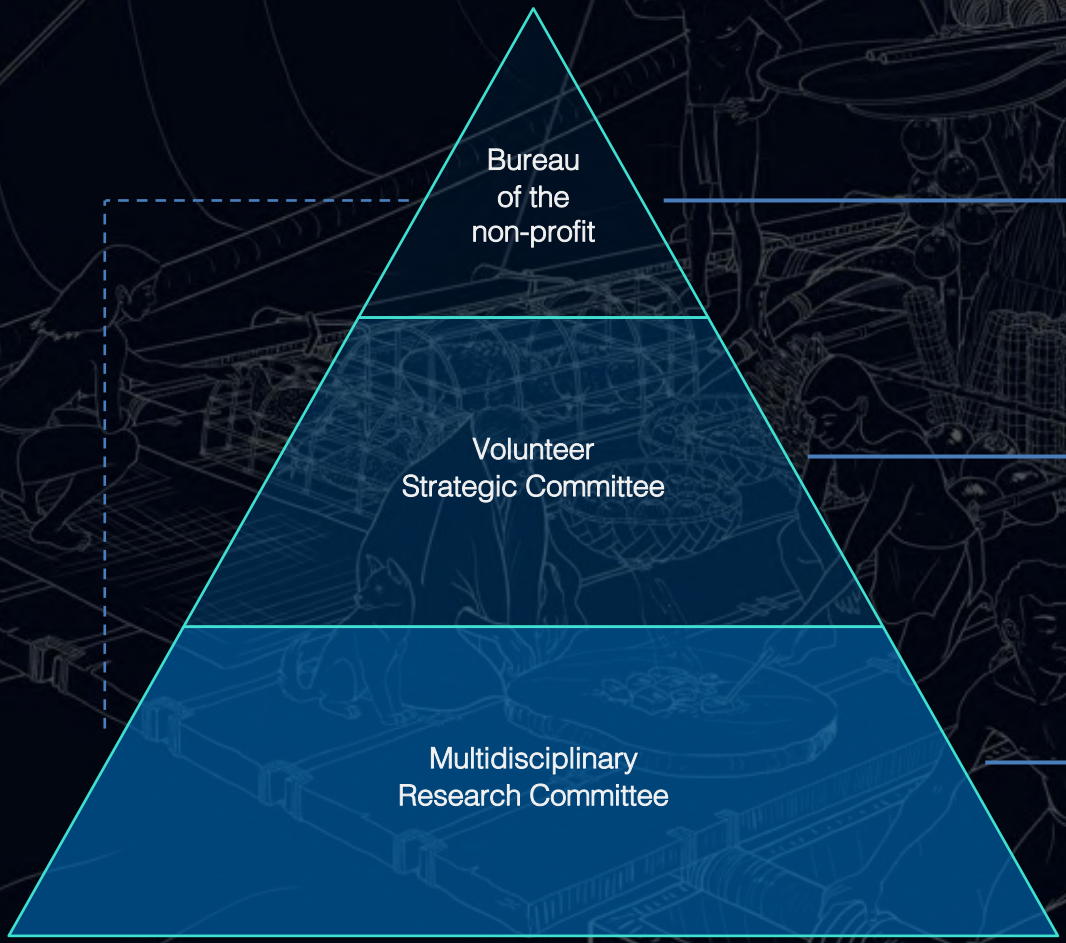
Philosophy: "no sustainability of the human system without taking into account the capacities of the ecological support"

Priority: ecological
Target: long-term

Very strong sustainability

economy social ecology

Our non-profit governance



Administration
Dissemination
Communication, investors' relationship
Transversal management of maritime projects
Stakeholder of the steering committee with Bora Bora
Orchestration of the Research Committee

Policy Recommendations
Skills sponsorship
Networking

Multidisciplinary research
Co-construction (TRL 6)

Founding member, Bureau

Frédéric Pons

President

Frédéric Pons, the founder and President of The Indigo Civilization, a non-profit, public-interest organisation, is a French philanthropist and entrepreneur with over 25 years of experience in marketing, strategy, and executive management. Throughout his career, he has successfully developed and launched innovative projects for prominent international brands across diverse multicultural environments.





After a pivotal moment in his life, Frédéric chose to redirect his focus and dedicate himself to a higher purpose, channelling his efforts into a pioneering cause that serves the greater good of all life on Earth. A lifelong admirer of the sea and its mysteries, Frédéric's mission now centres on bringing to fruition the study, experimentation, and deployment of sustainable, desirable, viable and generative Smart Open-sea Ecosystems.

To learn how to live in symbiosis with and on the oceans…

Our Strategic Advisor

Jacques Rougerie

For more than 30 years, Jacques Rougerie has based his work on biomimetic, bio-inspired, resilient and sustainable architecture. In this spirit, he has built underwater habitats and laboratories, sea centres, ships with transparent hulls, underwater museums, floating village projects, and a base and a lunar village.





As a child, on the distant beaches of Africa, his friends built tree houses. He wanted to build them under the sea or in space, and become an explorer of the future. Fascinated by Jules Verne's novels, "20000 Leagues Under the Sea" and the voyage "From the Earth to the Moon" and later by the exploit of Gagarin and Commander Cousteau developing the world's first underwater habitat in the same year, Jacques Rougerie saw his destiny transformed by these two great space and oceanic adventures.

"There were no real architectural and technical references to build these new oceanic living environments. It was therefore essential for me to work with a multidisciplinary team and to be inspired by the genius of Leonardo da Vinci who told his students: "Go and take your lessons in nature, that's where our future lies." Because since the beginning of the world, 3,800 million years ago, nature has been drawing the most beautiful shapes, the most elegant curves and making the best materials. It is this biomorphic approach that is at the origin of my creations."

Foundation Jacques Rougerie

Founding member, Bureau

Guillaume Vichot

Vice-President

Guillaume Vichot is a naval engineer who graduated from ENSTA, IHEDN and AUDENCIA and specializing in maritime projects and contracts management. With a robust background in marine and naval project management, particularly with Naval Group, he has gained extensive expertise in this field. As Managing partner of Oppy International, a marine project accelerator, he develops and manages complex projects for international clients, guiding them from design and industrialization to end-user satisfaction.

In his role, he ensures adherence to Quality-Cost-Delivery objectives and orchestrates a range of interfaces, including Design, Production, QHSE, Purchasing, Supply chain, Customer relationship, End-Users and Local authorities management. Through this, he effectively manages multidisciplinary and multicultural teams, ensuring seamless collaboration across diverse participants.



Founding member, Bureau

Sophie Hoehlinger
General Secretary

Sophie Hoehlinger is an executive with a rich educational background and extensive experience in the pharmaceutical and healthcare industries. She holds a European Board Diploma from ECODA and a Board of Director Certificate (climate and biodiversity option) from Sciences Po Paris, both obtained in 2024. Her academic journey began with a bachelor's in biology from Louis Pasteur University, and she has further honed her skills through executive programs at Vlerick Business School, INSEAD, IESE Business School.

Sophie's key strengths lie in P&L management, business strategy, digital transformation, and team empowerment. She is known for her collaborative leadership style, strategic finesse, and ability to simplify complex situations. Passionate about bridging tradition and innovation, Sophie is dedicated to driving long-term success through diversified human capital. As a biophile diver, Sophie considers the oceans as the most obvious ally of humankind.



Strategic committee, honorary member

Rutger de Graaf

Global and adaptation floating habitat solutions

Rutger de Graaf is an engineer and an entrepreneur who is recognized as the world's leading expert on resilient urban floating solutions. A Dutchman, he is, among other things, the founder of Blue21, a consulting and high-tech company fully specialized in the development and application of climate-proof floating building technologies for housing, energy, logistics and food production in social and ecological impact projects in the Netherlands and abroad.

He participated in the EU-funded project Space@Sea and was recently appointed to the Busan Marine Smart City Task Force, a UN-supported project. He contributes to build and use floating infrastructure as new engines for South Korea's growth and as powerful levers to address climate change.





Strategic committee, honorary member

Koen Olthius
"Aquatecture" or Floating Architecture

Koen Olthuis (1971), co-founder of the famous Dutch architecture firm Waterstudio, studied architecture and industrial design at Delft University of Technology. Waterstudio has a compelling expertise in floating urbanism and has been chosen to build the floating island of the Maldives , currently under construction.

In 2007, he was chosen as No. 122 on Time Magazine's list of the most influential people in the world due to the growing global interest in water developments. In addition, the French magazine Terra Eco chose him in 2011 as one of the 100 green people who will change the world.





Strategic committee, honorary member

Denis Lacroix

Ocean foresight

Denis Lacroix launched the prospective reflection at IFREMER in 2006 ((French Research Institute for Exploitation of the Sea). The collective work focuses on marine renewable energies, deep mineral resources, environmental scenarios for 2100, sea level rise, etc. Author and contributor of numerous books, he carries out training missions in foresight and strategic monitoring in 5 universities in France and Europe.





» The Indigo Civilization project is rich in visions for humans, as for nature, in close connection with the sea. Will we be able to replace the current military and economic thalassocracies with projects that value co-construction rather than competition, links rather than goods, trust rather than mistrust?

his project carries precisely the dynamics of a new alliance with the sea, so that this global common good also carries creative utopias. Young people also need a desirable future. Here is a concrete example: it invites us to take off. »

Strategic committee, honorary member

Morgan Rae

Marine-Based Designer | Regenerative Hospitality Pioneer

As an experienced guide to aquatic living, Morgan Ræ brings her decades of hospitality research to style the circular economy and deep-sea space. To elevate the standards of design and raise awareness of our water connection, L'eautelier is part-studio, part-host, mixed with the fluidity and resilience of its element of choice.





L'eautelier recently hosted the Dreams Do Come True Exposé during the 2022 UN Ocean Conference in Lisbon and was co-host of the I ♡ NY Sea water awareness series during the 2023 UN Water Conference.

Ræ's latest accolades include four design awards including #6 of the 2024 World's 50 Best Hotels for Royal Atlantis, and 2021 Radical Innovation. Ræ has also been featured on numerous podcasts including Seasteading Today and Top Floor, for her aquatic design. Having worked on over 100 projects worldwide, holding over 25 years of experience, she is one of the pioneers of the nomadic design studio concept.

Ræ has worked with recognized hotel brands, including Kerzner's Atlantis and One&Only Resorts, Nômade, SohoHouse & 1Hotels, Westin, Sheraton, 11Howard, Fairmount, Fontainebleau, Cosmopolitan Las Vegas, Hard Rock, MGM, Selina, and hospitality-focused residences such as BMW's Mini Living and aquatic companies like America's Cup and Royal Caribbean.

Current works include an algae-based bed & breakfast designed specifically for solo travellers wanting a digital detox.

Strategic committee, honorary member

Damien Serre

Resilience strategies and applied sciences





Damien Serre is Prof., Associate Researcher at UVSQ-CEARC (cearc.fr) and CEO of TheClimateSandards Company and RESCUESolutions. He is leading R&D projects in the area of resilience to climate risks with a special focus on resilience assessment, critical infrastructure management, spatial decision support systems to optimize resilience of different types of hazard with a strong expertise on floods.

He chaired or co-chaired many international tracks or session in his area of expertise e.g. the EGU General Assembly in Vienna in 2009, 2010, 2017 and 2018 as well as FLOODRISK 2016 International Conference in Lyon in 2016 (Disaster risk and recovery session). He was editor of the Journal of Water and Climate Change (IWA) 2013-2021, is editor of the journal Urban Risk Studies (ISTE) and member of the Editorial Board of the Journal of Flood Risk Management (Wiley).

Strategic committee, honorary member

Jack Dyer
Blue Economy & Finance Advisor





Dr Jack Dyer as a specialist climate change, development and blue/ocean economist, has over 10 years global/African consultancy, lecturing and entrepreneurship experience with a BSC Hons in Economics from the University of Kent, a Master of Commerce (Maritime Economics/Law) and PhD in climate change's impact on the future of Pacific and global blue economies/marine resources, ecosystems, communities and individuals.

His climate change, circular green and blue economy experience ranges from cruise and marine tourism to education, MSP, marine protected areas, natural disasters business, drones, ship repair, finance and psychology space economy, maritime law, ocean governance, logistics.

Dr Jack Dyer, has been involved in researching as an academic, researcher, lecturer, entrepreneur and consultant to improve the prospects in creating a sustainable and profitable; oceanic eco-conscious destiny for the future of the blue economy and Earth.

Strategic committee, honorary member

Simon Nummy

Sustainable design in constrained environments





Simon Nummy is a sustainable design consultant and architect with over 20 years of experience across large-scale commercial projects in Europe, Asia, Australia, and the Middle East. Specializing in sustainable design for transportation infrastructure, including metro systems, light rail, high-speed rail, bus networks, and marine projects.

Before joining NEOM, Simon spent over a decade in the Middle East working with 2oa.studio, ATKINS, and Mott MacDonald. Prior to that, he worked in Australia for HASSELL and COX Architects, contributing to a diverse range of projects, such as metro systems, sports stadia, industrial and research facilities, high-rise residential buildings, education campuses, and hospitality developments.

