Maripark Blueprint

EY

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INDEX

01

A baseline study answering the overall question, which similar initiatives are known around the world, and what lessons can be learned from them?

PREFACE/VOORWOORD 6

BASELINE 15

INTRODUCTION 17

RESEARCH PROCESS 19
- Background 20
- Status 21
- Geography 22
- Transition 24

SELECTED CASE STUDIES 27

02

A portfolio of potential business opportunities, through analysis of the activities and their respective high level feasibility, financial, and stakeholder value.

PORTFOLIO 51

INTRODUCTION 53
- Value potential 54

RESEARCH PROCESS 55

BUSINESS OPPORTUNITIES 61

PRELIMINARY CONCLUSIONS 88

03

An assessment towards a recommended legal framework, followed by a high-level legal structure and tax impact assessment, leading to a proposed organizational structure of a Maripark entity.

ORGANIZATION & STRUCTURE 91

INTRODUCTION 93

LEGAL FORM 95

TAX CONSIDERATIONS 103
- Profile 104
- Jurisidiction 110
- Enablers & Barriers 110
- State Aid 111
- Conclusion 112

ORGANIZATIONAL STRUCTURE 113

04

A transformation roadmap that will facilitate the transformation of an offshore windfarm to the first Maripark in the Dutch EEZ, which will serve as a template for subsequent initiatives.

TRANSFORMATION ROADMAP 117

INTRODUCTION 119

MARIPARK 2050
- Opportunity 120
- Direction 121
- Rethink 122
- Development 124
- Success factors 125
- Roadmap 126

APPENDICES 133

SOURCES 162

Voorbij de koudwatervrees

Een blauwdruk voor de succesvolle ontwikkeling en exploitatie van een Maripark, als cruciaal onderdeel van een duurzame blauwe economie.

Vóór de Nederlandse kust liggen de Nederlandse territoriale wateren: een stuk zee, driehoekig van vorm, ter grootte van anderhalf keer het Nederlandse landoppervlak. Het maakt deel uit van één van de drukste zeeën ter wereld, de Noordzee.

Sinds mensenheugenis wordt die Noordzee bevaren en bevist door de volkeren die eromheen leven. En nog steeds is de Noordzee een essentiële bron van voedsel, energie en welvaart voor de landen die eraan grenzen, met een unieke natuurwaarde.

We moeten opnieuw nadenken over wat de Noordzee voor ons kan betekenen, maar ook over wat wij voor de Noordzee kunnen betekenen

De vraag hoe we die bron van welvaart gebruiken, optimaliseren én beschermen, is in het licht van wereldwijde megatrends actueler dan ooit. Bevolkingsgroei, klimaatverandering en verlies van biodiversiteit dwingen ons om opnieuw na te denken over wat de Noordzee voor ons kan betekenen, maar ook -omgekeerd- wat wij voor een duurzaam gezonde Noordzee kunnen betekenen. Hoe kunnen we de ruimte op zee maximaal benutten voor duurzame voedselproductie en de opwekking van hernieuwbare energie, terwijl we tegelijkertijd haar natuurwaarde niet alleen respecteren, maar tevens stimuleren? Met andere woorden: hoe komen we tot een duurzame blauwe economie?

Deze studie richt zich op de ontwikkeling van een cruciaal onderdeel van zo'n blauwe economie: Mariparken. Een Maripark is een ruimte binnen de huidige en toekomstige windparken op zee die niet één enkele bestemming heeft (zoals tot nu toe gebruikelijk), maar waar meerdere activiteiten op gebied van voedsel, natuur en energie tegelijk plaatsvinden, waardoor de ruimte op zee beter wordt benut en schaalvergroting wordt versneld. Zie het als een duurzaam bedrijventerrein, maar dan op zee.

Uit deze studie blijkt om te beginnen dat de ontwikkeling van Mariparken wereldwijd nog in de kinderschoenen staat. Hoewel er enkele voorbeelden zijn van succesvol commercieel gebruik, bevinden de meeste projecten zich nog in de beginfase en blijken ze -zowel binnen als buiten windparken- lastig op te schalen. Daarvoor zijn meerdere oorzaken aan te wijzen, zo blijkt uit een inventarisatie van 50 van zulke projecten in de hele wereld. De benodigde initiële investeringen zijn hoog en de terugverdientijd is lang, met navenante risico's, waardoor private investeerders en andere partijen koudwatervrees hebben. Wet- en regelgeving zijn in de regel vaak nog onvoldoende toegesneden op het ontplooien van meerdere activiteiten tegelijk. Het blijkt lastig om de behoeften van verschillende gebruikers en belanghebbenden op elkaar af te stemmen waardoor synergievoordelen uitblijven. En de organisatie en het bestuur van Mariparken zijn vaak nog niet goed uitgewerkt.

Pilotprojecten over de hele wereld bieden waardevolle lessen voor Mariparken in de Noordzee

Tegelijkertijd wordt ook duidelijk dat al deze zaken opgelost kunnen worden. Uit een negental geselecteerde pilots zijn waardevolle lessen te trekken voor de ontwikkeling van Mariparken in de Noordzee. Zo blijkt bijvoorbeeld uit het Dual-Use offshore energiepark in Haiyang (China) dat er aanzienlijke voordelen kunnen worden gehaald uit het gedeelde gebruik van infrastructuur. Het Energy Island voor de kust van Denemarken is een recent voorbeeld van een publiek-private samenwerking. In Sanggou Bay (China) wordt grootschalige zeewierproductie rendabel gecombineerd met aquacultuur. Op de Thimble Island Ocean Farm aan de oostkust van de Verenigde Staten blijken financiële overheidsgaranties, gedeeld materiaalgebruik, een duurzame manier van oogsten en steun van de lokale gemeenschap een winnende combinatie. En het Oxagon project voor de kust van Saoedi-Arabië bewijst het nut van het opzetten van een solide organisatie voordat de daadwerkelijke ontwikkeling van start gaat. En dit is nog maar een greep uit de inspiratie die er óók in de hele wereld voor het oprapen ligt.

VOORWOORD

Het draait niet alleen om commerciële waarde, maar ook om maatschappelijke waarde en natuur-ontwikkeling

Er liggen dus kansen voor economische activiteiten indien we bereid zijn om voorbij bestaande kaders te kijken en beschikbare ruimte binnen de windparken optimaler te benutten. Deze studie heeft 19 verschillende mogelijke activiteiten onder de loep genomen, inclusief de ondersteunende activiteiten die daarbij komen kijken, zoals beveiliging en monitoring. Voor de beoordeling daarvan is een lijst met criteria opgesteld waarbij niet alleen is gekeken naar de financiële waarde van zulke activiteiten, maar waar ook de maatschappelijke waarde zoals natuurontwikkeling wordt gequantificeerd.

Daaruit blijkt dat met de kennis van vandaag, waarbij in enkele gevallen voorbij de huidige toegestane vormen van medegebruik binnen windparken op zee wordt gekeken, 9 economische activiteiten op termijn gefaciliteerd kunnen worden door een Maripark. Voedselproductie en energieopwekking spelen daarbij de hoofdrol, maar de kansen blijven niet tot deze sectoren beperkt. Het gaat om de volgende activiteiten:

- **Passieve visserij**
- **Schelpdierkweek (oesters en mosselen)**
- **Zeewierproductie**
- **Waterstofproductie**
- **Windenergie**
- **Drijvende zonnepanelen**
- **Energiewinning uit golfslag**
- **Onderzeese datacenters**
- **Duurzaam toerisme**

Van alle activiteiten gaan zowel de financiële- als de maatschappelijke waarde er flink op vooruit als ze onderdeel van een Maripark zouden zijn, grotendeels door de synergievoordelen die er binnen een Maripark gerealiseerd kunnen worden. Ook (ondersteunende) activiteiten met een hoge maatschappelijke waarde zoals natuurherstel, waarbij de financiële business case lijkt te ontbreken, kunnen binnen het Maripark worden ondersteund.

Met het inzicht in deze bedrijfsactiviteiten, komen ook de contouren van de faciliterende rol van de overheid in zicht. Die rol is vergelijkbaar met andere grote infrastructuur-projecten, waarbij een overheidsorganisatie de basisinfrastructuur ontwikkelt en in bezit heeft, de basis waarop bedrijven kunnen floreren. In dit geval zou de overheid bijvoorbeeld de ontwikkeling en het eigendom van vaartuigen voor meervoudig gezamelijk gebruik van en naar het Maripark op zich moeten nemen, kabels, verankeringen en andere infrastructuur kunnen aanleggen, maar ook na kunnen denken over kleinere platforms of kunstmatige eilanden, zodat de synergiën tussen de verschillende economische activiteiten maximaal kunnen worden benut. Maar zeker zo belangrijk in dat verband is de ontwikkeling van een ondersteunende juridische en fiscale structuur.

Omdat de ontwikkeling van nieuwe blauwe economiën nog onontgonnen terrein is, zijn er geen standaardoplossingen voorhanden voor de juridische structuur van Mariparken en de fiscale status die ermee samenhangt. Evenmin bieden de initiatieven in het buitenland die zijn onderzocht, een oplossing die zonder meer is te kopiëren. Toch kunnen er wel degelijk voorlopige aanbevelingen worden gedaan over de meest voor de hand liggende rechtsvorm, fiscale impact en organisatiestructuur.

Zowel een B.V. als een Coöperatie bieden de kaders voor vruchtbare publiek-private samenwerking

Kijkend naar de meest voor de hand liggende en kansrijke activiteiten binnen een Maripark, en rekening houdend met de eisen die de Nederlandse overheid aan staatsdeelnemingen stelt, zijn twee rechtsvormen voor een Maripark kansrijk: een Besloten Vennootschap en een Coöperatie. Beide rechtsvormen verschillen op deelgebieden, maar ze bieden beide de kaders voor een vruchtbare publiek-private samenwerking. Bovendien zijn ze zodanig ingeburgerd en 'geolied' dat ze uitstekende mogelijkheden bieden voor het runnen van een soepele dagelijkse operatie zonder onnodige complexiteit.

Belastingen kunnen – binnen de huidige wet – een bevorderende of een belemmerende factor zijn voor een Maripark-entiteit, voor de gebruikers ervan en voor andere stake-holders zoals de overheid (enablers en barriers). Denk bijvoorbeeld aan vrijstellingen, aftrekposten of lagere tarieven die leiden tot minder belastingheffing (enabler) of een onduidelijke of onbedoelde uitwerking van de wet met als resultaat onverwacht juist meer belasting of meer administratieve verplichtingen (barrier). Deze potentiële enablers en barriers hangen onder meer samen met de locatie van het Maripark: buiten of (deels) binnen de 12-mijlszone. Denk bijvoorbeeld aan vragen zoals: hoe pas je douaneregels toe in een Maripark dat op de 12-mijlszone-grens ligt? Of: is de infrastructuur voor een Maripark roerend of onroerend?
Bij het creëren van nieuwe enablers of het wegnemen van bestaande barriers – door een wijziging of aanvulling op de huidige wet – zijn de lange-termijn effecten, de samenloop met overig (groen) fiscaal beleid en de EU-regels voor staatssteun een aspect om scherp in het oog te houden. In een volgende stap zal het fiscale landschap gedetailleerd in kaart worden gebracht om bij te dragen aan een verdere uitwerking van het Maripark concept.

Een cruciaal uitgangspunt bij de aanbevelingen voor de organisatiestructuur is de wens om met Mariparken niet alleen financiële waarde, maar ook maatschappelijke en natuurlijke waarde te creëren en te borgen. Dat vraagt om sterke betrokkenheid van stakeholders, wat tot uiting komt in de toevoeging van een duurzaamheidscommissie op het niveau van de raad van commissarissen en een aan de RvB verbonden duurzaamheidsraad. Naleving van regelgeving, vooral met betrekking tot Veiligheid, Gezondheid en Milieu (HSE), moet worden gehandhaafd via een specialist (bijvoorbeeld een vertegenwoordiger van de overheid) in de Raad van Toezicht.

Omdat de overheid haar betrokkenheid na verloop van tijd kan beëindigen of verminderen, houdt de aanbevolen structuur rekening met een flexibele aanpak.

Een strategische routekaart schaart verschillende belanghebbenden rondom één gedeelde visie

De afgelopen decennia is veel tijd en energie besteed aan haalbaarheidsstudies, onderzoek, technologieontwikkeling en pilotprojecten. Maar nergens ter wereld is nog een voorbeeld van een werkelijk volwassen, succesvol en schaalbaar Maripark, als onderdeel van een duurzame blauwe economie. Er is dus ook nog geen betreden pad om daar te komen. Deze studie stelt als eerste een eerste aanzet voor een routekaart om dat doel daadwerkelijk te bereiken.

Naast de operationele waarde heeft de routekaart ook een cruciale mentale waarde: hij bevordert het bewustzijn rondom Mariparken en de blauwe economie, hij speelt een vitale rol in het communiceren van het transformatietraject en hij schaart de veelheid aan belanghebbenden rond één gedeelde visie.

DE ROUTEKAART BESTAAT UIT 4 STAPPEN:

1. De eerste stap beslaat de periode 2024 tot 2026, oftewel de eerste jaren vanaf vandaag. In deze periode moet de focus liggen op een overzichtelijk, goed te managen gebied binnen een windpark van rond de 1.000 hectare, een schaal waarop operationele processen getest en geoptimaliseerd kunnen worden. De investeringen in deze eerste fase moeten vooral in bewegende activa gedaan worden, zoals schepen en drijvende platforms, dan wel eilanden. Tegelijkertijd moet het organisatie- en besturingsmodel van de Maripark-entiteit worden opgezet en doorontwikkeld, en parallel daaraan kan de benodigde politieke besluitvorming plaatsvinden.

2. De tweede stap op de routekaart beslaat de periode 2026 tot 2028 en staat in het teken van expansie. Bouwend op de inzichten en ervaringen uit de eerste fase wordt de omvang en de impact van de activiteiten vergroot. Om de toenemende schaal en complexiteit goed te managen groeit ook de organisatie zelf mee.

3. In de derde fase (2028-2030) worden meerdere Mariparken operationeel. Ze worden onderling met elkaar en met vaste infrastructuur zoals eilanden en platforms verbonden, zodat er een netwerk van activiteiten ontstaat waarbinnen maximale synergie wordt gerealiseerd.

4. In de vierde fase, vanaf 2030 en verder, wordt het uitgerijpte concept gebruikt als blauwdruk voor de internationale uitrol naar gebieden met een sterke economische en demografische groei.

Om deze doelen te bereiken zijn er 6 kritische succesfactoren bepaald:

- **Een helder regelgevend kader,** rekening houdend met de complexiteit van offshore activiteiten en de tijd die het kost om die activiteiten te laten renderen
- **Een geïntegreerde fiscale strategie,** rekening houdend met de wettelijke enablers en barriers voor het Maripark en haar stakeholders (onder meer door de fysieke locaties van Mariparken) en de mogelijkheid om nieuwe enablers te creëren of barriers weg te nemen (rekening houdend met de Europese staatssteunregels)
- **Een effectieve financieringsstructuur,** rekening houdend met de belangen van zowel grotere als kleinere bedrijven, NGO's en (semi-)overheden en faciliterend voor innovatieve financieringsvormen ten behoeve van projecten die naast financieel rendement ook maatschappelijk en sociaal rendement opleveren
- **Effectief stakeholdermanagement en -communicatie,** rekening houdend met de dynamiek tussen verschillende partijen die opereren op een gedeelde basis
- **Planning in samenwerking,** rekening houdend met de belangen van verschillende partijen en met de ontwikkeling van nieuwe technologieën en veranderende omgevingsfactoren op zee
- **Borging en monitoring van veiligheid,** rekening houdend met de uitdagingen die gepaard gaan met een veelheid van actoren in een uitdagende offshore omgeving.

In de ontwikkeling van een duurzame blauwe economie komen twee dingen op een unieke manier samen.

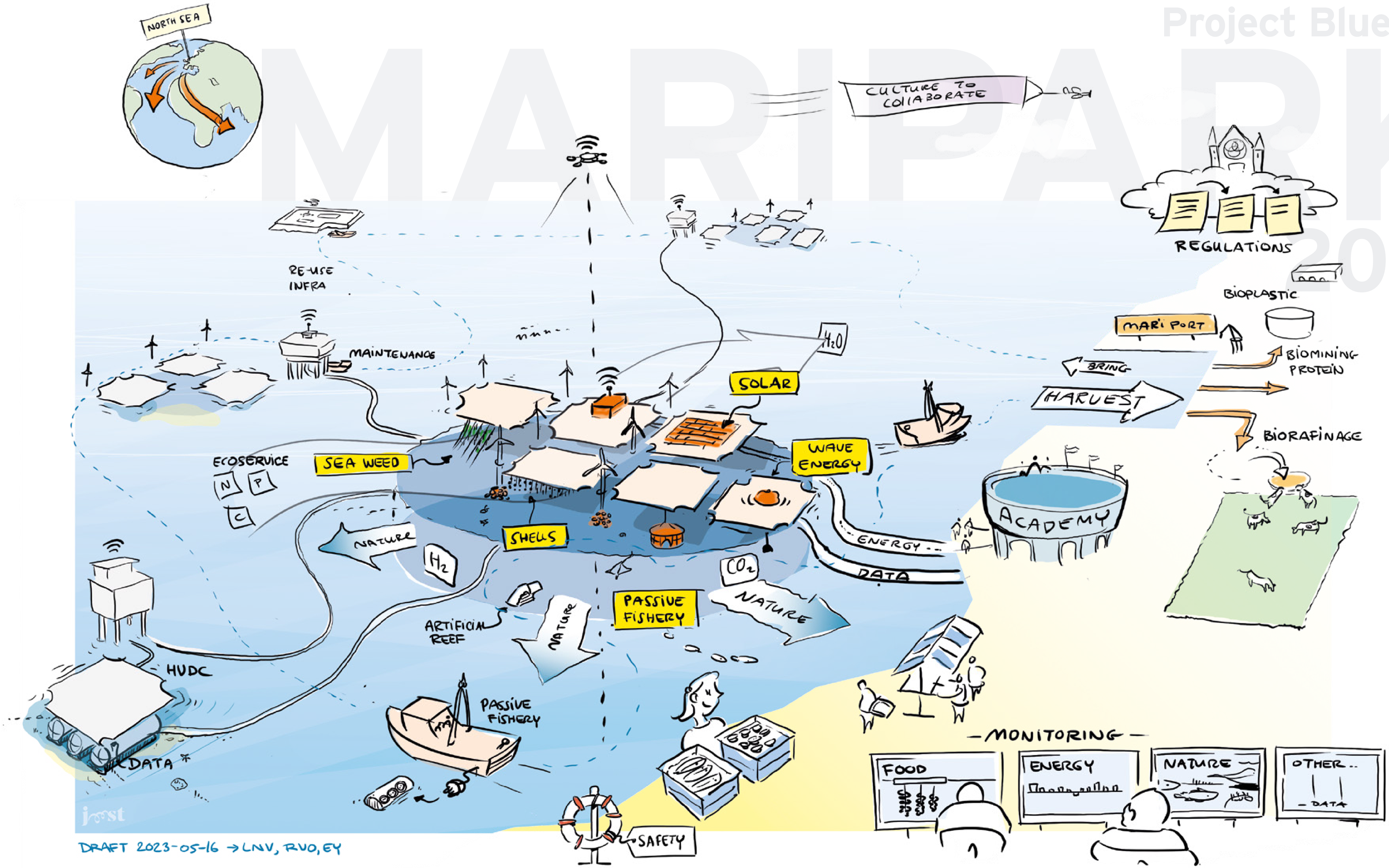
Het eerste is de noodzaak om economische ontwikkeling te creëren die past binnen nieuwe maatschappelijke normen. Daarbij is het beschermen van kwetsbare natuur alléén niet meer voldoende; we moeten een stap verder durven gaan en actief zorgen dat de natuur zich kan herstellen en kan floreren.

Een niet te missen kans voor Nederland

Het tweede is de maritieme expertise en het ondernemerschap waar ons land wereldwijd bekend om staat. Van visserij tot wereldhavens en van landaanwinning tot de Deltawerken, onze omgang met de Noordzee is al eeuwenlang een bepalend onderdeel van de Nederlandse identiteit en een succesvol exportproduct.

Beide aspecten bij elkaar opgeteld maken de ontwikkeling van Mariparken, als cruciaal onderdeel van die blauwe economie, een niet te missen kans voor Nederland. Deze studie biedt het vertrouwen om de koudwatervrees achter ons te laten en die kans met beide handen te grijpen.

MARIPARK 2050



01

Baseline

A baseline study answering the overall question, which similar initiatives are known around the world, and what lessons can be learned from them?

According to our research, no similar concept has been proposed elsewhere.

Baseline
Introduction

Context

Global megatrends – such as population growth, climate change, and environmental degradation – are driving the urgent need to rethink and optimize the use of ocean space. However, there is growing concern that the ocean space is being developed for single-use (an area solely used by one business activity); efficiencies in space use and synergies could be created by applying a more holistic approach. Developing an area to accommodate several business activities ("multi-use" or "MU"), making more efficient use of the ocean is part of the solution, as resources in close geographic proximity are shared, representing a shift away from exclusive resource rights. MU requires a specific governance structure as different stakeholder interests need to be aligned to create synergies, reduce risk and avoid conflict.

Approach

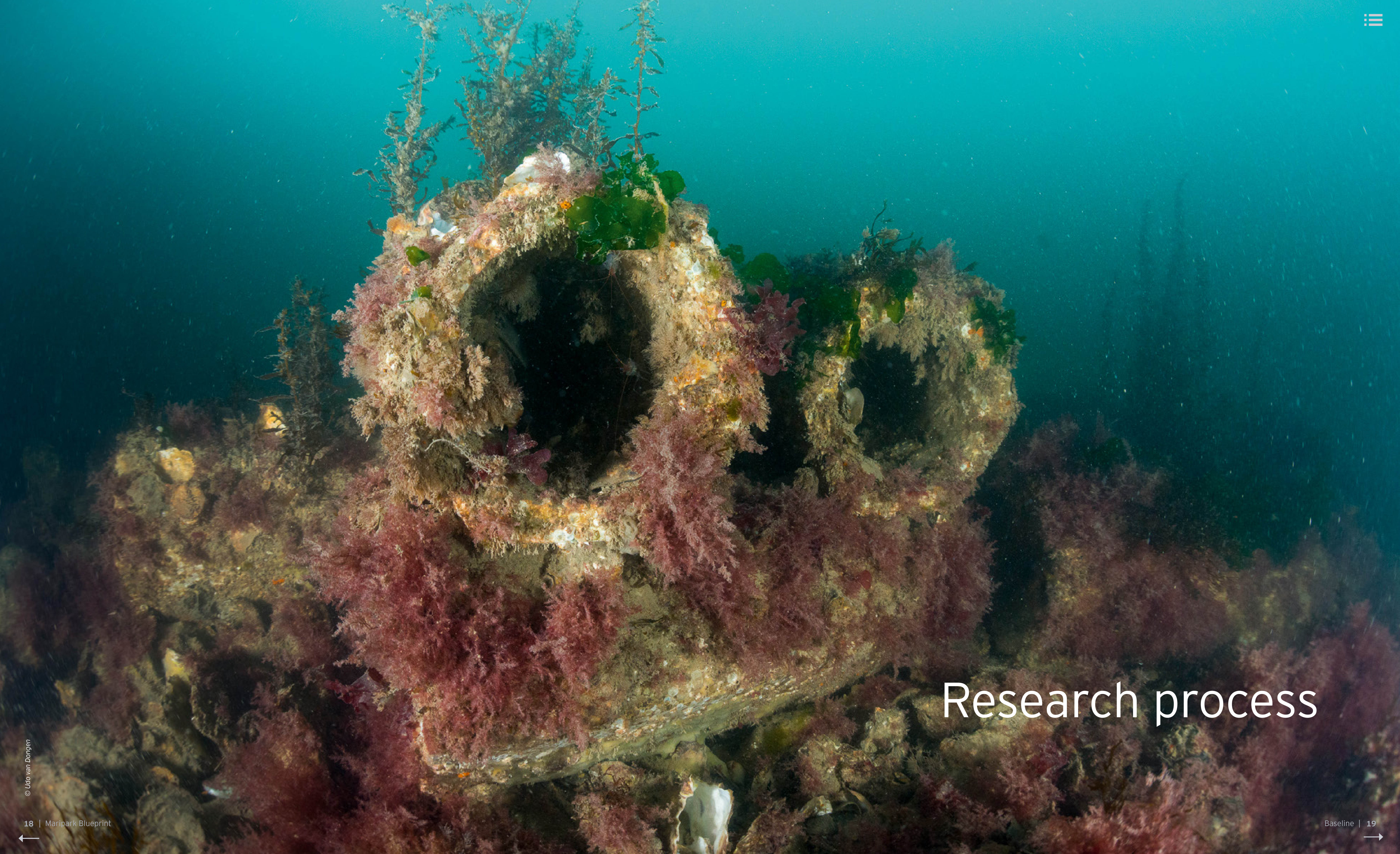
An analysis of similar initiatives from around the world has been conducted to establish a governance structure for a Maripark in the Dutch North Sea. The research process involved detailed review of scientific literature and reports for approximately 50 dual and MU projects. The selected projects are at various stages of development, ranging from research to commercialization. A shortlist of 9 projects was then created, prioritizing those that are more mature in terms of commercialization and, ideally, support both food and energy production. Interviews were conducted with project stakeholders, like business owners and project managers.

Findings

The outcome shows that, despite widespread efforts, there is a limited number of successful dual and MU projects, with this type of application being poorly executed globally and little evidence of commercial operation. In the North Sea, discussions on dual-use often focus on combining renewable energy with aquaculture. However, most of these projects have yet to advance beyond the research or pilot stage. The following pages detail lessons learned and provides an in-depth analysis of case studies.

Key takeaways

Multi-use projects offer a unique opportunity for industries to benefit from synergies, including cost savings from shared resources and infrastructure. However, realizing these benefits will require strong collaboration and trust across various industries. Managed coordination and governance will be critical to facilitate this sharing of resources. The research highlights that an effectively governed Maripark can serve as an ideal framework for the optimized use of ocean space. According to our research, no similar concept has been proposed elsewhere.



Research process

BACKGROUND

A Maripark could address pressing environmental issues and add societal benefits

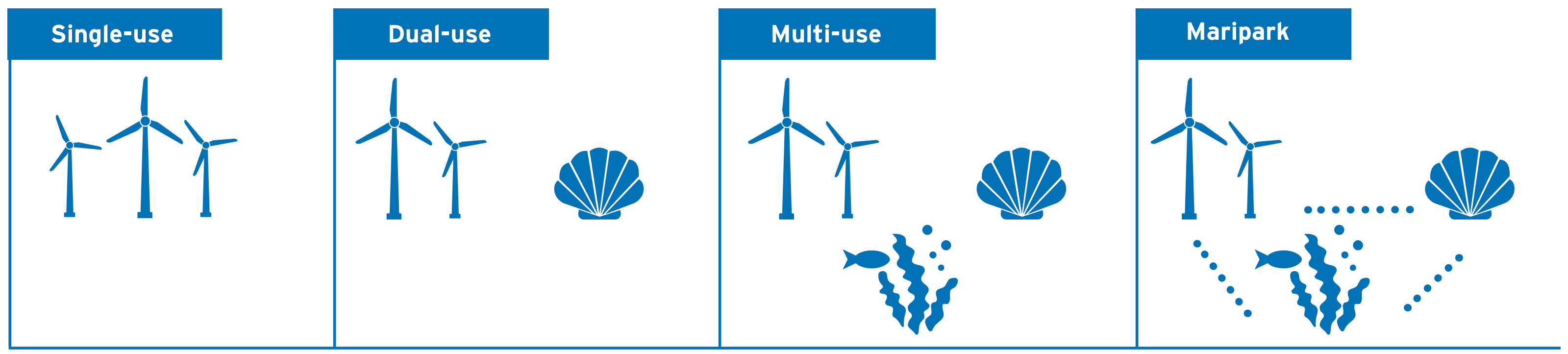
Scientific literature and reports were investigated, and expert interviews about global use-cases for MU were conducted. Commercial applications remain limited, despite research exhibiting feasibility and benefits.

The considerable efforts throughout the world, particularly in Europe, mainly involve small-scale initiatives, rather than MU applied at a commercial scale. The majority of projects have yet to develop beyond the piloting stage and are currently incapable of providing significant contributions to food production or economic value. However, there are several notable exceptions, such as the Thimble Island Ocean Farm Community Supported Fishery (CSF), which was started in 2010 in the US, where 60 acres of leased ocean grounds is being used for commercialization to grow kelp, oysters, clams and mussels.

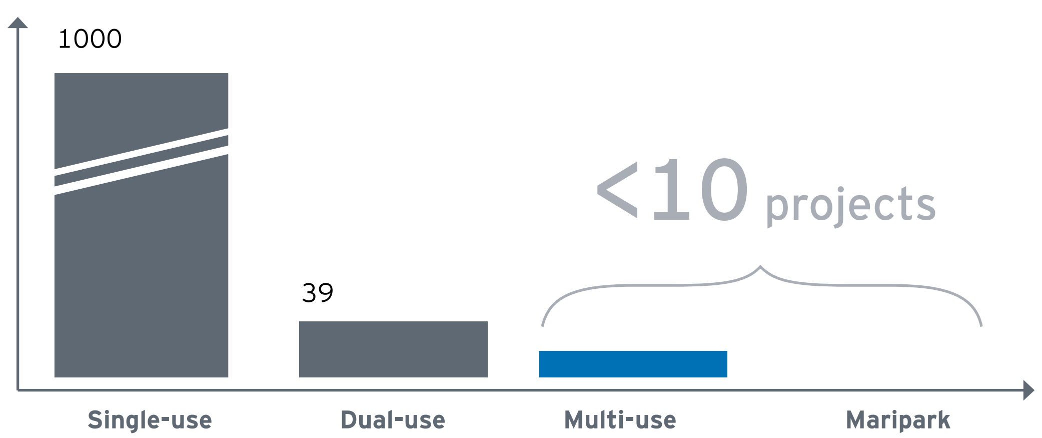
Despite being a potential key to solving many pressing environmental issues and adding societal benefits, the current progress in MU development may be too slow to reach commercialization in the near future.

Environmental issues (e.g. global warming, limited space on land and at sea) and societal benefits (e.g. job creation, economic growth) are addressed by developing the North Sea with MU in mind. However, MU development is similar to the lifecycle of offshore wind and hydrogen, as significant initial investments are required to reach commercialization stage. This results in high levels of risk being involved, discouraging many private sector investors. Therefore, ongoing and planned projects tend to rely on public funding for research and technology development and are locally supported by marine spatial plans*. Many of the benefits – such as sharing of infrastructure, development costs and production synergies – are still theoretical and need to be validated in real-world settings. For example, the AquaWind project in Spain showed promising results in its harborside trials for combined wind energy and fish farming. Yet, it will only provide full demonstration of its potential by 2026, when it is planned to become operational.

A move is foreseen from single-use towards multi-use and a more holistic integrated use of the ocean



Maripark would be the first of its kind as there is currently a lack of fully developed projects [1]



* A marine spatial plan is an important tool for addressing the challenges of increasing demand for ocean resources and the potential for conflicts between different uses. It aims to organize the use of ocean and coastal resources in a way that balances the needs of different stakeholders and users. It involves mapping out the locations of different activities and uses in the marine environment, such as shipping lanes, fishing grounds, and protected areas, and then developing plans and policies to manage and coordinate these activities.

STATUS

Current projects face significant risks and legislative hurdles, resulting in projects failing to benefit from the potential symbiosis of a Maripark

The analysis shows that the development of MU projects is a complex and lengthy process, with multiple challenges and obstacles.

MU ocean projects are often marked by prolonged periods of planning and permitting, followed by small-scale piloting. This differs from renewable energy projects, which are increasingly gaining legislative traction. For example, the North Sea Energy Island in Denmark requires an estimated ten years of planning and five years to implement. Even after this time, very few commercial MU applications have become operational and even fewer have become profitable.

There can be multiple reasons for not moving forward, linked to high levels of complexity and a large number of stakeholders.

Obstacles to progress can include a lack of funding, political support, understanding of stakeholder needs, and/or appropriate regulatory frameworks, along with technical obstacles. For example, AquaLast in Germany did not progress to commercialization as the applied technology failed to deliver the expected results. The overall complexity and the number of stakeholders involved demonstrates the need for a clear governance structure.

Many of the analyzed projects have been going through extensive planning and piloting, but only a few have been operationalized.

A lack of available, comprehensive data and knowledge about the business opportunity's effect on the ocean's ecosystem can impede planning and implementation of these projects. This can increase costs and create uncertainty regarding the long-term feasibility and sustainability of the projects. Additionally, expanding from the pilot stage can be hindered due to increased understanding of the effects on the area such as the ecological and environmental impact.

Many of the analyzed projects have been going through extensive planning and piloting but few have been commercialized

	Planning		Pilot		Implementation		Operationalization
	Start	Duration	Start	Duration	Start	Duration	Start
Haiyang Offshore Energy	2019	2y	2021	<2y	2022	11y	2024
North Sea Energy Island	2017	10y			2028	5y	2033
Lerøy Ocean Harvest							2017
Edulis	2013	1y	2017	3y			
Thimble Island Ocean Farm					2005	<1y	2005
Aquawind			2022	4y			
Oxagon	[2021]	[1]y			2022	2y	2024
Sanggou Bay							late 1980s
Liaoning Province							N/A**

Commenced – ended | Commenced – current | Planned | No data / Not applicable

**Zhangzidao Group Co.Ltd (ZONECO) was established in 1958. Reliable aquaculture data can be found from 2000 onwards.

THE NORTH SEA

GEOGRAPHY

Joint initial planning is critical to realize financial viability and commercialization

Multi-use within wind farms is still in its infancy, meaning that practices can change over time due to new development.