From 1995 to 1997, Simon worked with Ken Yeang in Kuala Lumpur, Malaysia, where he was involved in the concept design and development of bio-climatic high-rise and master planning projects. He was shortlisted for the LAGI 2014 competition with #HelioTweet and for LAGI 2019 with ANTHROPOCENE, which was exhibited at MASDAR. Simon also won the Seasteading Institute's 2015 competition with "Storm Makes Sense of Shelter", showcased at the V&A Museum in London as part of "The Future Starts Here: 100 Projects Shaping the World of Tomorrow."

Strategic committee, honorary member

César Jung-Harada

Ocean multidisciplinary impact innovation





Cesar Jung - Harada is a French - Japanese designer, environmentalist, educator, and entrepreneur, passionate about ocean technology, impact innovation, and education based in Singapore.

Cesar is an Associate Professor of Design at the Singapore Institute of Technology and is currently a candidate Ph.D. in Design and Ocean Innovation at the CNAM (France), Director of MakerBay LTD (Hong Kong Makerspace), Scoutbots LTD (Ocean Robotic Startup). Cesar serves as a Trustee of the board of HBKU (Qatar), the Wyng Foundation (Hong Kong).

Cesar was a Researcher and Project Leader at MIT, and holds a master degree from the Royal College of Art (Design Interactions), and another Master Degree from the ENSAD Paris (Animation). Cesar regularly delivers workshops and keynotes at international conferences in places such as the UN, Harvard or TED. Lately Cesar has organised an exhibition in Singapore of his project of International Ocean Research Station.

Strategic committee, honorary member

César Ducruet

Transport, ports and logistics





César Ducruet, geographer, is senior researcher at the French National Centre for Scientific Research (CNRS). He is currently working at the EconomiX laboratory (Paris-Nanterre) on the local impact of contemporary maritime globalization. His research focuses on technological innovation, connectivity, employment, vulnerability, environment, and health issues in a port and port-city context. He is principal investigator of the ANR-funded research project "Maritime Globalization, Network Externalities and Transport Impacts on Cities" (MAGNETICS) (2023-2026).

César has been expert for various international organizations (OECD, World Bank, WHO) and works regularly with numerous partners in Asia (Korea Maritime Institute, JETRO, ASEM, Chinese Academy of Sciences, ECNU, Fudan University, Shanghai Maritime University). His publications include three edited volumes on Maritime Networks (2015), Shipping Data Analysis (2017), and Port Systems (2023) in the Routledge Studies in Transport Analysis. Two additional volumes are under preparation: “Port-Cities and Globalization since the 1950s” and “Healthy Port Cities: Mitigating Environment and Public Health Impacts of Ports and Shipping” (2025-2026).

He is also associate member of porteconomics.eu, scientific board member of SFLOG, GIS Axe Seine, GDR OMER, RETE Association, international advisory board member of PortCityFutures, and editorial board member of Journal of Transport Geography, Maritime Business Review, International Journal of Transport Economics, and Portus.

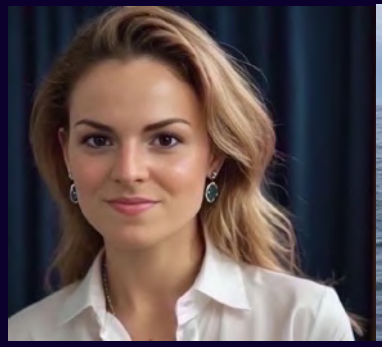
Our Heart patron

Emma-Claire Fierce

Artist, explorer and top athlete, Emma-Claire embodies the values of creativity, generosity, integrity and audacity advocated by The Indigo Civilization. She is the first French woman to swim across the Oceans7, a marathon swimming challenge consisting of seven iconic open water channel crossings.

Known for her outstanding contributions to extreme swimming and sports science, she has been officially recognized as an Ocean Expert by UNESCO. This prestigious recognition highlights her expertise in ocean studies and her commitment to advancing the scientific understanding of human adaptation to extreme environments.

“The Indigo Civilization is not a project—it is more. It is beyond us all. It is a cultural and civilizational positive construction grounded in the values of unity, creativity, beauty, inclusion and transformation across nations and generations. It envisions a harmonious collaboration with the oceans and the richness of our biology”.





Youth Lead Ambassador

Lucca Stevenson

Lucca Gianni Figueiredo Stevenson is an International Relations graduate from PUC-SP with a focus on climate governance, global markets, and sustainable finance. He is the founder of Abaixando a Maré, an initiative dedicated to addressing the economic and policy impacts of rising sea level through climate adaptation and international cooperation. Lucca has spoken at COP30 and engaged with Brazil's Ministry of Climate on policy recommendations related to sea level rise and coastal adaptation.

He has professional experience at the France–Brazil Chamber of Commerce, where he contributed to investment-oriented country reports, policy briefs, and high-level international engagements. He speaks Portuguese, English, French, and Spanish.





Indian Ocean Ambassador

Manon Mauvais





Manon Mauvais holds degrees in law and economics (University of Paris 1 Panthéon Sorbonne), as well as in environmental project management (Sciences Po Paris). Specialized in supporting economic actors in the face of environmental issues, she worked as a consultant on plastic pollution, with the legislator on environmental policies, then at the French Office for Biodiversity on a citizen mobilization mission.

For the past six years, she has been working in the Indian Ocean — Reunion Island, Mayotte, and now Nosy Be in Madagascar. As CSR Manager of AMANTA Group, she supports tourism players in taking environmental issues into account, with a conviction at the heart of her action: to build and live in awareness of the environment and biodiversity.

As part of her duties, she carries out ecological restoration projects — coral restoration in Nosy Be, partnerships with local associations for the preservation of biodiversity, refuges for birds, vegetable gardens and botanical trails — aimed at strengthening biodiversity and the resilience of tourist establishments. She also supports energy sobriety initiatives (renewable energies, control of water consumption) and designs actions to raise awareness among visitors of the major environmental issues of the century, with particular attention paid to marine biodiversity, which she practices herself on a daily basis through diving and freediving.

Our core partners

Sharing our vision & commitments

AMPHIBIA DEVELOPPEMENT

GLOBAL OTEC

blue21

BLUEREVOLUTION.org

CLIMATE FOUNDATION

THECLIMATESTANDARDS

Commune de Bora Bora
POPORA TO TATOU OIRE

CRIOBE UAR3278

YOUNGO
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New European Bauhaus
beautiful | sustainable | together

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skema
BUSINESS SCHOOL

Waterstudio.NL

APPENDIX 2

CONTEXTUAL INFORMATION ABOUT BORA BORA & FRENCH POLYNESIA

PRELIMINARY DATA FROM SHOM

INDIGO CIVILIZATION

Challenges and assets of French Polynesia

Key challenges

Demographic slowdown and cultural resilience:
decrease in births and emigration of young people/talents.
(20% of 18-25 left the territory, in 5 years – ISPF, 2022)

Sustainable tourism transition:
reconciling ecological and socio-economic interests.

Structural trade deficit.

Energy, food and tourism dependence.

Carbon footprint / inhabitant:
60% higher than the world average.

Pollution and immediate environmental challenges:

- Degradation of terrestrial and marine ecosystems,
- Loss of biodiversity.

In 2100, 1/3 of the 118 islands of Polynesia would be uninhabitable due to rising sea level (French CSE – 2025).

Key assets

Positive economic conditions(cf. IEOM 2024 report):
growth, inflation control and employment dynamism.

Profitable high-end touristic economy (+13% in, 2024).

Exceptional development potential conducive to the development of a blue economy whose current weight remains low:

- Environmental heritage,
- Vast maritime area (48% of the French EEZ),
- Diversity of natural resources.

Potentials of an open-sea ecosystem-based blue economy (cf. Innovation Strategy 2030) :

- Eco-cultural tourism,
- Green logistics hub,
- Aquaculture,
- Marine renewable energies,
- Biotechnology,
- Research.

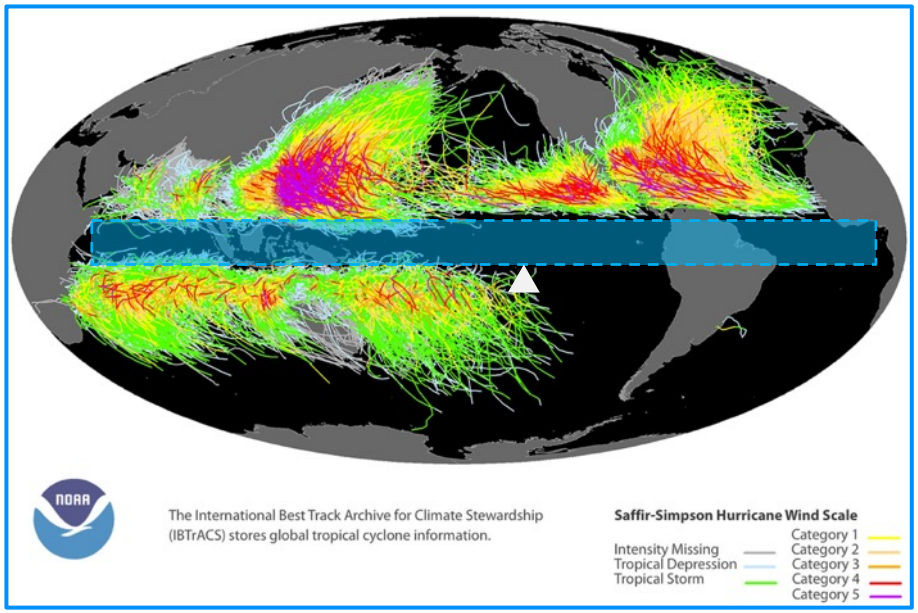
Making Polynesia a space for innovation

Synergies with the 2030 Innovation strategy / Cap 2033, A fano Rā

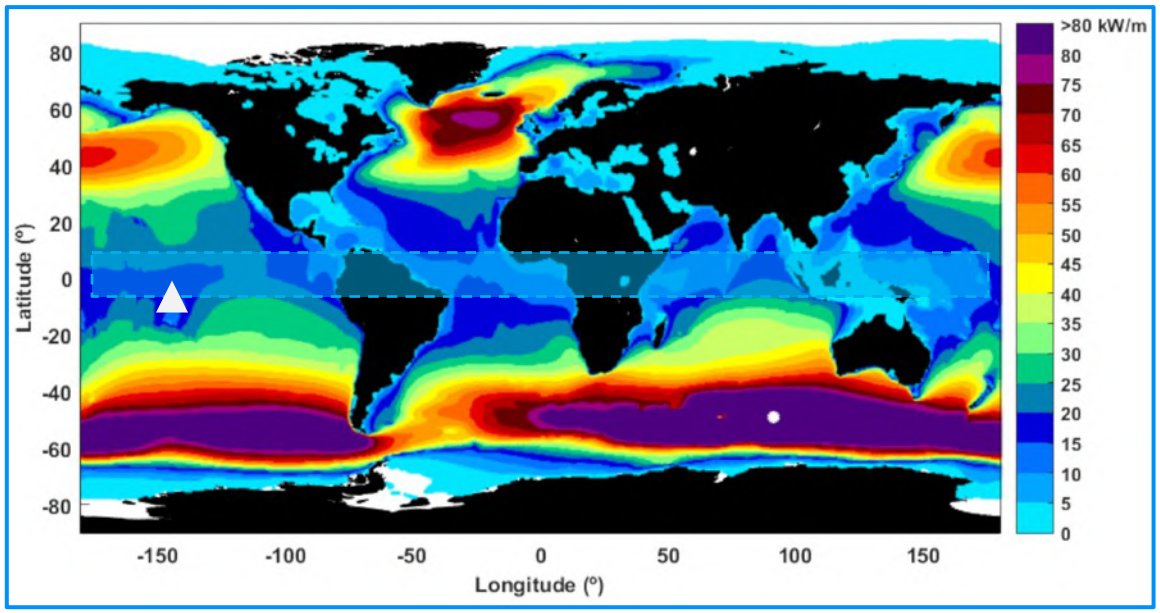
Activities	Priorities of the Polynesian Blue Economy strategy	Synergies Smart Open-sea Ecosystem (/5)
Environment	Tackling marine pollution	3
	Monitoring, protecting and defending MPAs to preserve biodiversity	3
	Limiting anthropogenic pressures on coasts and reefs	5
Transport	Initiating the energy-efficient transition to alternative propulsion energies	4
	Encouraging the development of an eco-responsible shipbuilding industry	2
Aquaculture	Becoming a global benchmark in aquaculture	5
	Developing an offshore multi-trophic aquaculture sector	5
	Promoting artisanal aquaculture and fishing	3
Tourism	Be a model of eco-responsible tourism	5
	Becoming a showcase for cultural tourism	4
Logistics	Developing the attractiveness of Papeete's port	1
	Making Polynesia a decarbonized and sustainable logistics hub in the Pacific Ocean	1
Marine Energies	Developing MRE demonstrators to move towards energy autonomy	5
	Generate a trade surplus (electricity, H_2)	4
R&D	Strengthening a sector of excellence to better understand the ocean	4
	Be a major source of biotechnology valorisation	5
	Becoming a pilot territory for the bioeconomy	5

BORA BORA, A FAVOURABLE EXPERIMENTATION AREA

Calm waters and favourable weather conditions to maximize viability and reliability and minimize risk and cost.
The cyclone risk in French Polynesia is almost zero in normal years, more important during El Nino years, with cyclones remaining confined to the west of the South Pacific and the Indian Ocean.



Tropical cyclone tracks since 1842 – NOAA data base

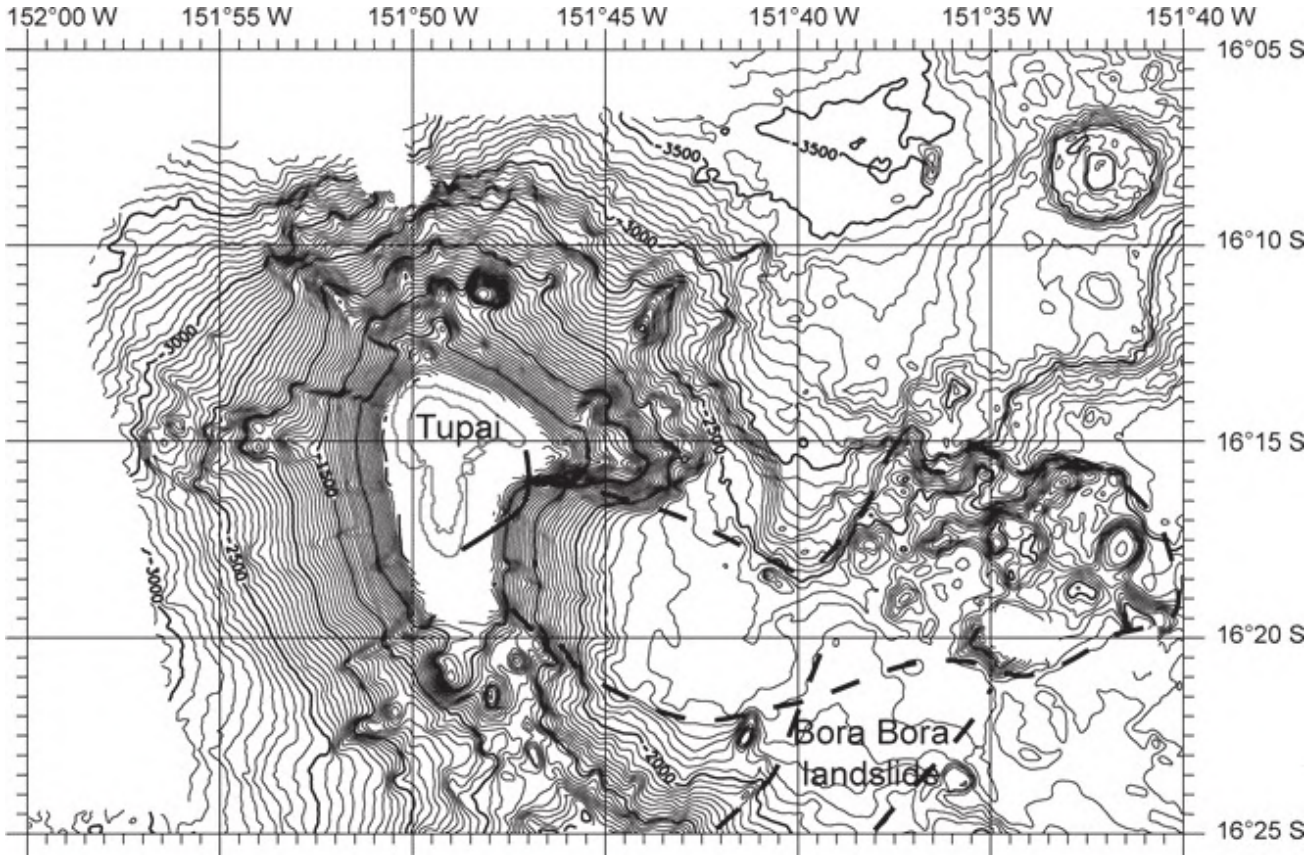


30-year average wave power (1989-2018) – ERA5 database

Particularly favourable theoretical experimentation area

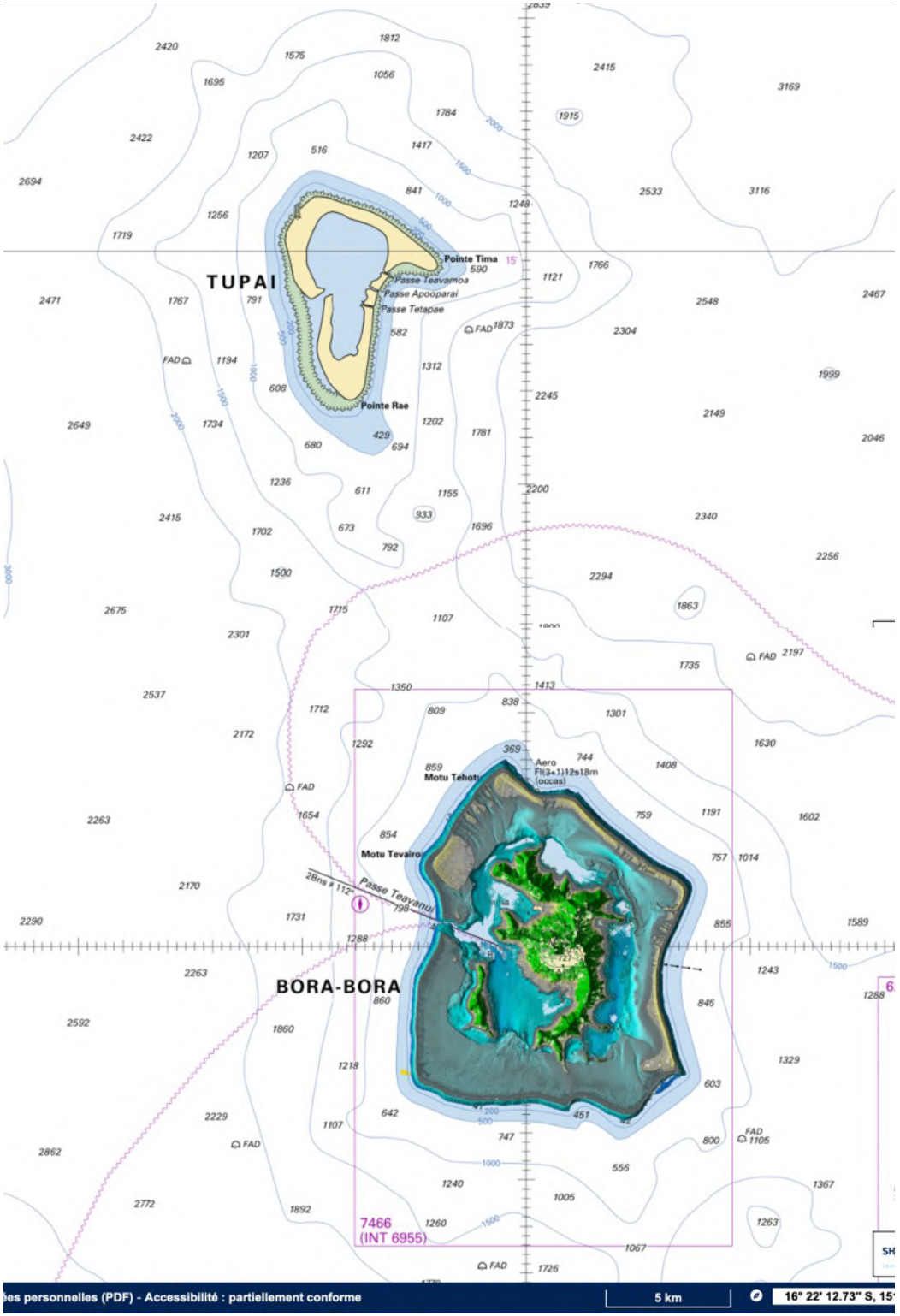
Bathymetric chart

Data provided by Valérie Clouard



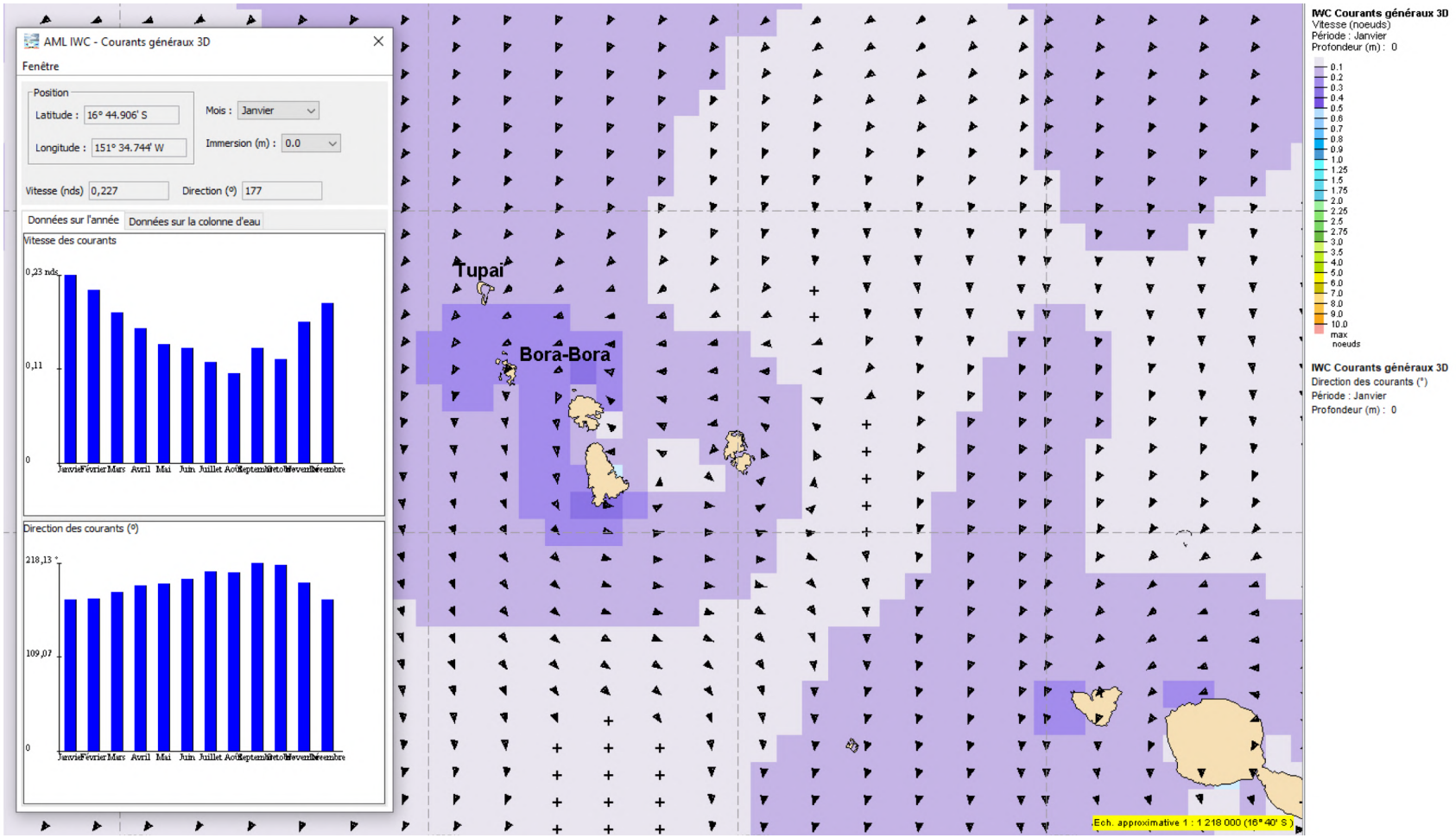
Bathymetric chart

Data provided by SHOM



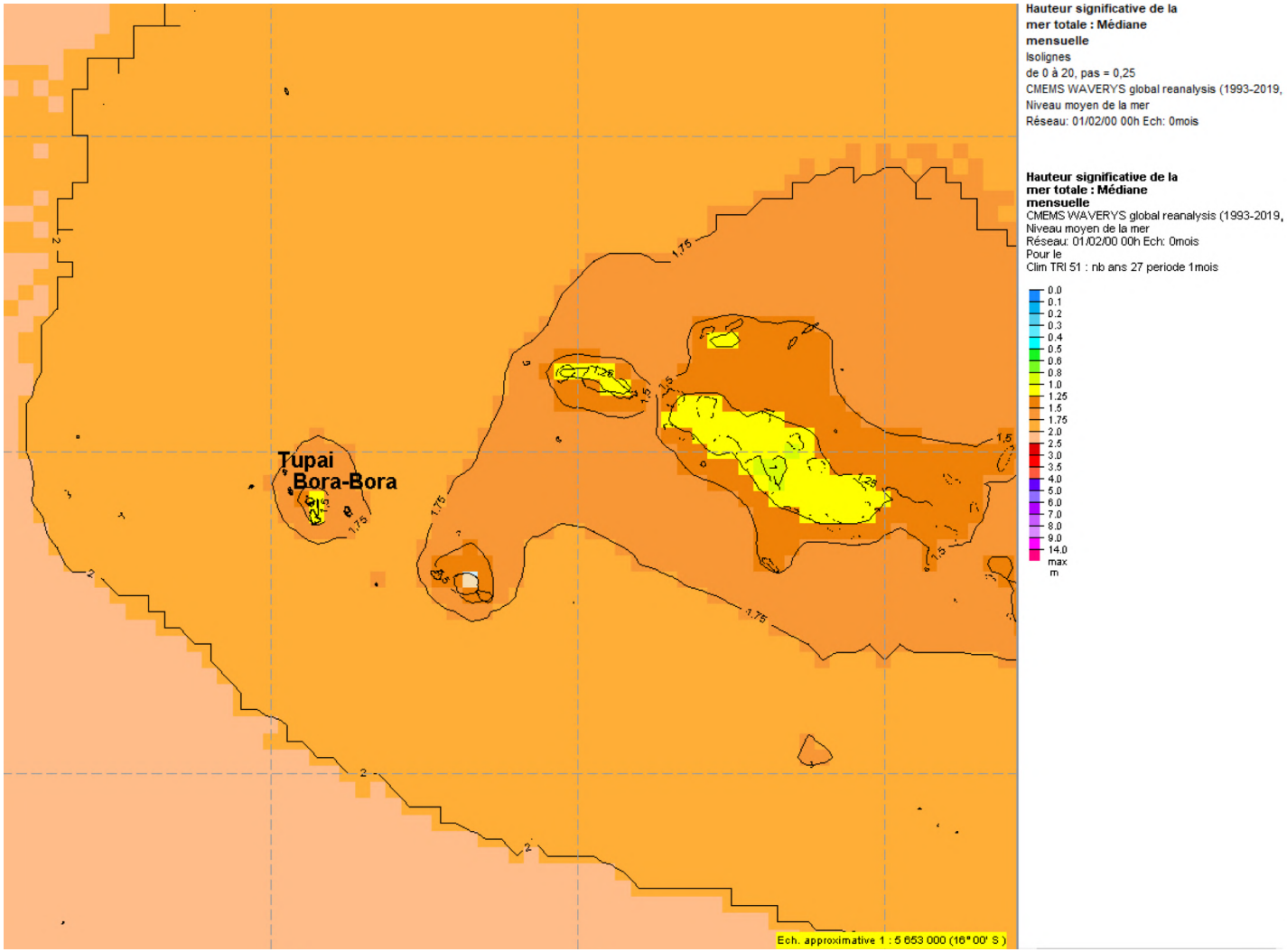
MAP OF CURRENTS

DATA PROVIDED BY SHOM



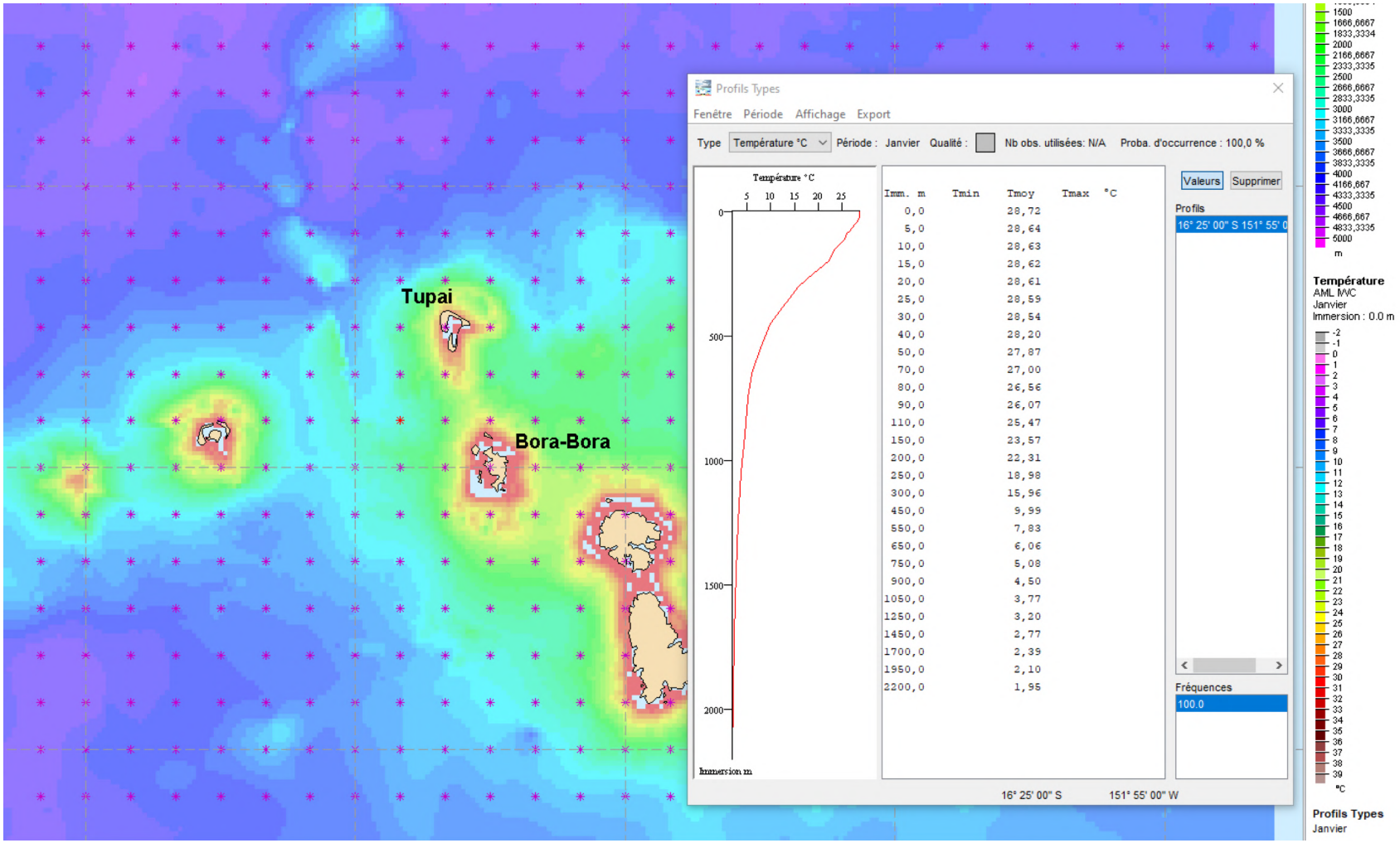
MAP OF SWELL