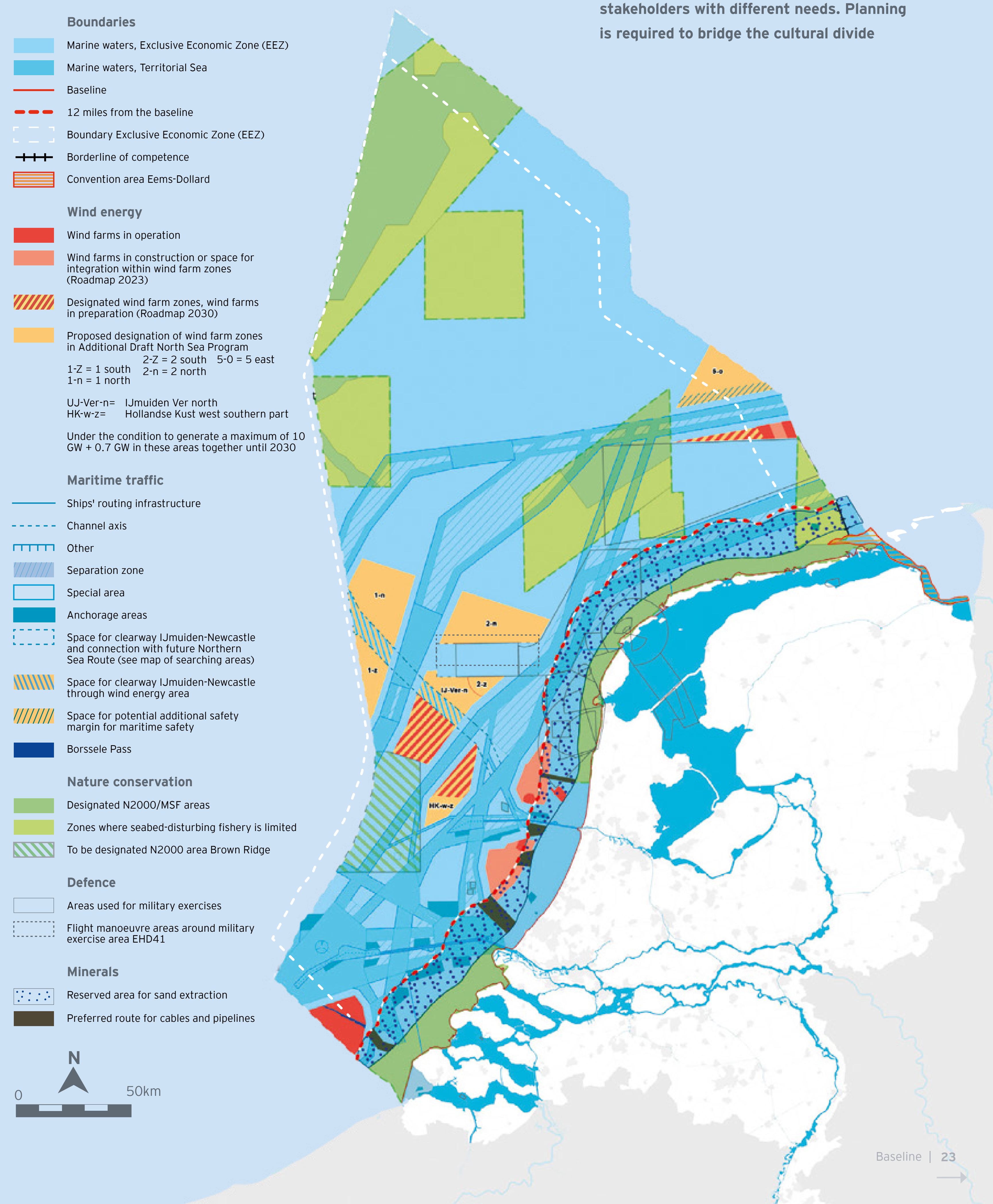
MU of oceans and seas introduces multiple risks that are best handled with a wide range of stakeholders. The existing frameworks for handling multiple activities tend to be sector-specific with little integration between the various uses. To enable significant growth, it is necessary to bridge the cultural divide among various ocean space stakeholders, such as between wind farm developers and the fishing industry. Platforms and tools that could enable successful development are available – such as the Community of Practices North Sea on Marine Spatial Planning. However, individual actors still tend to view themselves as independent entities rather than as interconnected components in the system. A harmonious approach to MU must integrate risks, maritime safety, and environmental impacts [2]. Barriers to project development may include obtaining permits, navigating the regulatory frameworks and a missing financial safety net.

Financial and environmental benefits are expected to be realized when activities at sea are planned together in the starting phase.

Co-planning at the early stages of development enables the optimization of the area and resources, and more efficient deployment. For example, shared infrastructure, such as maintenance and harvesting vessels and buoys, can be procured together and shared, reducing the investment need per activity.

STRUCTURAL VISION MAP NORTH SEA

The North Sea is currently used by various stakeholders with different needs. Planning is required to bridge the cultural divide



TRANSITION

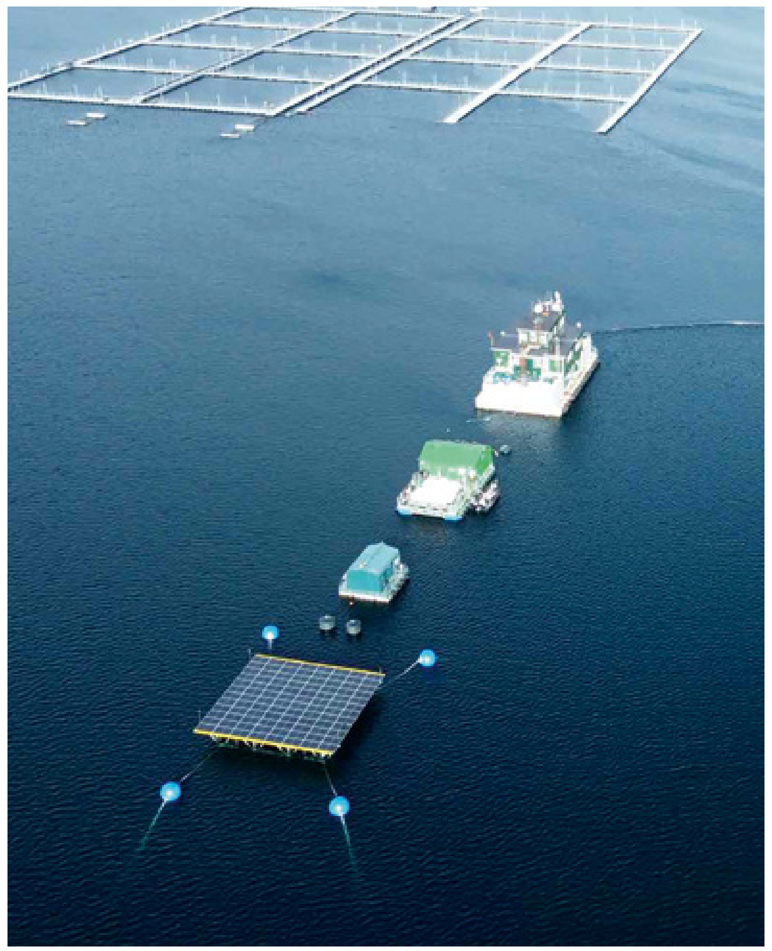
Existing projects showcase the need for close stakeholder management and governance structures need to be further developed

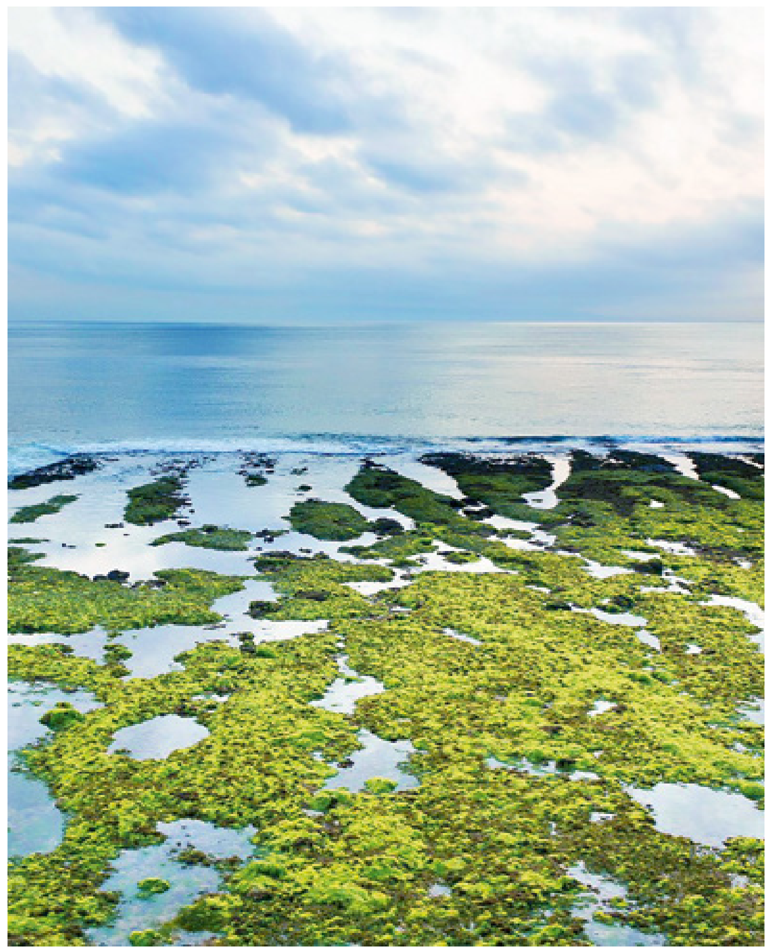
The majority of case studies are pilot and development projects, therefore the governance and legal issues are expected to differ from commercialized projects.

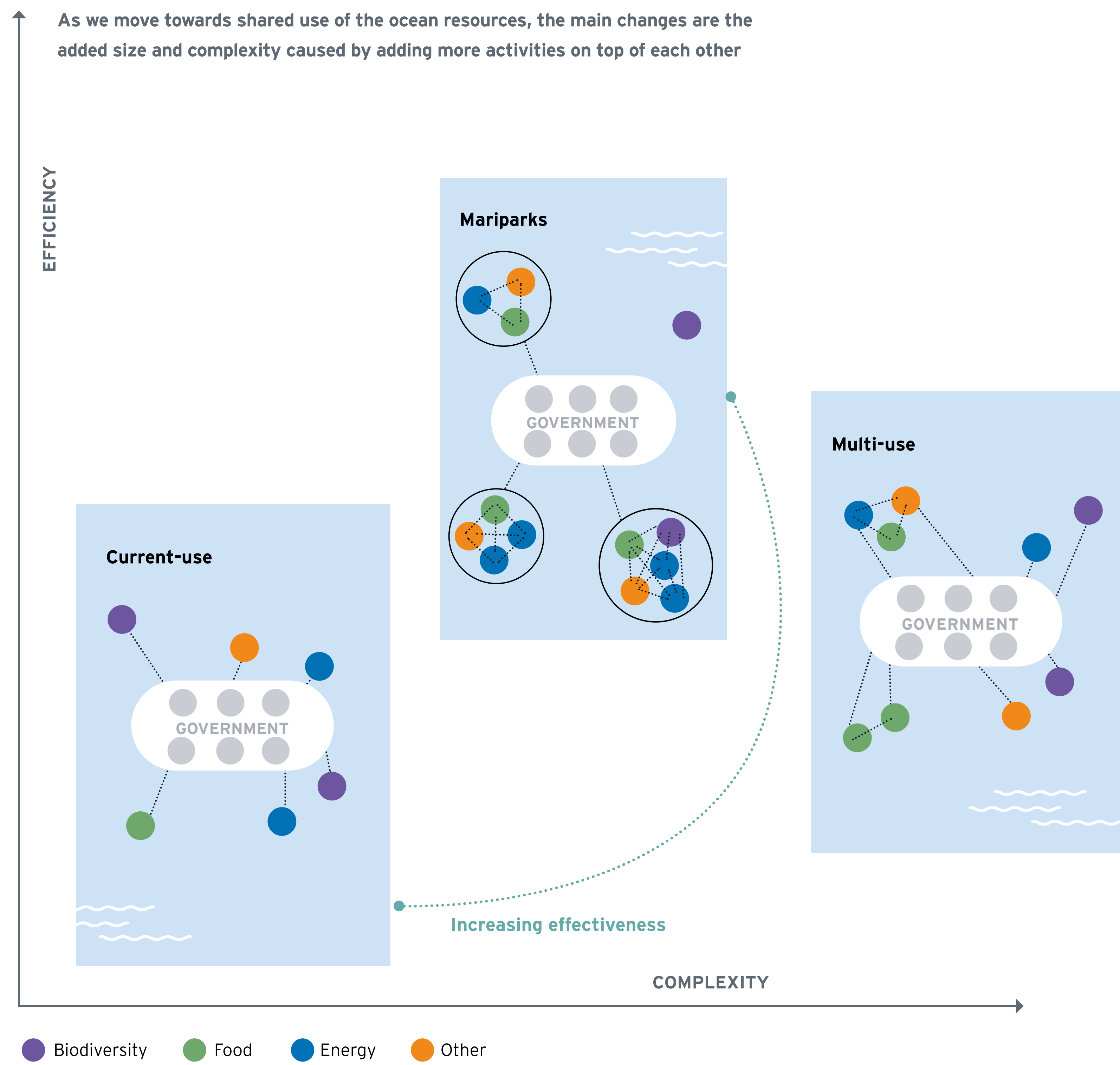
Current governance structures are limited as there are no existing commercial-scale Mariparks in the world. The selected cases lack the scale and complexity of the Maripark's expected commercial operations. In a Maripark, there needs to be a heightened focus on safety to address the increased complexity, driven by the close interaction between multiple stakeholders in a narrow space. Due to the unknowns in managing these operations, it is crucial that the Maripark governance has a multidisciplinary approach that incorporates areas such as operational services.

The study of global cases and applications provides useful reference points, but the extent to which this knowledge is transferrable to the North Sea remains uncertain.

The diversity of MU types and applications is highly location-specific and depends on the contextual conditions such as support within local communities of MU initiatives, local policies and biogeography. The North Sea is characterized by harsh conditions with strong winds and short and high waves, causing offshore activities and operations to be more complex and thereby expensive. Further, local conditions are unique, requiring adaptive management plans to reduce uncertainty [3]. However, governmental involvement, through regulations and incentives, has been a driving force for many of the case studies analyzed. Therefore, government involvement can be seen as a universal, and not location specific, topic.








© Mark Barto

Selected case studies on multi-use

CASES

The case studies highlight some characteristics of multi- and dual-use

Globally, a significant number of initiatives focused on dual- and multi-use in oceans can be found.

Europe, in particular, has emerged as a leader in the development of these initiatives and research. More than €65m has been placed into EU projects targeting dual- and multi-use. Additionally, other regions around the world are also starting to show interest in MU ocean projects.

Identified initiatives mainly aim to demonstrate the feasibility and potential of using oceans in a multi-purpose way.

Despite few projects converting to profitable business to date, all initiatives provide insights and lessons learned that are beneficial to advance the Maripark concept.

48 EVALUATED DUAL- AND MULTI-USE PROJECTS | **30** COUNTRIES

9 projects have been researched in more detail, based on their maturity and a focus on food and energy production, while also providing benefits for nature.

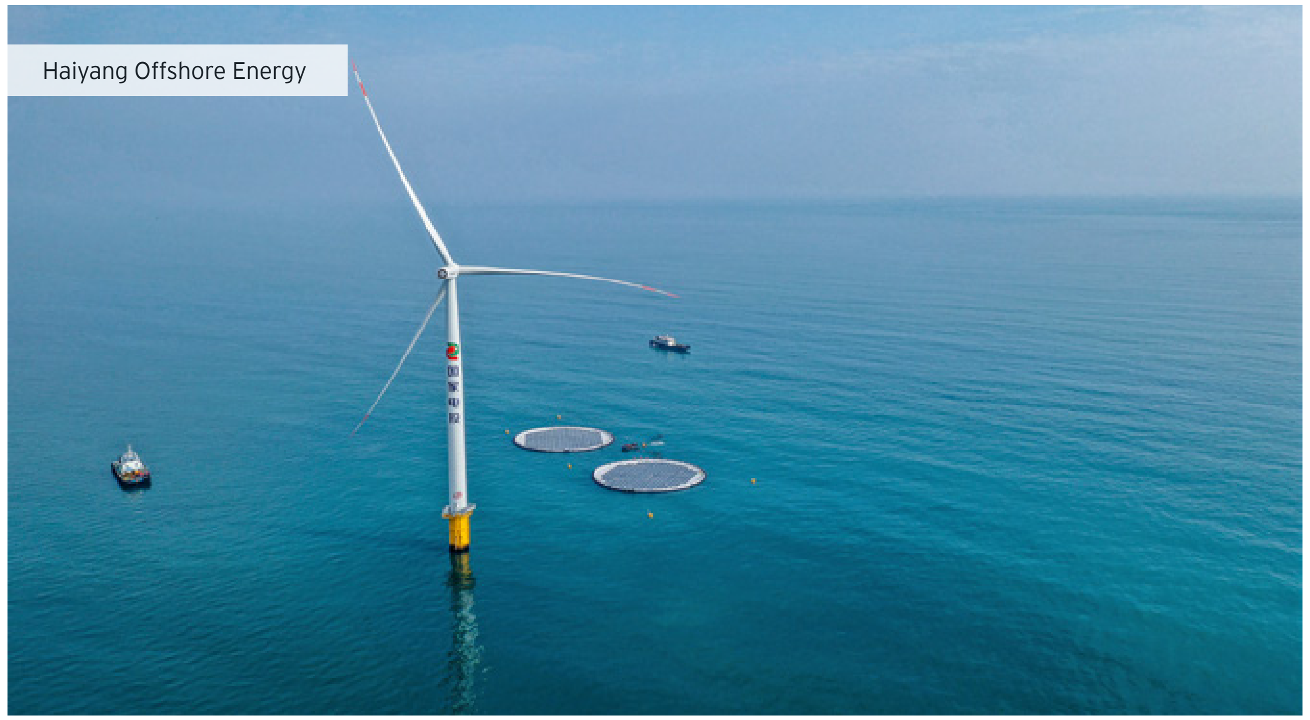
Three elements of specific interest have been highlighted: governance structures, stakeholder models and involvement, and business challenges that were faced in these projects. These three areas can provide valuable lessons for the Maripark development in the Dutch North Sea.


Edulis

© Gust Lesage


Danish Energy Island

© Danish energy agency


Haiyang Offshore Energy

© Ocean Sun


Oxagon

© NEOM


Thimble Island Ocean Farm

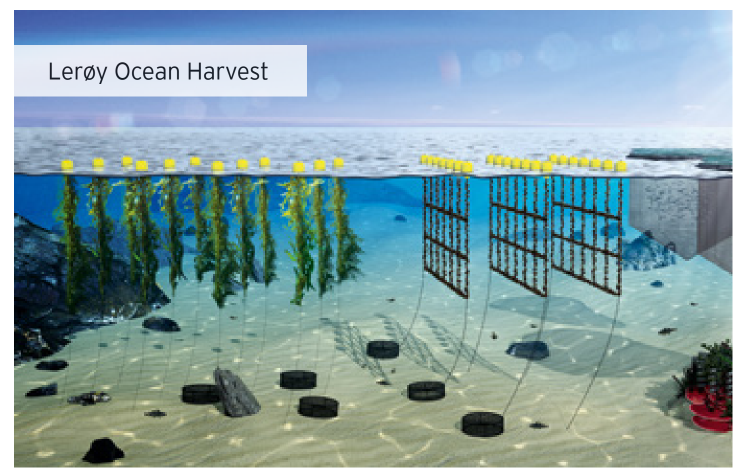
© GreenWave


AquaWind

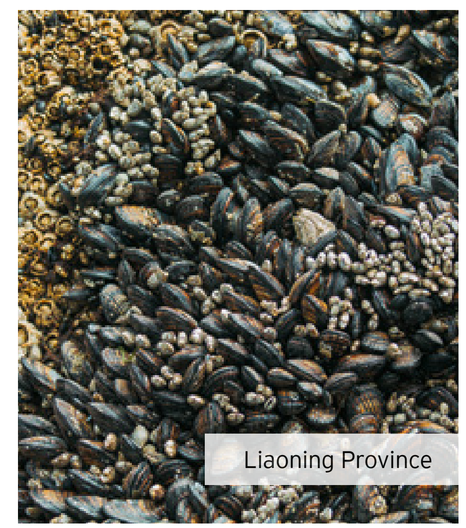
© W2Power technology


Sanggou Bay

© Øivind Strand / Institute of Marine Research

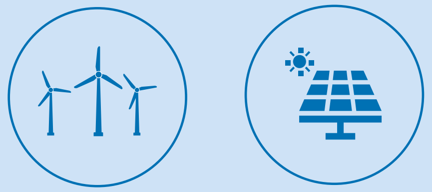

Lerøy Ocean Harvest

© Lerøy Seafood


Liaoning Province

01 SELECTED CASE

Haiyang, offshore energy in China



Wind energy

Floating solar

TRL

Lessons learned

The dual-use project was not planned as such in the beginning and floating solar was added only after the wind farm was finished. Nevertheless, synergies could be realized due to the joint usage of infrastructure. Further, adding floating solar to the monopiles optimizes the grid usage and diversifies the energy mix. Globally, there are thousands of ground-fixed monopiles with large potential to combine solar energy with offshore wind. In addition, case #1 offers a successful example of an offshore implementation of floating solar.

Innovations

This project marks the world's first offshore floating hybrid wind - solar project, following successful onshore and nearshore pilot. The wave height of more than 10 meters makes the local conditions challenging.

Scalability

Large-scale energy production depends on the level of output generated, driven by solar irradiation, downtime due to environmental conditions and other outages. It is necessary to have space available with safe distances between the wind turbine infrastructure and solar energy infrastructure, as well as strong anchoring (due to the current).

Chinese offshore energy: Increasing infrastructure utilization by combining wind and floating solar energy production

In the Shandong province, the State Power Investment Corporation (SPIC, Chinese state-owned) first constructed 40 turbines 30 kilometers offshore. Following this, it connected two 50 meter diameter floaters with a turbine transformer to increase the use of its submarine infrastructure and reduce the levelized cost of electricity (LCOE) [5].

The pilot was completed in 2022. Subject to successful further testing, more floaters will be added to the wind farm.

The environmental impact of floating solar is dependent upon the local conditions. Studies show that it can create new habitats (similar to the area below offshore structures) and reduce algae bloom formation by acting as a sun blocker. However, it can negatively impact local corals. The Haiyang offshore energy project is located at a sea depth of more than 15 meters, which is expected to reduce the negative impact on the environment. However, the environmental impact will need to be evaluated once on-site tests have been finalized.

PROJECT TIMELINE

2021 — Project inception — Development

2022 — Pilot construction finalized — Policy and planning

2023 — Testing & full implementation — Pilot and testing

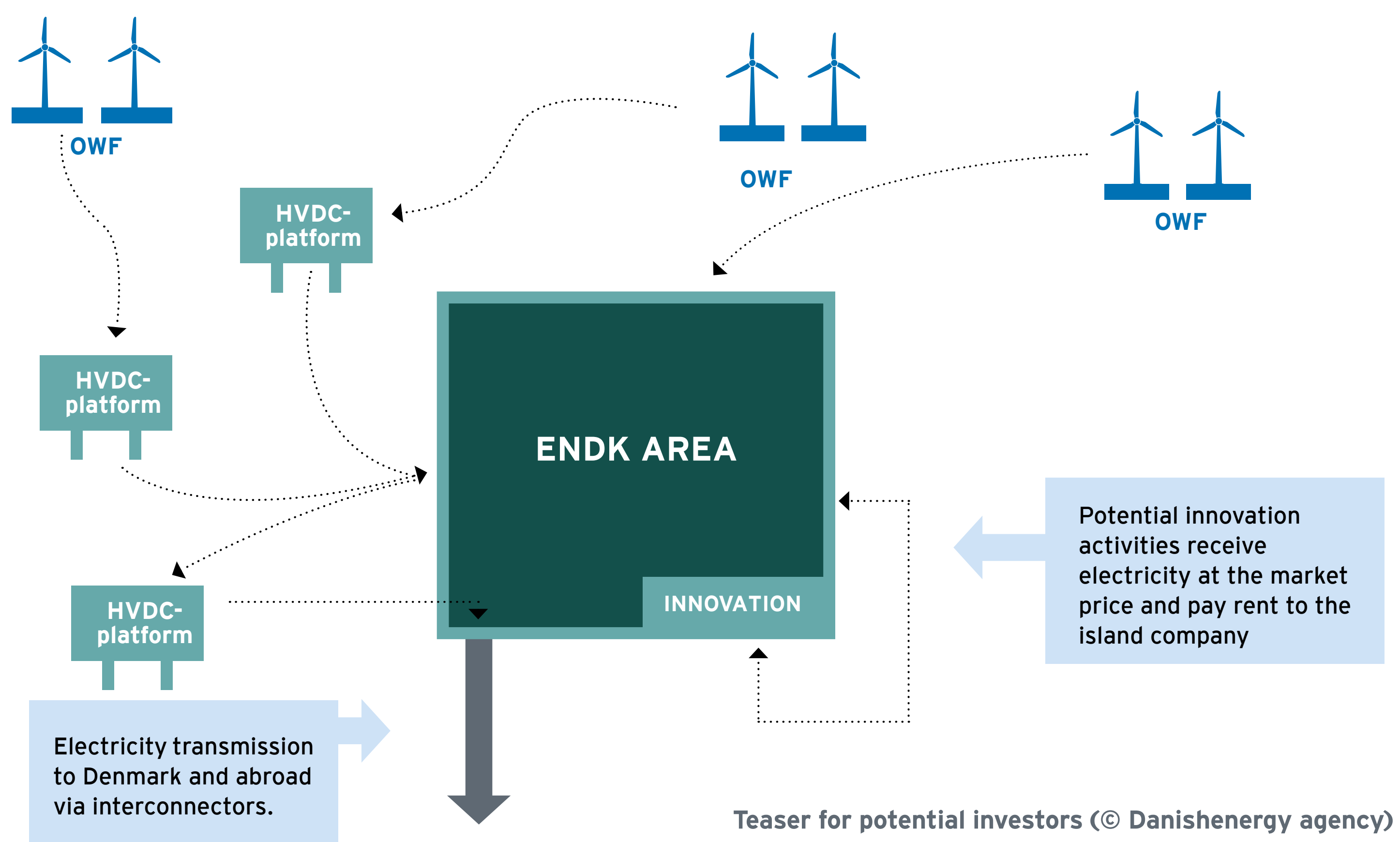
02 SELECTED CASE
The Energy Island in the North sea, Denmark

Wind energy   Green power station

TRL

Lessons learned

This project is driven by the Danish government. The Danish Energy Agency is trying to increase efficiency and reduce costs by involving a private partner in this project. Also, involving all stakeholders and conducting thorough environmental investigations is key for succeeding with this project [6]. Collaboration with countries like the Netherlands, Germany and Belgium is also important for realizing this project.



Teaser for potential investors (© Danishenergy agency)

Proposed business model [7]

Innovations

This will be Denmark's first artificial energy island, and will together with similar initiatives in Germany, the Netherlands and Belgium increase power supply and efficiency in Europe. In addition, surplus capacity will create opportunity for innovation related to Power-to-X innovation and value creation [7].

Scalability

There is potential for upscaling of the surrounding wind parks and capacity of the Energy Island from the planned 3 GW to 10 GW. In addition, the island's area could be increased, allowing for bigger Power-to-X projects or other innovative business cases [6,7].

The Energy Island in the North Sea: A hub for large scale distribution and innovation offshore

The Energy Island in the North Sea will be located 80 kilometers west of Denmark in shallow waters. It will be an artificial island and work as a hub for connecting and distributing electricity from offshore energy production [7].

Energy can be efficiently transported from the surrounding offshore wind farms to end-users on land, by having high-voltage direct current (HVDC) connected to, or located on, the island.

The Danish Energy Agency is preparing a tender for the construction of the Energy Island in the spring of 2023. A private company will construct the island. After construction, the Danish government will buy 50.1% of the island. The island also has space for innovation through for example Power-to-X, but this has not yet been determined. It is up to the owner company of the Energy Island to decide which business activities are selected [7].

Illustration of the Energy Island (© Danish energy agency)

PROJECT TIMELINE

2017 – Agreement between TenneT Netherlands and TenneT Germany, Energinet to develop energy islands in the North sea

2021 – Decision to establish artificial island in Denmark

2028 – Construction of the island and installation of offshore wind farms

2033 – Power connected

Pilot (2017–2021) → Go live (2028–2033)

03 SELECTED CASE
Lerøy Ocean Harvest, nearshore seaweed and mussel production in Norway

Seaweed

Blue mussels

TRL

Lessons learned

Harsh weather can make multi-use of the same ocean space challenging. This case study shows that it is important to address these risks and review possible ways of applying MU. It is key to monitor how the different businesses will affect each other. This is key to prevent any negative impacts among the different operations.

Innovations

The combination of seaweed and blue mussel farming, while absorbing waste from the fish farms, is positive for the overall environmental impact of the operation.

Scalability

Production of the mussels and seaweed depends on the availability of area and level of nutrition available. It is expected that economies of scale will come into play.

Lerøy Ocean Harvest: Seaweed and mussel production at the western coast of Norway

Lerøy Ocean Harvest is owned by Lerøy Seafood Group and is Europe's second-largest seaweed-producer [8]. The initial goal was to combine fish farms, seaweed, and mussels in a multi-trophic aquaculture system [9].

The seaweed can absorb CO_2, nitrogen, and phosphorus, all of which are emitted from the fish farm, thus the intention to place seaweed and mussel farms located nearby the fish farm. After project review, the seaweed and mussel farms were moved at least one kilometer away to reduce the risk of feeding barges being unable to gain access in harsh weather [8]. Due to the mass balance principle, they still manage to reduce the impact of the by-products from the fish farms even though they are not located next to each other. There are potential synergies between sharing crew and vessels for seaweed and mussels, due to different times of harvest.

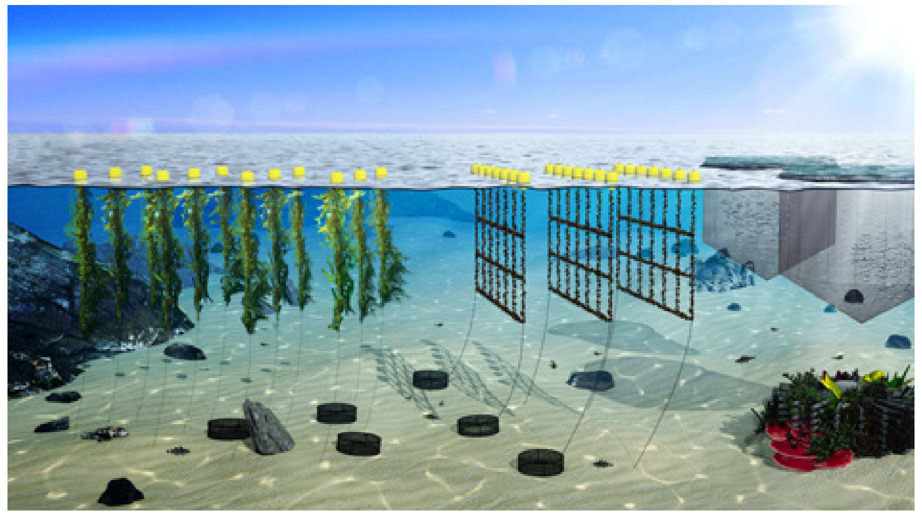


Illustration of the original plan (© Lerøy Seafood)

PROJECT TIMELINE

2021 – Company founded

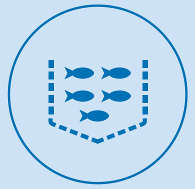
2022 – Harvested 177 tons of seaweed

Go live

04 SELECTED CASE
Sanggou Bay, nearshore large-scale seaweed farming in a multi-trophic aquaculture in China

Kelp

Bivalves, abalone and oysters



Aquaculture

TRL

Lessons learned

The strong, local demand for fish, shellfish and seaweed for consumption has supported the early exploration of symbiosis of different food sources. Large-scale seaweed production combined with aquaculture can be economically feasible and add environmental benefits.

Innovations

Numerous studies support the environmental and economic benefits of this successfully operated, commercial MU. There is decades-long experience in measuring various factors, including the combination of aquaculture types, density, seasonal variations in nutrient concentrations from rivers entering the bay or antibiotic resistance. This has resulted in an immense knowledge source. It also provides a good income for the local farmers.

Scalability

Sanggou Bay has already achieved scale and commercialization. It produced 100 tons (fresh weight) of fed fish, 130,000 tons of bivalves, 2,000 tons of abalone and 800,000 tons of kelp, across a surface of over 100 km² [10].

Illustration of the original plan (© Lerøy Seafood)

On a bay surface of over 100 km² in China, large-scale seaweed farming in combination with aquaculture is fully commercialized

The main driver for introducing a more coordinated approach was too much sediment and high phosphorus levels from too many intensive-fed aquaculture systems in the area. The combined farming of fish, seaweed, shellfish, abalones, bivalves and oysters offers better environmental conditions and, consequently, a higher output.

MU has been practiced in Sanggou Bay since the late 1980s. Various interdisciplinary studies, combining biology, fishery, physics and chemistry, were conducted between 2011–2015. Over the past decades, the Chinese government promoted and funded the development of sustainable aquaculture across China.

Initially, the key focus was to maximize food production. More recently, other factors, such as consumer concerns related to food safety practices and sustainable production, have been impacting aquaculture.

The timeline for this project is unknown.

05 SELECTED CASE

AquaWind, offshore wind energy plus aquaculture in Spain

Wind energy

Aquaculture

TRL

Lessons learned

Although the project is in its early stages, it sets out to demonstrate an innovative approach that combines renewable energy production and aquaculture into an integrated solution.

This novel concept demands a greater level of reliance between the various project stakeholders, ranging from those taking part in the energy production process to those charged with administering the aquaculture activities.

Innovations

The combination of these two distinct fields represents a significant advancement in sustainable development, as it allows for the simultaneous production of clean energy and seafood while minimizing the environmental impact of both industries. The project is attempting to create a mutually beneficial relationship between these two industries by digitizing collaborative activities, showing how remote management can be done and the impact one activity may have on the other.

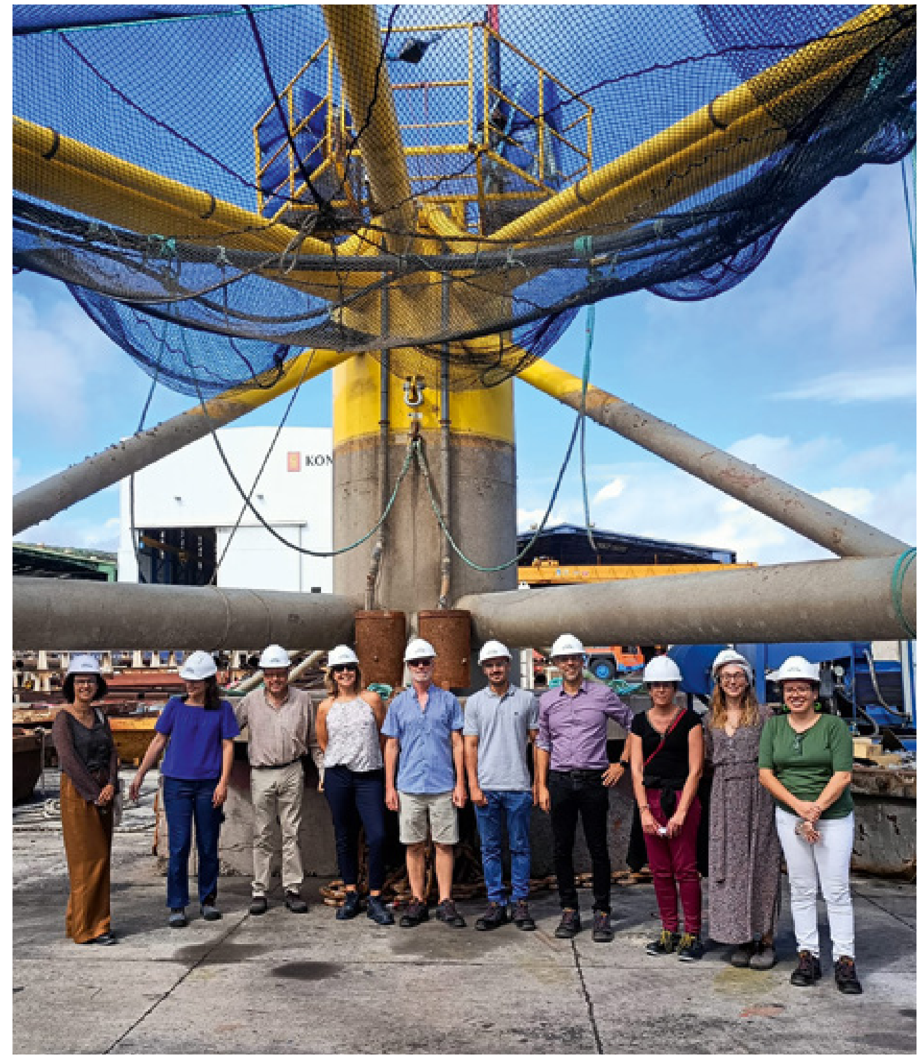
Scalability

The ability to scale a floating platform that combines energy production with fish farming will depend on the local environmental parameters. The depth of the sea, the presence of nutrients, and other regional parameters can all play a major role in determining how successful the platform will be at a given location.

Combining offshore wind and fish farming

The AquaWind project aims to demonstrate the feasibility of an integrated multi-use solution that combines floating wind technology with aquaculture. It will be the first European initiative that combines the production of renewable energy with fish farming. The project will concentrate on two species of fish, namely sea bream and amberjack. These two species were chosen for their economical and ecological significance [11].

This project is bringing together a variety of stakeholders, including research and development centres, businesses, and a regional governing body. By focusing on engaging stakeholders and gaining social acceptance, this project attempts to not only create new technical advancements but also make sure that the local communities are in support of the project. It is led from the Canary Islands by ACIISI and has been supported largely by the European Union, which has provided 80% of the project's costs (~€1.3m) while the remainder is covered by the nine partners from France, Spain, and Portugal [12]. The project partners are Consulta Europa, The University of Las Palmas de Gran Canaria, PLOCAN, The Maritime Cluster of the Canary Islands, EnerOcean, INNOSEA, WavEC, and Canexmar.



PROJECT TIMELINE

2022 – Project start, legal and social conditions

2023 – Structural design and testing

2024 – Harborside trials

2025 – Demonstration at the pilot scale

Governance → Design and testing → Demonstration

06

SELECTED CASE

Edulis project, offshore mussel culture within wind farms in Belgium

Wind energy

Mussels

TRL

Lessons learned

While developing and implementing efficient farming methods and monitoring systems is crucial to ensuring successful offshore food production, effective communication among stakeholders is equally important. This involves dialogue between farmers, operators, distributors, suppliers, and also regulatory entities and local communities. By improving communication and ensuring information flow, all parties can work together more efficiently.

Innovations

The overarching goal of these projects is to create a new method of cultivating mussels and oysters in offshore wind parks. The project's key innovation lies in the development of a unique material and a new conceptual design for construction [13]. By using the hard substrate around wind turbine foundations, the goal is to promote nature restoration and provide a favorable environment for oyster larvae to settle, which in turn enables the restoration of oyster reefs [13].

Scalability

The success of mussel farming is largely determined by the characteristics of the local environmental parameters, such as temperature, salinity, and availability of nutrients. It is expected that similar economies of scale that benefit seaweed production will affect the financial potential of mussel farms.

Belgian offshore wind farms: Combining the deployment of renewable energy and aquaculture

The Edulis project was a novel effort that sought to pilot food production within an existing offshore wind area, offering a unique opportunity to explore the potential of utilizing otherwise unused space.

The Edulis initiative was the result of a partnership between several entities within marine research and sustainable food production. Led by Ghent University, this demonstration project brought together 5 private enterprises, a research collaborator, and the Institute for Agriculture, Fisheries and Food Research (ILVO) with the aim of evaluating the practicality of growing mussels in the C-Power and Belwind wind farms, situated 30-50 kilometers away from the Belgian shoreline. The project was primarily funded through private investments, with additional support from both Flemish and European funding sources.

Offshore Belwind windpark (© Gust Lesage)

Harvested mussels (© Gust Lesage)

PROJECT TIMELINE

2013 – C-POWER windpark operational

2014 – National marine spatial plan approved

2017 – First installation of mussel culture system

2019 – Pilot project finished

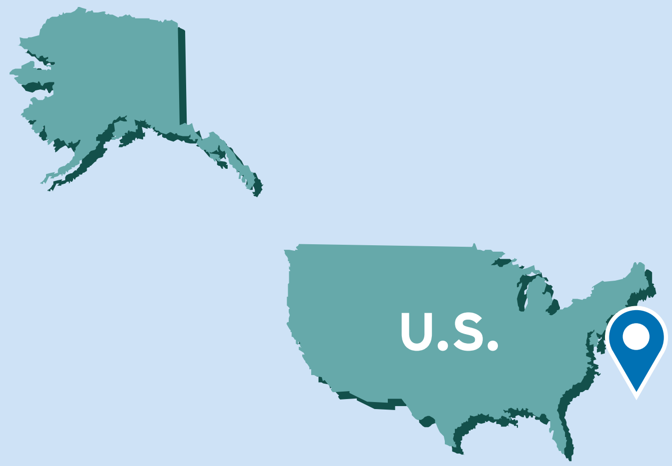
Development

Policy and planning

Pilot and testing

07 SELECTED CASE

Thimble Island Ocean Farm, nearshore mollusks and kelp aquaculture in the US



Kelp

Oysters, mussels, other mollusks

TRL

Lessons learned

Financial security, community support, shared materials and a three-tier harvesting system* form the building blocks of a successful sea farm. There is large risk involved in starting a sea farm, due to high exposure to natural elements. A financially secure environment such as government-funded crop insurance is key to attracting maritime entrepreneurs. A license to operate is contingent on entrepreneurs securing community support at sea and onshore. The financial viability of ocean farms depends on synergies, such as the sharing of materials, particularly boats, that require high capex. Sea farming can create environmental benefits, both in cleaning and enhancing ocean biodiversity. Oysters and other shellfish are known to filter water, e.g. remove excess nitrogen. Additionally, kelp can form a habitat for new and indigenous species. To maintain these species, it is important their habitat is not destroyed during harvesting periods: one third of the kelp should be harvested, with two thirds remaining for shelter.

Harvesting v (© GreenWave)

Innovations

Both government and community support enable successful commercialization. For Thimble Island Ocean Farm, the government-provided crop insurance proved an essential safety net. Additionally, the communities that support in financing and boat-sharing can yield co-beneficial results.

Scalability

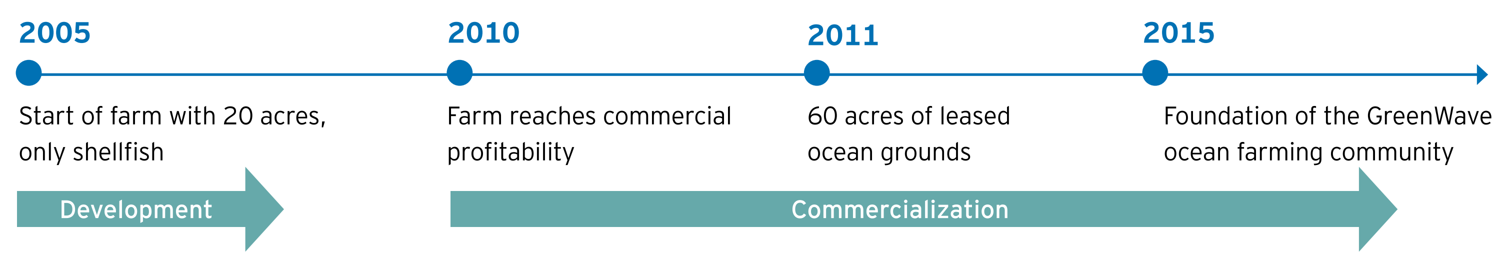
Scalability depends on biogeographic conditions as well as on the political and social environment. Community support provides the foundation to operate, and financial support offers the security to dare to venture.

Thimble Island Ocean Farm Community Supported Fishery (CSF) is a successfully commercialized ocean farm

Founded by a maritime entrepreneur, the farm grows kelp, oysters, clams and mussels. The farm offers an example of how collaboration between different ocean farms – combined with community involvement and government financial security (i.e. crop insurance) – can create an environment in which entrepreneurship can flourish.

The farm's owner also set up the GreenWave initiative [14] to enable regenerative ocean farms to become commercial in a sustainable way. GreenWave is a community where knowledge and data is shared, with training and support for ocean farmers to replicate and scale initiatives.

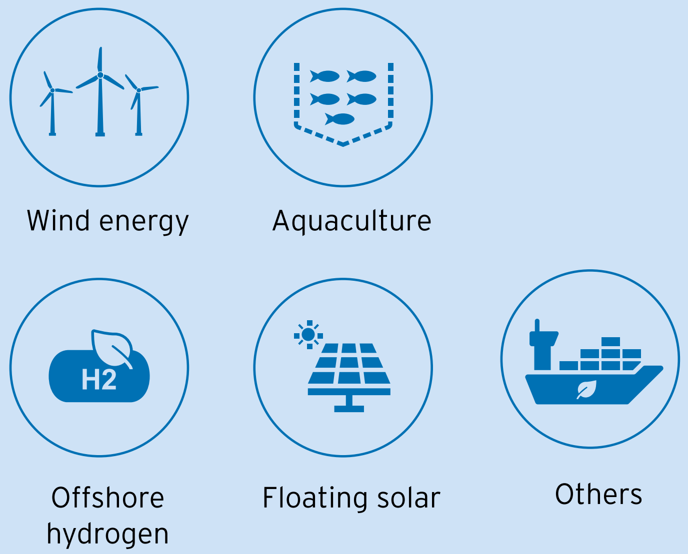
PROJECT TIMELINE



*Harvesting a maximum of 33% of total plant at a time to maintain a safe habitat for sea organisms. Hereby increasing biodiversity permanently.

08 SELECTED CASE

Oxagon, nearshore sustainable economic hub in Saudi Arabia



Lessons learned

Building a solid governance structure was a key milestone at the beginning of the project, to avoid potential conflict of interest. Oxagon is not only the largest, but also the most progressed multi-purpose project that goes beyond food production.

TRL

Oxagon (© NEOM)

Innovations

Oxagon is part of NEOM (special economic zone in Saudi Arabia), which includes a range of mega projects like The Line (linear smart city), Trojena (mountain tourism destination) etc., and an expected investment volume of $500b. Oxagon is a planned industrial hub, partially on land and partially on water, and is designed for future-proof concepts such as the circular economy and clean energy [15].

Scalability

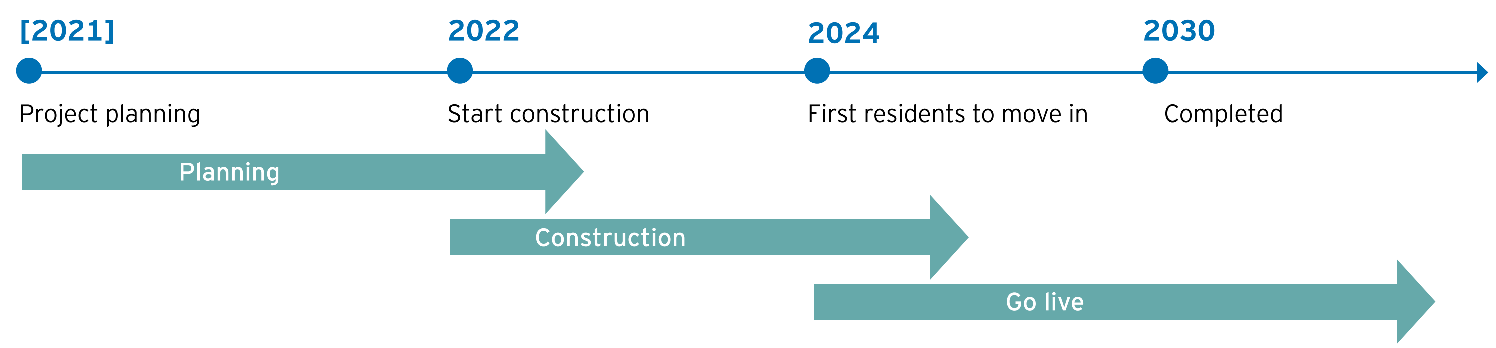
As the largest floating structure globally, Oxagon has the potential to reach sufficient scale to be economically viable. The city is built to become a global business hub for revolutionizing industries, including start-ups to Fortune 500 companies.

Saudi Arabia is building a multi-billion maritime city, the largest floating structure in the world

On a total area of 48 km², Saudi Arabia is building a multi-purpose, part offshore, part onshore multi-use city. It will house a broad set of industries, such as energy, food and hydrogen production and a hub for clean manufacturing, including semiconductors, research facilities, an automated and integrated physical and digital port and supply chain. The city is planned to run fully on clean energy, providing living space for 90,000 people and employment for 70,000. The city's infrastructure is owned and built by the Saudi Arabian government's Public Investment Fund. Industry firms and other stakeholders are selected as partners.

Construction of the city started in 2022 and its first residents are expected to move in by 2024. Its large structure with high business and trade activity is expected to have a significant impact on the local ecosystem. However, there is little information from local studies about its impact.

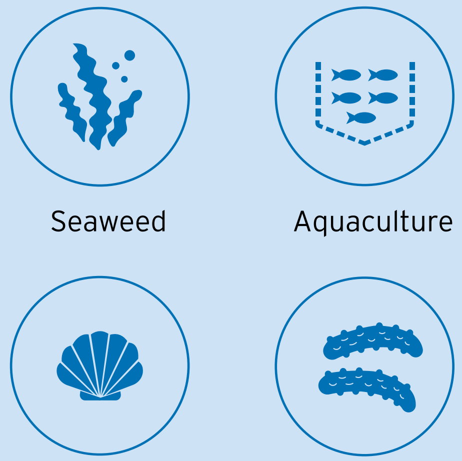
PROJECT TIMELINE



09

SELECTED CASE

Liaoning Province, offshore large-scale multi-trophic aquaculture in China



Seaweed

Aquaculture

Bivalves, abalones

Sea cucumber

Lessons learned

A private sector company, which is the sole operator of the area, has been profitably producing food, including seaweed, in a rough offshore sea. The impact on the environment, however, is not known.

TRL

Innovations

Over the past decades, efforts have been undertaken to optimize ecological conditions, including co-culturing a range of species and creating artificial reefs. However, detailed documentation of results and progress is difficult to access as the area is operated by a private sector company.

The production numbers indicate that large scale offshore aquaculture production can be fully commercialized and may be economically feasible. The impact on nature however is not known.

Scalability

The Liaoning Province 100 km^2 sea area is farmed by a private sector company and achieved scale and commercialization decades ago.

Sea cucumber (© Kindel Media)

Bivalves

Large-scale offshore multi-trophic aquaculture production has been commercialized for decades

The 100 km^2 sea area site has been in operation for decades. In 2005, 28,000 tons of food was produced with a value of more than $60m and a net profit of $18m. In 2014, 351,000 tons of seaweed, 2,327,000 tons of bivalves, 59,000 tons of finfish, 25,000 tons of shellfish and 129,000 tons of other food, such as sea cucumbers, were produced [16].

Zoneco Group (alias Zhangzidao) is a publicly listed company in China, active in the marine products industry and integrating breeding, marine aquaculture and the processing of aquatic products. The company was founded in 1958. Zoneco is authorized to farm the Liaoning Province in Northeast China [16].

Cages for fish farming. iStockphoto/RADZONIMO

Zoneco Group was once the most valuable listed seafood company in China. However, in recent years, the company was subject to various scandals. In 2014, it was scrutinized by investors following losses due to the death of its marine shellfish stocks from extreme temperatures. China's stock market regulator took action against the company for inaccurate filings on its aquaculture reserves. In 2019, the company reported that 80% of its scallops stocks had died, resulting in a significant decrease in the company's share price.

The site is situated about 64 kilometers from mainland China and cultivation takes place at a sea level depth of 10-40 meters, in an area with strong currents (maximum about 1m/s).

The timeline for this project is unknown.

AQUALAST, NORTH SEA FARM#1 & SWIMSOL

North Sea Farm #1 in the Netherlands

Description of the project
A 160 hectare seaweed farm will be constructed within an offshore wind park with a yield of 1,000 tons of wet seaweed per year.

Lessons learned
The project is still in an early stage with no current lessons learned that can be applied to Maripark.

Wind energy   Seaweed

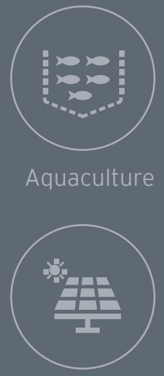
AquaLast in Germany

Description of the project
This is a pilot project in the German North Sea to test the possibility of aquaculture in offshore wind farms, to make better use of the available area. The pilot tested and evaluated induced loads on a monopile-supported wind farm.

Lessons learned
The project demonstrated that the technology used did not work as planned. It does not provide any stakeholder lessons.

Mussels   Wind energy

swimsol.com/solar-projects/fishfarm-solarsea-chile-swimsol



Aquaculture

Floating solar

Swimsol in Chile

Description of the project
This offshore floating solar energy system is installed near a fish farm, helping to power it sustainably. Solar panels are produced by Swimsol and have a Solar LPG hybrid grid.

Lessons learned
This private partnership does not provide any MU governance or stakeholder lessons.

Artist's impression of a solar park by SolarDuck. © Illustratie SolarDuck

Long list of dual- and multi-purpose projects

Region	Project name	Country
EUROPE	Edulis	Belgium
	North Sea 3	Belgium
	Energy Island (North Sea)	Denmark
	Energy Island (Baltic Sea)	Denmark
	Route du Littoral	France
	Aqualast	Germany
	AQUA-LIT	Germany
	AquaPrimus	Germany
	AquaSector	Germany
	MUSICA	Greece
	MUSES - Case Study 6	Italy
	ALLIANCE	Latvia
	Oceans of Energy	Netherlands
	NORTH SEA FARM #1	Netherlands
	RWE and SolarDuck	Netherlands
	H2opZee	Netherlands
	PosHYdon	Netherlands
	SOMOS	Netherlands
	Lerøy Ocean forest	Norway
	Loch Fyne	Scotland
	AquaWind	Spain
	W2Power	Spain
	Galatea-Galene offshore	Sweden
	Offshore wind and fisheries	UK (Scotland)
	EU-SCORES*	Several countries
	Mermaid*	Several countries
	H2OCEAN*	Several countries
	TROPOS*	Several countries
	ORECCA*	Several countries
	MARINA*	Several countries
	UNITED*	Several countries

Large projects with locations in several countries.

Region	Project name	Country
ME & AFRICA	NEDO	Mauritius
	Oxagon	Saudi Arabia
	Abagold	South Africa
	SBRC	UAE
AMERICAS	Swimsol fish farm power supply	Chile
	Bay of Fundy multi-trophic aquaculture	Canada
	Thimble Island Ocean Farm CSF	USA
	The ReefLine	USA
	Ocean Era	USA
APAC	Haiyang offshore	China
	Liaoning Province	China
	Sanggou Bay	China
	Hokkaido	Japan
	Tokyo Bay eSG	Japan
	MPOF/HEP	Australia
	IOEM	Australia
	Great Barrier Reef	Australia

©Solarduck

02

Portfolio

A portfolio of potential business opportunities, through analysis of the activities and their respective high level feasibility, financial, and stakeholder value.

Portfolio Introduction

Context

Multi-use represents a commercially viable prospect for the development of the North Sea. However, no commercial cases are, as yet, operational in the Dutch Exclusive Economic Zone (EEZ) in the North Sea. This chapter defines blue economy* business opportunities that can be realized in the EEZ and in a Maripark, including a high-level overview of their required resources. A comprehensive understanding of viable business opportunities is a prerequisite to define a potential governance structure and transformation plan for a successful Maripark. Ecological conditions for diverse business activities are supportive, and recent technological advancements and strategic policies endorse the acceleration of ocean use. Nonetheless, the objective of the Maripark constrains options, as it aims to develop commercially feasible opportunities that also contribute to nature and society as a whole.

Approach

For the Dutch EEZ in the North Sea that could form part of a Maripark project, 19 existing and emerging business opportunities have been identified as potential business activities. As requested, we have looked at all plausible opportunities, unrestricted by the current policy around shared use within wind farms**. These encompass a range of activities from food and energy production to ecosystem services, with supporting activities such as monitoring and security. A framework was developed to analyze and evaluate the business activities regarding their feasibility, financial, and stakeholder value. The analysis and evaluation was divided into two stages: high level and a deep dive. Business viability in the EEZ was determined first, followed by the viability in a Maripark, including a symbiosis assessment.

Findings

The outcome shows that 9 out of 19 business opportunities are relevant for a Maripark. All 9 of the business opportunities are viable in the EEZ and would benefit from a Maripark, financially and, to a lesser extent, at a stakeholder level. Business opportunities related to energy have the highest financial and stakeholder value. Energy is followed by food, and other business opportunities such as sustainable tourism and subsea data centers.

Key takeaways

The commercial viability of several business opportunities may require (further) technological development and/or adjustments to adapt to offshore situations. Symbiosis has been identified between business opportunities, mostly through capex synergies. Some can be realized between businesses, while others require government sponsorship, such as a shared multi-use vessel. To organize and realize the identified large offshore synergy potential, a supporting legal and tax structure would need to be established.
Like many large infrastructure undertakings, a government entity should develop and own basic infrastructure, providing the foundation for businesses to thrive.

* Blue economy is defined as the "sustainable use of ocean resources for economic growth, improved livelihoods and jobs while preserving the health of ocean ecosystem." [17] (MENA Blue Program, World Bank)
** The North Sea Programme 2022-2027 mentions co-use in realized wind farm zones and refers to nature development, food (passive fishing, aquaculture) and renewable energy generation and storage (electricity from or on the water and installations for hydrogen production)

VALUE POTENTIAL

A Maripark framework may enable shared-use symbiosis and lead to increased financial and stakeholder value for the business activities

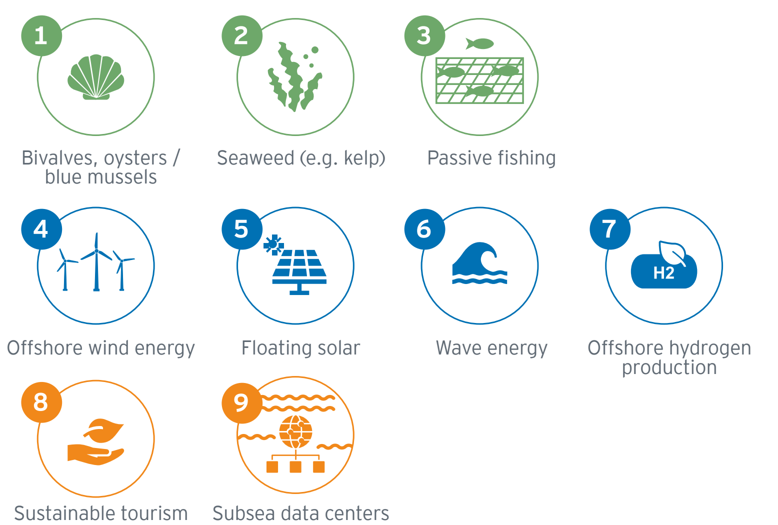
Energy-related business opportunities have the highest stakeholder and financial value.

Wind energy is currently the most valuable and highly commercialized opportunity and could be the foundation of a Maripark. However, as North Sea space is limited, other opportunities could be added to enable high synergies. The financial value of food-related business opportunities is lower, driven by the high operating costs. Aquaculture-related business opportunities, including bivalves, oysters, and seaweed, have the highest environmental value. Aquaculture, especially regenerative aquaculture, has an extraordinary potential to make a positive impact on the environment, e.g. through carbon sequestration, increasing fish stocks and improving water quality. Many aquaculture installations require minimal investment and yield profits on a relatively shorter timescale than energy-related opportunities.

All 9 business opportunities could benefit from a Maripark, both in cost reduction and increased stakeholder value.

Recurring costs – such as farming workforce or energy loss for energy transmission – constitute a substantial part of the total financial costs. Sharing or even avoiding some recurring costs among the businesses further increases the net present value for each business opportunity. A Maripark can also positively impact the stakeholder value of businesses. For example, research efforts can be combined to achieve faster results and broader contributions to science and future projects. Another high-cost item is decommissioning – for example, for offshore wind turbines. This could be lowered by integrating exit options across businesses in the planning stage.

The investigated business opportunities



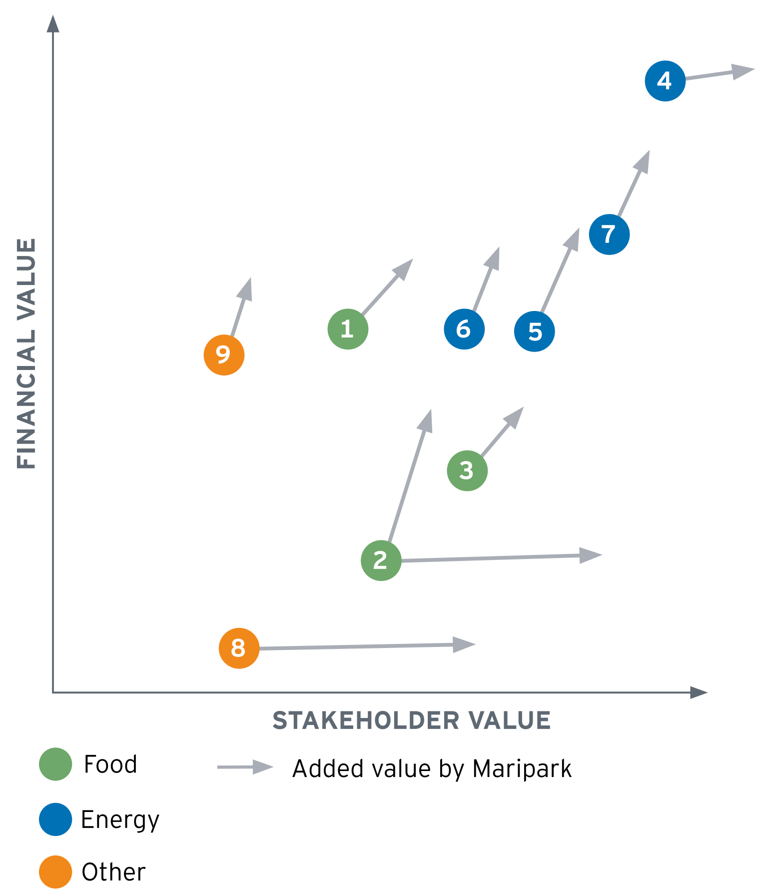
A successful Maripark requires a solid foundation, something a well-governed government-owned entity could facilitate.

At least three governing requirements can facilitate a successful Maripark, as described below:

1> Innovative financing structures are possible with a solid, government-owned, entity that provides guarantees and counter-party credibility for financing.

2> Supporting activities such as monitoring and digital governance provide the necessary foundation for financial viability, and make businesses better positioned to achieve long-term sustainable operations by allowing them to capitalize on synergy opportunities.

3> Simple, rapid and transparent processes lead to reduction in complexity, increased efficiency and a more scalable organization. Many innovative companies are small companies and startups that depend on rapid time to market for their products and services. For them, high transparency is critical to ensure efficient communication, stakeholder management, collaboration, and trust.



*The in-depth analysis of the supporting activities is not in the scope of this analysis. Details on potential synergies with a Maripark are not provided and the positioning in the above graph is based on estimates. Low financial value is defined as an NPV close to zero and high financial value is defined as a highly positive NPV, given the dimensions meaningful for the Maripark. NPV assumptions include subsidies.

Research process

RESEARCH PROCESS

There are many established and potential business opportunities for ocean-based industries in the North Sea

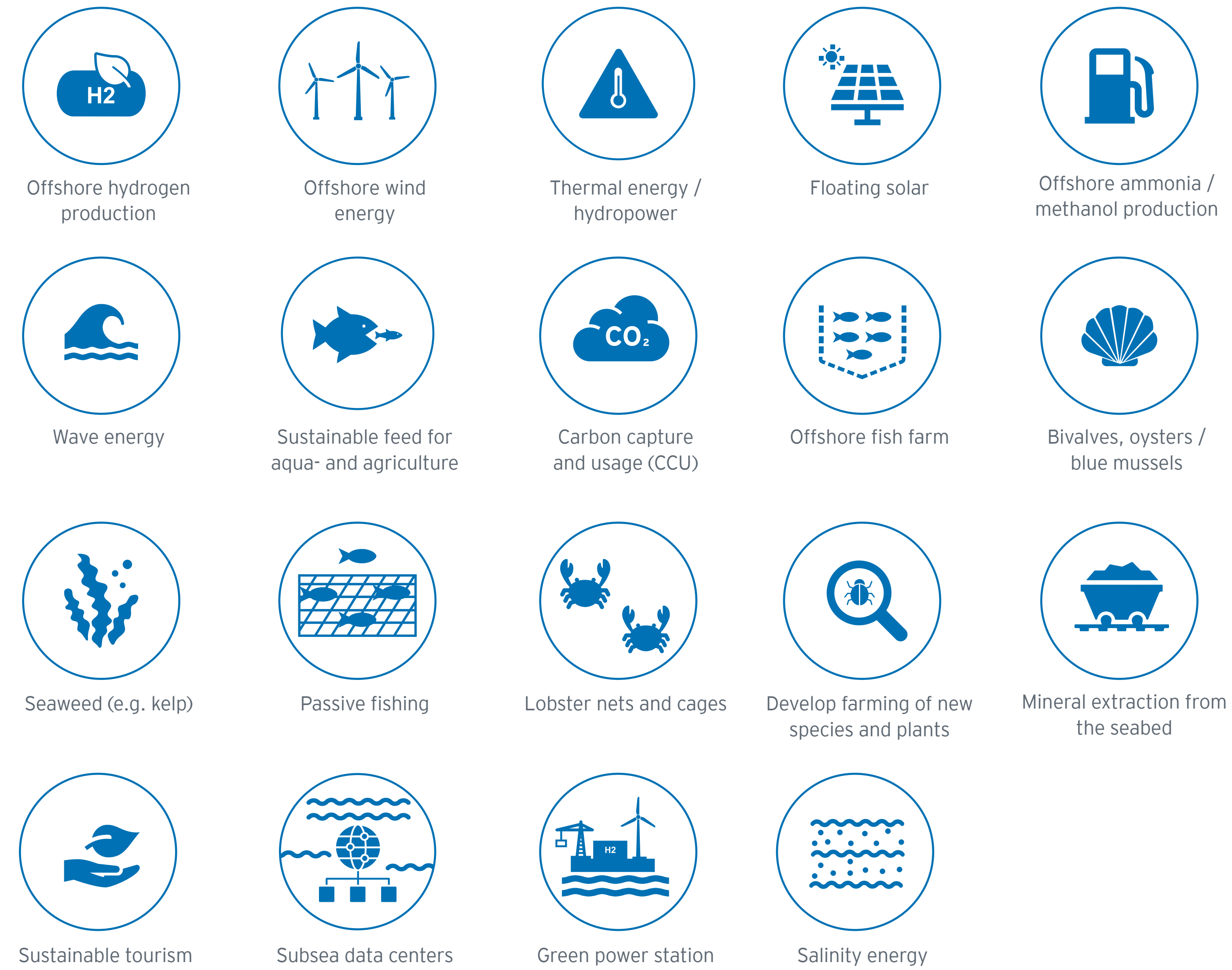
The North Sea presents promising conditions for a diverse range of business activities, with recent technological advancements and strategic policies accelerating the growth and usage of this ocean space.

Established and emerging blue economy will be vital to achieve the targets for renewable energy, food production and nature. The 19 potential business opportunities cover a broad range of activities, including food and energy production, and other services, along with supporting activities such as digital surveillance, monitoring and security. These business opportunities offer a strong foundation for the development of a sustainable offshore park in the Dutch North Sea. The combination of these activities in a Maripark can realize both social and economic benefits, while providing the long-term protection and preservation of the natural environment.

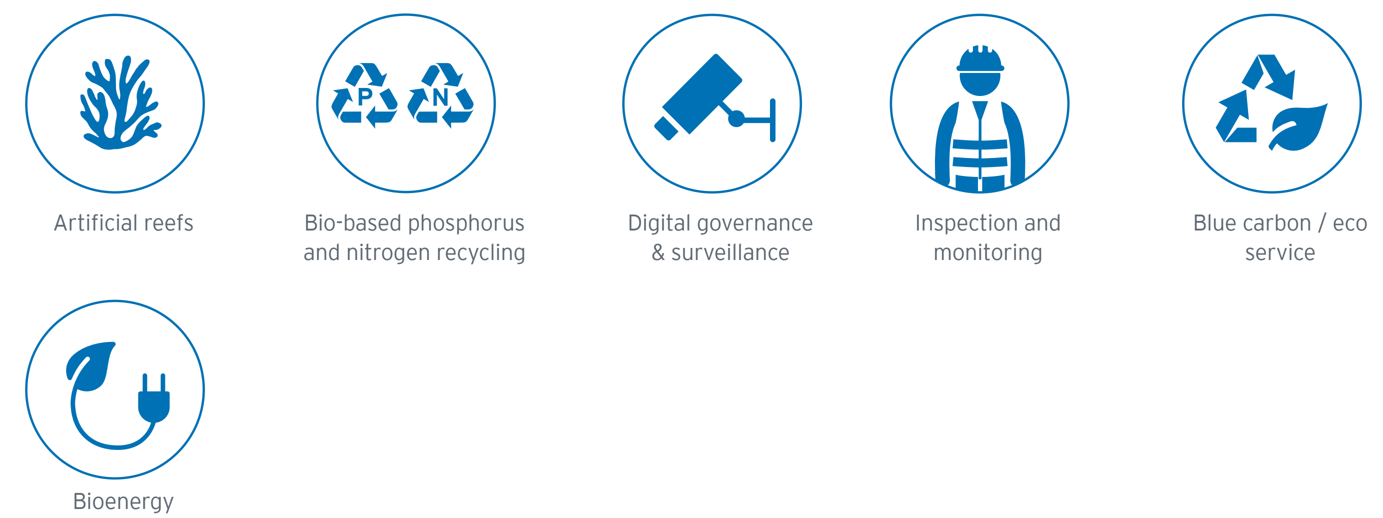
The Maripark framework sets out to achieve a challenging goal: to develop a sustainable offshore shared-use area in the Dutch North Sea that meets the needs and expectations of multiple stakeholders.

The ocean business activities are growing increasingly complex with multiple activities and interests at play. The selection criteria can serve as a basis for a transparent and objective evaluation of potential business activities in a Maripark. These criteria provide a common ground, even though their relative importance may vary. Fact-based criteria can be used to create scenarios that optimize the benefits for all parties and ensure the long-term viability of the park.

Established and potential blue ocean business opportunities in the North Sea



Blue economy supporting business activities



Suitable business opportunities were evaluated according to a selection framework

A comprehensive framework for integrating business opportunities that incorporates a range of key criteria was developed.

The selection criteria cover multiple aspects of shared ocean use and take into account the increasing number of stakeholders involved. These criteria provide a foundation for performing a balanced evaluation of potential constellations of activities and to determine their priority within the Maripark framework. By utilizing these criteria, it is possible to compare and contrast alternative activities, and determine the most effective approaches for managing and utilizing the offshore space. The approach provides a fact-based and data-driven methodology for assessing the potential impacts and benefits of different business opportunities and allows the identification of those activities that are most aligned with the overarching goals of the Maripark. The criteria comprises both quantitative parameters, such as production capacity/rate, and qualitative parameters, such as social acceptability.