DATA PROVIDED BY SHOM



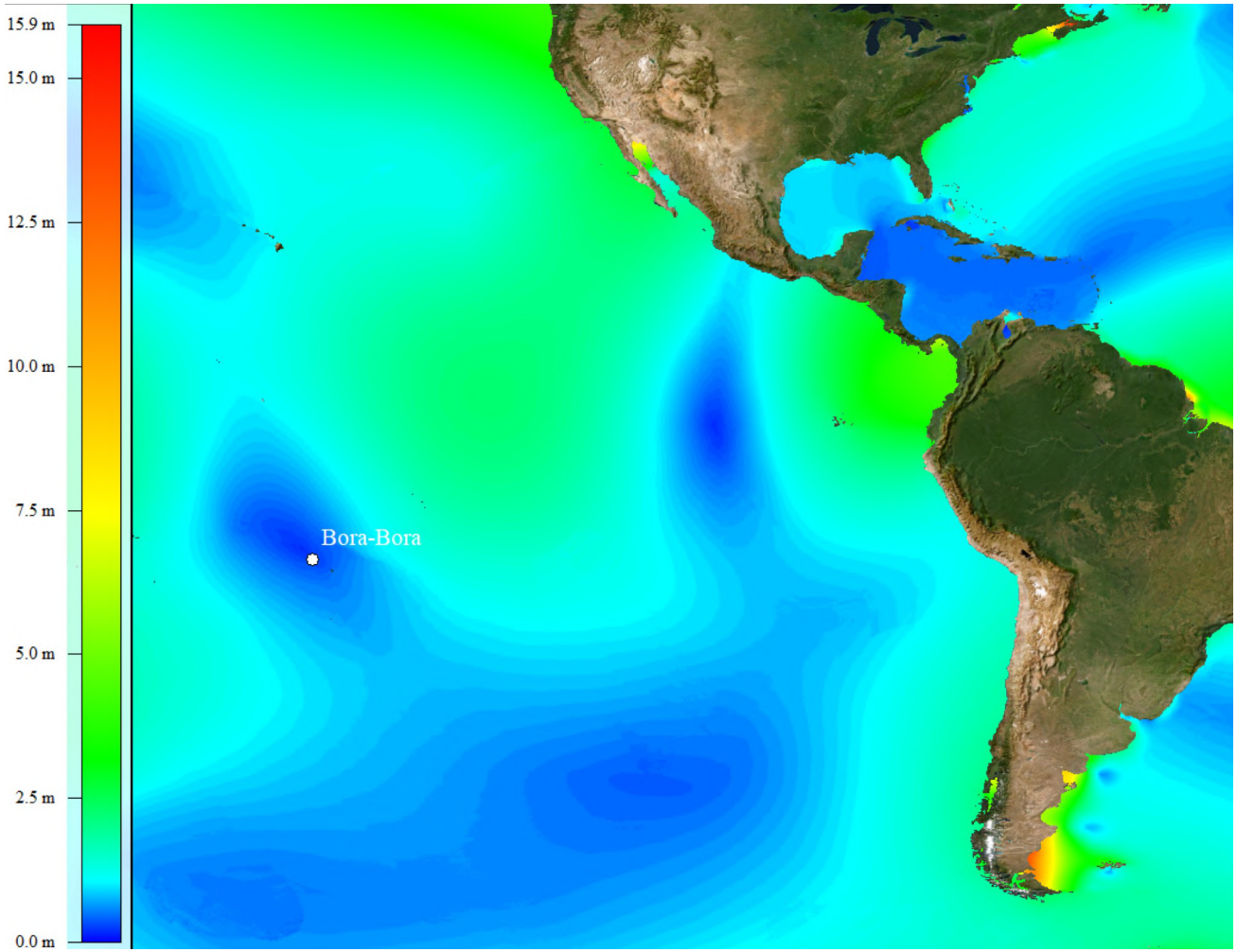
MAP OF WATER TEMPERATURES

DATA PROVIDED BY SHOM



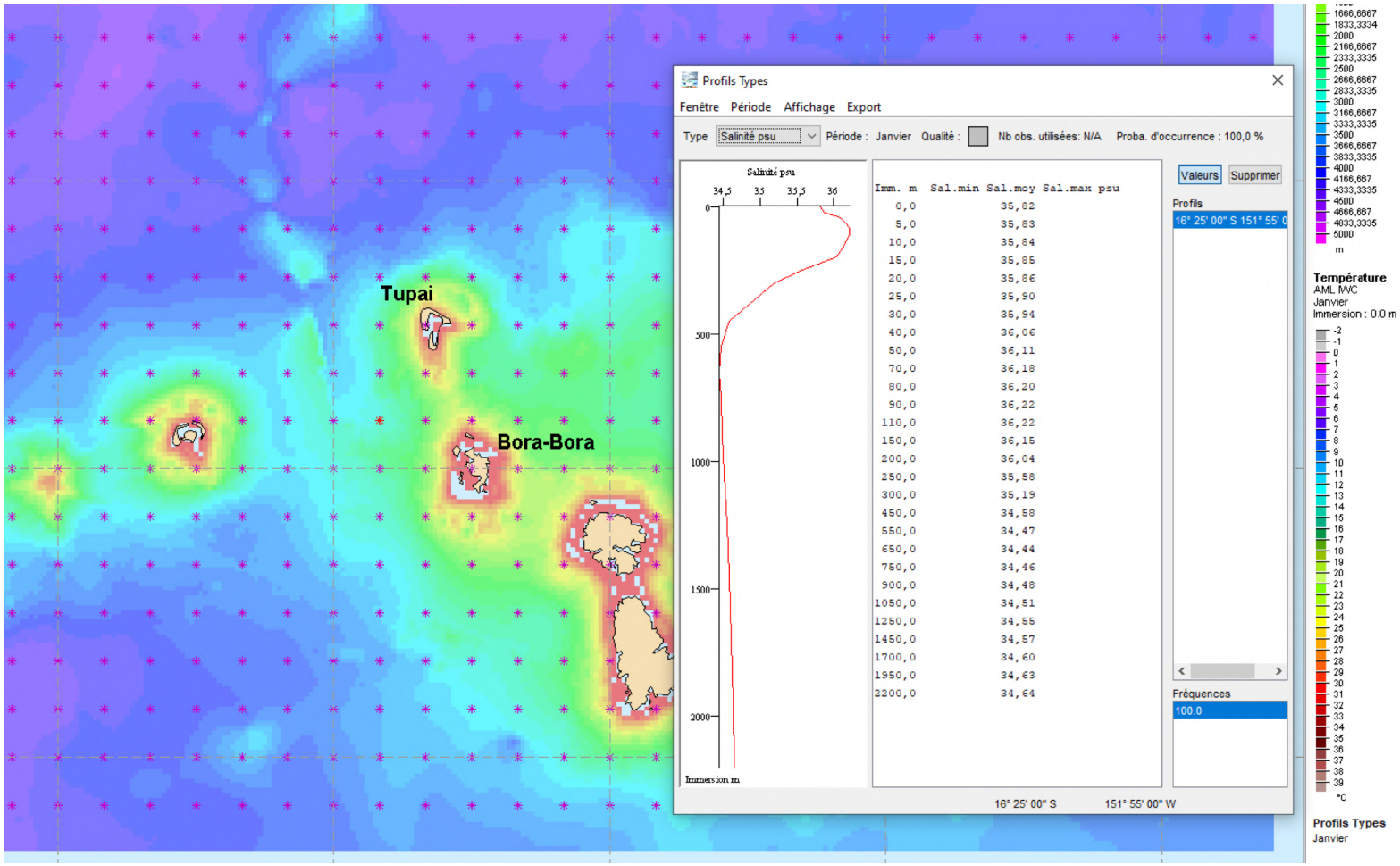
MAP OF TIDAL RANGE

DATA PROVIDED BY SHOM



MAP OF SALINITY

DATA PROVIDED BY SHOM



APPENDIX 3

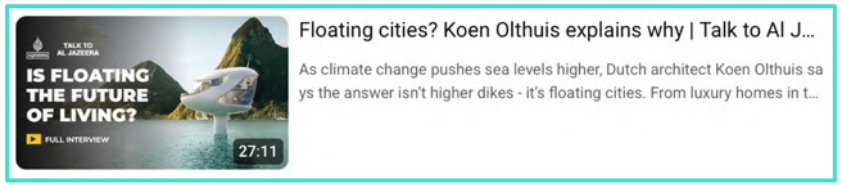
RECOMMENDED VIDEOS



INDIGO CIVILIZATION

We recommend four videos in which our members and supporters share their forward-looking vision and express themselves about the opportunity to consider a new cooperation between humans and the marine world.

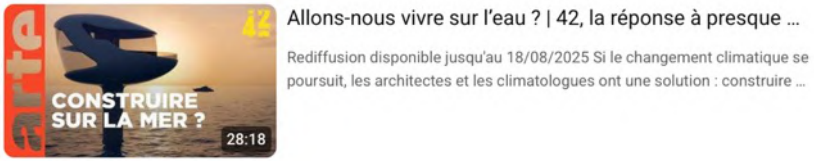
Jacques Rougerie, Koen Olthius, Rutger de Graaf



https://youtu.be/gaXGMm_cMxc?si=RnW2pgD48vR8zrqO



https://youtu.be/yiOouuceXTc?si=zJjWoHyatqLydj1S



https://youtu.be/EQe4uLa7DBU?si=XPjqA0S-0YFSmbmh

APPENDIX 4

PRE-ANALYSIS OF THE BENEFITS / RISKS

INDIGO CIVILIZATION

Maritime architecture and resilience

Expected benefits	Associated risks
Creation of a new three-dimensional, modular, and scalable activity space.	Complexity in module design and integration.
Liberation of part of the coastal and lagoon areas subject to anthropogenic pressures.	Shift of pressures toward open marine ecosystems.
Possibility of installation in areas less exposed to certain land and coastal constraints.	Exposure to cyclones, extreme swells, currents, and ocean events.
Adaptability to sea level rise thanks to a floating architecture.	Structural fatigue, aging, corrosion, biofouling, and anchor failure.
Pooling of infrastructure and equipment.	Systemic failure: a failure can affect several interdependent activities.
Possibility of modular manufacturing, assembly, and maintenance.	Logistical difficulties, maintenance costs, and availability of intervention resources.

Energy and biogeochemical resources

Expected benefits	Associated risks
Valorisation of the oceanic thermal gradient to produce energy (OTEC).	Insufficient net efficiency after consumption of pumping and auxiliaries.
Access to a deep cold-water source for SWAC and cooling.	Pipe failure, corrosion, clogging, and excessive power consumption.
Use of nutrient-rich deep waters to support organic production.	Modification of thermal and chemical gradients, ecological imbalances.
Potential freshwater production.	Energy costs, brine management, and quality of produced water.
Renewable energy production and reduction of dependence on imported energies.	Intermittency of certain sources, storage, and the need for backup systems.
Potential valorisation of hydrogen and oxygen.	Industrial complexity, safety, costs, and lack of guaranteed outlets.

Biodiversity and ecological regeneration

Expected benefits	Associated risks
Creation of new marine habitats around biophilic structures.	Artificialization of the environment and alteration of ecological balances.
Development of biodiversity associated with floating structures.	Attracting species without real increase in biodiversity at the ecosystem scale.
Development of algae crops and marine permaculture.	Invasive species, diseases, trophic imbalances, and ecological conflicts.
Potential support for biological productivity through artificial upwelling or depth-cycling.	Local eutrophication, algal blooms, and deoxygenation.
Development of a blue carbon ecosystem.	Net carbon sequestration not demonstrated and overall carbon balance unfavourable.
Creation of favorable zones for certain marine species.	Risks of collision, entanglement, and disturbance of wildlife.

Economy and financial model

Expected benefits	Associated risks
Creation of a new maritime economic sector in Polynesia.	Difficulty in structuring a sufficiently competitive local value chain.
High-end scientific regenerative tourism as a financing engine.	Excessive dependence on a wealthy international clientele.
Income diversification through co-activities.	Overestimated or insufficiently marketable secondary incomes.
Pooling operating costs and infrastructure.	CAPEX and OPEX are underestimated, especially for maritime equipment.
Creation of skilled jobs and new skills.	Difficulty in recruiting and training the necessary skills locally.
Potential for international replication and model spreading.	High adaptation costs and absence of a universal business model.
Attracting private and philanthropic investors.	Difficulty in reconciling financial profitability, public interest, and environmental requirements.

Territorial development and autonomy

Expected benefits	Associated risks
Potential reduction of food dependency in Bora Bora.	Insufficient local production or inadequate to dietary habits.
Contribution to energy autonomy.	Insufficient production, difficulty in connection and distribution.
Creation of economic activities complementary to land activities.	Competition with existing local companies.
Strengthening territorial resilience to climate change.	Dependence on complex infrastructure vulnerable to operational disruptions.
Development of a Polynesian maritime excellence sector.	Dependence on expertise, technologies, and external suppliers.

Sociocultural dimension and governance

Expected benefits	Associated risks
Residents' involvement in the design of the project.	Consultation without real influence over decisions.
Youth participation and development of new professional prospects.	Gap between the training offered and the real needs of the territory.
Preservation of cultural identity and traditional customs.	Perception of an artificialization of the relationship with the ocean or a privatization of maritime space.
Economic opportunities for fishermen and local stakeholders.	Conflicts of use, notably with fishing, navigation, and tourism activities.
Creation of an open education and research space.	Unequal access to profits and concentration of value among certain actors.
Public-private governance involving stakeholders.	Decision complexity and conflicts of interest between investors, operators, and territory.

Legal, regulatory, and insurance framework

Expected benefits	Associated risks
Development of a new model of maritime spatial organization.	Complex legal qualification of infrastructure and its activities.
Creation of a reproducible framework for other territories.	Significant differences between national and territorial regulations.
Development of new approaches to maritime governance.	Difficulty in distributing responsibilities among the different operators.
Potential for developing new insurance products.	Lack of coverage or disproportionate insurance premiums.
Contribution to the evolution of maritime management practices.	Administrative delays and uncertainties about the necessary permits.

Logistics, security, and operations

Expected benefits	Associated risks
Concentration of activities within an integrated whole.	Operational coordination complexity.
Pooling of transport and maintenance resources.	Dependence on maritime and weather resources.
Creation of a maritime services and logistics platform.	Supply disruption and equipment unavailability.
Development of new expertise in maritime safety.	Accident, fire, medical evacuation, or loss of critical systems.
Automation and remote monitoring.	Cyberattack, communication outages, and control system failures.

Risk prioritization

Priority risk	Initial probability	Potential severity	Criticality
Structural performance in extreme conditions	To be determined	Very strong	Very high
Failure of anchoring systems	To be determined	Very strong	Very high
Ecological impacts of deepwater pumping	To be determined	Strong	Very high
Insufficiently profitable business model	To be determined	Very strong	Very high
Inability to obtain appropriate insurance	To be determined	Very strong	Very high
Excessive dependence on tourism	Average	Strong	High
Underestimation of CAPEX and OPEX	Average	Very strong	Very high
Insufficient sociocultural acceptability	To be determined	Strong	High
Logistical or operational failure	Average	Strong	High
Disturbance of marine species	To be determined	Strong	High
Difficulty in marketing by-products	Average	Average	Moderate to high
Local recruitment difficulties	Average	Average	Moderate

Very high criticality
Risks that could jeopardize the overall feasibility of the project.

High criticality
Risks that could compromise an activity or economic viability.

Moderate criticality
Risks that can be managed through design, governance, or operational measures.

Mitigation measures and validation indicators

Risk	Proposed mitigation measures	Validation Indicators (KPIs)
Holding at sea	Numerical simulation, pond testing, independent engineering, redundant design.	Permissible loads, fatigue, movement, safety factors.
Deep anchoring	Geotechnical studies, dynamic modelling, testing, and inspection.	Line holding, calculated lifespan, availability.
Deep pumping	Hydrodynamic study, plume monitoring, and flow control.	Temperature, nutrients, dissolved oxygen, plume extent.
Biodiversity	Initial state, control areas, independent ecological monitoring.	Specific richness, abundance, biomass, presence of sensitive species.
Blue Carbon	Life cycle analysis and carbon accounting protocol.	Net carbon footprint, continuity, additionality.
Profitability	Audited business plan, degraded scenarios, sensitivity analysis.	SORT, VAN, DSCR, break-even point, occupancy rate.
Tourism dependence	Income diversification and gradual scaling.	Share of non-hotel revenues, concentration of revenues.
Social acceptability	Ongoing consultation, Local Council, co-decision mechanisms.	Participation, satisfaction, integrated proposals, local jobs.
Insurability	Early dialogue with insurers and classification societies.	Notice of pre-insurability, exclusions, premiums, and deductibles.
Logistics and security	Backup plans, redundancy, preventive maintenance.	Operational availability, response time, incidents.

APPENDIX 5

PANEL OF OFFSHORE INFRASTRUCTURES AND PROJECTS,

NONE IS A SMART OPEN-SEA ECOSYSTEM

INDIGO CIVILIZATION

OBJECTIVES : RESILIENCE & ADAPTATION

To escape environmental threats or invasions, people around the world have learned to live on water: the Bajau and the Moken in Southeast Asia, the Sama-Bajau in East Africa, the Malaita people in Oceania, the Uros in South America, the Venetians from the 5th century onwards, or more recently, the Dutch in Europe. They have adapted brilliantly with low-tech solutions available at the time to build resilient aquatic infrastructures: kelong, pile dwelling, lake city, etc.







OBJECTIVES : MISCELLANEOUS WORK

Between 2 and 3 million workers live at sea, offshore and at least half of the year, on mobile or fixed infrastructure: fishery, naval force, merchant navy, oil & gas platforms, cruise ships









OBJECTIVE: SURVEILLANCE

13 km from the British coast, the Maunsell Forts were built in 1942 to guard the Thames estuary against enemy invasion. Abandoned by the British army since the late 1950s, this infrastructure has still been in place for more than 80 years. Up to more than 2,000 people lived simultaneously on these maritime installations.