- Fit for economic zone includes the basic requirements needed, such as salinity gradients for salinity energy or maximum height of waves for floating solar.
- Environmental impact describes impacts on nature, such as carbon balance and biodiversity impact.
- Technology readiness is defined by the Technology Readiness Level (TRL), 1-9, to be compatible with Dutch government initiatives and targets, such as the Dutch's government's North Sea Programme 2022-27.
- Political strategy fit has been added as a criteria with a primary focus on Dutch targets. EU goals were also considered if no Dutch target could be linked.
- Social acceptance is determined through a detailed social acceptance study that analyzes thousands of news articles, research, forums, twitter posts, blogs and other sources has been conducted to gain insight about the perception of the business opportunity within Dutch society.
- Financial potential covers the potential Net Present Value (NPV) on an isolated basis.
- Maripark synergy potential assesses the positive financial aspects a Maripark could add to a single business opportunity.
- Key socio-economic factors quantifies the positive and negative impacts of the business opportunities, such as job creation.
- Other factors include indirect value to the environment, such as a positive impact on biodiversity.

MAJOR CRITERIA	SUB-CRITERIA	PARAMETER ATTRIBUTION
Feasibility	Fit for economic zone	Qualitative
	Environmental impact	Qualitative
	Technology readiness	Qualitative
	Political strategy fit	Qualitative
	Social acceptance	Qualitative and quantitative
Financial value	Financial potential	Quantitative
	Maripark synergy potential	Quantitative
Stakeholder value	Key socio-economic factors	Quantitative
	Other factors	Quantitative

In total, 9 business opportunities and 5 supporting activities have been further investigated

A more detailed investigation was conducted for the most promising activities for the Maripark.

The analysis aimed to evaluate and identify the most suitable activities to ensure the efficient and sustainable use of the offshore space. The research revealed that the current TRL is highly variable in most single-use business opportunities in North Sea conditions: few reach commercial levels of 8 (system complete and qualified) to 9 (actual system proven in operational environment). For multi-use settings, the TRL level was lower. This highlights that a shared-use offshore Maripark requires careful planning and coordination among stakeholders. This is needed to ensure that different activities can co-exist and complement each other without creating conflict, environmental harm or negative social impact.

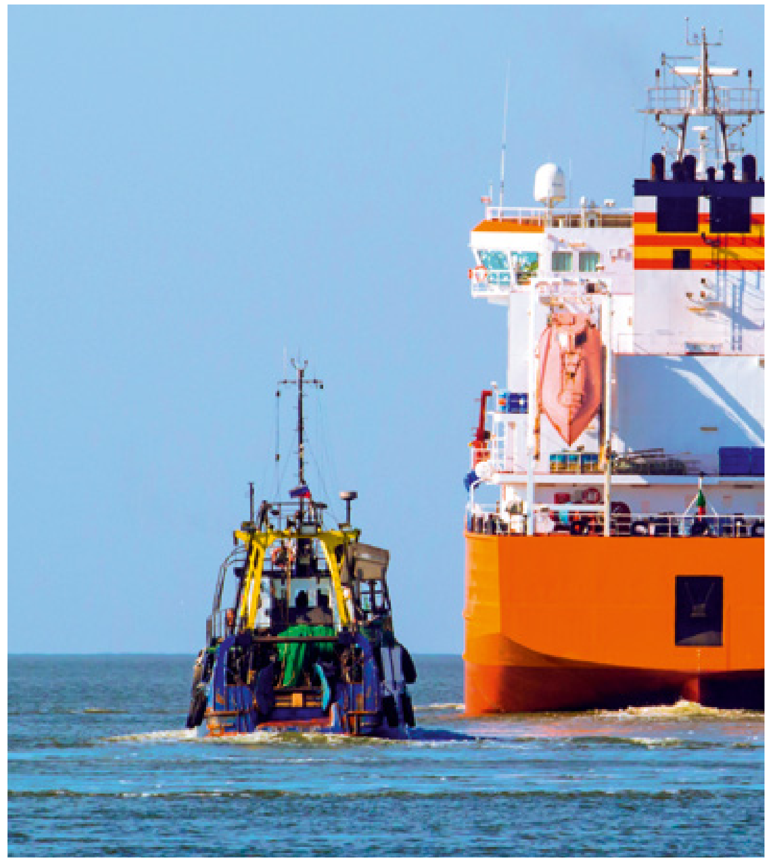
A total of 19 business opportunities were evaluated against the selection criteria and 9 high-potential business activities were selected for further investigation.

Each business opportunity was assessed based on its potential value for society and nature, and its financial viability. These prospects were analyzed for potential symbiosis, such as shared infrastructure and maintenance or using wind energy to produce green hydrogen.

The impact on the local environment and symbiosis were considered. A more detailed analysis of specific single-use cases is beyond the scope of this work.

The evaluation process highlights the importance of supporting industries.

The supporting activities – such as artificial reefs – do not create sufficient, independent commercial benefits or could be perceived as public duties rather than individual business opportunities. However, the activities are important add-ons to a Maripark and offer significant stakeholder value. For example, digital governance and surveillance is a significant contributor to the security of the Maripark, along with research activities in this relatively new field. These activities should be included early in the planning process of a Maripark.



Each business opportunity shares key characteristics

Key characteristics of high potential business opportunities

Only the business opportunities that fulfill the following characteristics were selected for the shortlist.

1 FEASIBILITY

There is a clear pathway for reaching TRL close to commercial levels of 8 to 9.

2 FINANCIAL VALUE

The selected businesses have the potential to generate a positive Net Present Value and full commercialization, subject to certain minimum size thresholds.

3 STAKEHOLDER VALUE

Contribution to well-being of society is positive, for example by creating jobs, adding to GDP and promoting innovation. The impact on the environment is neutral or positive, through initiatives such as nature restoration.

Key characteristics of supporting business activities

1 FEASIBILITY + **3 STAKEHOLDER VALUE**

The supporting activities enable different businesses to thrive and can be shared among businesses operating within a Maripark. Therefore, only criteria 1 and 3 above need to be fulfilled, as the economic viability of the supporting activities is too early to assess at this stage.

9 business opportunities have been identified as the most applicable for a Maripark

Food

- Bivalves, oysters / blue mussels
- Seaweed (e.g. kelp)
- Passive fishing

Energy

- Offshore wind energy
- Floating solar
- Wave energy
- Offshore hydrogen production

Other

- Sustainable tourism
- Subsea data centers

Blue economy supporting business activities

Supporting activites

- Artificial reefs
- Bio-based phosphorus and nitrogen recycling
- Digital governance & surveillance
- Inspection and monitoring
- Blue carbon / eco service

Business opportunities

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BUSINESS OPPORTUNITIES

The business opportunities are evaluated based on their value and possible symbiosis

On the following pages, each of the 9 shortlisted business opportunities will be described in more detail.

The general outline and decision criteria mirrors the approach described on the preceding pages. The business opportunities differ greatly in terms of financial and stakeholder value, as they range from food and energy business opportunities, to data centres and tourism. The methods and approaches that follow are used across the business opportunities to quantify some of the financial and stakeholder impacts in a consistent way.

19 EVALUATED BLUE ECONOMY BUSINESS OPPORTUNITIES | **9** DEEP-DIVES

The following analyses yield indications of the financial value, stakeholder value and symbiosis for each of the individual business opportunities.

The analyses of the blue economy business opportunities are based on a range of open sources, reports, and scientific papers, which are listed on the individual business opportunity pages. The data is complemented by EY research and expert interviews. Due to the low maturity of the individual cases and/or in the Maripark context, little data was found in scientific research or comparable sources. Therefore, the purpose of the analyses are to better understand the business opportunities, but - importantly - are not a commercial due diligence.

DESCRIPTION OF THE METHOD USED IN THE DEEP-DIVES OF THE BUSINESS OPPORTUNITIES

Size and value added by the Maripark

Since the size and area of a Maripark is not yet defined, an assumption of 1,000 hectares (ha) to 10,000 ha was made, using the lower end of the range for calculation purposes of the individual business opportunities.

For each business we determined the symbiosis potential for combining businesses in a Maripark. For most of these, the added value is still theoretical and was determined by expert interviews and desk research.

Stakeholder value

Number of jobs

When calculating the number of jobs for the individual business opportunities, the most recent published data from EU sources or reports were used. The number of jobs reflects the jobs that will be generated within the Maripark, which mostly relate to operations and maintenance. When only onshore data was available, we used an offshore multiplier of 2.6 [18].

Social cost of carbon (SCC)

The value of carbon-reductions was estimated based on the expected amount of CO_2-reduction of a realistic size of the business opportunity within 1,000 ha Maripark. This was multiplied by €875/metric ton of CO_2 to assess the SCC (rationale detailed below). The social cost of carbon is an estimate of the economic damages that would result from emitting one additional ton of carbon into the atmosphere. It puts the effects of climate change into economic terms to help policymakers and other decision makers understand the economic impacts of decisions that would increase or decrease emissions. The SCC differs from the current market price in the European Trading System (c. €80-100 in 2023YTD).

The SCC varies between studies, as different approaches, e.g. for discount factors, are chosen. A frequently quoted price is $185/metric ton of CO_2, based on K. Rennert et al. (2022) [19]. However, this study is controversial, as it calculates the current value of future damage by applying a discount factor of 2%. This means that future damage caused by current CO_2 consumption is discounted (lowered), implying that the welfare of the current generation has more value than future ones. Further, the study does not adequately consider climate tipping points, such as thawing permafrost, ice sheet disintegration, and changes in atmospheric circulation. The Province of Utrecht corrects these shortcomings, applying 0% discount rate and a 25% price pick up to correct for trigger points, which results in a SCC of €875 [20]. Utrecht is taking this price into account in its policy considerations and choices. This value is used in the analysis of this report, when estimating the stakeholder value.

Nature-based services (ecosystem services)

The specific nature services provided by the different business opportunities (e.g. nutrient uptake, carbon sequestration, restoration) varies widely. Due to the difficulty of the calculations, financial value was not specified for ecosystem services. The shortlisted business opportunities were assigned either a positive or negative value based on desk research and expert interviews.

Financial value

Financial value is defined as the Net Present Value (NPV) of cash flows until 2050, assuming a start of operations in 2030. When assessing the financial value of the CO_2 reduced, for example the future potential revenue stream generated by selling green energy certificates from the production of green energy, such as in offshore wind, a future carbon price of €250 was chosen, which will be the tax applied by the Dutch Government as of 2030 [21].

Few of the identified business opportunities for the Dutch North Sea are at a fully commercial stage meaning that the financial information is based on available reports, expert interviews, and EY research. When assessing the financial value of the individual business opportunities, an operation that is applicable to a single Maripark is considered.

BUSINESS OPPORTUNITY 1

Bivalves, Europmiean flat oysters (Ostrea edulis) and Blue mussels (Mytilus edulis)

Overall assessment

European flat oysters and blue mussels have many overlapping features biologically, but the supporting business operations differ due to different growth patterns. The overlaps include their value to the ecosystem; that both are indigenous to the Dutch North Sea and their harvest times are from September-April. Both oysters and mussels are already grown and harvested in the Dutch North Sea. Despite these commonalities, the result of the necessary business operations differing due to different growth patterns is lower operational synergies.

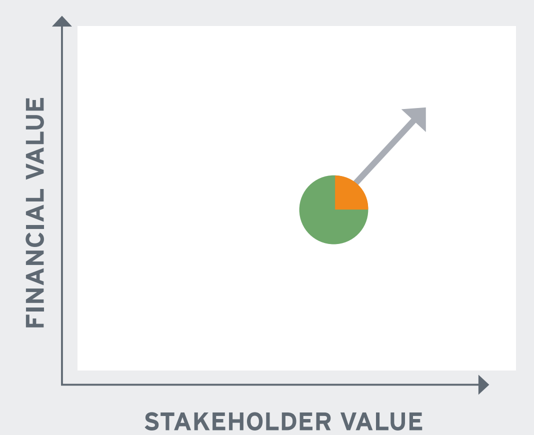
Differences include offshore growth infrastructure and harvesting. Mussels are best grown off the sea bed, on semi-submerged longlines anchored with heavyweight blocks at more than 20 meter depth [22]. Offshore oyster pilots in the North Sea, however, exhibit that oysters are best grown on the sea bed. Current pilots have been with domes and cages [23].

European flat oyster and blue mussel culture has the potential to create positive value for stakeholders by:

- Job creation
- Improving water quality
- Growing indigenous species (greater diversification of cultured oyster species by increasing the European flat oyster population)

Positive financial outlook is driven by:

- High TRL level of mussel culture, even in wind parks
- Steep scientific progress resulting in rapid cost reductions as knowledge is acquired
- Synergies between the "sea farming" products



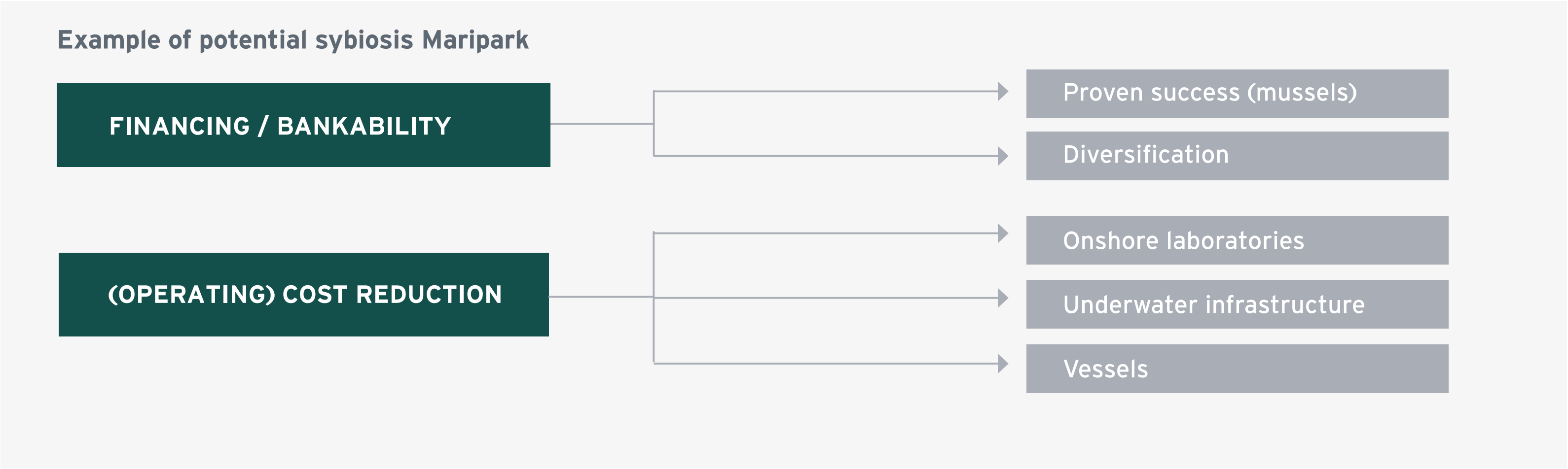
- **Potential for 371 jobs related to mussel culture**
- **€80m revenue potential for mussels**
- **NO_x filtration of 20-100 liters per shell**

Suitable for Maripark

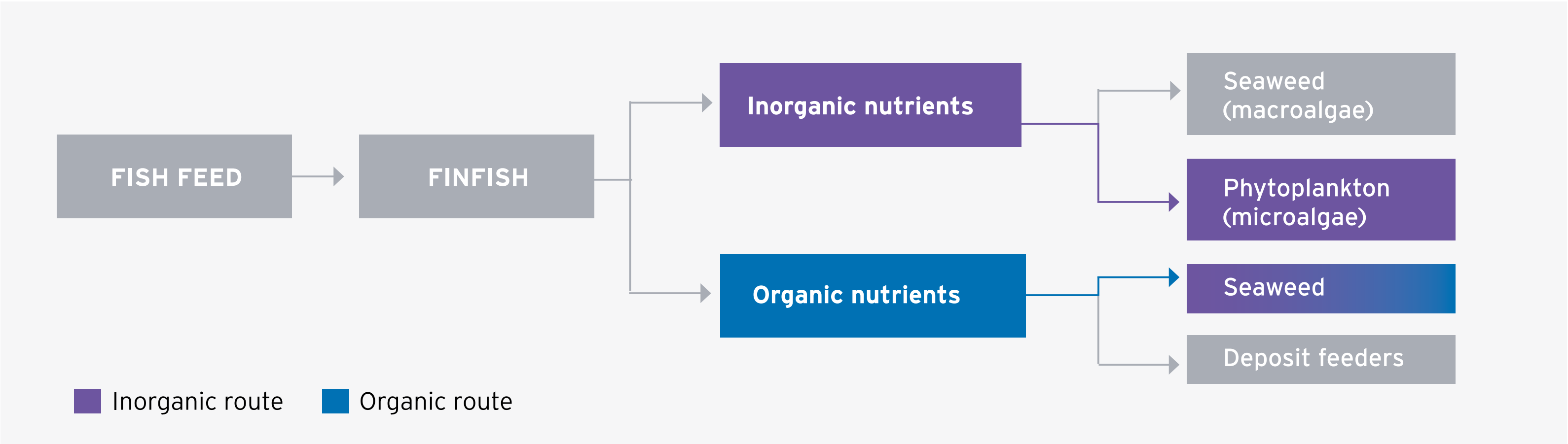
Stakeholder value contribution: Biodiversity Energy Food Impact made by Maripark

Added value by the Maripark and symbiosis examples

The primary added value of a Maripark bivalve culture is increasing bankability from potential symbiosis. The dual offshore use with windfarms and mussel culture has been piloted multiple times (MERMAID, Edulis, AquaLast, Lerøy Ocean forest). An analysis of the pilots demonstrates an expected opex synergy potential of 15% [22] from combining vessels and monitoring.



Bivalves can filter both organic and inorganic nutrients (aquaculture example)



Stakeholder value

371 jobs from mussel culture

The economic contribution from job creation in offshore oyster and mussel culture is expected to be high. The job creation potential for oyster farms is currently unknown as there is a low TRL for the industry and the offshore industry will vastly differ from nearshore oyster culture. However, an estimate can be made for mussel culture as nearshore and offshore practices are similar. Job creation would be around 371 FTE for 1,000 ha of offshore operations, based on the 2011 FTE/ha estimate for nearshore mussel culture, with an offshore multiplier of 2.6 [24].

This estimate does not take sharing of crew resources into account. The economic added value for wages are c. 1-3% of the final price for oysters, and around €2.5k per ha for mussels each year.

Natural nitrogen filters

The offshore production of these bivalves also holds strong ecological value. Firstly, both European flat oysters and blue mussels are indigenous to the Dutch North Sea so their re-introduction adds biological value to the natural ecosystems. They also increase sea life and biodiversity, as 3.6 times more fish can be found around mussel farms and there is 30% greater biodiversity around oyster farms [25]. Oysters and mussels also improve water quality. Like most bivalves, oysters and mussels filter out sediment and nitrogen – a single oyster can filter >100 liters of water per day; a mussel up to 20 liters [24].

Financial value

>€80m revenue potential for mussels alone

Financial returns vary per species. Offshore oyster farming's TRL is too low to determine the profitability of practices [23, 26]. From the two oyster species farmed in the Netherlands, the European flat oyster is the most expensive: the 2019 price was 31-45% higher than the Pacific cupped oyster [27, 28]. Offshore mussel farming appears profitable, with a yield of 42k kg/ha [24]. Current mussel prices are €1.94/kg, meaning revenue would be around €81.5m for 1,000 ha of offshore mussel farming [28, 29]. Capex for installing a 98 ha offshore farm is c. €59m, including onshore infrastructure. Shared vessel use can result in 10% capex synergies [22]. Large offshore farms (TRL 7) with an expected output of 40m kg cost c. €20m in opex per year [29].

15% opex synergies

For offshore mussel culture that is combined with wind energy, experts expect this multi-use to result in a 15% reduction of opex, as the crew, materials and monitoring can be shared. For example, one crew can be trained to combine wind turbine and aquaculture activities – such as checking the mussel longlines on a turbine inspection round. This combination does, however, require a new kind of multi-purpose vessel, yet to be designed [22, 29]. Additionally, oyster and mussel culture have synergies across vessel use and operations throughout the products' lifecycles.

Feasibility

Fit for economic zone

Both bivalve species are indigenous to the Dutch economic zone and are already grown in the Dutch North Sea – although nearshore [26]. It is uncertain whether offshore mussel culture is technically feasible, as the value chain requires a daily harvesting of fresh mussels during harvesting season – to keep the supermarket stocks fresh and the infrastructure running [29].

Political strategy fit

The planned Dutch North Sea Programme 2022-2027 considers the usage of the space between the windfarms for, amongst others, crustacea [30]. The EU is generally supportive of sustainable aquaculture projects, recognizing the contribution to rural job and wealth creation and a reduced reliance on seafood imports [26].

Social acceptance

Regarding social acceptance, no objection to the culturing of indigenous oysters is expected. However, there are known objections for mussels as a result of market disruption that could be caused by subsidizing offshore mussel farming. Objections predominantly come from the traditional mussel sector that expects a negative economic impact. There are offshore parties, such as OOS, that are interested in piloting offshore mussel culture. OOS has done lab research and developed offshore mussel farming infrastructure [29].

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Limitations / To be further researched

- Numbers are based on normative descriptions in ideal situations and may be outdated in some cases. E.g. the nearshore FTE/ha ratio is based on 2011 data, and it is likely that operations are now more efficient.
- Numbers do not take synergies into account as they are based on stand-alone operations, which may result in lower job creation value or higher profit margins.
- Further research is required on offshore oyster culture in the Dutch North Sea. Currently, the TRL level is too low to understand if this is a viable business opportunity, both for seabed and deep sea infrastructure.
- Further research is required on the availability of mussel and oyster seed in the North Sea. To date, there has been enough seed but it is unclear if there is sufficient seed to upscale operations.
- Further research is required on the presence of phytoplankton at sea depth of 10-20 meters. Good mussel and oyster growth depends on the supply of sufficient nutrients, particularly phytoplankton. Phytoplankton concentrations at a depth of 10-20 meters, where the mussels would be cultured, are largely unknown.
- Further research is required on the economic impact of higher volumes of mussels produced, especially regarding the impact on the yield of the Dutch mussel industry.

BUSINESS OPPORTUNITY 2

Seaweed

Overall assessment

The available reports, scientific literature, and expert interviews demonstrate high stakeholder value for the production of seaweed. Considering the environmental parameters of the Dutch North Sea, seaweed by itself has a low total financial value and its profitability will depend on the local environmental factors [31].
Production volumes need to be increased and the value chain improved to maximize product value and make seaweed production profitable [32]. With increased production and a developed value chain, the production and processing of macroalgae has the potential to achieve significant metrics, such as increased revenue and profitability.

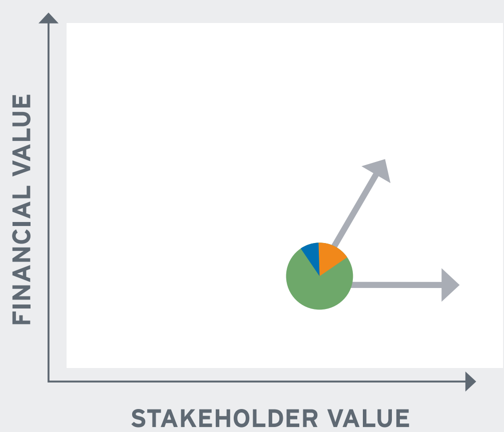
Macroalgae/seaweed production has the potential to create positive value for stakeholders through:

- Sequestering carbon
- Delivering eco-services
- Job creation
- Contributing to the Dutch knowledge-based economy through the development of industry-leading knowledge, science, and education

Positive financial outlook is driven by:

- Opportunities for seaweed to deliver nature services (biodiversity credits)
- Carbon sequestration (carbon credits)
- Use as an input factor for novel bio-based products, such as pharma, bioplastics and biostimulants
- Potential for production of bioenergy such as biogas and ethanol
- Accelerated need for increased production of food and feed

Given the need for scale, the scalability potential created through synergies with the Maripark is expected to significantly enhance the financial viability of macroalgae/seaweed production.



- **Potential €2.7b market and 135 FTEs for a Maripark**
- **Potential for food production**
- **Potential for reduction of €9.8m eq. CO_2 emissions in a Maripark**

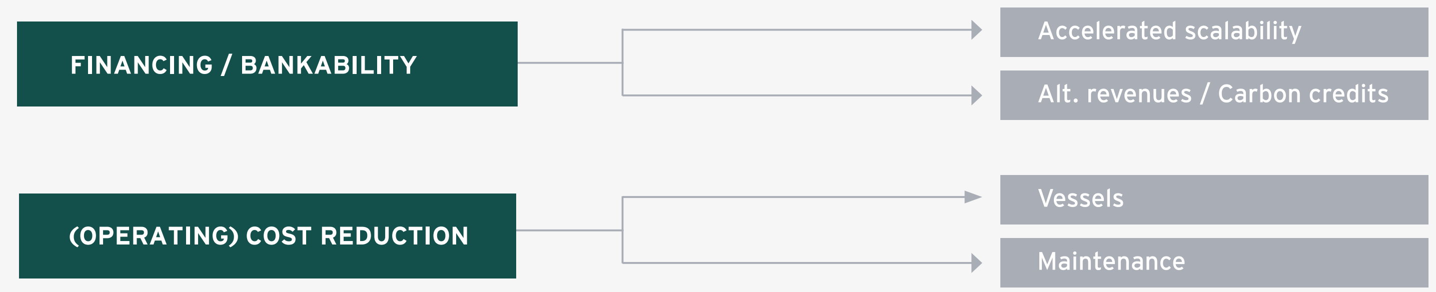
Suitable for Maripark

Stakeholder value contribution: Biodiversity Energy Food Impact made by Maripark

Added value by the Maripark and symbiosis examples

The impact of the Maripark on seaweed depends on the purpose of the produced seaweed. If it's mainly used as an ecosystem service (e.g. as bioremediation for coastal pollution), the enabling of a large-scale farm due to the Maripark increases the stakeholder value. An alternative is to farm seaweed for commercial applications, for which the added value of a Maripark of seaweed and macroalgae production primarily consists of increased bankability and cost reduction elements. Overall, the Maripark can play a key role in making seaweed production financially viable by providing the necessary infrastructure and support for scaled-up production. The Maripark can also serve as a hub for the collection and distribution of seaweed and macroalgae, which can reduce logistics costs and improve market access of seaweed.

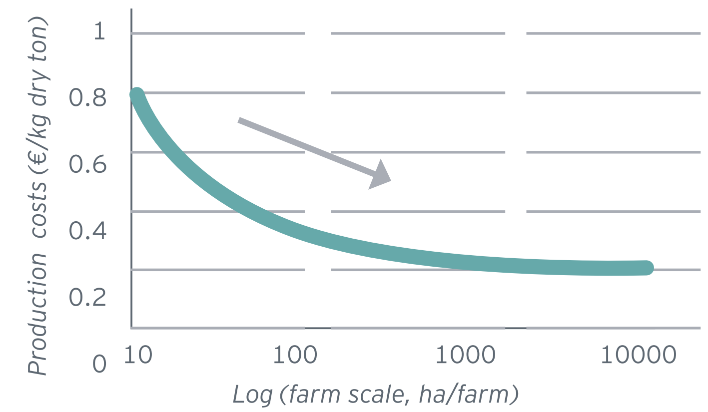
Example of potential sybiosis Maripark



Scalability

The financially viability of seaweed production, competing against land-based bio-production, requires large volumes (>1,000 ha), which is in line with the assumption of a Maripark size [33].
The main costs associated with seaweed farming are labor intensive process steps, as well as the capital expenditure required for fixed infrastructure and logistics (e.g. ships) [32]. Seaweed production can be designed to be modular and flexible to accommodate scaling. However, for successful scaling, the rest of the value chain, like further processing, would also need to be developed and scaled up simultaneously. The additional land-based activities (e.g. hatchery/labs, refinery/processing) primarily required to produce seaweed are likely to require limited space, and therefore are not considered to be a bottleneck for scaling to any level.

As farm scale increases, production costs decrease [32]



Stakeholder value

Potential for 135 jobs related to the Maripark

A 2020 study suggests that seaweed production could create 38k FTEs jobs in Europe by 2030 [34]. Based on the study, 27 FTE per 10,000 ton of wet seaweed produced can be applied to a 1,000 ha farm in a Maripark. This yields 30-50 wet tons per ha [35], which would require 81-135 FTEs related to hatchery, farming and harvesting, processing, logistics, marketing, and sales. Most of the jobs related to the seaweed production will be onshore jobs.

Seaweed production can have a positive impact on nature as it provides a natural habitat for animals, absorbs carbon emissions and, therefore, reduces ocean acidification [35, 36]. The total effect on the environment is dependent on the type of seaweed and scale. If the seaweed farm is exceeding the sustainable production limit, the impact can be negative [35].

57k tons CO_2 sequestered

Assuming a carbon sequestration of 57.64 tons CO_2/ha/year [38], a 1,000 ha farm in a Maripark has the potential to sequester 57.6k tons of CO_2 annually. When multiplied by a social cost of carbon of €875, this CO_2 sequestering yields €50.4m for a Maripark [20].

Another research paper has estimated that the ecosystem services for the North Sea region – such as fisheries value generated by seaweed, nutrient removal and carbon sequestration – has a value of $71k per ha per year [36].

Financial value

€2.7b market potential in Europe
Proof for the large-scale offshore production in the North Sea is still lacking, but the inferred total seaweed market potential is estimated to be €2.7b in Europe in 2030 [34]. Today, the European seaweed market has a value of €840m [42]. Seaweed can provide a valuable input source for various use cases, such as for biostimulants in agriculture, bioactive compounds in pharma, methane reduction for livestock production, etc. The price of the final product, which requires further process steps, is influenced by the type of seaweed being harvest, and end use, with a range of $400-$800 per dry ton [33, 31]. Using a carbon price of €250, the 57.6k tons of CO_2 sequestered could yield €14.4m for a Maripark [21].

Potential for synergies in a Maripark
The production costs include those for hatching, farm gear, vessels, equipment, personnel, logistics, and onshore costs. High scalability effects are expected on capex and opex. Reaching a farm size of 100 ha gives a production cost of $350 per dry ton, and a 1,000 ha farm lowers the cost to slightly over $200 per dry ton [32].

Considering a 1,000 ha farm, the cost of purchasing a multi-use vessel is estimated to be €10m [41]. The proportion of the production cost estimated in [33] related to farming gear and vessels is over 50%, so the possibility of sharing infrastructure such as concrete blocks, buoys, and vessels with other business opportunities in the Maripark, like floating solar will lower costs.
Also, multi-purpose boats used for the deployment, maintenance, and harvest could be shared by other business opportunities in idle time or co-shared for joint trips (e.g. maintenance at the seaweed farm combined with maintenance at the wind farm and floating solar) further driving down the operating costs.

Feasibility

Fit for economic zone
Seaweed production requires areas with sufficient nutrients and light for growth, salinity and temperatures. The North Sea fulfills the criteria for seaweed species, as demonstrated by pilot projects such as the Algae Demo in the North Sea which is currently running [39]. Demonstration of large-scale seaweed cultivation at open sea and the positive effects thereof on the ocean still lacks proof.

Moderate TRL level offshore
The TRL level of offshore seaweed is considered moderate [35]. There are also questions related to how the quality of the seaweed is affected when increasing the scale of the seaweed farm. If the farm is too large, the production of seaweed in the area is somewhat limited due to the availability of phosphate and nitrate. A paper from 2023 modeled that there is a potential for sustainable production up to 100,000 ha with a yield of 10 dried ton per ha, to be farmed in the Dutch North Sea [37].

Political strategy fit
There are very few public controversaries about the production of seaweed. Results from a social media analysis shows that there are mixed, but mostly neutral and positive mentions on seaweed [43] in the analyzed period. The planned Dutch North Sea Programme 2022-2027 (annex to the Draft National Water Program 2022-2027) considers the usage of the space between the windfarms for the cultivation of seaweed and shellfish [40].

Limitations / To be further researched

- Considering the seasonal character of the production, the value chain may be inefficient if designed on peaks. This is because the value chain then has free capacity during long periods of the year.
- The long-term impact of carbon sequestration is driven by the time it takes until the carbon is released again. The social value could be adjusted by the length of the carbon cycle to gain a better understanding of the short and long-term impact.
- The market potential for direct consumption should be further researched since this will have an impact on the investments for drying/processing and refining (proteins, valuable contents) of additional production. Measurement of carbon capture for long/short term and in relation to this, the willingness to pay for ecoservice by governments should be further researched.
- Quality of the seaweed produced further offshore at large-scale is unknown.
- The benefits of the CO_2 sequestering depends on the use of the CO_2.

Passive fishery

Overall assessment

The long-term plan for the Dutch North Sea involves designating 27% of the area to offshore wind parks by 2050. By permitting passive fishery within these wind parks, two opportunities arise for the traditional fishery industry. Firstly, it would enhance development of offshore passive fishing methods.

Secondly, it would extend the current fishing grounds. The potential of passive fishery in the North Sea to provide a stable source of food suggests a significant value for stakeholders. Passive fishery aligns with environmental targets set by the Dutch government, as it contributes to the reduction of emissions and of bycatch while minimizing seafloor disturbance compared to active fishing methods. Although there are entry barriers, such as high initial costs associated with acquiring harvesting vessels, it also offers the potential for synergies with passive fishery activities within the Maripark.

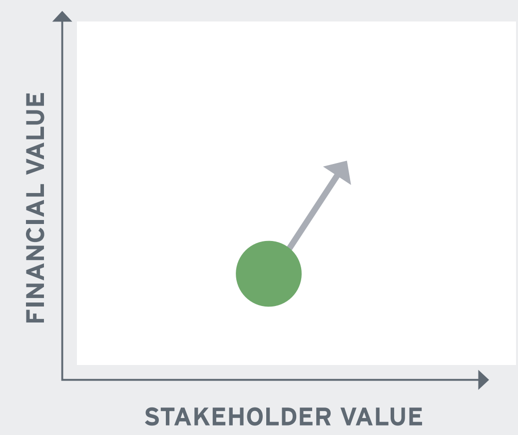
Passive fishery has the potential to create positive value for stakeholders through:

- Increased available fishing grounds
- Lowering carbon footprint of the fishery sector
- Job creation
- Contributing to the Dutch knowledge-based economy through the development of industry-leading knowledge, science, and education

Positive financial outlook is driven by:

- Diversification of income streams for traditional fisheries
- Potential to deliver premium products that are aligned with sustainable fishing practices
- Lower costs of operation and operational efficiency
- Accelerated need for increased food and feed production

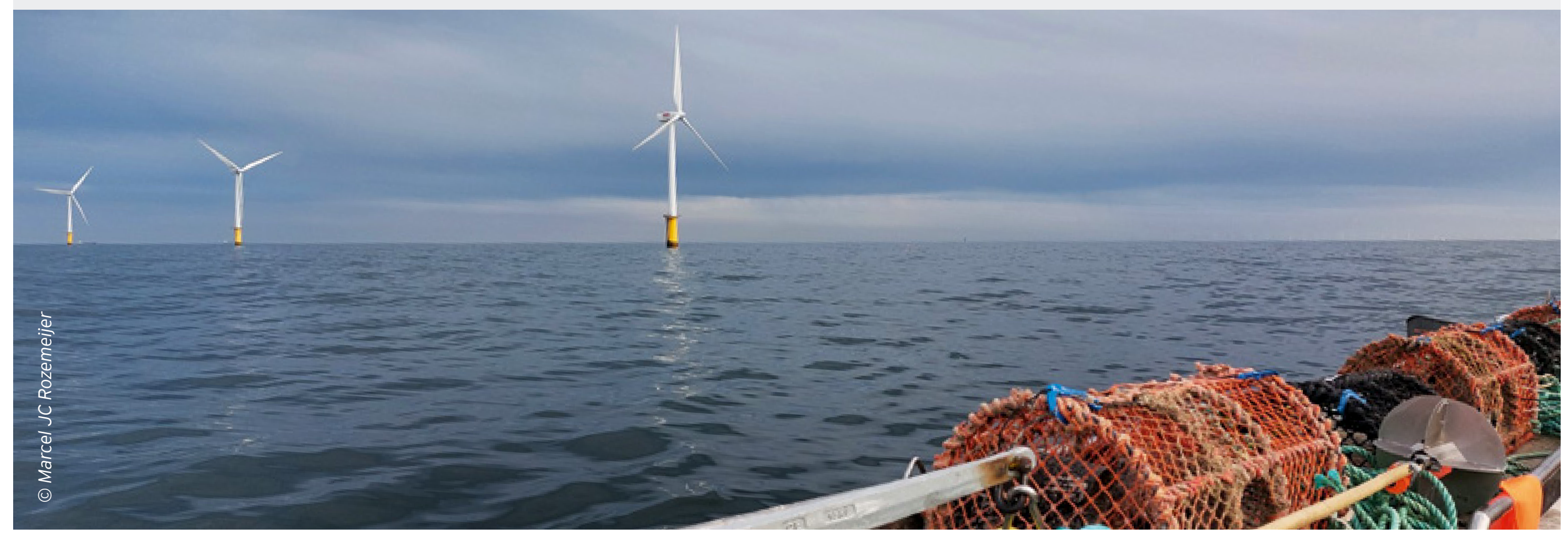
The potential to share the high upfront costs with other businesses and additional fishing grounds available in a Maripark are expected to significantly enhance the financial viability of passive fishery.