❌ Single-functional infrastructure
✅ Resilient offshore infrastructure



OBJECTIVE: OCEANOGRAPHIC RESEARCH

16 km off the coast of Venice, the Acqua Alta Oceanographic Tower has been measuring waves and tides in the Adriatic Sea for 45 years.

http://www.deos.tudelft.nl/ers/tower.html

❌ Shallow Monofunctional Infrastructure (16m)
✅ Resilient offshore infrastructure



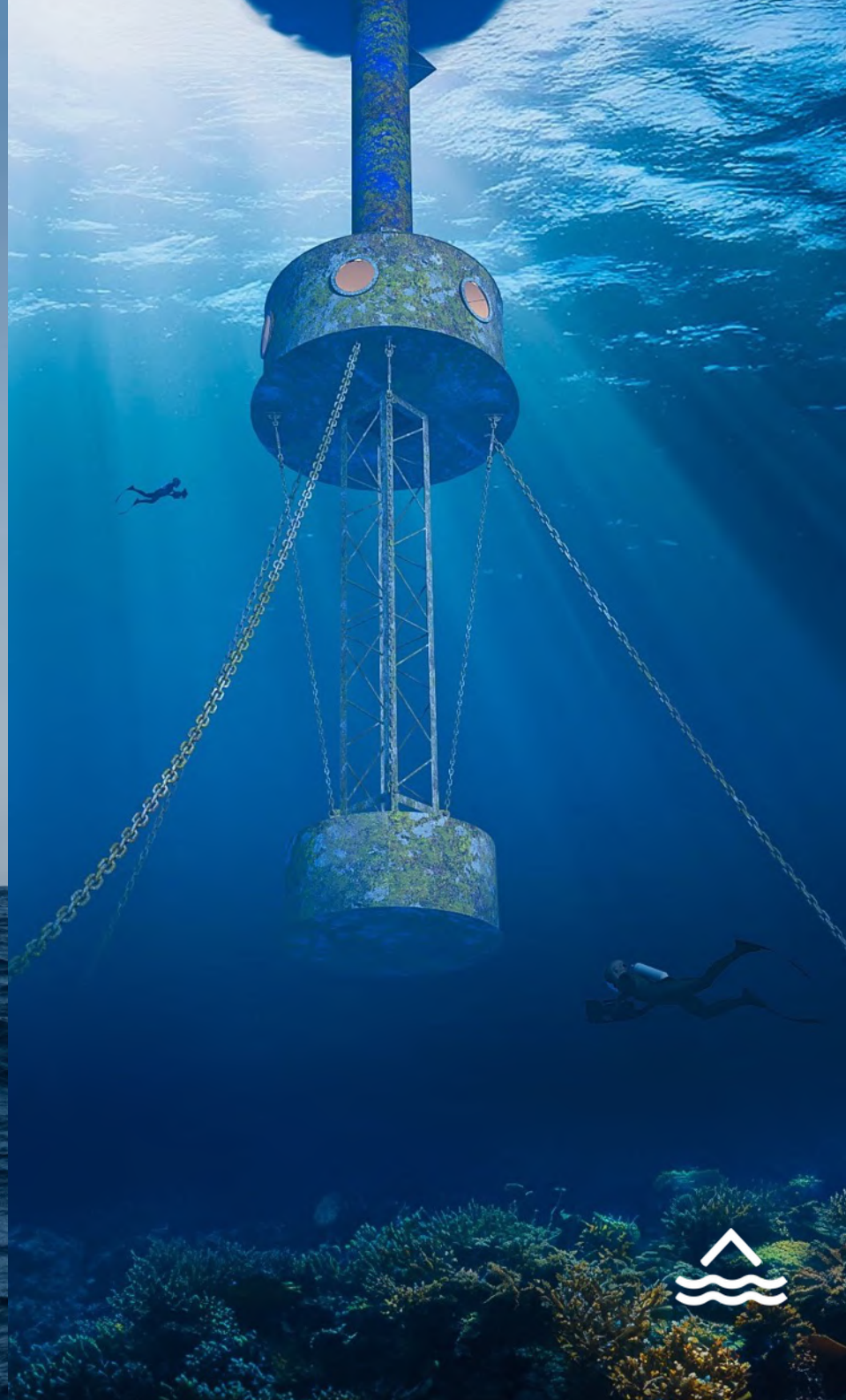
OBJECTIVE: INDIVIDUAL TEMPORARY HABITAT

In Panama, Ocean Builders creates and experiments eco-friendly high-tech floating homes (depth from 20 to 200m). Life above the waves: « at Ocean Builders we believe that true caring for the oceans requires one to actually live there ».

https://oceanbuilders.com

❌ High-end real estate project above all, limited local positive impact
✅ Small, biophilic smart offshore infrastructure







OBJECTIVE: RESILIENCE AND ADAPTATION, INCLUSIVE HABITAT

In March 2021, the Maldives formalized the start of construction of a modular floating city in the centre of an atoll. This country of 2000 islands having an average altitude of 2m is threatened by the inevitable sea level rise.

Delivery: from 2027
https://maldivesfloatingcity.com/

❌ Not self-sufficient in energy and food, waste management?
✅ Climate change adaptation habitat, integrated design

Crédit photo : Dutch Docklands / Waterstudio

OBJECTIVE: MULTIDISCIPLINARY RESEARCH

In the Canary Islands, PLOCAN project aims to become a world-class testbed that helps accelerate the development of technologies and knowledge to conserve, regenerate and use marine renewable resources in an efficient and sustainable way, ensuring equitable prosperity for users and effective environmental protection.

https://plocan.eu/en

❌ Grounded infrastructure incompatible with great depths, non-biophilic
✅ Very interesting Atlantic Maritime Future Laboratory



OBJECTIVE: ECO-TOURISM

In Malaysia, Seaventures Dive has converted an oil rig for scuba diving activities. Disused platforms become rich artificial reefs, conducive to eco-responsible aquatic tourism: upcycling of existing infrastructures and qualitative economic activities of eco-tourism. Around 15,000 offshore platforms have been identified in the world...

https://seaventuresdive.com

❌ Single-use and ugly infrastructure
✅ Reconditioning of relevant platform into artificial reef



OBJECTIVE: FISH FARMING

SalMar, a major player in global aquaculture, is testing an offshore Smart Fish Farm in Norway, 8 kilometres from the coast. The company aims to create the world's most reliable and intelligent offshore farming operations, with the highest fish welfare requirements and a zero-emission value chain ambition.

Under testing
https://salmarakerocean.no

❌ Single-use (fish farming), industrial design
✅ Infrastructure resistant to one of the most dangerous seas

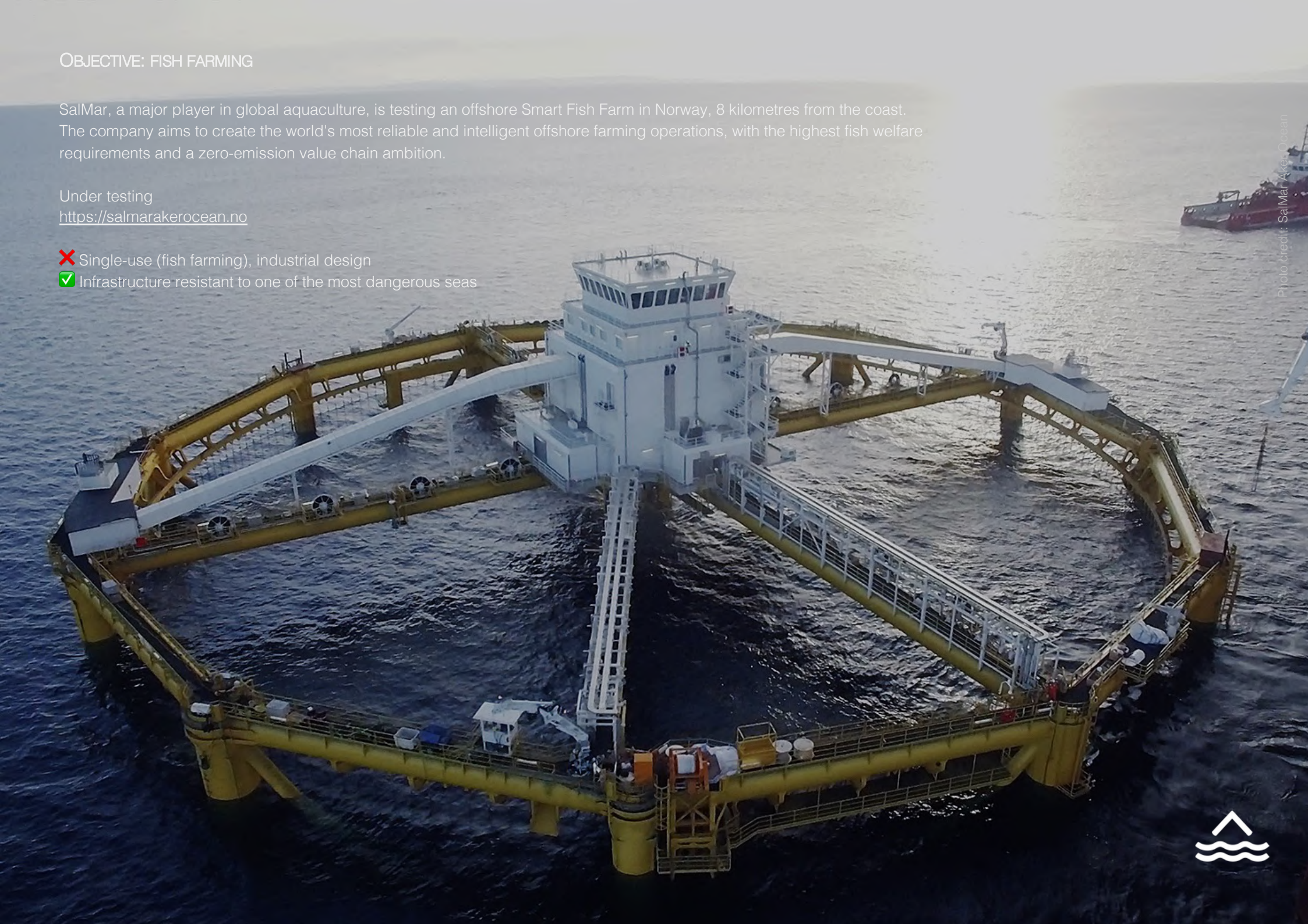
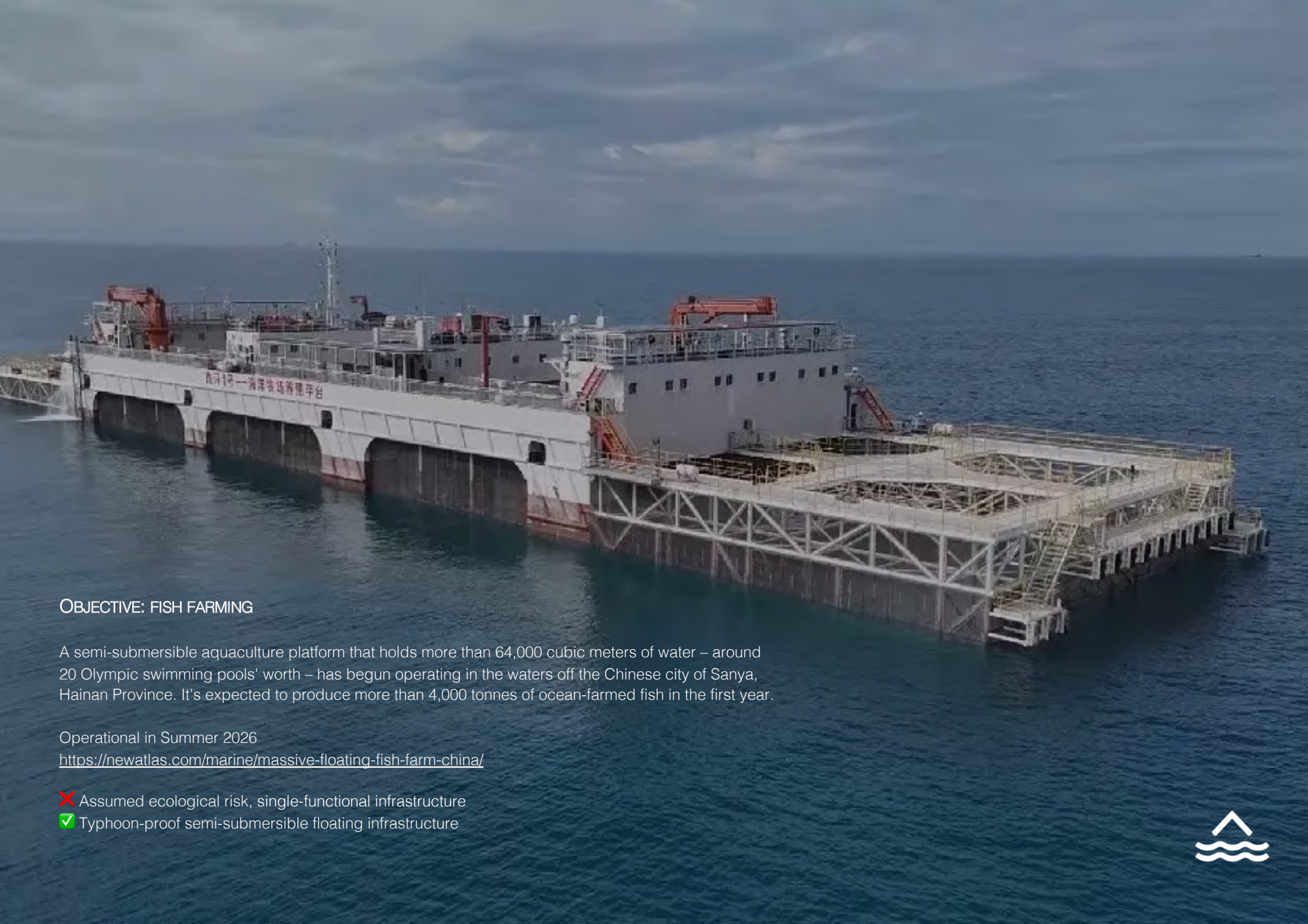


Photo credit: SalMar Aker Ocean



OBJECTIVE: FISH FARMING

A semi-submersible aquaculture platform that holds more than 64,000 cubic meters of water – around 20 Olympic swimming pools' worth – has begun operating in the waters off the Chinese city of Sanya, Hainan Province. It's expected to produce more than 4,000 tonnes of ocean-farmed fish in the first year.