- **Potential for 200-300 jobs in the Dutch North Sea**
- **Extends fishing grounds**
- **Reduced ecological footprint (less petrol, bottom stirring)**

✓ **Suitable for Maripark**

Stakeholder value contribution: Biodiversity Energy Food → Impact made by Maripark

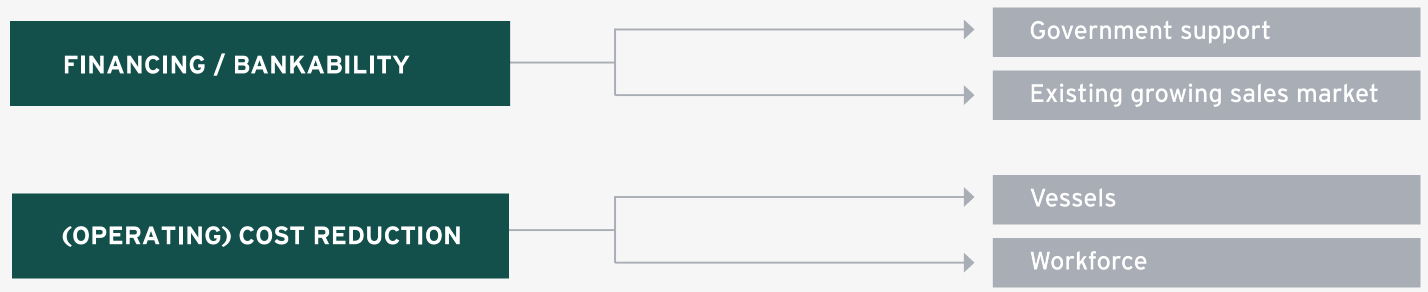


Added value by the Maripark and symbiosis examples

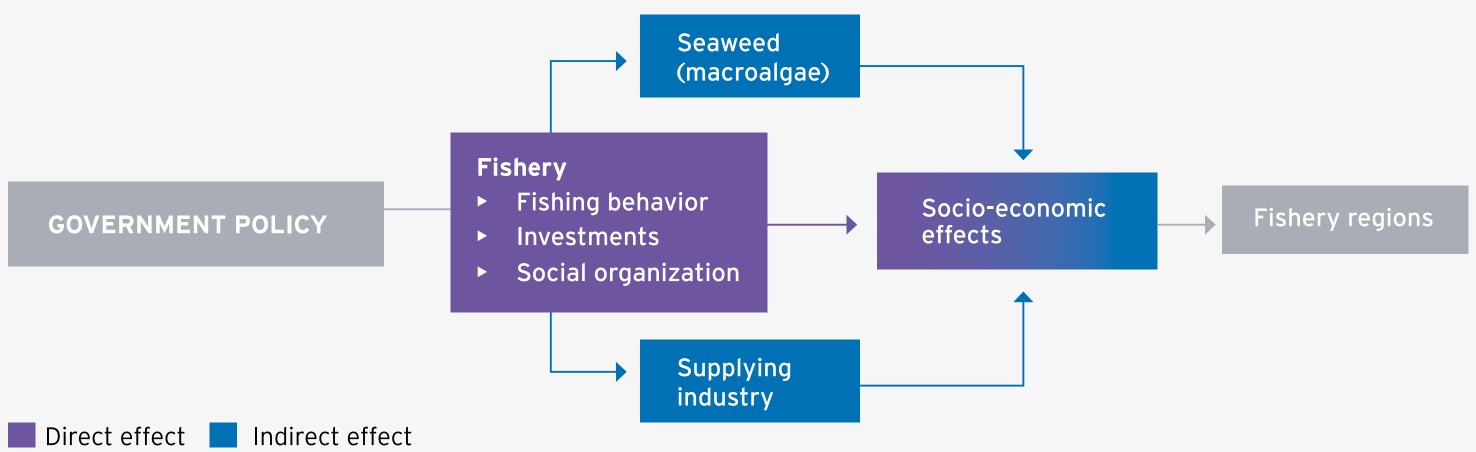
The primary added value of a Maripark lies in the expansion of available fishing areas, allowing fishers to access new territories and potentially increase their catch. Furthermore, the underwater infrastructure of the Maripark creates unique ecosystems that attract diverse species and enhance biodiversity.

Additionally, the vessels used for passive fishing can be combined with the maintenance activities of offshore energy activities, leading to shared infrastructure, reduced costs, and improved efficiency. There is also potential to allocate fishery subsidies towards the creation of multi-use vessels, serving both passive fishery and other functions within the Maripark.

Example of potential sybiosis Maripark



How government policy affects fishery



Stakeholder value

Potential for 200-300 jobs in the North Sea

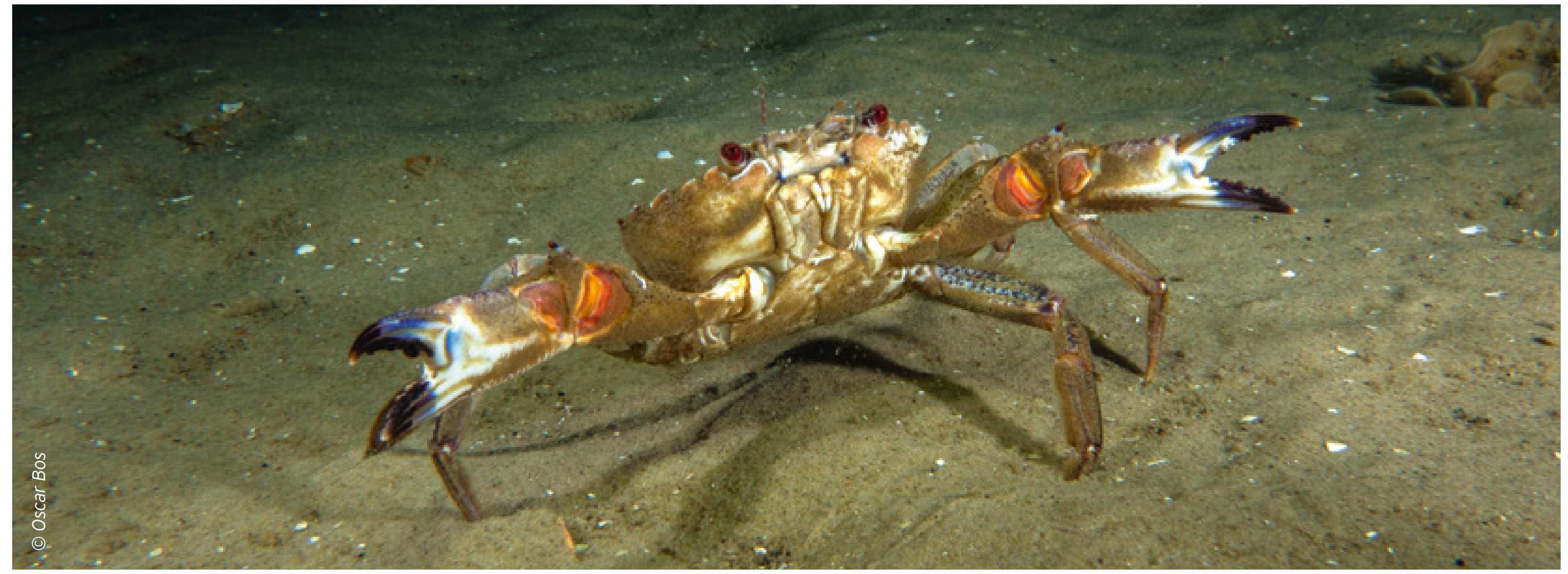
Between 2009-2021, the active Dutch fishing fleet has seen a steady decline. The number of large fishing vessels (i.e. trawlers) declined by 57% to 6 in 2021, sea fishing cutters declined by 5% to 283. For small sea fishing, available data from 2009 onwards exhibit a 15% decrease to 232 officially active fisher boats in 2021 [28]. Estimations indicate that there will be capacity for 100-150 small passive fisher boats in the North Sea [44], which would account for c. 25% of the current Dutch fleet. Assuming 2 FTE per vessel [45], the job potential for the North Sea is 200-300 jobs.

Extends fishing grounds

Currently, trawling is not permitted within offshore wind parks [46]. However, by utilizing these areas for passive fishing, stakeholders can capitalize on the untapped potential within the North Sea, maximizing the benefits of sustainable and responsible fishing practices. Such expansion of fishing grounds provides an opportunity for passive fishery to grow and further enhance stakeholder value.

Reduced ecological footprint

Passive fishery methods exhibit several advantages such as lower seabed disturbances, reduced fuel use, and decreased bycatch compared to traditional fishing practices [44].



Financial value

€24-32m labor productivity in the Netherlands

In 2018, the total export value of fish in the Netherlands was €3.8b [47]. Economic feasibility is highest for fishing shellfish, with the potential of growing them between offshore wind parks [44].

With an estimated availability of 200-300 full-time equivalents (FTE) for passive fishery in the North Sea and a labor productivity rate of €120k per FTE [45], the total labor productivity in the Netherlands would range between €24m and €36m.

Potential for synergies in a Maripark

Production costs include those for hatching, farm gear, vessels, equipment, personnel, logistics, and onshore costs. Multi-purpose vessels and well-trained staff can be deployed at other business opportunities in the food domain, leading to synergies of capex and opex. An example is joint trips and maintenance (e.g. combining collecting crab posts with light maintenance of floating solar panels). The cost of purchasing a multi-purpose electric vessel is estimated to be €5-10m [44].

Feasibility

Fit for economic zone

Between 5-10 years are expected to be required for the seabed to recover after the completion of offshore wind construction [44]. During this timeframe, a diverse range of aquatic species, both existing and new, may repopulate the area, attracted by the hard substrate on which wind parks are built [44]. Notably, in the Dutch North Sea, electricity cables to and from offshore energy generation are buried deep below the seabed surface, resulting in minimal electromagnetic radiation within the seabed. This is beneficial as studies have shown that electromagnetic radiation can cause harm to North Sea crabs [44].

4 potential techniques

Currently, 4 techniques, namely handline, jigging, set gillnet, and pots, are being tested in the Borssele wind park [44]. However, it is important to note that there are no full-scale operations of passive fishery within offshore wind parks currently active in the Netherlands.

Political strategy fit

The Noordzeeakkoord states that research will be done regarding the possibility of shared use of the space within a wind park, allowing for fishing activity [46]. A target of the Dutch government is making the fishing sector more sustainable, lowering seabed disturbances and fuel consumption [48]. Passive fishery meets these targets by reducing the amount of seabed disturbances compared to traditional fishing and use of fuel by using electric ships [44].

Limitations / To be further researched

- Assigning the plots should be done in consultation with Maripark entrepreneurs. Fishery requires extra attention as fish habitats and swimming lanes vary per species and are location-specific.
- Further research is required on the design and optimization of fishing gear. This aims to ensure selective targeting of desired species while minimizing bycatch and reducing any potential negative effects on marine biodiversity.
- Further research is required on the potential impacts of passive fishery activities on the marine ecosystem, including interactions with non-target species, habitat alteration, and overall ecological dynamics.

BUSINESS OPPORTUNITY 4

Offshore wind energy

Overall assessment

Offshore wind is set to be a key source of renewable energy within the EU and globally. Rapid technological development has led to cost-effective installation and operation. The North Sea is relatively shallow and has a favorable wind-climate [49], making it a suitable place for developing offshore wind parks. In addition to the three wind zones that are already being developed – Borssele, Hollandse Kust zuid (Dutch south coast) and Hollandse Kust noord (Dutch north coast) – an additional 7-16 GW of offshore wind is currently in development in the Dutch part of the North Sea for 2023 to 2030 [50, 51].

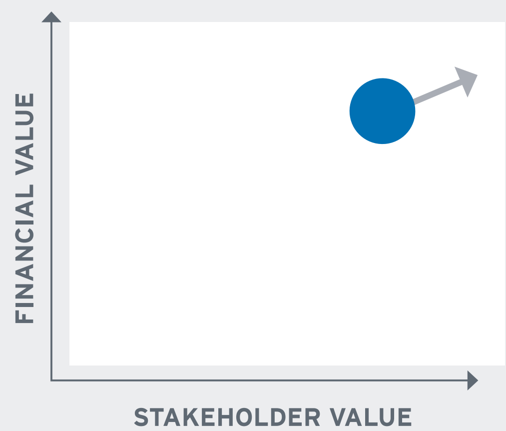
Offshore wind energy is considered to have moderate to high stakeholder value, similar to other forms of renewable energy. Offshore wind energy is currently profitable as a stand-alone business case, yet it can benefit from shared infrastructure (e.g. cabling or foundations) along with other forms of offshore energy generation [53].

Offshore wind energy production currently has the potential to create positive value for stakeholders by:

- Providing renewable energy
- Providing low-cost energy
- Job creation and promoting industrial development

A positive financial outlook is driven by:

- A maturing market, with decreasing investment costs compared with newer forms of renewable energy
- Incentives from both EU and NL legislators to develop offshore wind
- A need for more renewable energy



- **Potential for improved grid integration for offshore renewables**
- **Potential for > 1,100 jobs related to a 100 MW facility**
- **Potential for reduction of CO_2 emissions**

✓ **Suitable for Maripark**

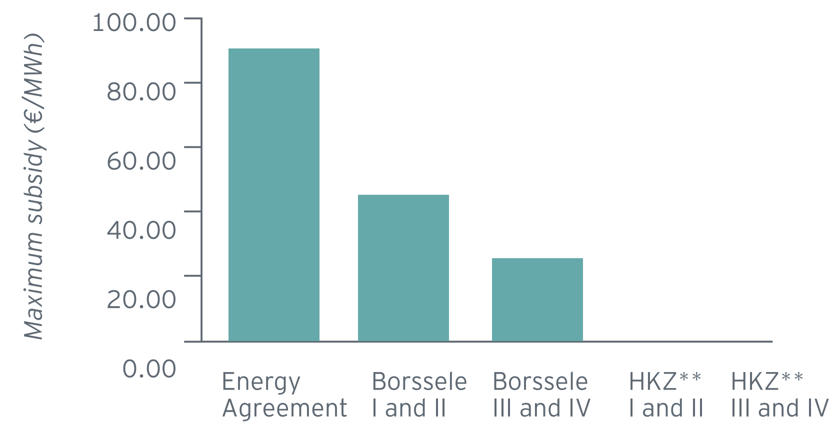
Stakeholder value contribution: Biodiversity, Energy, Food, Impact made by Maripark

Added value by the Maripark and symbiosis examples

Offshore wind is relatively mature, therefore, the Maripark's added value is predominantly from shared vessels, improved stakeholder management, license to operate, and potential symbiosis regarding safety and monitoring. Offshore wind could add to Maripark's value by providing infrastructure, shared maintenance personnel (with e.g. floating solar), and shared monitoring and surveillance. In addition, the heavy underwater infrastructure needed for offshore wind might be used as anchors by other business cases, lowering the total capex.

Example of potential sybiosis Maripark

Role model for other business opportunities



From emerging technology to financially viable energy production
There has been a significant expansion of the Dutch offshore wind industry in recent years, partially due to subsidies. However, the industry has now advanced to the point where it can grow without the need for direct government support*.

Experts have noted that this transition away from subsidies may serve as a valuable example for other emerging offshore industries that are having difficulty getting started.

* TenneT does finance the connection from offshore wind parks to the Dutch mainland, which could be seen as indirect government support.
** Hollandse Kust Zuid

BUSINESS OPPORTUNITY 5

Offshore floating solar

Overall assessment

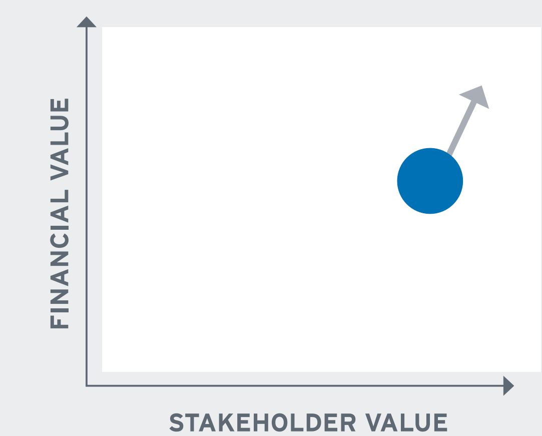
Offshore solar energy, like other renewable energy sources, is considered to have moderate to high stakeholder value. Offshore floating solar energy currently requires subsidies and increased marginal energy production to be profitable [53]. Increased technological developments are, however, expected to drive the maturity levels of offshore floating solar to profitability [49, 54]. The financial feasibility of floating solar energy in areas such as the North Sea where solar irradiation is low will rely on its integration with other renewable energy sources where infrastructure, such as grid cabling, can be shared [53]. In this context, offshore floating solar is estimated to reach levelized cost of electricity (LCOE) values competitive with other forms of renewable energy by 2030 [49].

Offshore solar energy production has the potential to create positive value for stakeholders by:

- Providing renewable energy
- Balancing wind park energy output
- Job creation and promoting industrial development

A positive financial outlook is driven by:

- Steep learning rates that lead to rapid cost reductions as deployment increases
- Ability to provide renewable energy during low wind conditions
- Accelerated need for more renewable energy



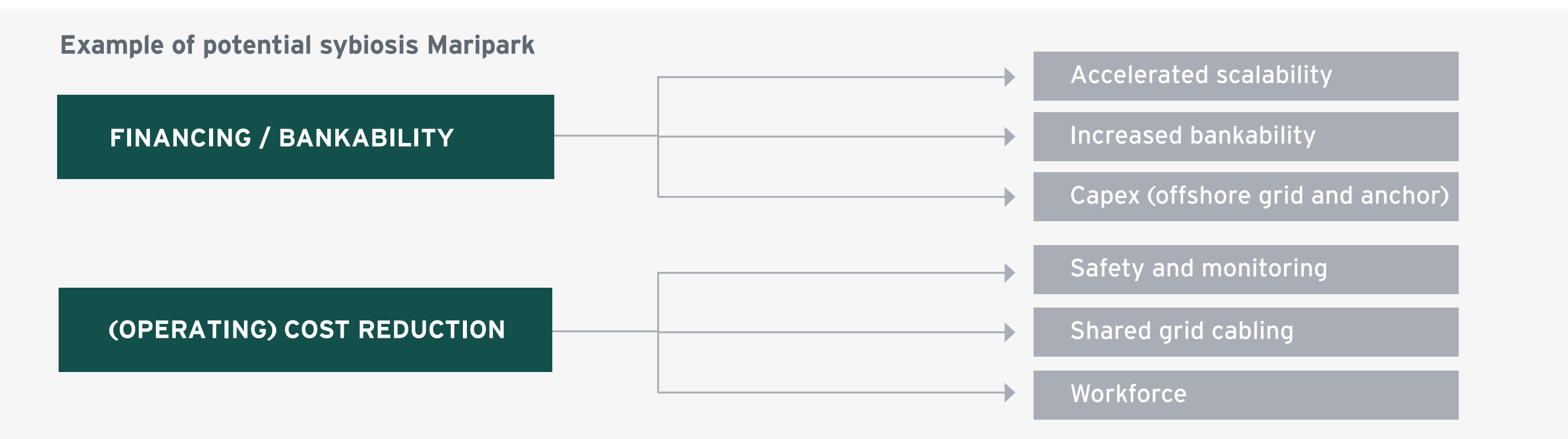
- **Potential for improved grid integration for offshore renewables**
- **Potential for ~626 jobs related to a 100 MW facility**
- **Potential for reduction of CO_2 emissions**

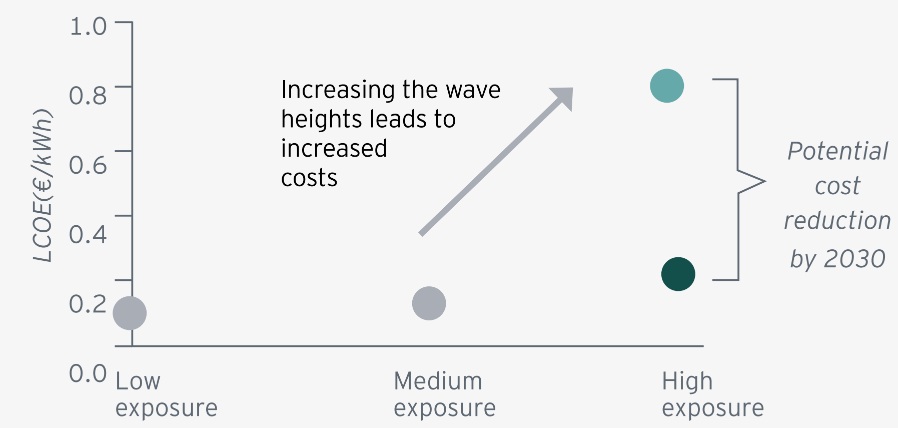
Suitable for Maripark

Stakeholder value contribution: Biodiversity Energy Food → Impact made by Maripark

Added value by the Maripark and symbiosis examples

Offshore floating solar in a Maripark could benefit from value by reductions in capex, opex and improved stakeholder value. In the Dutch North Sea, critical enabling factors for offshore solar operations are the shared-use of monitoring and safety operations, which are provided by a Maripark. Floating solar adds value to the Maripark by increasing the overall capacity factor of the grid connecting cable. More stable energy provision may also allow for additional businesses to operate, such as offshore production of hydrogen or ammonia [55]. The successful development of floating solar in the high exposure conditions of the North Sea could also be replicated elsewhere and the technology exported.





Role model for other business opportunities

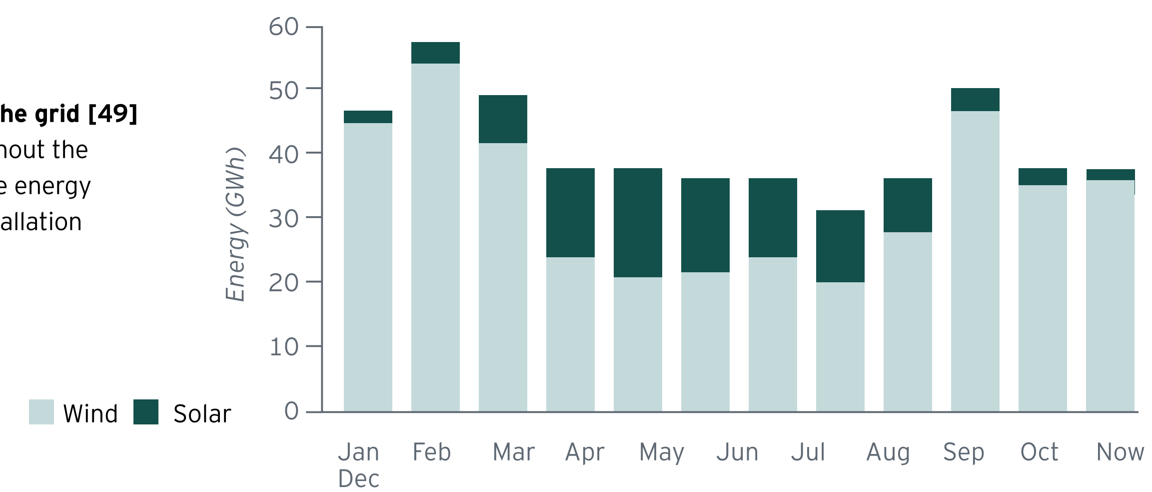
Both scale and environmental conditions affect the LCOE of offshore solar [3].

Increased scale and reduction of over-engineering is expected to reduce the LCOE of offshore solar.

Energy mix

Floating solar provides stability to the grid [49]

Solar balances the energy mix throughout the year, despite providing only 25% of the energy as in a similar-sized offshore wind installation (100 MW in the example).



Stakeholder value

Moderate TRL level offshore

Different pilot projects and demonstration facilities on the kilowatt-peak (kWp) scale have been deployed. The TRL varies between different technological solutions. Consequently, estimates of the levelized cost of electricity (LCOE) for offshore solar is limited by the lack of commercial operations [53, 54]. The applicable solutions for the North Sea with high waves are early in the development phase with low TRL levels of around 2 to 4 [54].

Potential for Dutch industry and ~626 jobs related to a Maripark

There are many opportunities for local communities and Dutch industry to take part in a floating offshore solar industry.
Key actors include utility and energy companies, system suppliers, EPC (engineering, procurement, and construction), contractors, material suppliers and project developers [54]. Estimates from the onshore solar PV industry suggest that a 100 megawatt-peak (MWp) facility could generate approximately 450 direct jobs in the value chain, with 110 of those jobs in operations and maintenance [18]. This offers a potential for 626 jobs created in an offshore facility.

47k tons of CO_2 emission removed

Electricity generated by photovoltaics has been estimated to be ~32 gCO_2/ KWh [56]. In comparison, the average CO_2 emissions per KWh in the Netherlands is 481g CO_2. Given an annual electricity production of 104 GWh for a 100 MWp facility [49], there is potential to reduce the CO_2 emissions by 47,000 tons, saving €41.1m in social cost of carbon per 100 MW facility.

Financial value

Potential for ~104 GWh in a Maripark

The direct financial value of offshore floating solar represents the income derived from production and delivery of electricity. An assumed ~1.0-1.5 km² facility within a Maripark that has 100 MW installed capacity has a potential for approximately 85-104 GWh annual production. The profitability, however, depends on the cost of deployment, operations, and maintenance. Costs of floating solar are expected to be higher than conventional solar, both for acquiring panels and for installation and maintenance. Offshore solar also requires the construction of grid connections to the mainland, which is a significant expense. At present, subsidies are needed to support the deployment of offshore floating solar [49]. Significant cost reductions are expected as the cumulative installed capacity increases [49, 53].

Potential for synergies in a Maripark

Depending on the conditions at the specific site, hybrid systems combining solar power and offshore wind can increase the capacity and energy production per unit surface area significantly compared to setups with wind only [58]. As wind generally produces more energy in the winter and solar produces more in the summer, combining offshore wind and solar PV can help smooth the power output by over 60%. The overall profitability of combining offshore floating solar with offshore wind will depend on the electricity price.

Feasibility

Fit for economic zone

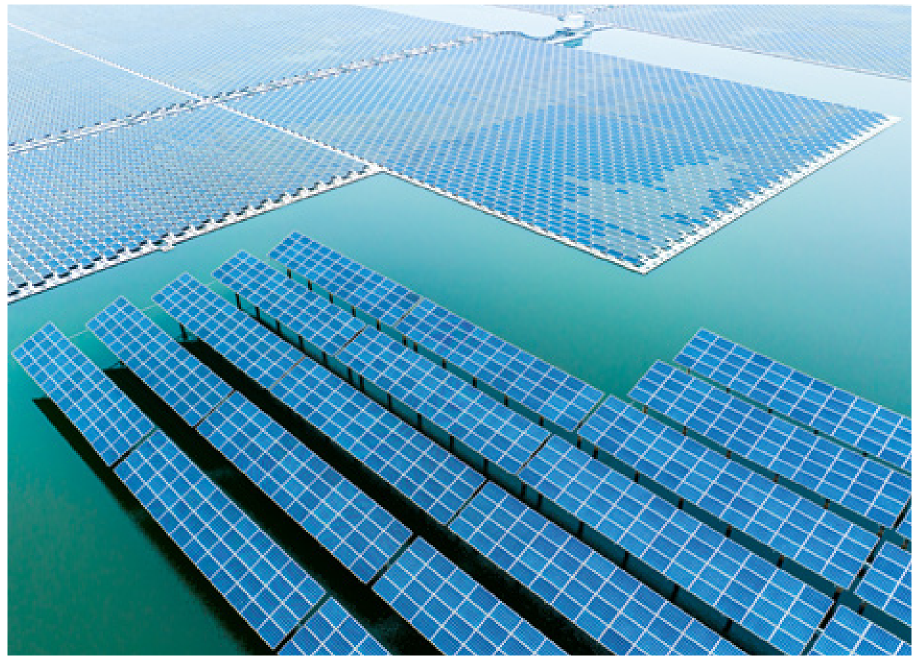
There are several factors that affect the feasibility of offshore solar in the EEZ. The irradiation and, therefore, the effectivity of solar panels increases closer to the equator. At higher latitude, the panels require tilting to collect more sun, which may increase installation and maintenance costs due to wind drag. However, cooling effects are likely to cause additional energy gains [57]. When a total potential of 45 GW installed capacity in the Dutch North Sea is assumed [54], there is a potential for 46.8 terawatt hours (TWh) annual production.

Political strategy fit

The deployment of floating offshore solar represents an opportunity for the Dutch government to reach its ambitions of reducing the greenhouse gas emissions by 49% by 2030 and 95% by 2050. A roadmap for PV systems and applications in the Netherlands estimated that the offshore capacity could reach 50 gigawatt-peak (GWp) in 2030 [59].

Social acceptance

Although there is not much experience from similar offshore solar projects, the social acceptance of floating offshore solar is expected to depend mainly on the aesthetics and environmental impacts.



The deployment of offshore floating solar may result in positive and negative environmental impacts that vary from site to site and include physical, chemical and biological impacts [53, 60]. The combination of wind and solar results in a higher energy output per ha and can reduce the area needed for construction, thus providing more room for activities such as fishing and nature restoration.

Limitations / To be further researched

- Offshore solar in North Sea conditions is still in an early stage of development and current estimates for LCOE must be improved and verified.
- Construction of floating solar in high waves and strong winds is still a major cost driver.
- Currently, the size of offshore solar projects is in the kilowatt-peak (kWp) range, demonstrating the need for large-scale pilots and demonstration projects.
- Gain a better understanding of the risks involved in offshore operations.
- The combination of wind, solar and aquaculture systems in a single structure [58] is a relatively new concept and the feasibility of its implementation in the Dutch North Sea should be further researched.
- The potential for technology export for offshore solar in high exposure environments is currently not mapped out.
- The potential environmental effects of deploying solar panels in the North Sea should be carefully evaluated.
- The current experience with decommissioning is limited, so it is important to further address the financial and technical aspects.

Wave energy

Overall assessment

Wave energy can be a useful addition to the energy mix of the Maripark. Wave energy converters produce renewable energy and as for solar are expected to yield moderate to high stakeholder value. Wind turbines are planned to be deployed across the North Sea. Wave energy converters can add value to the Maripark as wave energy complements wind energy [61] and, in combination, has moderate to high stakeholder value due to a lower intermittency. Energy created by wave generators is also easier to predict [62], which is positive for stakeholders.

However, the wave energy sector is still characterized by a low TRL level and have a higher LCOE than other renewable energy sources, such as offshore wind. The costs need to decrease to be competitive.

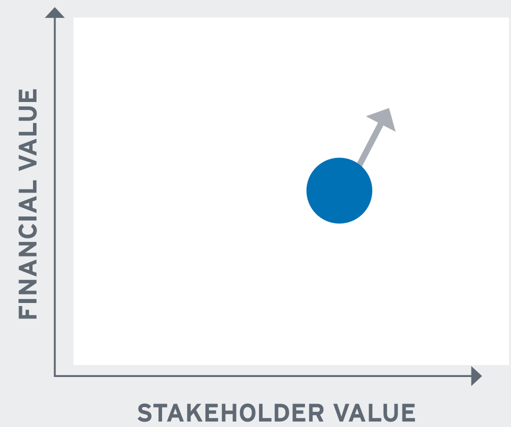
A decrease in costs is expected as the cumulative installed capacity increases towards 2030 and 2050 [49].