Operational in Summer 2026
https://newatlas.com/marine/massive-floating-fish-farm-china/

❌ Assumed ecological risk, single-functional infrastructure
✅ Typhoon-proof semi-submersible floating infrastructure

OBJECTIVE: FISH FARMING

Mariculture Systems aims to become the first company to install a large offshore fish farm off the coast of Portugal in March 2026, from a semi-submersible platform. The first farm, approved by the Portuguese authorities, will grow sea bass and sea bream and will be located about 15 kilometres off the southern Algarve region of Portugal.

https://www.mariculture-systems.com

❌ Single-functional infrastructure
✅ Resilient offshore infrastructure







Photo credit: Elia

OBJECTIVE: PRODUCTION OF RENEWABLE ENERGIES

The Princess Elisabeth Island will be located almost 45 km off the Belgian coast and will be an extension of the electricity grid in the North Sea. It will connect wind farms from the sea to the mainland and create new connections with neighbouring countries.

Delivery : 2030
https://www.elia.be

❌ Single-use (energy) and non-biophilic industrial project
✅ Infrastructure resistant to one of the most dangerous seas

OBJECTIVE: PRODUCTION OF RENEWABLE ENERGIES

From 2030, Vindø will be the world's first floating artificial island to produce renewable hydrogen from offshore wind power on a large scale. Located a hundred kilometres from the coast, this 120,000 m2 structure will be close, in logistical terms, to offshore oil.

Delivery : 2030
https://www.windisland.dk

❌ Single-use (energy) and non-biophilic industrial project
✅ Open tough sea resilient infrastructure, human worker ecosystem



Photo credit: Vindø

PRIORITY OBJECTIVE: ECO-TOURISM

Dubai Reefs is a floating living laboratory project for supposed marine restoration and especially ecotourism.
The project aims to create more than 30,000 jobs in a green economy.

Delivery : 2030
https://urb.ae/projects/dubaireefs/

❌ Tourist vocation above all, real coastal ecological impact vs. anthropogenic activities?
✅ Biophilic project, non-invasive and floating infrastructure

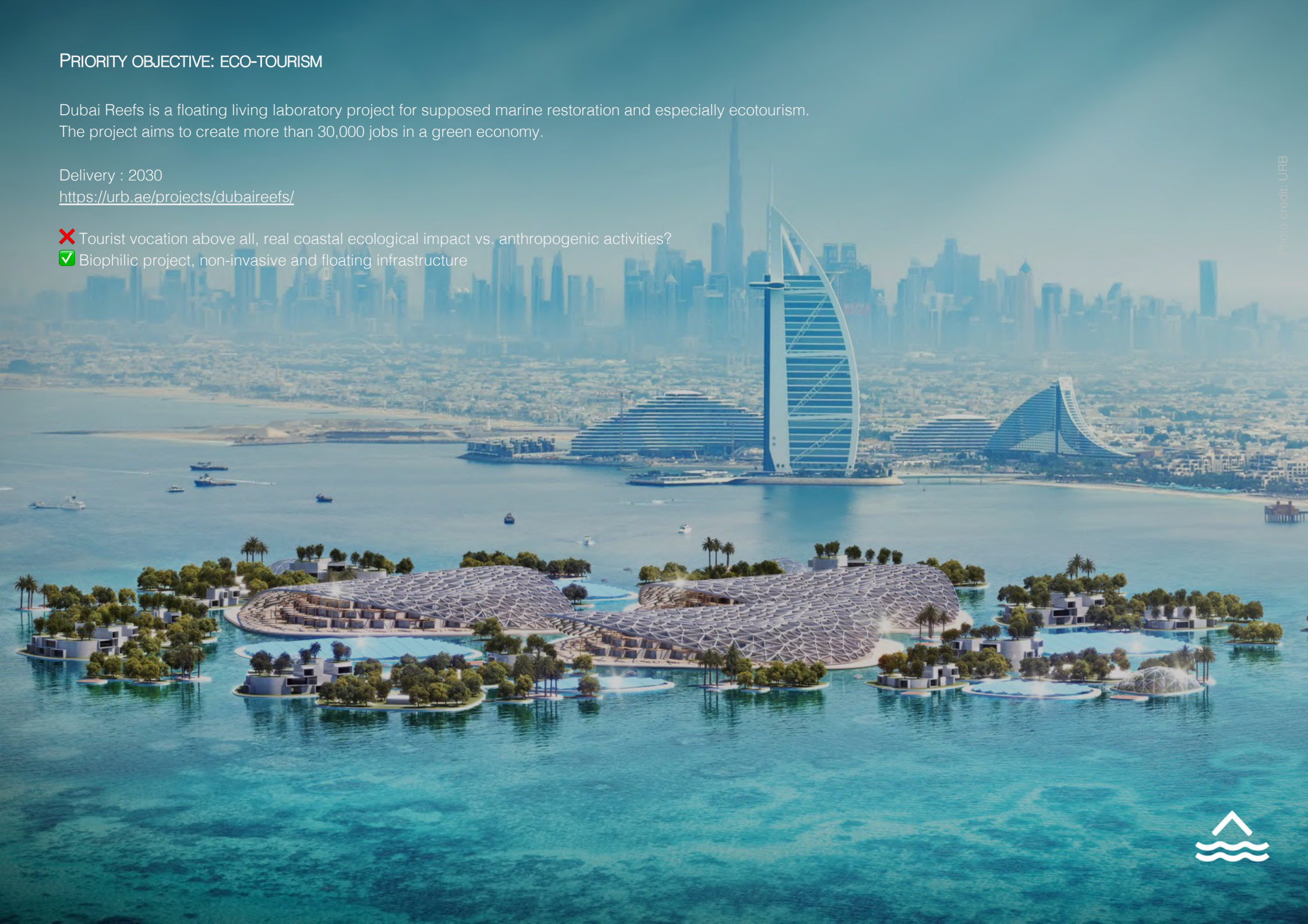


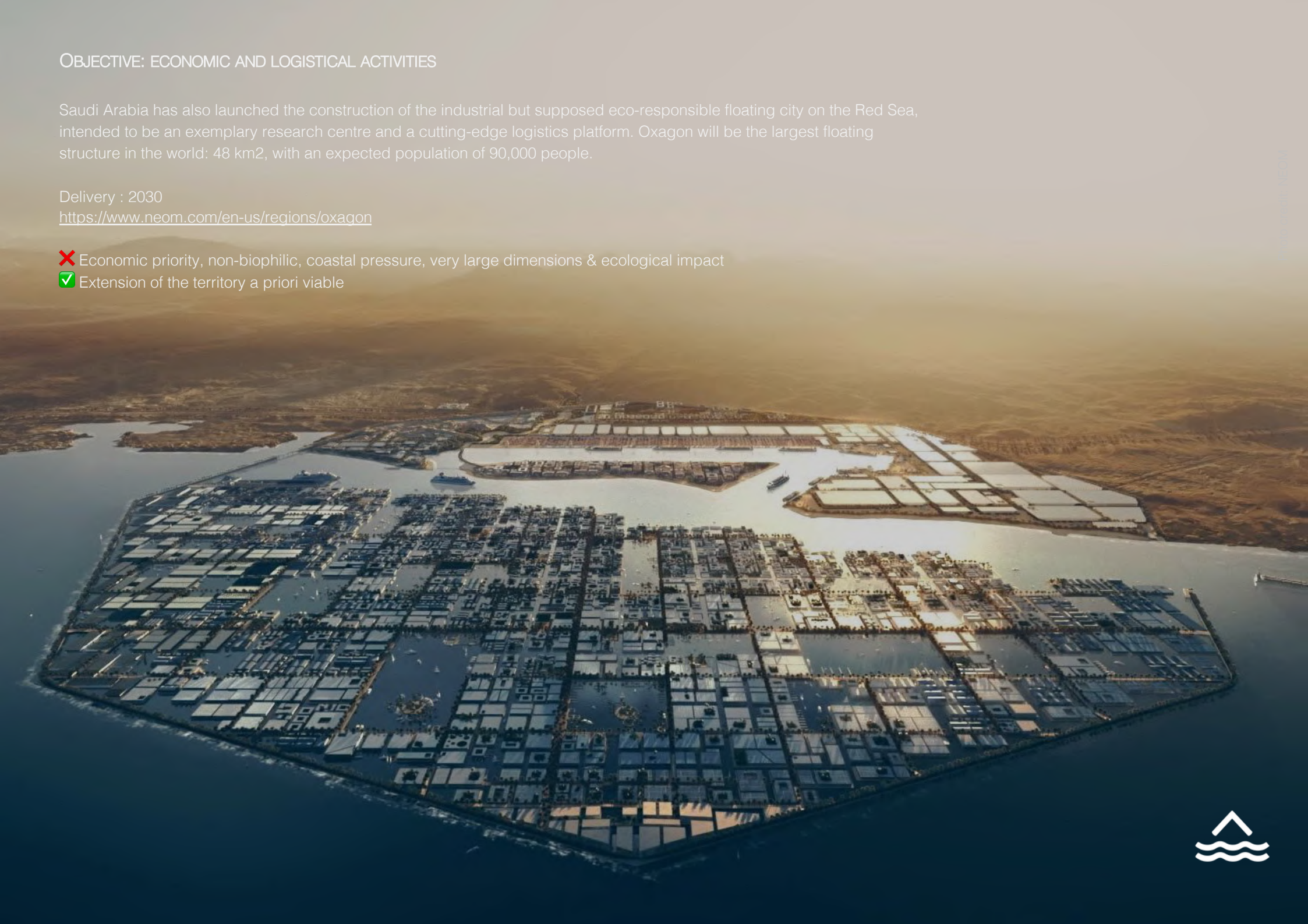
Photo credit: URB

OBJECTIVE: ECONOMIC AND LOGISTICAL ACTIVITIES

Saudi Arabia has also launched the construction of the industrial but supposed eco-responsible floating city on the Red Sea, intended to be an exemplary research centre and a cutting-edge logistics platform. Oxagon will be the largest floating structure in the world: 48 km2, with an expected population of 90,000 people.

Delivery : 2030
https://www.neom.com/en-us/regions/oxagon

❌ Economic priority, non-biophilic, coastal pressure, very large dimensions & ecological impact
✅ Extension of the territory a priori viable



APPENDIX 6

ABOUT TENSION-LEG PLATFORMS



INDIGO CIVILIZATION

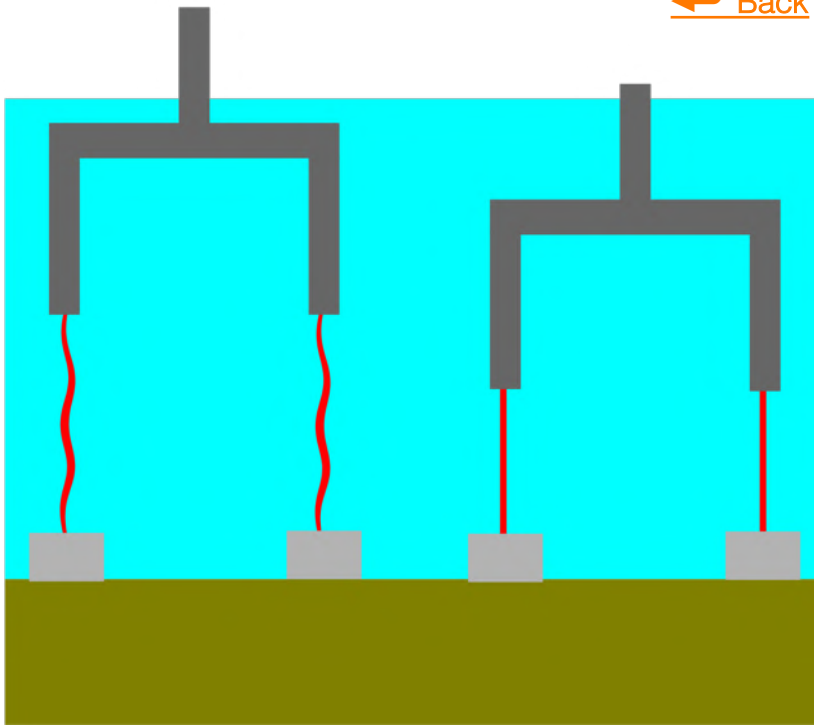
TENSION-LEG PLATFORM

SAFETY, STABILITY AND COMFORT IN DEEPWATER

Back

A tension-leg platform (TLP) or extended tension leg platform (ETLP) is a type of fixed marine structure, used for many oil platforms but also studied in the context of floating offshore wind turbines. Such a platform is connected to the seafloor by stretched steel cables. It is particularly suited for water depths greater than 300 metres (about 1000 ft) and less than 1500 metres (about 4900 ft). In the case of the Mangolia platform in the Gulf of Mexico, the water depth is 1,432 meters above the platform.

The platform is permanently moored by means of tethers or tendons grouped at each of the structure's corners. A group of tethers is called a tension leg. Having a high axial stiffness (low elasticity), tension legs keep he structure deeper in the water than its natural waterline — in other words, the platform has excess buoyancy. Virtually all vertical motion of the platform is eliminated.



Source: Wikipedia

Illustration of a tension leg mooring for a floating platform

Left-hand side: free-floating, cables (red) not under tension

Right-hand side: cables have been tensioned ballasted floating structure (grey) underwater cables (red) connect seabed anchors (light grey) with lower legs

APPENDIX 7

AIMING FOR AGILE TECHNOLOGY TO GAIN ENERGY SELF-SUFFICIENCY (OTEC)

INDIGO CIVILIZATION

ENERGY SELF-SUFFICIENCY OF SMALL ISLANDS

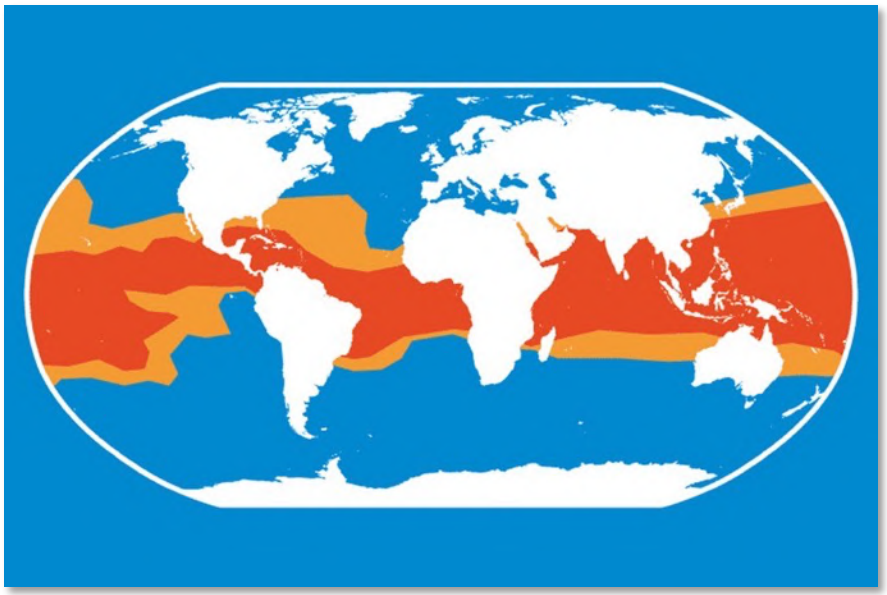
AGILE, COMPACT, MODULAR AND LOAD-BEARING OTEC TECHNOLOGY

Back

To supply an SOE that is also used for tourism and can accommodate 70 guests and its staff, we estimate an **energy requirement of 1,200 MWh/year**. To achieve the self-sufficiency of such a SOE, an **integrated OTEC unit with a net power of 150 KW** would have to be deployed.

However, the **compact offshore module such as the one currently being tested by Global OTEC in the Canary Islands aims to generate 500 KW** with a load factor of 90%. The surplus energy produced by the SOE will be used for decarbonised local and inter-island transport and will contribute to Bora Bora's energy demand.

Our project aims to make the efficiency and viability of small, compact, agile, modular and extremely resistant OTEC offshore units viable to meet the self-sufficiency needs of small island and coastal territories present in the red zone of the graph opposite.



Source: Global OTEC

GLOBAL OTEC

APPENDIX 8

BUDGET OF THE PHASE 1



INDIGO CIVILIZATION

Phase 1: Budget

105 K€ for a 18-month scheme

Back

Works		Subtotal	% of Total
01	Public consultation and project management	35 200 €	33,7%
02	Scientific symposium & framework	21 500 €	20,6%
03	Youth Actions	40 100 €	38,3%
04	Communication & PR	7 800 €	7,5%
Total		104 600€	100.0%

About 60% of this budget is financed by pro bono services. To access more details…

APPENDIX 9

ESTIMATED BUDGET – PHASE 2

INDIGO CIVILIZATION

PHASE 2 : ESTIMATED BUDGET

2,88 M€ OVER 36 MONTHS

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PROVISIONAL BUDGET	YEAR 1	YEAR 2	YEAR 3	SUB-TOTAL
Team meetings	20 000 €	20 000 €	30 000 €	70 000 €
Travel & operating expenses	35 000 €	35 000 €	50 000 €	120 000 €
Multidisciplinary Research & Innovation	850 000 €	675 000 €	870 000 €	2 395 000 €
Cartography & modelling of a 25 km2 marine area at Tupai	*300 000 €*	*- €*	*- €*	300 000 €
Marine Engineering + technical simulation (Hydromec+)	*30 000 €*	*50 000 €*	*120 000 €*	200 000 €
Naval architecture + 3D simulation	*50 000 €*	*50 000 €*	*100 000 €*	200 000 €
Oceanography + environmental impact survey	*75 000 €*	*125 000 €*	*150 000 €*	350 000 €
IMTA / algoculture + demonstrator	*150 000 €*	*150 000 €*	*150 000 €*	450 000 €
Marine energies (OTEC, H2, H2O) + demonstrator	*100 000 €*	*125 000 €*	*125 000 €*	350 000 €
Pollutions / rubbish / up-recycling + demonstrator	*80 000 €*	*110 000 €*	*110 000 €*	300 000 €
Mesology / Philosophy / Society	*40 000 €*	*40 000 €*	*70 000 €*	150 000 €
Financial and economic engineering and simulation	*20 000 €*	*20 000 €*	*20 000 €*	60 000 €
Governance / Legal	*20 000 €*	*20 000 €*	*20 000 €*	60 000 €
Project coordination and management	90 000 €	90 000 €	90 000 €	270 000 €
TOTAL	1 010 000 €	835 000 €	1 035 000 €	2 880 000 €

APPENDIX 10

COMBINING DIFFERENT SUSTAINABLE ENERGIES IN THE SAME SPACE

INDIGO CIVILIZATION

A RELIABLE AND UNIFIED ENERGY SYSTEM

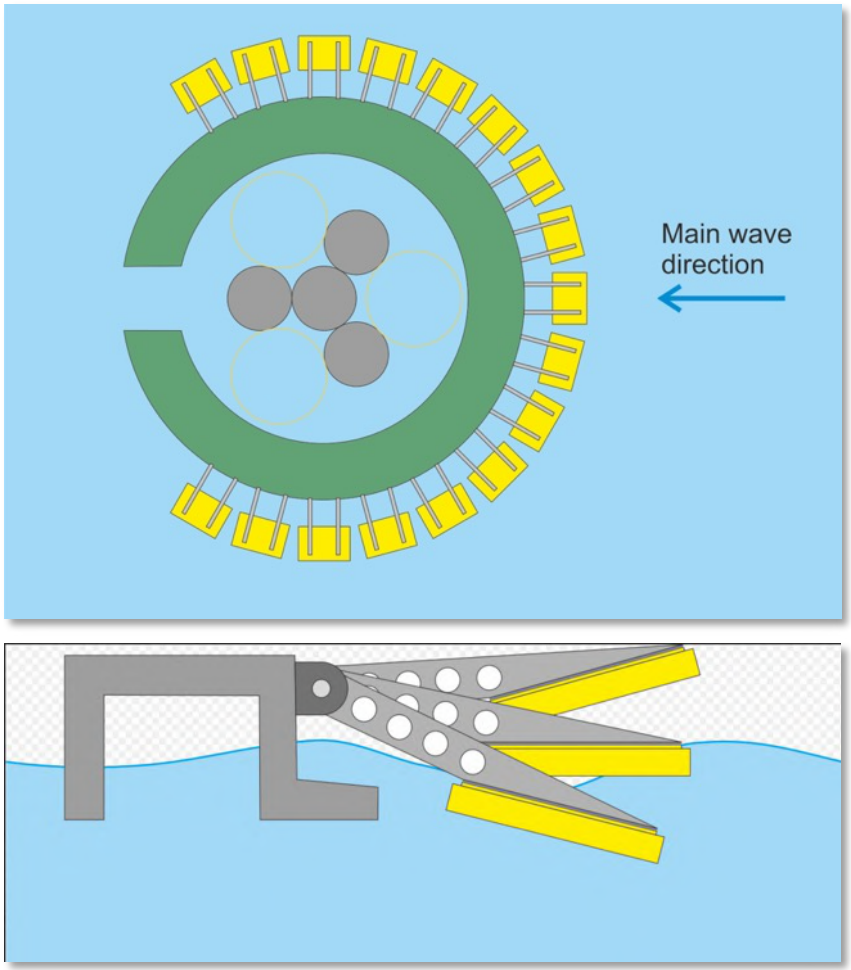
FRESH WATER AND ELECTRICITY PRODUCTION

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To supply an SOE that is also used for tourism and can accommodate 70 guests and its staff, we estimate an **energy requirement of 1,200 MWh/year**. To achieve the self-sufficiency of such an SOE, it would be necessary to deploy an **energy production unit delivering a net power of 150 KW**.

Inspired by its MediWave system, NoviOcean offers a simple unified system that harnesses the **natural energy of waves and swells** to produce not only **electricity** – **with an average power of 300 KW** – but also **fresh water** by reverse osmosis. This system can be easily combined with other types of sustainable surface energy: solar and hydroelectric energy. The surplus energy produced by the SOE will be used for decarbonized local and inter-island transport and will contribute to Bora Bora's energy demand.

Our project aims to make the efficiency and viability of small, integrated, agile, modular, and resilient offshore power generation units viable to meet the self-sufficiency needs of small island and coastal territories.



Source: NoviOcean

NoviOcean

Appendix 11

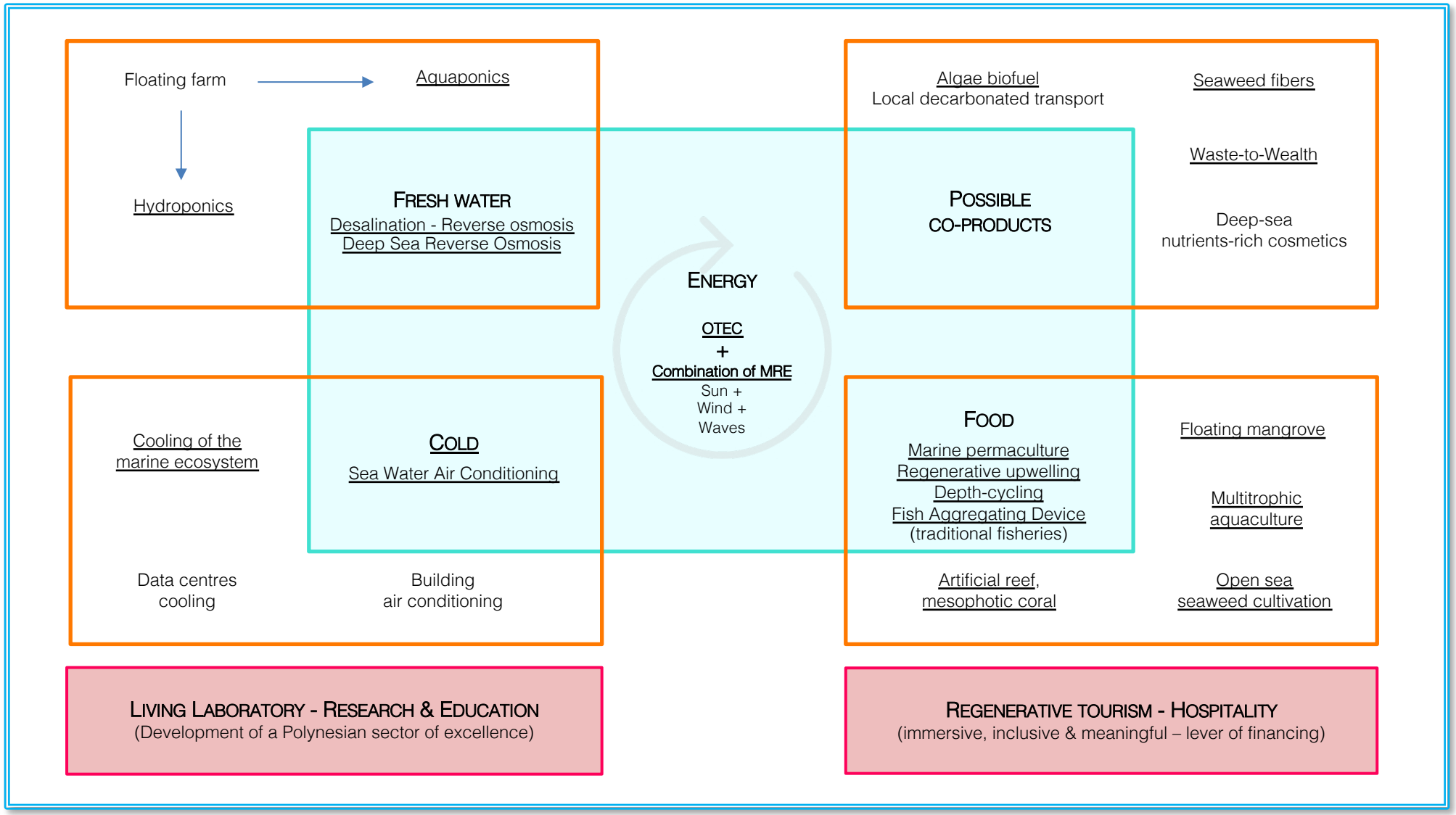
Map of possible intertwined co-activities



INDIGO CIVILIZATION

CIRCULAR MODEL TARGETING AUTONOMY AND UPSCALING

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APPENDIX 12

LINK TO FREQUENT ASKED QUESTIONS

INDIGO CIVILIZATION