Offshore wave energy production has the potential to create positive value for stakeholders by:

- Providing more reliable and predictable renewable energy
- Reducing CO_2 emissions
- Job creation

Positive financial outlook is driven by:

- Reduced cost of technology
- High electricity prices
- Ability to provide renewable energy during low winds



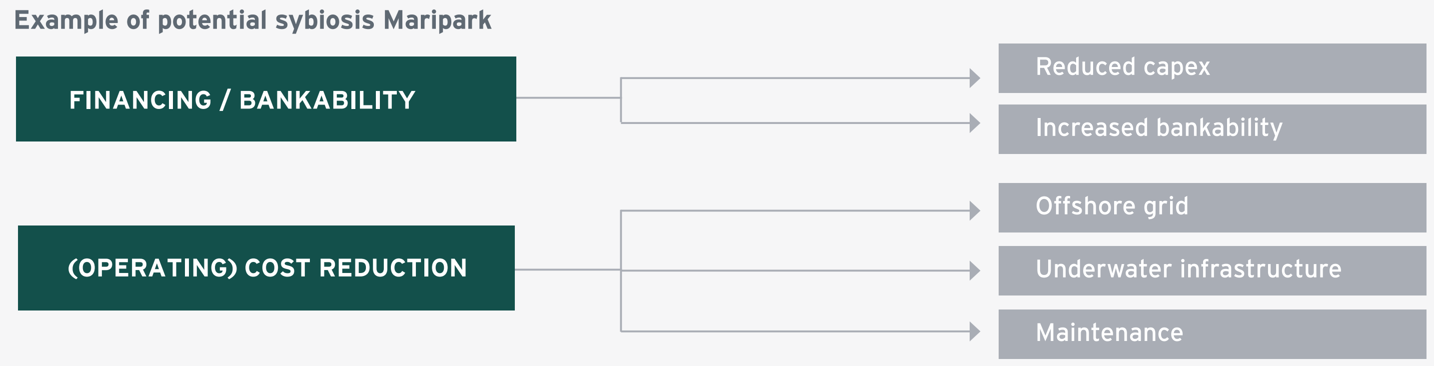
- **Potential for more stabile energy production**
- **Potential for ~228 jobs related to a 100 MW facility**
- **Potential for reduction of 184k tons CO_2 emissions**

Suitable for Maripark

Stakeholder value contribution: Biodiversity, Energy, Food, Impact made by Maripark

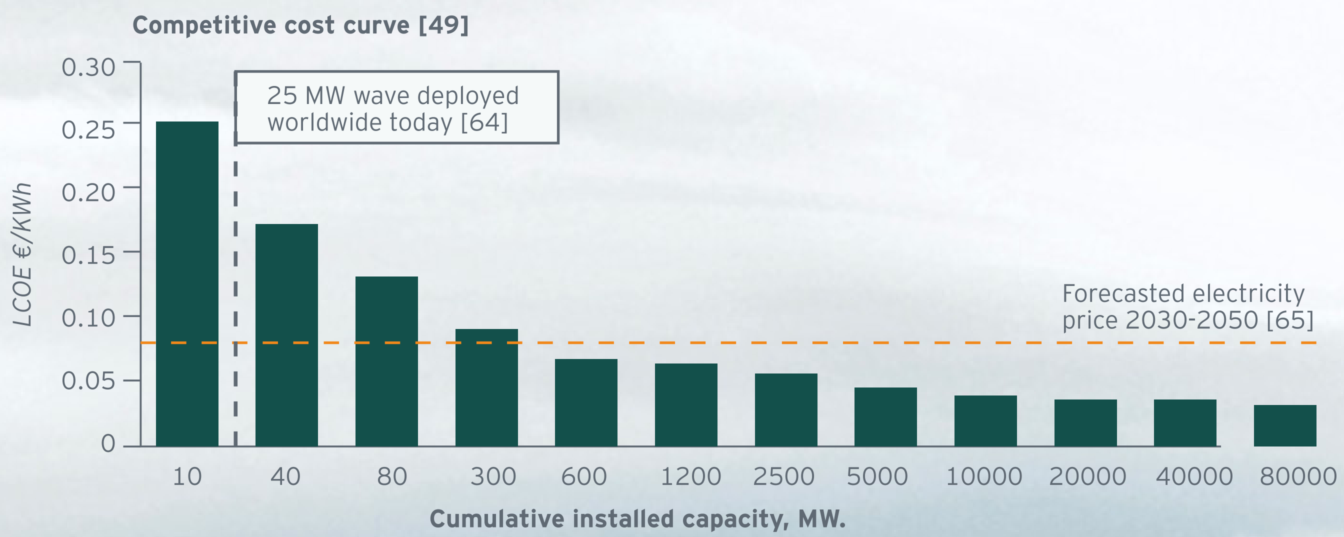
Added value by the Maripark and symbiosis examples

The added-value of a Maripark for offshore wave relates mainly to reduced capex and, therefore, increased bankability. Stand-alone, wave energy is not so financially appealing, but a Maripark can increase the financial value. If wave energy converters can share the offshore grid with the offshore wind turbines, it will decrease the overall LCOE [49]. Wave energy can provide a back-up to wind energy which reduces intermittency and the need for fossil fuels. The Maripark could, therefore, add a higher stakeholder value due to the increased renewable energy provided to the grid.



Scalability

As more wave energy is deployed, the LCOE is expected to decrease, making it more competitive with other energy sources.



Stakeholder value

Potential for 403 jobs related to the Maripark

Successful deployment of wave energy generators reaching the potential of 0.4 TWh annual electricity production in Borssele and the realization of the wave energy value chain can yield many jobs for a Maripark [66]. Assuming the potential is fulfilled and applying direct job estimates per MW of 1.76 [67], a 0.4 TWh yearly production would support 201-403 jobs*. These jobs are related to manufacturing, transport, administration, operation and maintenance.

184k tons CO_2 emissions reduced

Wave energy is a renewable energy source with no pollution when generating energy. A life-cycle assessment (LCA) estimates that electricity generated by wave energy releases CO_2 emissions of 24.1-46.0g CO_2/KWh [68]. When compared to the Dutch average emissions of 481g CO_2/KWh [69], 0.4 TWh wave energy production in a Maripark could yield an annual reduction of 184k-174k tons CO_2 if electricity from the Maripark replaces 0.4 TWh of the average Dutch production. This reduction gives a social value of €152m-€161m*. However, the wave energy generator creates noise that potentially harms life at sea and requires space that, for example, cannot be used by fisheries. Wave energy is considered more predictable and reliable than other more developed sources such as wind and solar energy [70]. This is because it is easier to predict the size of the waves rather than the hours of sunshine or wind. This is positive for stakeholders and could increase the capacity of renewable energy in the Netherlands.

Financial value

LCOE is expected to decrease

The financial value of wave energy depends on several factors, such as the price of electricity and LCOE. The levelized cost of electricity for wave energy is still too high to be competitive against other renewables such as hydro and wind power. The LCOE is expected to decrease from 0.16-0.75 €/kWh (2022) to 0.13-0.35 €/kWh (2030) as technology is developing [64], but the LCOE is still at a high level. The total NPV of this business opportunity depends on the development of technology and energy price towards 2030, but as of current, the NPV is not expected to be high. Using a carbon price of €250, the reduction of CO_2 of 184-174k CO_2 annually, yields €43.5 - €45.9m [21].

Potential for opex and capex synergies

Wave energy generation requires large investments in transmission cables to transport the electricity onshore. If the wave energy generators are near offshore wind turbines or a floating solar park, there is potential to share these costs. This will lead to a significant reduction in capex. However, more studies are required to conclude this. To reduce operational costs, the same crew and vessels could be used for maintenance. The potential capex and opex synergy leads to a reduced LCOE for the wave converters [49]. Wave energy is regarded as complementary to wind energy, as there are still waves when the wind has stopped [6].

Feasibility

Fit for economic zone

Wave energy converters need waves to generate power. The wave energy density in the North Sea is estimated to be 8-12 kW/m, which is significantly lower than in open ocean where the potential can be more than 80 kW/m [71]. However, the capex and maintenance cost of wave energy generation is potentially lower than in the open sea, due to milder conditions. The potential of yearly electricity generated in the EEZ is estimated to be 2.6 TWh. For example, in Borssele wind park, there is potential for 0.4 TWh per year of wave energy to be generated [66].

Political strategy fit

The planned Dutch North Sea Programme 2022-2027 does not include wave energy generation for this period but it is not excluded for coming periods.

Social acceptance

There are little-known public controversies about wave energy converters. Wave energy generators are not very visible to the public and the public recognizes its high potential and limited risks. A social media analysis shows that almost all mentions in the analyzing period are considered neutral [43].

Moderate TRL level

There are many potential technologies for offshore wave energy generation being tested in pilots world-wide. The most promising are at a moderate to a high TRL [64]. There is currently no preferred technology within the industry.

Limitations / To be further researched

- There is a lack of design convergence which could lead to longer development times [64].
- There are still high capex costs.
- Needs further research on the impacts across the full energy supply when combined with wind, and its integration in the energy system.
- The environmental impact of deploying wave energy generators needs further study.
- There is a need to better constrain the seasonal supply with more waves in the summer than in the winter.
- Decommissioning (both financially and technically) experience is limited and needs more research.

* *Assuming a capacity factor of 40%-20%, 0,4 TWh (400,000 MWh) would require 114-228 MW of installed capacity (MW=MWh / (capacity factor*hours in a year)). This yields 201-403 direct jobs based on 1,76 jobs per MW.*

** *Multiplying the social value of carbon, € 875, with the total CO_2-reduction.*

BUSINESS OPPORTUNITY 7

Offshore green hydrogen production

Overall assessment

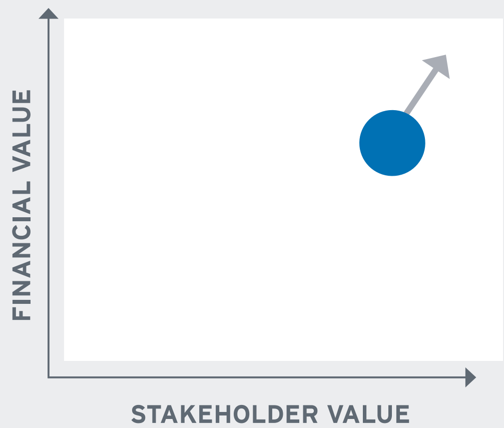
Offshore green hydrogen production can yield a higher financial value than an onshore facility as of 2030 [72]. It can be an important contributor to reducing climate emissions at high volumes, which brings high stakeholder value. Hydrogen (H_2) production is possible within a Maripark, based on an assessment of relevant studies and interviews with experts. Green hydrogen production is within the policy scope of both the Dutch government and the EU to achieve decarbonization in Europe. Moving the production facility close to where electricity is generated (e. g. wind farm or offshore solar) could yield benefits such as reduced transition loss. Transporting hydrogen using existing gas pipelines offers the possibility to reduce infrastructure costs at a large scale.

Offshore green hydrogen production has the potential to create positive value for stakeholders by:

- Balancing the energy supply
- Transporting energy
- Job creation and supporting industry
- A clean energy carrier to replace fossil alternatives

A positive financial outlook is driven by:

- Accelerated demand for renewable energy carriers
- Reduced costs of renewable energy
- Steep learning curves that lead to rapid cost reductions as deployment increases



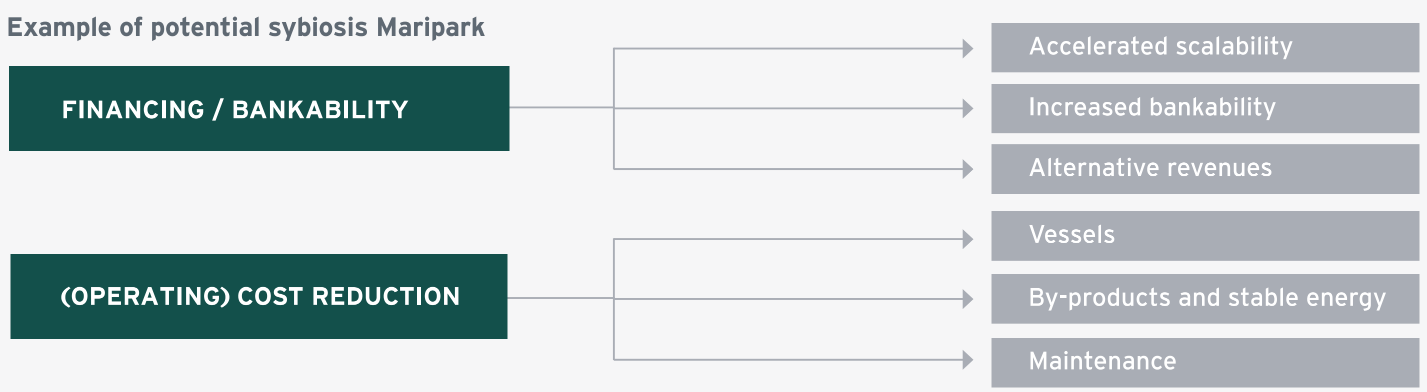
- **Potential for over 375 jobs related to the Maripark**
- **Potential for stabilization of energy supply**
- **Potential for reduction of 222k tons of CO_2 emissions**

✓ **Suitable for Maripark**

Stakeholder value contribution: Biodiversity Energy Food Impact made by Maripark

Added value by the Maripark and symbiosis examples

The added value of a Maripark for an offshore hydrogen facility primarily consists of reduced distance to energy generation and the potential for shared vessels and maintenance costs. There is also potential for additional income by providing electricity when the wind turbines are not generating energy or by-products, such as heat and oxygen, that can increase bankability. The Maripark enables reduced transmission loss by producing hydrogen closer to the source of electricity. This has a positive effect on stakeholder value.



Expected development

Both electrolyzers in the graph make use of offshore wind [72]. Reduction of costs related to electrolyzers and offshore wind is expected to reduce the $LCOH_2$.

Competitiveness against grey hydrogen depends on future renewable energy price, price of fossil fuels such as natural gas and carbon taxes. Towards 2030, it is expected that green hydrogen will have less production costs than fossil-based hydrogen [73].

Stakeholder value

Potential for 375 direct jobs in a Maripark

An offshore hydrogen production facility has the potential to generate a high number of jobs. For a Maripark, a 300 MW production is assumed [73]. By assuming 0.5-1.0 jobs per MW in two scenarios for 2030 for onshore H_2 production*, a facility of this size can generate 238-375 jobs, of which respectively 131-134 is related to operations.

222k tons of CO_2 emissions reduced

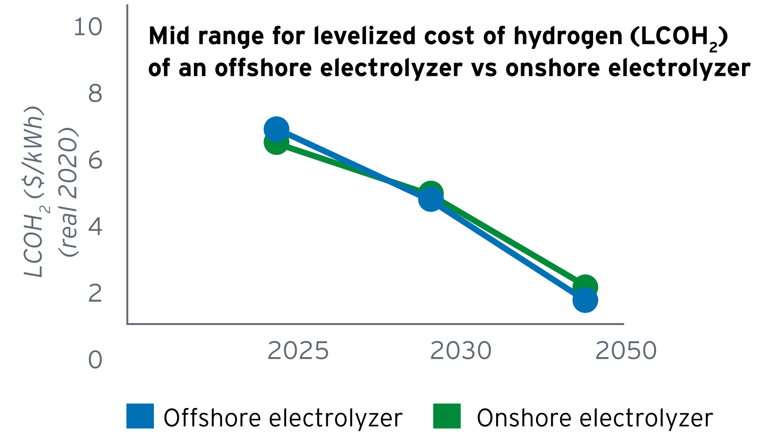
A 300MW offshore H_2 facility can produce up to 22k tons of H_2 [73]. If this is green H_2 (produced by using renewable energy, emits 0.3-1 kg CO_2/kg H_2) replacing grey H_2 (produced by using natural gas or methane, emits 9.2-11.1 kg CO_2/kg H_2) [76], the CO_2 emissions are reduced by 196k to 222k tons of CO_2. This reduction is valuated at €172m-€194m**.

However, installing an offshore hydrogen facility can have an unwanted effect on birds, ecosystem and life at sea [77]. This is due to noise and potential emissions. The size of the effects, however, is uncertain. It will also have a visual impact. Potential leakage of hydrogen negatively impacts indirect GHG emissions [77]. This is because any leakage may cause chemical reactions and increases other GHG gases such as methane, ozone and water vapor.

Financial value

Expected increased financial viability

With the current technology, production of H_2 is expensive and depends on government subsidies. Depending on the price of fossil fuels, CO_2, and electricity, it is forecast that from 2030 onwards, green H_2 will be competitive with fossil-based H_2 [80].
The offshore production of green H_2 has a higher cost than similar operations onshore, but in 2030 it is forecast that this will change [72]. Based on a carbon price of €250, the reduction of 196k-222k tons of CO_2 yields €49.5m-€55.5m [21].



High potential for synergies

The use of existing platforms and pipelines can reduce capex. Assuming that the electricity is used for producing hydrogen, producing H_2 offshore and transporting H_2 instead of electricity to shore reduces both energy loss and costs [77]. H_2 can also be stored for energy during periods where production is higher than demand. When combined with an offshore renewable power station, H_2 can be distributed directly offshore, for example, as 'green' fuel for shipping. Vessels used for operations and maintenance can also be shared with other businesses.

Some offshore aquaculture operations may require pure oxygen, freshwater and a stable energy supply [77]. An H_2 production facility offshore can contribute to industrial synergies by delivering by-products such as oxygen and heat. If also utilizing some of the produced hydrogen to generate electricity offshore through a fuel cell, freshwater is a useful by-product that can be used by other business opportunities.

https://overdick-offshore.com/news/2020/large-scale-offshore-hydrogen-production

* Assuming 0.5 and 1 jobs/MW and multiplying the recurring jobs by 2.6 [75]
** Multiplying the total reduced CO_2 by a social value of €875

Feasibility

Fit for economic zone

Hydrogen is produced using renewable energy and freshwater. Distilling saltwater offshore is technically feasible but increases the cost vs. onshore. The wind parks of the North Sea produce renewable energy that can be used in green H_2 production [78]. The H_2 produced must either be stored offshore or distributed via pipelines to shore for storage. It may be possible to use existing pipelines for the transport of H_2. Using existing oil and gas platforms for hydrogen production could be a more cost-efficient solution. The North Sea has a high number of these platforms, making this business opportunity fit for the economic zone.

Political strategy fit

The planned Dutch North Sea Programme 2022-2027 expects H_2 production to be established offshore near wind farms.

Social acceptance

Social media analysis shows that public opinion on offshore hydrogen is 95% neutral over the analyzed period [43].

Moderate TRL level

The TRL level of offshore H_2 is moderate. Technically, the electrolyzers have a high TRL but producing hydrogen in offshore conditions using seawater is still at a pilot stage [79].

Limitations / To be further researched

- Low-energy conversion efficiency.
- Environmental impact of the offshore hydrogen production needs to be studied.
- More research on the potential for integration with several offshore renewable energy sources at the same time.
- Safety aspects when operating the facility offshore near to other business opportunities.
- Large electrolysis capacity is needed to realize profitability [77].
- Storage of hydrogen offshore can be a limitation.
- How to efficiently use the by-products in a Maripark.

BUSINESS OPPORTUNITY 8

Sustainable tourism

Overall assessment

Tourism is an important sector of the Dutch economy, accounting for 4.4% of GDP in the years before COVID. Sustainable tourism, defined by the UN Environment Program and UN World Tourism Organization as "the development of tourism activities with an appropriate balance between environmental, economic and socio-cultural dimensions to ensure their long-term sustainability" [81], is a possible business opportunity within a Maripark. It is largely based on boat fleets and has no large offshore infrastructure development requirements. Also, there are onshore operational opportunities and supporting activities, such as information and educational centers. These may provide socio-economic benefits to local communities and improve the social license to operate of offshore wind farm projects.

Overall, sustainable tourism in a Maripark setting is considered to hold a low financial and a low to moderate stakeholder value. Assuming the sustainable tourism will occur on an appointment-only basis, total tourism volume will be limited.

Sustainable tourism has the potential to create positive value for stakeholders through:

- Raising social acceptance of Maripark business opportunities
- Raising tourists' environmental awareness
- Job creation and ripple effects for local communities

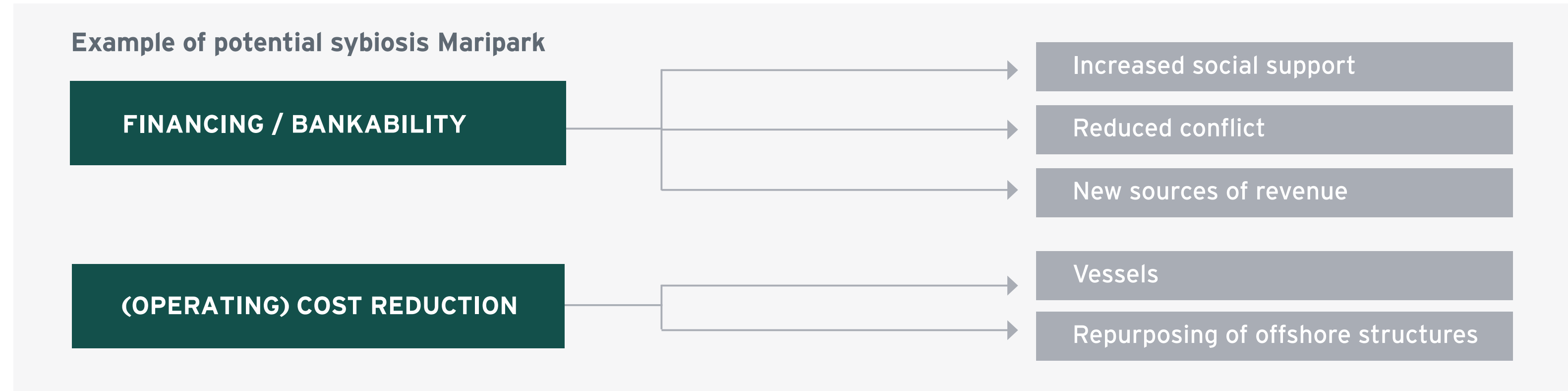
Positive financial outlook is driven by:

- General increased awareness of sustainability
- Leveraging the proximity of multiple sustainable business activities in a Maripark

Added value by the Maripark and symbiosis examples

Sustainable tourism could benefit from the added governance and collaboration with other Maripark business activities. Sustainable tourism at a Maripark could showcase multiple sustainable businesses and a novel way of using the ocean space.

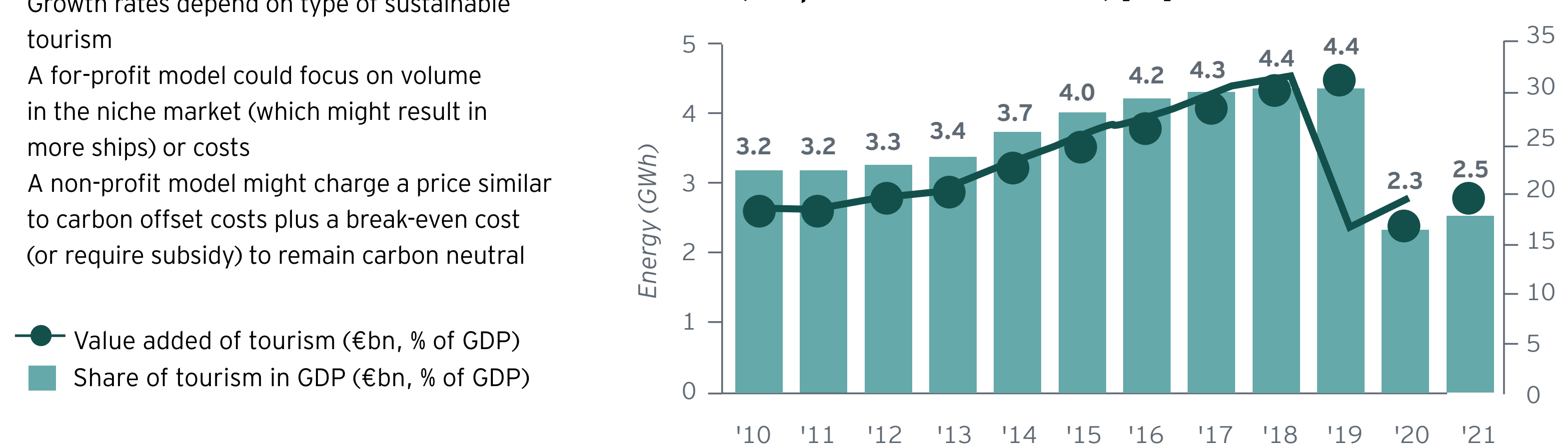
Additionally, public access to a Maripark could increase social acceptance for the other business activities, leading to higher stakeholder value. Sustainable tourism also offers opportunities for existing business activities to diversify and gain alternative sources of revenue. This might increase tourist numbers, compared with a single use business case.



Expected development

- Growth rates depend on type of sustainable tourism
- A for-profit model could focus on volume in the niche market (which might result in more ships) or costs
- A non-profit model might charge a price similar to carbon offset costs plus a break-even cost (or require subsidy) to remain carbon neutral

Tourism is a key component of the Dutch economy and is growing (except for 2020 due to COVID) [82]



BUSINESS OPPORTUNITY 9

Data centers

Overall assessment

Underwater data centers (UDC) are considered to have a medium stakeholder value, mainly driven by the significant energy saving potential of underwater vs. on land servers. Data centers consumed more than 2% of the electricity in the Netherlands in 2019, expected to rise to 10% by 2030 [83]. Globally, the power consumption of data centers has doubled every four years in the past ten years, due to increased usage of IoT and cloud services, amongst others [84]. Cooling represents a significant cost item as it constitutes 40% of the total energy consumption of conventional data centers [84]. One of the first UDC pilots, conducted in 2018 in Scotland by Microsoft, revealed a Power Usage Effectiveness (PUE) of 1.070 vs. 1.125 of a comparable land-based data center constructed by the firm in the same time period [85], significantly lower than the PUE of Dutch data centers (c. 1.210) [86].

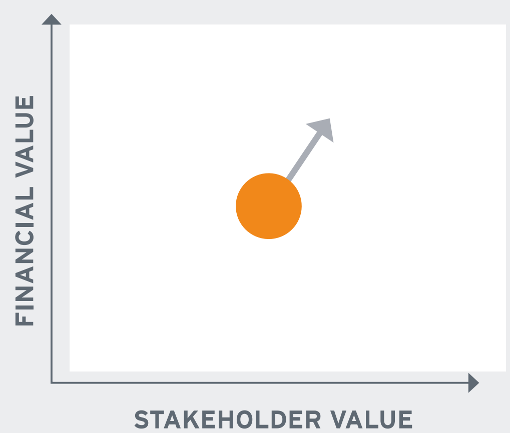
Time to market seems to be extraordinarily short with fully commercialized projects currently in the construction phase and expected to be finished in Q4 2023 both in Hainan (China) and in the US.

UDCs have the potential to create positive value for stakeholders through:

- Reducing energy needed for cooling
- Lower latency if placed in close proximity to data usage
- Using no fresh water for cooling (evaporation)

A positive financial outlook is driven by:

- Growing demand for data centers (IoT, big data etc.)
- Initial investment costs are still high and expected to decrease over time (economies of scale and learning curve effect)
- Short time to market due to high standardization
- Can be placed close to renewable energy sources
- More ideal conditions reduce technical server failures
- Lower infrastructure needs than on land (no transformation from low to high voltage and back)



- **Potential to significantly reduce power usage of data centers**
- **Potential for reduction of 14.2k tons of CO_2 emissions**
- **Quick to market solution due to high standardization**

Suitable for Maripark

Stakeholder value contribution: Other Energy Food Impact made by Maripark

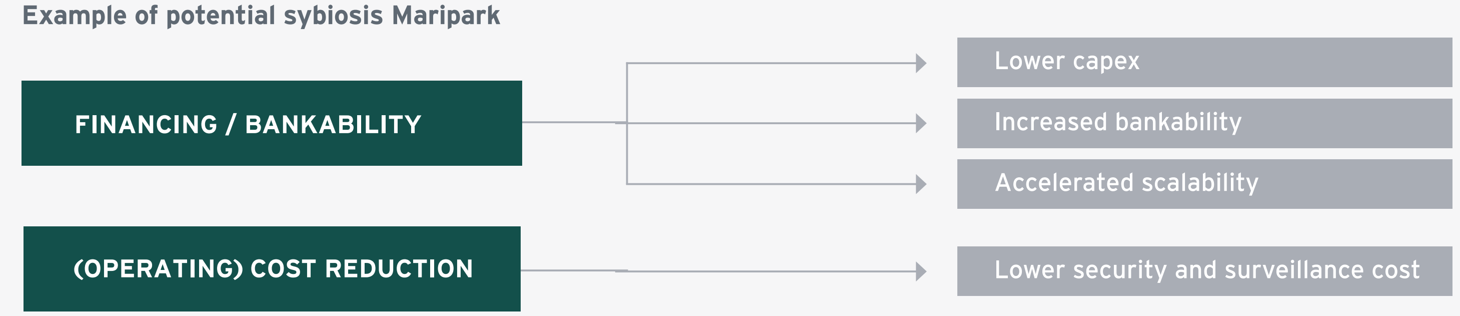
Added value by the Maripark and symbiosis examples

The added value of a Maripark on underwater data centers lies primarily in the close proximity to renewable energy sources, as well as shared security infrastructure. Underwater data centers may add to the Maripark value by lowering the investment needed for capacity buildup for onshore energy transportation, as well as infrastructure needs like transformers, as energy would not have to be transformed to high voltage for transportation and back to low for server usage [87]. Further, energy transportation losses could be reduced.

The lower energy transportation losses due to close proximity would also positively impact stakeholder value, as the green energy could be used elsewhere.

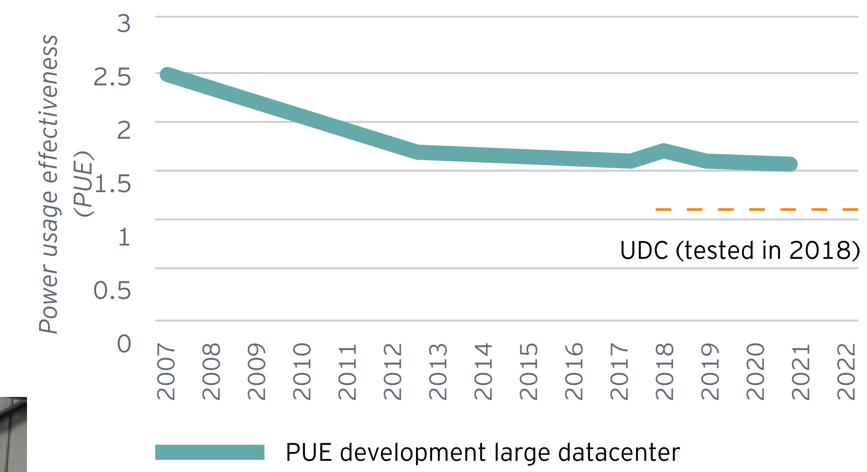
Note: IoT refers to Internet of Things and is defined as the interconnection via the internet of computing devices embedded in everyday objects, enabling them to send and receive data.Power usage effectiveness (PUE) is a metric used to determine the energy efficiency of a data center. PUE is determined by dividing the total amount of power entering a data center by the power used to run the IT equipment within it. PUE is expressed as a ratio, with overall efficiency improving as the quotient decreases toward 1.0

Example of potential sybiosis Maripark



Data center efficiency development [88]

Global average PUE, calculated as the total facility energy / IT equipment, is a measure to determine the energy efficiency of a dater center. It declined continuously in the past years. However, an ideal stage of 1 is difficult to reach, due to the significant amount of energy needed for cooling. UDCs use sea water for cooling and with a tested PUE of 1.070, are more energy efficient.



Stakeholder value

14.2k tons CO_2 reduced

A Microsoft pilot included one 12.2m pressure vessel with 864 servers, 27.6 petabytes of storage and a power load of 240 kW. It reduced PUE from 1.125 to 1.070 and estimated carbon savings of 750t CO_2 [89]. Assuming a commercial size of 100 pressure vessels as planned in the Hainan region and the US, avg. PUE of 1.210 of Dutch data centers, avg. emissions of 481g CO_2/KWh in the Netherlands and a power load of 240 kW, c. 14.2k tons of CO_2 could be saved. Multiplied by a social cost of carbon of €875 equals c. €12.4m.

A Low latency

About 40% of the global population live within 100 km of the coast, according to the UN [90]. Placing data centers close to the data usage could reduce latency, which is about 5 μsec/km [91].

350k m³ annual potable water saving

On land, water based cooling systems use around 25.5 m³ of water per year and kW, due to evaporation cooling effects, and use on average 57% potable water [92]. UDCs do not need fresh water for cooling. This would imply potable water saving potential of c. 350k m³ for a data center of 24k kW, which equals the average annual private water consumption of 7.5k people in the Netherlands in 2021 [98].

Additional stakeholder value from job creation is low to negative. Frequent physical maintenance is not meaningful due to the high costs of accessing the servers. Maintenance is conducted from distance and broken servers are taken offline.

A further advantage is the low conflict of space, since the sea floor is less crowded than space on land. A commercially meaningful size of 100 pressure vessels would use less than 5% of the space of the assumed size of a Maripark, but about a quarter of the offshore wind energy output.

Financial value

Exp. higher initial costs

Commercialized UDCs have only been piloted and tested since 2018, leaving limited long-term experience in terms of costs. The cost of the planned UDC with 100 pressure vessels in the Hainan region is expected to be $879m and includes c. 4.2k 1U servers. The vessels offered by the production company have a power load of 360KW [94], this would equal to c. $24/W for the entire site. As a comparison, on land data center production in 2022 in the Shanghai region cost $6.8/W [88]. Revenue is expected to be c. €41m for a 42k kW data center, based on average revenues achieved in the Dutch data center market [97].

Lower operating costs

The operating cost structure of UDCs differs greatly from land-based data centers. The biggest cost driver for operating cost is the low amount of energy needed for cooling. Further, energy consumption is more stable than on land, due to the stable water temperature during the day and across seasons. On land physical maintenance, rent and energy costs are the major cost factors [91]. Frequent physical maintenance is not economically meaningful for UDCs. Hence, UDCs are designed to operate independently for years. Broken servers are fixed remotely and taken offline in case of physical failure. A Chinese UDC producer expects a maintenance cycle of 5-6 years and a lifespan of 25 years [94]. Further, due to the favourable conditions offshore, the failure rate is just c. 1/8 the failure rate of a land-based data center [95]. This is in part due to the vessels being designed for an oxygen, water and dust free environment (lower corrosion) and to operate in stable temperatures (no expansion and contraction of equipment) [92].

According to a US-based UDC producer, 90% of costs can be saved over the lifetime of a UDC [89]. Further data is needed to provide a well-founded conclusion.

Short time to market

Time to market is short from planning to operation, being 90 days, as standardized UDCs can be manufactured on land and easily transported, as the measures of the pressure vessels are close to the standard shipping container sizes. Comparable land-based data centers take years to build, due to permits and adaptation to physical conditions [96].

Feasibility

Fit for economic zone

UDCs are especially impactful in cold waters. Microsoft conducted pilots in the Scottish Sea, amongst others, in 36m sea depths, an average temperature of about 10°C, with 14.5 km/h current and waves of more then 18 meters. Hence, conditions were similar to those in the Dutch North Sea. A key requirement is the stable supply of green energy. Subject to the business opportunities for energy generation, as well as potential energy storage chosen, potential gaps would have to be filled from on land electricity. However, energy needs are stable and predictable, as the water temperature only moves within a small range throughout the year. The TRL level of UDCs in the North Sea is considered moderate.

Political strategy fit

Given the expected high growth of share in Dutch energy consumption, the Dutch government has announced and will impose new stricter rules for (hyperscale) data centers in the Netherlands. Discussions are taking place at national, regional and local levels [93]. UDCs would address the main concerns: land space limitations, close proximity to, and availability of, green energy, and water scarcity. However, subject to the use and parties involved, one could argue that the newly created renewable energy is used in way that is not line with the Dutch energy transition, as is it not lowering the carbon footprint of local businesses.

Social acceptance

The social acceptance is expected to be positive, due the high energy savings, limited impact on nature and since UDCs are not visible from land.

Other impacts

The impact from heat on the local environment is expected to be insignificant since water is moving, not allowing it to heat up around the vessels. Other environmental impacts are also expected to be modest, since only infrequent maintenance or other human interaction is executed during the use phase.

As shown by Microsoft's pilot, UDCs can be made to be fully recyclable, including the vessel, heat exchangers, servers, and all other components.

Limitations / To be further researched

- Bio-fouling, especially on external heat exchangers, which could disrupt the flow of heat could be an issue for long-term use. Various solutions like high speed of water flow, special coatings, sound and others are being tested.
- Information on cost structure varies significantly. Fully commercialized projects and multi-year analysis would be required to provide a clearer picture of financial value (NPV).
- Further research (impact assessment) will be required on the environmental impact of deploying UDCs in the North Sea.
- Include in list of permissible activities of area passports.

Preliminary conclusions

The analysis of cost items reveals significant offshore synergy potential, which could be realized in a Maripark

The costs related to business cases can be grouped into one-time investments, recurring items and decommissioning costs.

Offshore infrastructure is usually less developed, shorter in use and hence less proven in long-term usage, technically more challenging (e.g. due to strong currents and winds during construction) as well as subject to harsher conditions than on-land. Further, local circumstances like temperature for seaweed farming can substantially influence the outcome and hence require testing in a relevant environment. This can make offshore infrastructure investments more expensive than comparable projects on land. To lower the barriers to reach financial viability, especially for more emerging business opportunities, these initial infrastructure investments should be shared, which is a main objective of the Maripark.

Subject to the business opportunity, recurring costs like workforce for farming and energy loss for energy transmission constitute a substantial part of the total financial costs.

Sharing or even avoiding some of the recurring costs amongst business opportunities further increases the net present value of the individual opportunities. As seen for example with offshore wind turbines, decommissioning costs can also be a major cost item.

A Maripark can also positively impact the stakeholder value of businesses.

For example, by combining research efforts, valuable results can be achieved fast with more meaningful contributions to science and future projects.

As it is the case with other large infrastructure undertakings, a government entity should develop and own basic infrastructure.

This lowers the hurdles for private businesses to thrive, while also considering stakeholder value.

Over time, the Maripark will have to function independently as the government phases out its role of managing the Maripark.

Depending on its interests, the government is likely to remain involved to an extent. For example, specific infrastructure may continue to be in government hands, as well as certain capabilities such as monitoring or select legal obligations.

A supporting governance and organizational structure should be built, in order to realize synergy potential.

The legal and tax components, as well as the organizational implications are the subject of the next chapter.

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03

Organization & Structure

An assessment towards a recommended legal framework, based on the proposed strategy and design criteria, followed by a high-level legal structure and tax impact assessment which ultimately leads to a proposed organizational structure of a Maripark entity.

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Organization and structure

Introduction

Introduction

As mentioned in Chapter 2, a supporting legal and tax structure is needed to organize and realize the identified large offshore synergy potential. Most importantly, the legal and tax elements should be suitable to facilitate the required infrastructure and technical development as well as protect stakeholders and ensure a tax efficient set-up.

Chapter 3 proposes a governance framework for the Dutch North Sea Maripark that identifies the most feasible multi-use business combinations and business models. The legal and tax implications and considerations will be influenced by the business model and activities.

HVG Law LLP & the EY Tax team have assessed the options and recommended legal framework based on the proposed strategy and design criteria. A high level legal and tax impact assessment has been prepared to further support the business case and feasibility of the project (or to determine prerequisites thereof).

First, the legal form of the state-owned entity that holds the Maripark has been determined. Chapter 3 focuses on a single state-owned entity. However, an expansion of the structure with multiple (subsidiary) entities could be researched at a later stage. Second, a high-level tax impact assessment has been conducted based on the legal recommendations.

Requirement

- Compliant with Policy Document on State Participation 2022
- Government-owned entity / state participation ('staatsdeelneming')
- Entity is the owner of the assets and liabilities
- Public and private financing
- Exit scenario
- Flexible governance structure design

Findings

No "off-the-shelf" solution. The high-level legal structuring and tax impact assessment found that, in practice, there is no 'off-the-shelf' structure or tax treatment that can be used in the blue economy or that has been applied in the benchmarked multi-use cases and projects.

Two legal forms seem the best fit for a Maripark entity. There are two Dutch legal structures that can be used for legal purposes and meet the Maripark entity criteria: the Dutch private limited liability company ('besloten vennootschap') and the Dutch cooperative ('coöperatie'). These legal forms are used in practice and should not increase the complexity of the decision-making or running of day-to-day business. However, there are various barriers from a legal perspective that are common across both of the legal structures.

Tax offers various potential enablers and barriers to be further researched at a later stage. There are various enablers and barriers regarding tax within the current regulations that might apply to either the Maripark entity or users of the Maripark (the businesses). These should be researched at a later stage. Additional tax regulations could be introduced or extended to help the business case of Maripark users. State aid regulations should be closely monitored when new benefits are granted to specific users or other businesses. In addition, placing (part of) the Maripark inside or outside of the 12-mile zone can have a big impact on the legal and tax aspects and, consequently, the business case of the Maripark.

The main tax barriers noted are:

- Customs requirements when the Maripark is located outside of the 12-mile zone
- Whether the Maripark can be considered a VAT-entrepreneur
- Whether real estate transfer tax is applicable and state aid for new benefits

Please note that these tax barriers are in our view mostly cost increasing, and not necessarily blockades for the project.

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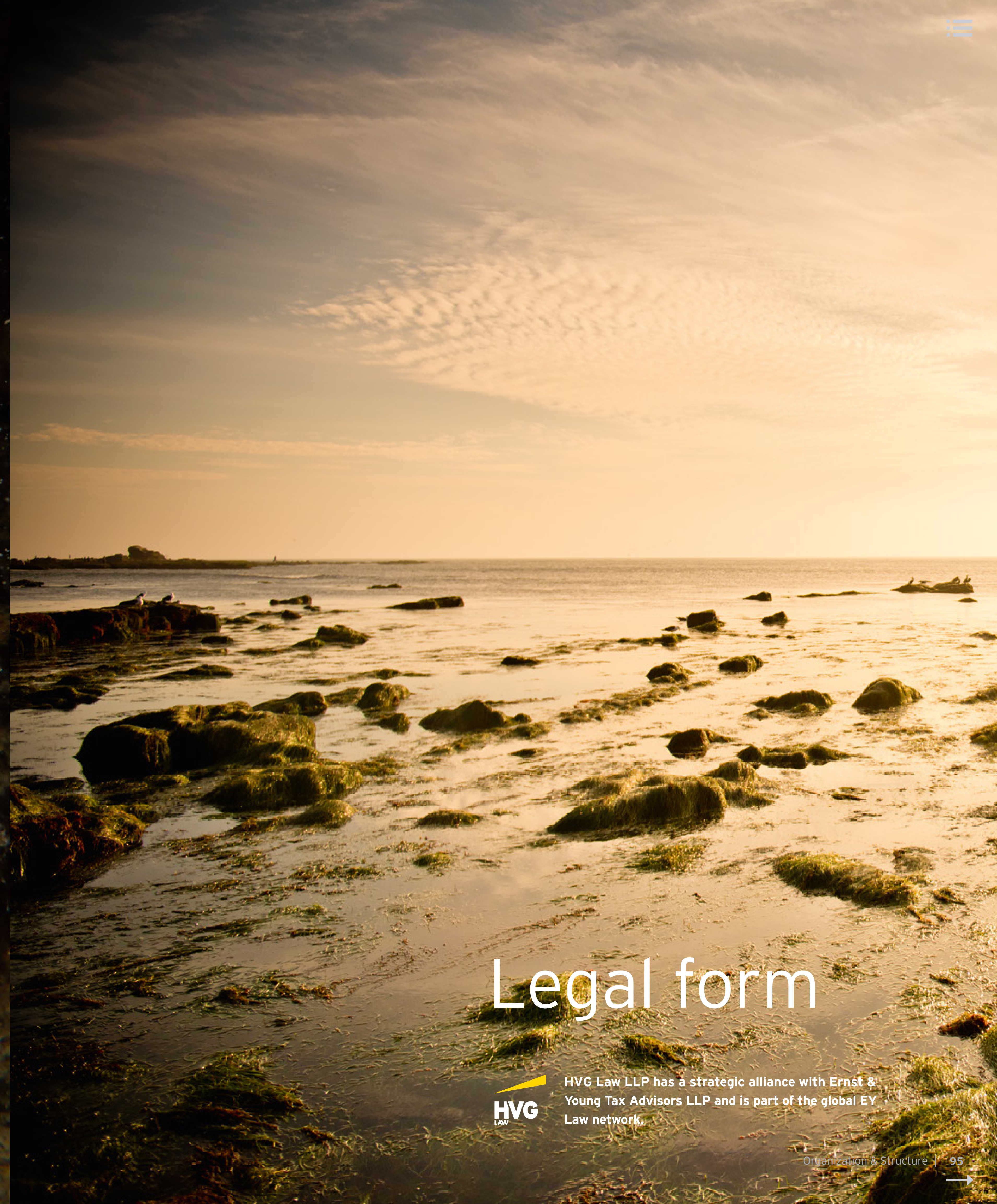


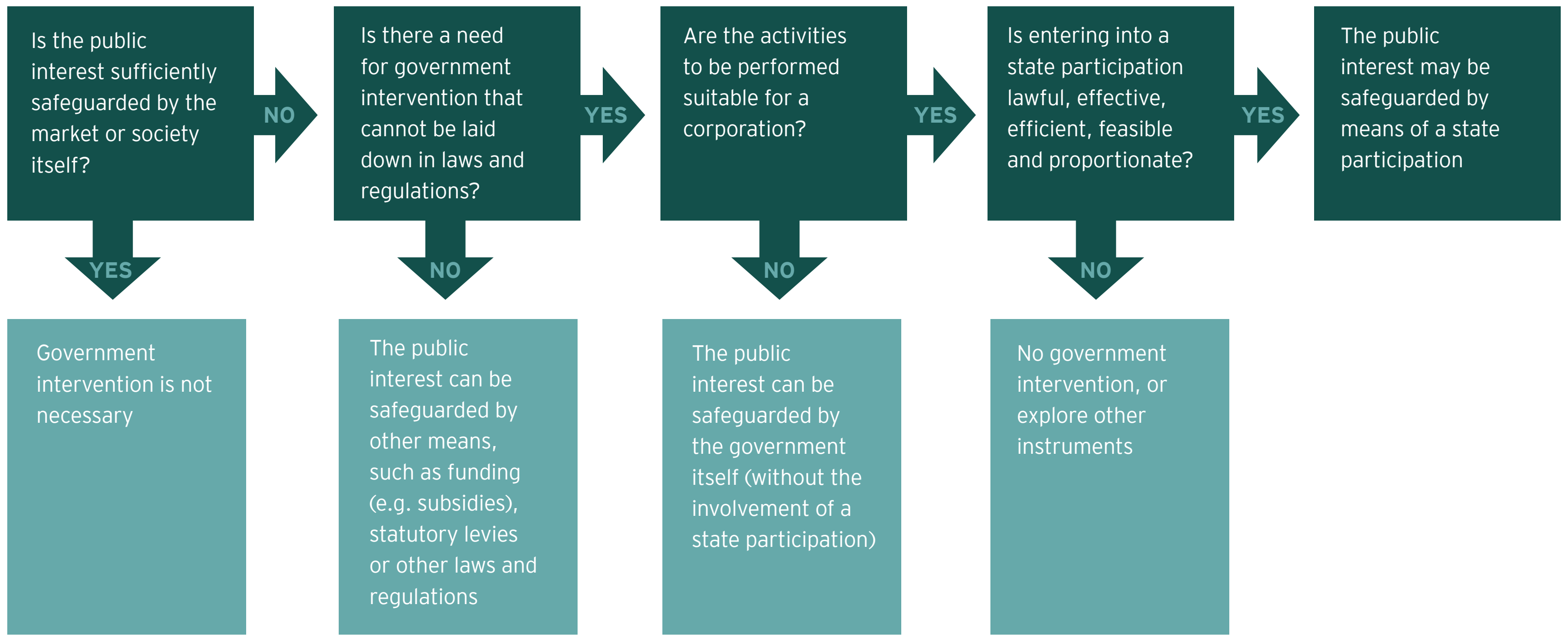
Legal form

HVG Law LLP has a strategic alliance with Ernst & Young Tax Advisors LLP and is part of the global EY Law network.

LEGAL FORM

Organization & Structure

The Policy Document on State Participations 2022 contains a framework to determine if a state participation is the appropriate structure as presented in this figure*.



An underlying principle is that the Maripark should become a government-owned entity / state participation, therefore we have assumed that the framework has been (or will be) successfully completed, and have not assessed whether setting up the Maripark complies with the framework above.

A capital company structure, rather than a partnership, is best suited to meet the core principles

Dutch corporate law makes a distinction between a capital company ('kapitaalvennootschap'), which has a separate legal personality, and a partnership ('personenvennootschap'), which is without a separate legal personality.

Differences between capital companies and partnerships:

- Capital companies have a legal personality ('rechtspersoonlijk-heid') and are, as far as it concerns the law of property, equal to a natural person, unless the contrary results from law (art. 2:5 Dutch Civil Code). This means that capital companies are able to own assets and liabilities.
- Partnerships have no legal personality and, therefore, are not able to own assets and liabilities. The involved partners ('vennoten') are the owners of the assets and liabilities of the partnership. Examples of Dutch partnerships are the Dutch limited partnership ('commanditaire vennootschap') and the Dutch general partnership ('vennootschap onder firma').
- Due to the third underlying principle – the Maripark entity is the owner of the assets and liabilities – we will not further elaborate on the partnerships. An expansion of the structure to include multiple (subsidiary) entities could be researched at a later stage, for example, to flexibly support partnerships or, alternatively, segregate asset infrastructure or activities into specific use-types.

We refer to page 18 et seq. of the Policy Document on State Participation 2022.

LEGAL FORM

A high-level rating of the different Dutch legal forms against the principles

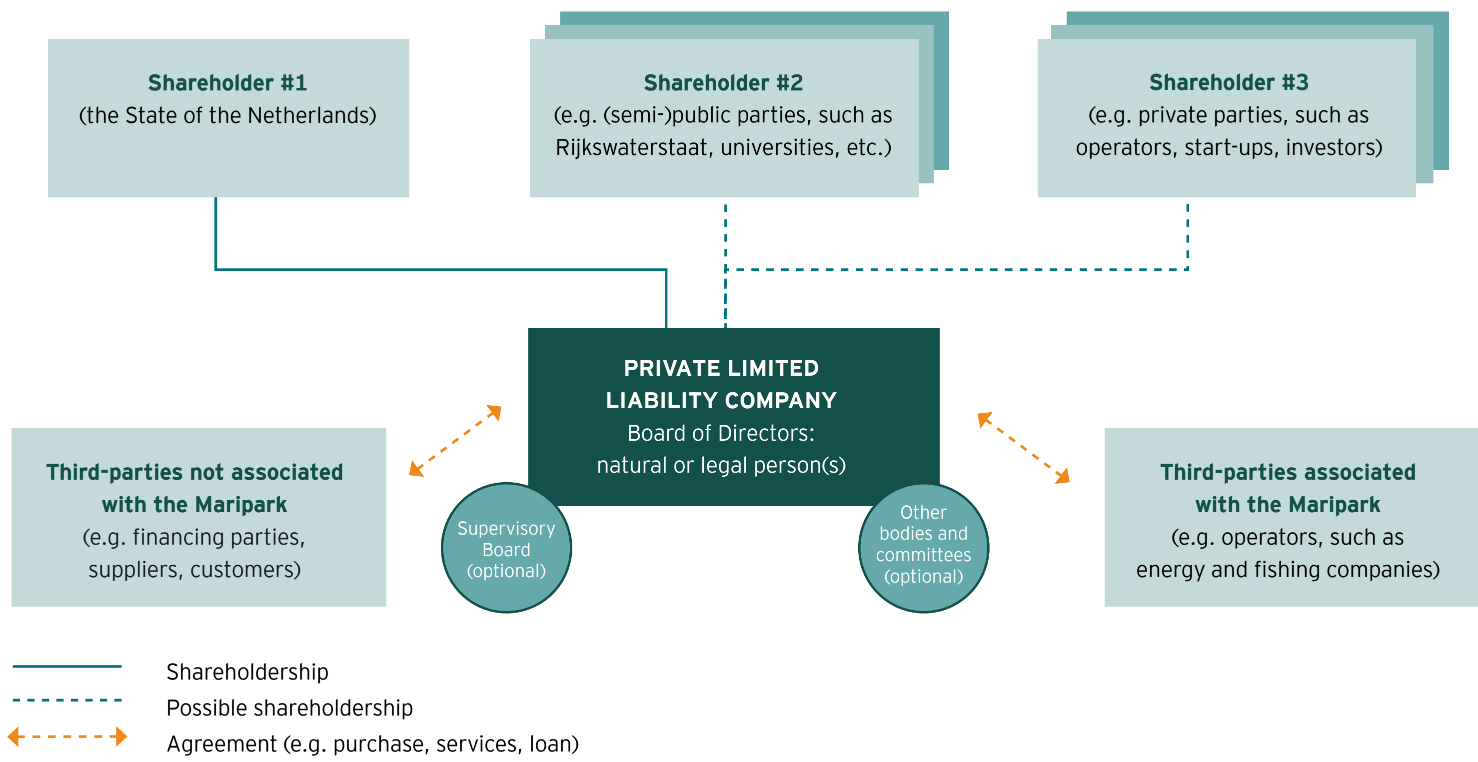
The different Dutch legal forms governed by private law (with legal personality) are measured against the underlying requirements. The blue dots indicate two suitable governance models: the Dutch private limited liability company and the Dutch cooperative.

#	Requirement	**Public limited company** ('naamloze vennootschap')	**Private limited liability company** ('besloten vennootschap')	**Association** ('vereniging')	**Cooperative** ('coöperatie')	**Mutual insurance association** ('onderlinge waarborg-maatschappij')	**Foundation** ('stichting')
1.	Compliant with Policy Document on State Participation 2022	Blue	Blue	Blue	Blue	Blue	Blue
2.	Government-owned entity	Blue	Blue	Orange	Blue	Orange	Orange
3.	Entity is the owner of the assets and liabilities	Blue	Blue	Blue	Blue	Blue	Blue
4.	Public and private financing	Blue	Blue	Blue	Blue	Blue	Blue
5.	Exit-scenario	Blue	Blue	Orange	Blue	Blue	Red
6.	Flexible governance structure design	Orange	Blue	Orange	Blue	Blue	Orange

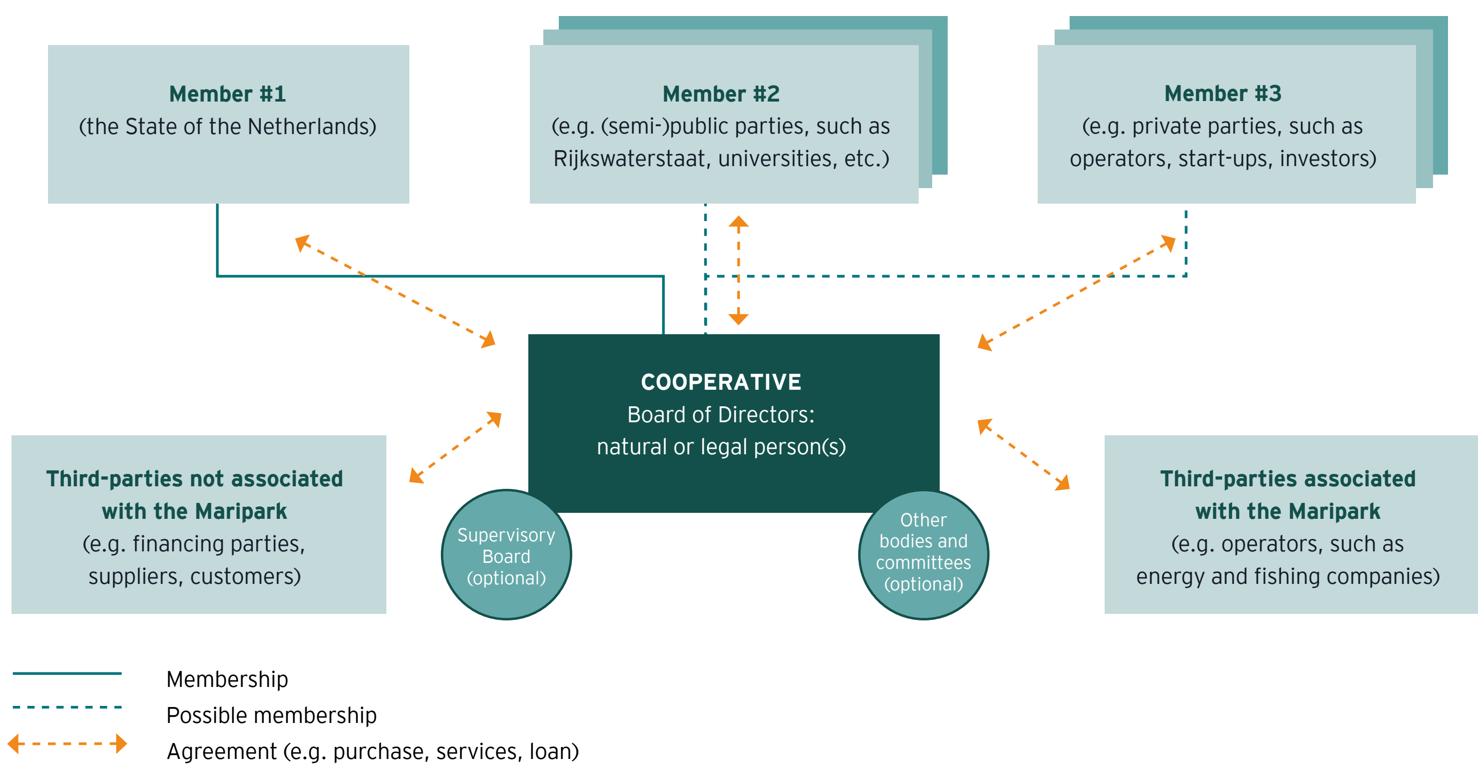
NB: Blue rating being the most suitable and red rating being unsuitable for the Maripark governance model.

How the possible governance models for the Maripark are structured

Option 1: A private limited liability company ('besloten vennootschap')



Option 2: A Dutch cooperative ('coöperatie') structure



Overview of differences between the two structures that need to be considered

Areas that differ	Option 1: Dutch private limited liability company	Option 2: Dutch cooperative
Mandatory law	Mandatory law ('dwingend recht') applies e.g. for the governance structure of the company.	More mandatory law ('dwingend recht') applies to the private limited liability company, for example regarding the governance structure of the company.
Incorporation	Incorporated by one (natural or legal) person.	At least two (natural and/or legal) persons are required in order to incorporate.
Purpose	Broader purpose/object.	Must meet certain material needs of its members under agreements where undertakings of the cooperative are carried out for the benefit of the members and must economically benefit members.
Statutory rules regarding capital and capital protection	Statutory rules apply regarding capital and capital protection.	Not subject to such statutory rules.
Relations	Shareholder relationship between the private limited liability company and its shareholders; contractual relationship between the company and its shareholder(s) is optional but not mandatory.	There are always two relations between the cooperative and its members, i.e. (i) the membership relation and (ii) the contractual relation.
Exit scenario	Slightly less flexible exit-scenario. Shareholders in the private limited liability company can transfer their shares (however, this can be limited in the articles of association) but shall always need the cooperation of a purchasing party.	The members of a cooperative are free to join and exit the cooperative (however, this can be limited in the articles of association) and do not need a purchasing party in order to effectuate the exit. Also, the accession and withdrawal of members is without specific formalities (e.g. no notarial deed is required).
Large company regime	If the Dutch large company regime applies to the private limited liability company, the supervisory board (instead of the General Meeting of Share-holders) is authorised to appoint, suspend and dismiss the directors.	If the Dutch large company regime applies to a cooperative, the General Meeting of Members remains authorised to appoint, suspend and dismiss the directors.
Public perception	A private limited liability company has a commercial character.	A cooperative is less commercial and has a social character.

Benchmark findings contribute to assessing the best possible governance structure for a Maripark

A benchmark analysis was conducted based on desk research and interviews and included several of the benchmark companies from Chapter 1, such as SolarDuck, Denmark's Energy Island and offshore renewable energy projects. These are our main findings from a legal perspective, where the findings could be included in Maripark's governance structure:

1. The benchmark companies or initiatives are not similar to the Maripark. No Dutch benchmark company or initiative is engaged in the multi-use of one framework;

2. Government intervention is highly likely due to the high costs of establishing Maripark's infrastructure, the business opportunities in start up/scale up phase and the high risks involved:
   - The Maripark entity (or its members/shareholders) may construct the infrastructure itself or can contract third-party contractor(s) to construct the infrastructure;
   - If the construction is outsourced, the Maripark entity retains the ownership of the infrastructure. However, it is also legally possible to transfer part of the ownership in the infrastructure (or the Maripark entity) to the third-party contractor(s), as compensation for their services.

3. A Dutch company is established and used for the Dutch benchmark initiatives (e.g. renewable energy, sustainable fishing, etc.). In most of these initiatives the private limited liability company or limited partnership is the preferred legal form:
   - The benchmark companies and initiatives do not have the same governance structure. For example, some benchmark companies and initiatives are operated by one party while others are joint ventures;
   - The benchmark companies and initiatives may carry out different projects (at different phases of completion) in separate legal entities, to manage the financial risks.

4. The applicable jurisdiction will be determined by the geographical positioning of the Maripark (e.g. within or outside the 12-mile zone / territorial sea). This will determine the rights and obligation of the Maripark entity, such as its ownership position.

There are potential legal barriers to consider within a recommended legal structure

- **Incorporation of the state participation:** If the Dutch State undertakes a legal action under private law (such as the incorporation of a cooperative of private limited liability company), it 'should take the so called preliminary parliamentary scrutiny procedure' ('voorhangprocedure', Clause 4.7 of the Dutch Government Accounts Act 2016 ('Comptabiliteitswet 2016')) into consideration. Pursuant to this procedure, the Dutch Parliament can give an opinion on the incorporation of a state participation, prior to this incorporation. E.g. this procedure opens the decision to an opinion from the Dutch Parliament on the incorporation of state participation.

- **State aid**: If the investment in the project qualifies as 'state aid', additional measures must be taken.

- **Procurement law (aanbestedingsrecht)**: Procurement orders by the government and public undertakings ('overheidsbedrijven') may be subject to procurement rules.

- **Jurisdiction**: Depending on the geographical positioning of the Maripark (e.g. within or outside the 12-mile zone / territorial sea) it must be determined which jurisdiction applies. This jurisdiction also determines (i) the authority of the Dutch State to issue permits/authorizations for the area and (ii) the rights and obligation of the Maripark entity, such as its ownership position (e.g. will the Markpark entity become the owner of the infrastructure to be built, or will, based on another (foreign) jurisdiction, another entity or country become the owner of such infrastructure?).

- **Decommissioning security system**: Questions need to be addressed including, do the Dutch laws and regulations already contain a mandatory decommission security system for the parties associated with the Maripark, or should, for example, such obligations be included in the decision to grant a permit ('besluit tot vergunningverlening') or a decommission security agreement entered into by the relevant parties?

Further potential legal barriers to the recommended structure need to be considered

- **Licensing regime (vergunningenstelsel)**: Based on our high-level assessment, various permits and exemptions are required for the development of the intended business opportunities/ activities. The entity is expected to require various permits for the infrastructure construction phase. Third parties associated with the Maripark (e.g. operators) will also need permits for the operating phase. There may be an overlap in the necessary permits, that might cause delay. To be reviewed whether an 'umbrella permit' for the Maripark activities can be issued by the Dutch State and whether it can offer a solution.

- **Licensing regime (vergunningenstelsel):** In addition to above, it will need to be assessed whether the existing laws and regulations are in line with initiatives such as the Maripark.

- **Maintenance of Maripark's infrastructure:** To be determined if the maintenance of Maripark's infrastructure is performed in-house or outsourced.

- **Contractual agreements:** Further details are needed regarding the specific rights and obligations of internal stakeholders (e.g. board of directors, general meeting, supervisory board, other committees/bodies) and external stakeholders (e.g. operators, suppliers, customers). Various template documentation should be in place for the different stakeholders, such as articles of association, regulations, members/shareholders agreements, template agreements.

- **Structure regime:** Large companies may fall under the so-called Dutch 'structure regime'. These companies are subject to additional legal obligations (e.g. regarding their governance structure).

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Tax considerations

TAX CONSIDERATIONS

Tax considerations

The previous section concludes that the B.V. and the cooperative are likely the most suitable entity types to structure the establishment of a Maripark for legal and governance purposes. Based on this legal recommendation, a high-level review of the tax implications and considerations of the potential activities was carried out. For the taxes reviewed, there is no difference between the legal forms of B.V. and cooperative (except for corporate income tax and dividend withholding tax, see further). A distinction, therefore, has not been made between the two.

The benchmark initiatives conducted for the legal structure were also carried out for tax. In these interviews, several tax items were repeatedly mentioned: the exact location of activities on the sea (within or outside the 12-mile zone) and the related tax consequences; funding possibilities, applicability of transfer tax, and applicability of specific favorable regimes. These have been included in our review.

The high-level tax impact assessment covers the following:

1. Profile for tax: summary functional analysis and transactional overview
2. Tax impact assessment: high-level overview of relevant taxes
3. Jurisdictional aspects: the 12-mile zone
4. Important enablers and barriers
5. State aid
6. Conclusion

HIGH LEVEL TAX ASPECTS / PROFILE

Profile for tax

Functional analysis

If one Maripark entity is initially established, the legal structure for the Maripark is unlikely to form a group of companies with intercompany transactions taking place between group companies, and a transfer pricing analysis of how these transactions will be priced within the group is not initially required.

For tax purposes, however, it is still useful to first form a clear understanding of the functions, assets and risks of a company to identify potentially relevant taxes and perform a subsequent high-level tax impact assessment. This can also form a useful base for further analysis if additional entities are considered and added to the structure.

We therefore summarize the business model and transactional form of the activities as described in the first phases of this project in a "functional analysis" (describing the principal contributions to value creation by the envisaged entity/ies) and "transactional overview" (depicting the expected contractual relations and the terms and conditions). The functional analysis describes the key functions performed, important assets employed, and important risks assumed. A functional analysis is essential due to:

- The functions undertaken by each related party typically correlate with the risks borne and the assets used;
- The functions, risks, and assets associated with a related party's operations usually have a significant effect on its profitability;
- The functional analysis provides the information and insight necessary to characterize any future intercompany transactions and transfer pricing policy (in case several group entities are set-up and transact with each other).

The following table offers a summary of the functional analysis for the potential involved parties.

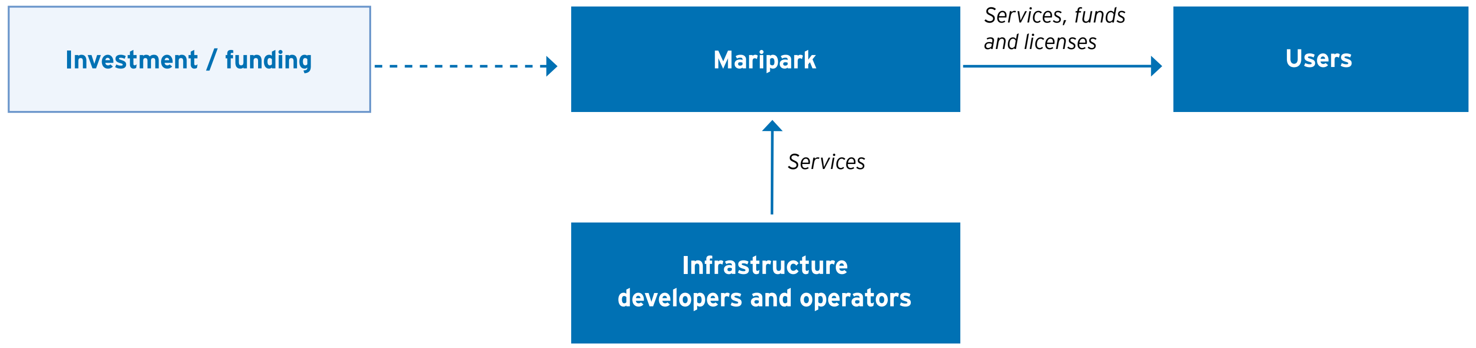
The table offers an overview of the functions, assets and risks of the identified potential parties involved in the set-up and operation of the Maripark.

Governance / Management	Use targets and environmental targets Overall governance framework Permits and inspections Area overall management and governance
Funding	Funding of enabling overall shared infrastructure Attracting loans, grants to support Funding of user specific infrastructure Attracting loans, grants & incentives
Safety	Offshore safety, calamities and rescue
Research & Development	Environmental impact research and goals R&D of technology required for activities
Construction (& decommissioning upon end)	(D)EPC of enabling overall shared infrastructure by developer with the necessary knowledge and capacity Construction of activity-specific infrastructure of user
Operation & Maintenance	Operation (e.g. transport, shelter), maintenance and repair services for shared Maripark infrastructure Operation and maintenance of business in the Maripark
Assets	Tangible assets – area use right Tangible assets – area infrastructure Financial & intangible assets
Risks	Operational/financial/market risks Technical failure risk Environmental risk

Maripark entity   3rd party Contractors   Users

Profile for tax

Transactional overview



Investment / funding
The Maripark entity will play a key role in securing funding from public and private sources in order to enable the existence of the Maripark itself. Investment and funding are important during the infrastructure construction phase as well as to attract users (defined as the enterprises conducting business) for example by providing loans or the right framework/setting to qualify for grants, subsidies and incentives opportunities. The overall shared infrastructure costs will initially stay with Maripark but can be re-charged to the users once they become profitable. The costs could be grouped into one-time investments, recurring items and decommissioning costs and may be allocable to one or more of the parties involved.

Services
The Maripark entity will be responsible for the maintenance of the shared infrastructure and safety. Maintenance infrastructure costs and workforce could potentially be shared among the users. In addition, Maripark may also provide a "one-stop-shop" type of administrative services such as support and management. Services can be outsourced to third parties and/or provided by qualified personnel employed by the Maripark or a combination of these. The Maripark is responsible for the governance framework to ensure the development and use are managed efficiently and effectively from an environmental, social and governance perspective. The payment of these service fees might be postponed to the moment the users become profitable or provided at a discount*.

Licenses / rent
The asset owner, Maripark will license or rent the use of the shared infrastructure to the users for a fee. These payments could be offered at a discount or postponed until the users become profitable*.

Potential intercompany transactions
If the parties involved are classified as related parties (e.g. owned by the same entity), potential intercompany transactions may exist for which an arm's length remuneration is due. Further analysis can be undertaken on the: (i) assessment of the potential relatedness of parties involved and (ii) classification of transactions and determination of the arm's length price*. The provision of services at a discounted fee shall be further analyzed from a state aid perspective.

** The provision of services at a discounted fee shall be further analyzed from a state aid perspective*

Applicable taxes

The following sections describe the Dutch taxes that might be relevant to the Maripark entity, its users and/or the State. Please note that the descriptions are high level and do not lead to conclusions. Important factors that need to be examined at a later stage are identified. The following topics are covered:

1. **Corporate Income Tax and Dividend Withholding Tax**
2. **Funding and subsidies**
3. **Employment tax**
4. **VAT and real estate transfer tax**
5. **Environmental taxes and permit fees**

1 Corporate Income Tax and Dividend Withholding Tax

Corporate Income Tax (CIT)
The taxable income of the entity is subject to Dutch CIT with a maximum rate of 25.8%. The tax basis is calculated as the global income (such as rent and leasing income) minus expenses (such as personnel cost, depreciations or financing expenses).
This net income is corrected with any applicable exemptions or non-deductible amounts. The taxable profit can deviate from the profits in the annual accounts as a result of temporary or permanent commercial-tax differences as a result of the specific tax regulations.

In general, CIT only leads to a cash out once the company is profitable. Compensation of prior-year losses could reduce the net cash payment. Special regimes might also be applicable to the Maripark organization and/or the future users of the Maripark. This could reduce the net tax costs and, therefore, increase the after-tax net result of the Maripark entity or for future users of the Maripark:

- **Tonnage regime:** This regime makes it possible to calculate the profits generated through sea shipping based on the tonnage that generates the profit, if certain conditions are met. The possibilities should be further examined at a later stage.
- **Agricultural exemption:** Based on this exemption, a company that is active in the field of agriculture is exempt from CIT under certain conditions. One of these conditions is that the company generates a profit of less than €7,500. This exemption might be relevant to sea farmers, so it is suggested to further examine the possibilities at a later stage.
- **Innovation box:** The innovation box reduces the taxable profits from a qualifying intangible asset when certain conditions are met, including the WBSO (see wage tax), applied for the development of the intangible asset. The application of the innovation box is limited to intangible assets for which a patent or specific permit has been granted (with an exception for certain small companies and software). The possibilities should be further examined at a later stage.
- **Energy/Environment tax credits (EIA/MIA):** This regime includes tax credits for designated energy or environmental investments. The possibilities should be further examined at a later stage.

Dividend Withholding Tax (DWT)
DWT is generally applicable to dividend distributions by Dutch resident companies. However, distributions by a cooperative to its members should not be subject to DWT unless such cooperative qualifies as a holding company of which the activities consist of holding activities for 70% or more. Various DWT exemptions or refunds of DWT could apply for B.V.s or cooperations that are subject to DWT, depending on the specific shareholder structure (type of shareholder and % of ownership) and the location of residence of such shareholders.
In general, a Dutch resident shareholder that is subject to Dutch CIT and applies the participation exemption regarding its investment in the Maripark entity should qualify for a DWT exemption. In addition, as an example, a Dutch governmental body as a shareholder that is not subject to Dutch CIT should be able to receive a refund of DWT under certain conditions. Hence, DWT should not result in a cash out.

2 Funding and subsidies

Funding

In addition to the general CIT remarks, it is important to note that the way of financing by the Maripark entity can influence the CIT position of the entity or its investors:

- **Debt** If the construction of the Maripark is financed with debt, the interest should generally be deductible for Dutch CIT purposes. However, if and to the extent the interest expense exceeds €1 million, the higher of the interest and 20% of the EBITDA, will not be deductible. Furthermore, based on the current drafts of the EU DEBRA legislation (future law), the deduction of interest on debts might be further restricted in the future.
- **Equity** Capital contributions into a B.V./Coop. should not be subject to taxation or stamp duties. If the contributing entity is not subject to Dutch CIT, further review with respect to the contribution should be performed to mitigate potential anti-abuse rules applicable at the level of the Maripark entity. Under current law, Dutch CIT does not have a notional interest deduction with respect to equity. However, this may change if and when the EU DEBRA regulation is passed.

In addition, depending on the chosen structure of equity to be provided, application of the Dutch participation exemption and DWT exemption (see prior sections) might be relevant. If multiple investors with a less than 5% shareholding will participate in the Maripark entity, the application of the participation exemption at the level of the Dutch investors subject to CIT might only be possible if a cooperation is chosen. In addition, no DWT exemption may be available for such investors if the Maripark is established through a B.V.

Grants and incentives / Subsidies

In our benchmark, we have seen set-ups that are not likely to fit in a European context (e.g. dedicated tax-free zones). However, there are many possible grants and incentives that may apply to the users of the Maripark, depending on their specific activities and investments and on the Dutch and EU programs that are available at the time. The Maripark entity could consider mapping the available and applicable programs for the envisaged types of multi-use and the applicable processes to apply. The Maripark entity could also further analyze possibilities to provide funds in the scale-up phase to users, such as loans potentially with an (environmental) performance-related discount or funds linked to some form of ESG governance support system (e.g. payment for ecosystem services and user profile requirement or nature restoration score card concepts, subject to further analysis from a state aid perspective). The users themselves could consider advance (Power) Purchase Agreements with their buyers for a guaranteed agreed off-take of their products to reduce the risk of their scale-up investment.

It is possible for an independently functioning entity to apply for (NL and/or EU) subsidies, even if it is a participation of the State.

The Maripark entity itself might also qualify for subsidies for (green) infrastructure at sea. In this regard, the legal form may have an impact (preferably a commercial entity such as a B.V.) as well as the stage of the work (preferably subsidies are requested before the start of the actual work). The possibilities should be further examined at a later stage.

From a green fiscal policy perspective, the government may wish to consider supporting users of the Maripark through, for example, existing, expanded and/or new grants, incentives or green bonds, depending on the available and expected programs, legislative possibilities (e.g. wage tax rate reduction or extension of WBSO with WBSO green) and subject to more detailed impact analysis. For tax purposes, subsidies are generally included in the taxable base of companies. It should be reviewed if and how subsidies and incentives may impact the effective tax rate of companies in light of expected minimum profit tax regulations (BEPS 2.0 Pillar 2).

3 Employment taxes

Wage tax is levied on employee wages, including on wages earned in the Dutch Exclusive Economic Zone (max. 200 nautical miles). The employer (withholding agent) is required to withhold this tax from employee (actual taxpayer) wages and remit it to the Dutch Tax Authorities. Since the wage tax is deducted from the wages, the wage tax should therefore usually not lead to an additional cash out. However, in addition to wage tax, national health insurance contributions and employee social security contributions must be paid. These are fully for the account of the employer and cannot be deducted from the wages. These do therefore lead to a cash out.

There are some remittance reductions, which permit an employer to keep a part of the withheld wage tax:

- **Remittance reduction for research and development (WBSO):** Applicable if and insofar the employee is involved in research and development under certain conditions. One of these conditions is that the company itself develops new software, a (tangible) product or production process, or conducts technical-scientific research. Another condition is that the entity runs an enterprise within the meaning of the CIT. Since a foundation or other limitedly taxable entity for CIT purposes does not automatically run an enterprise (as opposed to a B.V./cooperation which does), a B.V. or cooperation is a preferred option. The WBSO possibilities should be examined at a later stage.
- **Remittance reduction for maritime shipping (AVS):** Applicable insofar the employee qualifies as sea fairer (flying on sea vessels) under certain conditions. The possibilities should be further examined at a later stage.

In addition, the 30% facility (which renders 30% of the salary untaxed for wage taxes as extraterrestrial costs) might be applicable when foreign employees with specific expertise are hired. The possibilities should be further examined at a later stage.

4 Value-added tax and real estate transfer tax

Value-added tax (VAT)

Value-added tax (VAT) is levied on the supply of goods delivered and services rendered by an ‘entrepreneur’ (‘onderneming’) in the Netherlands other than exempt goods and services. A qualifying VAT entrepreneur (which should at least supply goods or services for remuneration) is also entitled to reclaim the VAT paid on goods delivered or services supplied to it in the framework of its VAT taxed activities. Therefore, VAT should in principle not lead to a cash out. If the Maripark entity is not a VAT entrepreneur however, VAT on goods delivered or services supplied to the Maripark entity will increase the cost price of these goods or services.

Special attention points are:

- To the extent VAT exempt supplies of goods and services are rendered, the entitlement to claim input VAT on costs can be limited (potentially leading to a VAT cost). The possibilities should be further examined at a later stage.
- The Dutch VAT rate is 21%. There are reduced rates of 9% and 0% available for specifically mentioned supplies of goods and/or services.
- VAT can also be reclaimed before the actual activities of a VAT entrepreneur start, as long as the intentions of a VAT entrepreneur are clear, objective and properly documented.
- VAT is subject to various compliance requirements that have to be adhered to strictly, to avoid penalties.

Real estate transfer tax (RETT)

Real estate transfer tax (RETT) is a tax levied on the sale of (rights to) real estate or shares/membership rights in entities consisting of more than 50% real estate. Based on our experience, it is likely that the Maripark entity and the users of the Maripark will be liable to RETT, since in most projects at sea, certain rights to the seabed will be acquired (in some cases to obtain ownership of the installations). In addition, depending on the VAT-position of the Maripark entity, it might be beneficial to structure the transfer as the delivery of a VAT-building site. The possibilities should be further examined at a later stage.

5 Environmental taxes and permit fees

Environmental taxes

Different environmental taxes exist, of which the following might (based on the currently available information) be relevant:

- **Energy tax:** A tax on (natural) gas and electricity, levied on either the delivery to the end user, or levied on the user if there is no delivery or no delivery can be recognized. Energy tax (when applicable) leads to a cash out. The possibilities should be further examined at a later stage.
- **CO_2 taxes:** Taxes on the emittance of greenhouse gases (CO_2) from installations, that for example produce concrete or steel and/or other items where during production a lot of emissions occur. CO_2 taxes – where applicable – are cost price increasing (mainly in the construction phase).
- **Carbon Border Adjustment Mechanism (CBAM):** Future law expected that will apply a (corrective) price on the import of items where during production outside of the EU a lot of emittance of carbon occurred for which no CO_2 levy was paid. The CBAM will initially apply to imports of cement, iron and steel, aluminum, fertilizers, electricity and hydrogen. CBAM – where applicable – is cost price increasing (mainly in the construction phase).

Permit fees

Different fees may be levied on permits, i.e.:

- **Mining levy:** Levied when there is a permit for the search for or extraction of mineral resources (minerals or substances of organic origin present in the subsurface, in a concentration or deposition occurring there naturally, in a solid, liquid or gaseous state, excluding source gas, limestone, gravel, sand, clay, shells and mixtures thereof).
- **Fees** for applying for environmental permits.

Jurisdiction and tax law framework

Choosing a location for the Maripark outside of the 12-mile zone can have potentially significant tax consequences. The high-level tax consequences of this scenario include:

- **Real estate transfer tax** based on our experience, not applicable to real estate situated outside of the 12-mile zone. This can be further examined in more detail at a later stage.
- **Energy taxes** might not be due if the Maripark is located outside of the 12-mile zone, insofar it concerns delivery to the end user also located outside of the 12-mile zone. However, this is very dependent on the specific circumstances of the case. The possibilities should be examined at a later stage.
- If and when the Netherlands and another country simultaneously would like to effectuate **income taxes** (with regards to either the Maripark entity, a user of the Maripark or another party involved), the rights to tax specific forms of income are governed by tax treaties. These treaties should ensure that double taxation is avoided. In general, it is expected that the Netherlands should have the right to levy taxes within the Dutch Exclusive Economic Zone (200-mile zone). If necessary, this should be further examined at a later stage.
- **VAT** is generally not applicable to supplies of goods outside of the 12-mile zone, and certain services rendered outside of the 12-mile zone.
- **If the Maripark** is located outside of the 12-mile zone, sailing back to land could trigger a customs declaration requirement and **customs duties** and **import VAT** could be due.
- **Moreover,** the (re-)introduction of goods from Maripark to EU could trigger a **CBAM** compliance requirement.
- Similarly, shipping goods (back) to the Maripark triggers a customs declaration requirement and potential other requirements.
- **In particular** when setting up the Maripark, export licenses could be required for the export of specific 'dual-use' equipment and goods (e.g. certain underwater survey equipment designed for seabed topographic mapping, certain types of sensors, or specific equipment used to process hydrogen that could be used for both civilian and military purposes).
- **The impact** of the customs duties and import VAT could potentially be mitigated via simplifications, authorizations and/or licenses. In addition, regarding products of sea-fishing and other products taken from the sea, relief from import duty may apply when released for free circulation. The possibilities should be further examined at a later stage.

HIGH LEVEL TAX ASPECTS / ENABLERS & BARRIERS

Enablers & barriers

CONSTRUCTION PHASE	OPERATIONAL PHASE	EXIT PHASE
CIT: EIA/MIA + tonnage regime + DEBRA for equity + DEBRA for debt **Employment taxes:** AVS + employer contributions **VAT:** exempt goods/services, non-entrepreneurship **RETT:** (12-mile zone), VAT construction site **Environmental taxes:** CO_2 taxes + CBAM (12-mile zone) **Permit fees** **Customs** (12-mile zone) **Subsidies**	**CIT:** Tonnage regime + agricultural exemption + innovation box + DEBRA for equity + DEBRA for debt **Employment taxes:** AVS + WBSO + employer contributions **VAT:** exempt goods/services, non-entrepreneurship **Environmental taxes:** Energy tax (12-mile zone) **Permit fees** **Subsidies**	**CIT:** Participation exemption **VAT:** exempt goods/services, non-entrepreneurship **RETT:** (12-mile zone), VAT construction site

This is a summary of the high-level tax implications and considerations. They are categorized as neutral factors (blue), enablers (green) and barriers (red) for every phase of the Maripark project. For a more elaborate overview of the regulations, please refer to the relevant sections.

The possibilities for Maripark in the operational phase might also offer additional benefits than those detailed before. If this is the case, the state aid rules might apply (which might be a disabler based on the timeline of a notification to the Commission or even of the possibility of the Commission refusing to allow the benefit). Please refer to the section below for additional information on the state aid rules.

It might also be possible to extend the scope of currently existing regulations (such as applying the WBSO to certain innovative green business models, to extend the governmental exemption for RETT (5.1.c) or by allowing the application of the innovation box without the presence of a patent). Of course, in such cases, the state aid rules might apply as well.

HIGH LEVEL TAX ASPECTS / STATE AID

State aid

State aid (general aspects)

A company receiving government support may gain a distortive advantage over its competitors. Therefore, Article 107 of the Treaty on the Functioning of the EU (TFEU) generally prohibits state aid unless exceptionally justified. State aid is defined as an advantage in any form whatsoever conferred by a national public authority to undertakings on a selective basis.

The following features must be observed for a benefit to be considered state aid:

- an intervention by the State or through State resources, which can take a variety of forms (e.g. grants, interest and tax reliefs, guarantees, government holdings of all or part of a company, or providing goods and services on preferential terms, etc.);
- the intervention gives the recipient an advantage on a selective basis, for example to specific companies or industry sectors, or to companies located in specific regions;
- as a result, competition has been or may be distorted; and
- the intervention is likely to affect trade between Member States.

From a state aid perspective, the economic substance of a benefit is what matters irrespective of the underlying form. The application of state aid rules is potentially triggered if the users of the Maripark (defined as the enterprises conducting business) receive a benefit irrespective of its form.

Considering our analysis covering tax reduction, reduction of price for services and other aspects, the risk of these being qualified as state aid is present if and insofar new benefits are created. If currently available benefits are used that have already been cleared by the Commission, no state aid rules should apply. A more detailed analysis is due as soon as the specific benefits are determined.

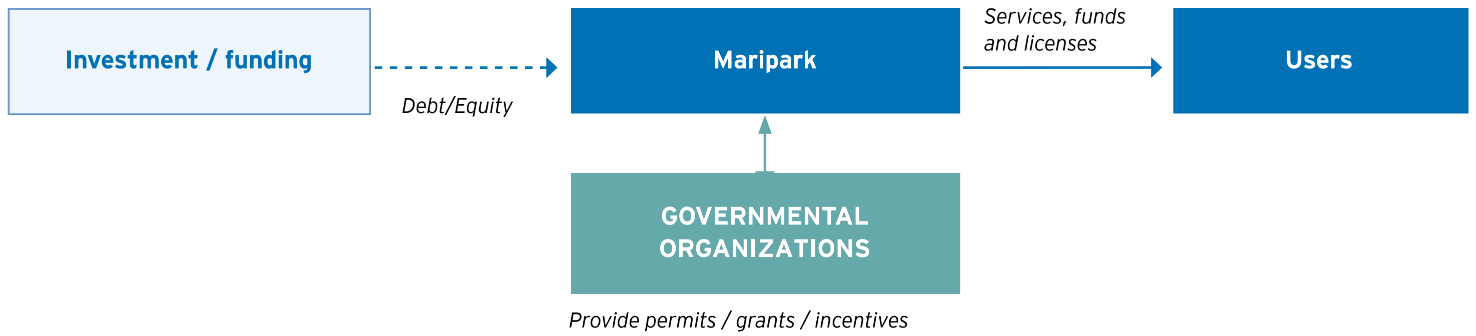
Nonetheless, having determined that a benefit exists, the Member State, i.e. the Government, must in principle notify the European Commission before the measure can be put into effect. Exceptions to notification obligation exist namely (i) aid covered by a Block Exemption (giving automatic approval for a range of aid measures defined by the Commission) (ii) de minimis aid not exceeding €200,000 per undertaking over any period of 3 fiscal years (€100,000 in the road transport sector) or (iii) aid granted under an aid scheme already authorized by the Commission. The non-compliance with the notification obligation/illegally granted state aid may bear the risk of recovery from the beneficiaries.

Each notification triggers a preliminary investigation by the Commission for which the Commission has two months (20 working days) to decide (i) if there is no aid within the meaning of the EU rules, and the measure may be implemented or (ii) the aid is compatible with EU rules, because its positive effects outweigh distortions of competition, and may be implemented or (iii) serious doubts remain as to the compatibility of the notified measure with EU state aid rules, prompting the Commission to open an in-depth investigation.

The General Block Exemption Regulation (GBER, Commission Regulation (EU) No 651/2014 of 17 June 2014) declares specific categories of state aid compatible with Article 107 and 108 of the Treaty on the Functioning of the EU, if they fulfill certain conditions. Aid related to energy production is in scope of the GBER. Furthermore, as part of the European Green Deal, the Commission has acknowledged the importance of these measures for the energy transition in Europe and has initiated the review of the state aid rules related to energy. In the meantime, a Temporary Crisis and Transition Framework has been adopted. The developments in this respect are worthy of constant monitoring. It is worth noting that other forms of state aid related to climate change mitigation and environmental protection are likely to follow a similar revision process. In particular related to fisheries and aquaculture, the Fishery Block Exemption Regulation (FIBER, Commission Regulation (EU) No 1388/2014 of 16 December 2014) brings forward certain categories of aid for sustainable development in fisheries and aquaculture. Similarly, the Commission has adopted revised rules for the fishery and aquaculture sector that include measures related to innovation and conservation.

Based on the above considerations, additional support measures may be put in place (as long as those are compliant with the state aid regime), however, further review is required depending on the specific measures set forth.

Conclusion



As shown in the high-level impact assessment, multiple enablers and barriers exist regarding the tax aspects of the proposed business model and legal framework for the Maripark, and apply to all of the parties potentially involved (as demonstrated in the overview above).

The next recommended step is to further examine the following potential enablers or barriers:

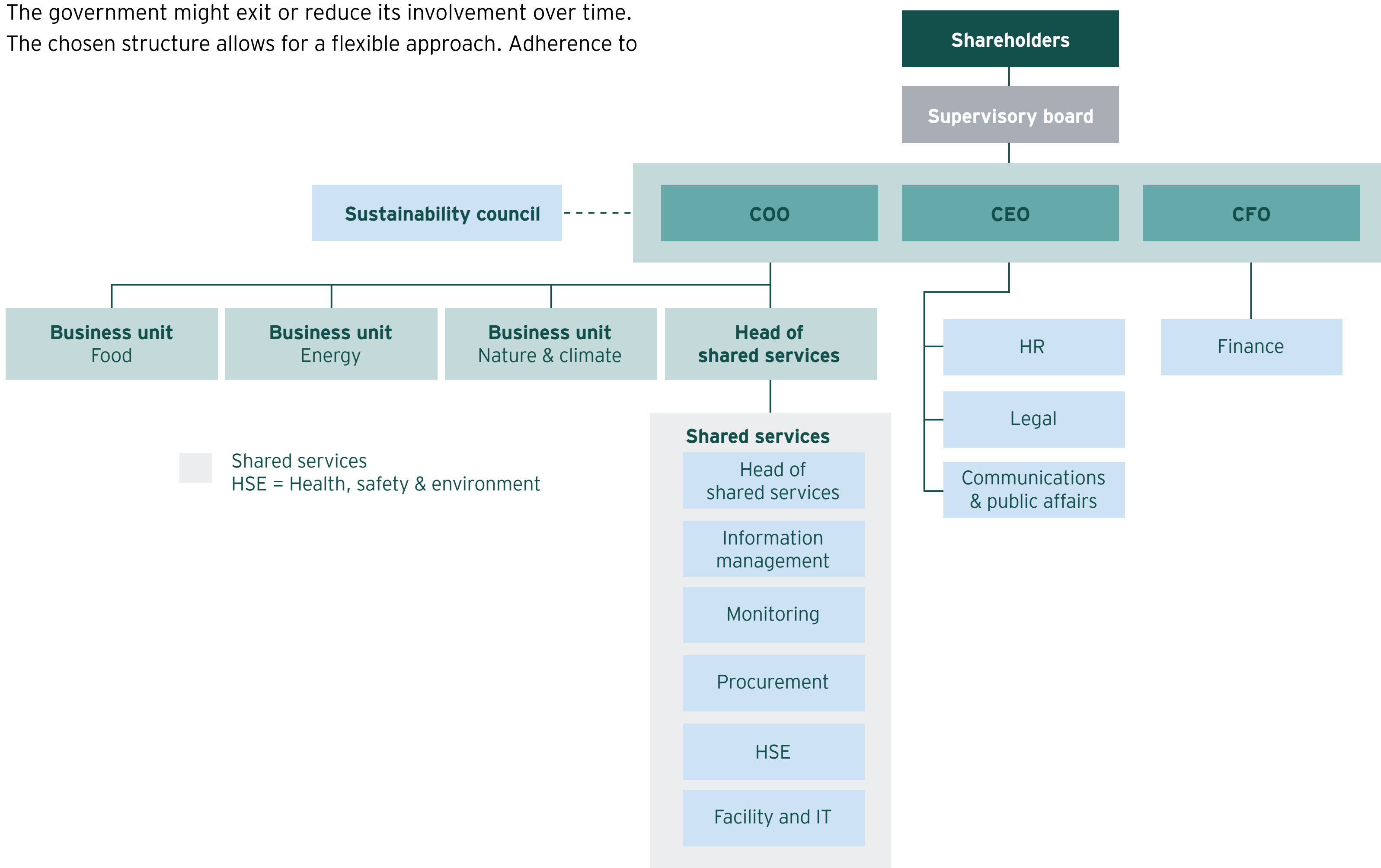
- **CIT:** Tonnage regime, agricultural exemption, innovation box, EIA/MIA, based on the investment structure: choice for B.V. or cooperation
- **Grants & incentives:** Possibly applicable subsidies and funding structures (existing, expected, newly introduced)
- **Employment taxes:** WBSO, AVS
- **VAT:** exempt goods/services, VAT entrepreneurship
- **RETT:** VAT-construction site, applicability
- **Environmental taxes:** Energy tax applicability (within and outside of 12-mile zone), CBAM outside of 12-mile zone
- **Customs:** Applicability of facilitation outside of 12-mile zone

At the discretion of the governmental organizations involved in any Maripark project, new enablers (for instance new types of grants) might be made available to further support the business case of the Maripark entity or its users. However, the Dutch State might need to notify the Commission of the benefits and cannot grant the benefits until approval is obtained. These factors could be further explored following a detailed design.

Proposed organizational structure of a Maripark

The organizational structure and functions are based on research from standard corporate governance frameworks and expert interviews. During the interviews conducted in the previous chapters in this report, it was evident that strong stakeholder involvement is needed. This has been reflected in the addition of a sustainability committee on supervisory board as well as sustainability council level.

The government might exit or reduce its involvement over time. The chosen structure allows for a flexible approach. Adherence to regulations, especially related to HSE, should be maintained through a specialized (e.g. government) representative in the supervisory board.
The size of the respective teams, as well as the dedication of the head functions (full-time vs. part-time) is subject to the size of the Maripark(s) and should be evaluated at a later stage.



Description of the top level functions

- **The Supervisory Board (SB)** exerts oversight and control over the Board of Directors (BoD) and the general affairs of the organization. The SB supervises subjects including company strategy and financial performance, business risks, structure and administration of internal risk management and control systems, financial reporting procedures and compliance with relevant laws and regulations. The SB's role, responsibilities and related tasks are formulated in the organization's Articles of Association and in a separate Supervisory Board Charter. 80% of the members of the SB are independent.

The Supervisory Board has three committees, which focus on specific and complex aspects of its supervisory responsibilities:
- The Audit Committee, composed of three members
- The Governance, Nomination and Remuneration Committee, composed of three members
- The Sustainability Committee, composed of three members

Each committee performs its duties under a specific charter that describes its role, responsibilities, organization and functioning. The committees make recommendations and advise the SB. The SB retains responsibility for all decisions and actions taken on the committees' recommendations. The SB meets two times a year.

- **The Board of Directors (BoD)** duties include developing and carrying out the organization's strategy within the risk profile approved by the SB, effectively structuring and staffing the organization, applying consistently the principles of sustainability to operations and developments, and achieving and properly reporting on financial targets and results. The BoD operates under its own Charter and is overseen by the SB. It's members include the CEO, CFO and COO. The BoD reports to the SB. It can decide on capex up to a certain (euro) amount.
  - The CEO has the overall responsibility for direction and strategy, defining long-term goals (except sustainability related targets), leadership of the executive team and overseeing their performance and development, setting performance expectations, delegating responsibilities, and making decisions on behalf of the Maripark. Collaborates with the BoD, providing regular updates on the Maripark's performance.
- **The CFO** is managing budgets, financial statements, cash flow, and financial reporting, ensuring compliance with relevant financial regulations and laws in addition to attracting loans, grants and incentives.
- **The COO** is responsible for the daily operations and coordination between the different business units. Overall, the COO is in charge of shared services. The COO is also responsible for stakeholder management.
- **The Sustainability Council (SC)** includes the BoD, the heads of the business units, external subject matter experts, a representative from the public community, a representative from an NGO and the people and planet experts from the business units. The role of the SC is to streamline stakeholder value initiatives and to align on sustainability initiatives and targets overall. The SC further has the power to pass sustainability targets. The SC reports to the BoD.
- **The three Business Unit heads** hold the day-to-day responsibility for building and maintaining the Maripark(s). They hold the technical expertise and report to the COO. They are responsible for developing and implementing business strategy in their respective fields. They are responsible for production, setting goals, identifying growth opportunities, and formulating plans to achieve business objectives. They all share the same support service functions.

Description of the remaining functions

Shared services are used by the three business units, report to the head of shared services and include:
- **Information Management (IM)**, responsible for management and administration of information and data related to the facility's operations.
- **Monitoring** is responsible for monitoring the impact of the Maripark activities on the local environment and life at sea. It aims to identify issues, risks, and opportunities and to provide feedback for performance improvement and accountability.
- **Procurement,** responsible for managing the procurement process and contract management for goods and services required for the offshore facility's operations.
- **HSE** is responsible for ensuring the safety and well-being of personnel working on the facility, protecting the environment and that the company meets its legal and ethical obligations.
- **Facility and IT** is responsible for ensuring that the offshore facility's technology infrastructure and systems are secure, reliable, and aligned with business objectives. It also oversees the development and maintenance of software applications used by the facility. In addition to the IT-part, this department is responsible for the facility of the organization meeting the standards required for the Maripark organization. As asset heavy infrastructure is part of the Maripark, a comprehensive asset management strategy needs to be in place. This includes regular maintenance and inspection, asset tracking and management, data analysis and visualization, risk management and technology and innovation.

Three departments report to the CEO:
- **HR** is responsible for attracting, retaining, and developing talent within the organization, and ensuring positive and inclusive work culture that fosters employee engagement, motivation, and productivity.
- **Legal** is responsible for ensuring compliance with Maripark governance standards, policies, and procedures. In addition, this department is responsible for overseeing Maripark's legal and regulatory compliance, including reporting requirements, ethical standards, social responsibility, and permitting.
- **Communication & Public Affairs** is responsible for handling and communicating the Maripark's vision, strategy, and performance to internal and external stakeholders, representing Maripark in media interviews, industry events, and other public forums.

The CFO oversees the finance function, which includes:
- **Accounting and reporting functions,** which ensure that the facility complies with accounting standards and regulations, and provide accurate and timely financial information to stakeholders.
- **Treasury functions,** which are related to cash management, risk management, banking relationships, investment management, treasury operations and debt management.
- **Business control functions,** which include financial planning and control, budget management, performance management, business intelligence, and financial administration. This is important for ensuring the integrity of the offshore facility's operations and financial reporting, identifying and mitigating potential risks, and providing accurate and timely information to stakeholders.

More details for the shared services and functions below the CEO and CFO are described in the appendix.

04

Transformation Roadmap

A transformation roadmap that will facilitate the transformation of an offshore windfarm to the first Maripark in the Dutch EEZ, which will serve as a template for subsequent initiatives.


© Oscar Bos

Transformation roadmap

Introduction

Context

To succeed in a complex undertaking like the Maripark project, it is essential to have a strategic guide and transformation roadmap. This chapter builds upon the foundations laid in the previous chapters and defines the objectives, goals, and milestones that will be necessary for developing the Maripark. The roadmap plays a crucial role in facilitating effective planning and resource allocation. Additionally, it enables the tracking and evaluation of progress throughout the process.

Approach

Based on a vision for the Maripark, the business strategy for its realization has been developed by synthesizing information from previous chapters and interviews with various stakeholders. By assessing the current state derived from the baseline and aligning it with the envisioned future state, gaps requiring attention have been identified. These findings have been incorporated into a comprehensive execution plan, which includes multiple work streams like business development, tax & legal, marine spatial planning and engineering, and consists of 8 strategic steps, which will serve as a guide for the development of the first Maripark and subsequent initiatives.

Findings

Developing future governance models for ocean stewardship is a time-consuming endeavor. Consequently, it is of utmost importance to commence this process rapidly to increase the likelihood of success. While certain aspects of the endeavor may require significant time and investments, it is possible to incorporate no-regret steps in parallel. For instance, a focus on mobile assets such as ships and floating islands can be pursued simultaneously, allowing for progress to be made while the broader governance models are being developed and time consuming (political) processes such as spatial planning are ongoing.

Key takeaways

The transformation roadmap presented in this chapter serves as an indicative guide, defining the strategic direction and identifying priority areas necessary for the realization of the multi-use benefits, as described in chapters 1 and 2.
It should play a vital role in effectively communicating the transformational journey, fostering increased awareness, and aligning stakeholders around a shared vision. By socializing and further detailing the roadmap, all parties gain a common understanding of the necessary steps and actions required, enabling proactive risk management and mitigation strategies. This forward-thinking approach is key to the long-term success of the project.

OPPORTUNITY

The preceding chapters have shown that there is a clear need to further develop the business case for the Maripark

This report has addressed many of the aspects affecting the development of the North Sea, including the drivers and challenges, relevant policies, emerging business opportunities, and applicable governance structures. The findings suggest that a governmental organization, the Maripark B.V., will be necessary to efficiently accelerate the development of multi-use in the Dutch North Sea.

The concept that is suggested in chapter 3 of this report, the Maripark B.V., can act as an instrument to lead the transition from single-use to multi-use. It takes into account needs for developing the area for multi-use and the realization of symbioses that were identified in chapters 1 and 2. The Maripark B.V. should focus on developing the key elements and governing structure that can serve several business activities and thus help to accelerate overall development.

Multi-purpose assets, such as vessels and offshore islands, should be invested in by Maripark B.V. and scaled as the number of Mariparks increases. The organization should not invest in assets that are very specific and have high depreciation rates, such as nets for seaweed, single use floating structures for offshore solar, etc.

THE MARIPARK B.V. SHOULD	
	Promote collaboration, participation, and engagement
	Invest in sector-unspecific assets and infrastructure
	Ensure effective policies and governing structures
	Exert ocean stewardship
	Facilitate data collection and environmental impact assessments
	Make sure targets are met for production of energy and food
	Oversee and keep budgets for climate impact and nature restoration
	Ensure safety for all activities within the Maripark

Based on the comprehensive analysis outlined in the preceding chapters, a detailed implementation plan and business strategy for the Maripark B.V. is suggested.

Lessons learned from state-of-the-art initiatives

>> 01 BASELINE

Detailed evaluation of high potential business activities

>> 02 PORTFOLIO

Comprehensive evaluation of tax, legal & governance structure

>> 03 ORGANIZATION & STRUCTURE

Transformation roadmap for Maripark B.V.

>>04 TRANSFORMATION ROADMAP

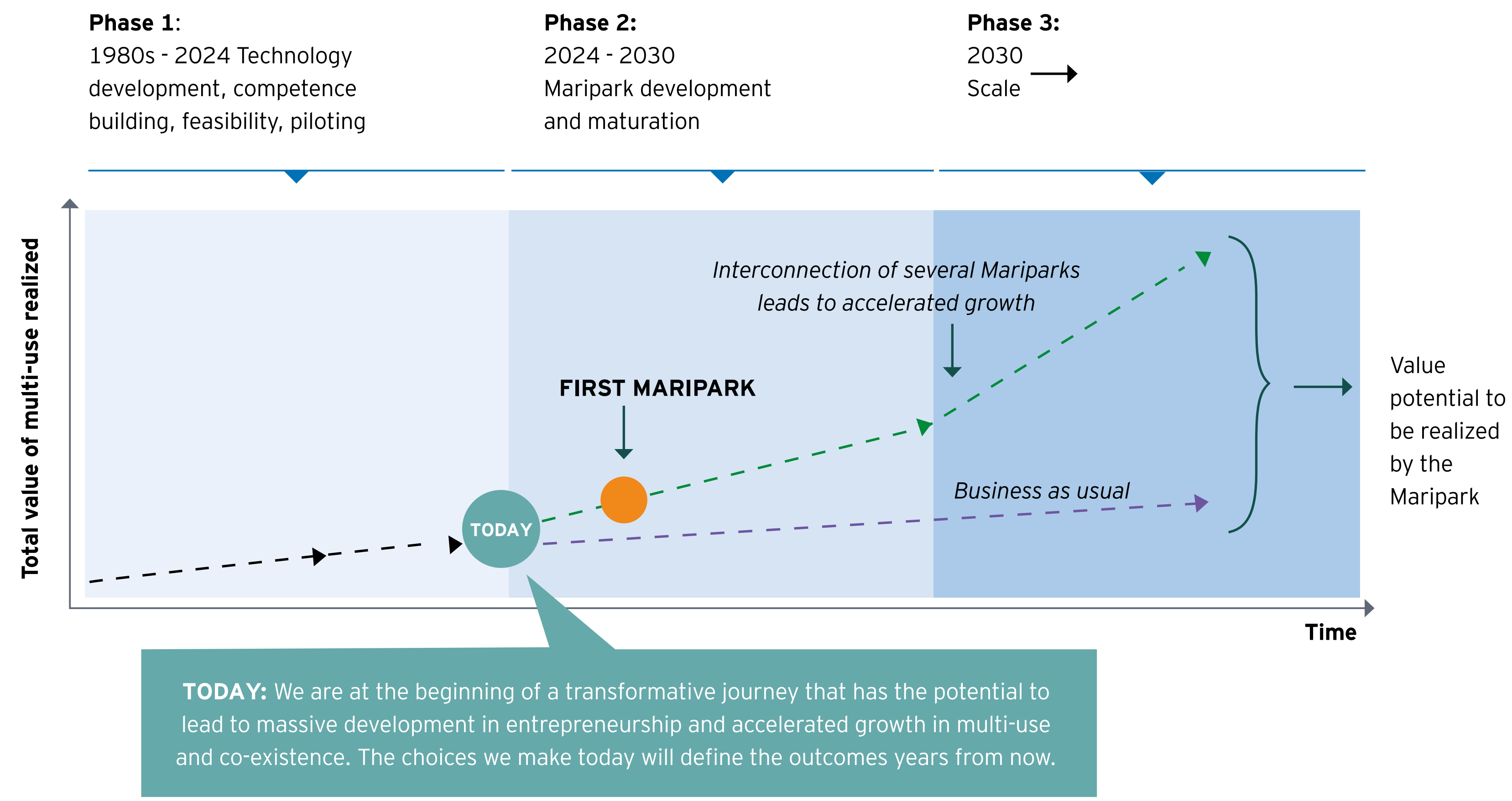
DIRECTION

Charting a new course: business as usual is not enough to realize the value potential that lies in multi-use

There have been significant investments and effort into piloting, development of knowledge and technology related to multi-use and co-existence.

However, offshore business activities face a unique set of barriers such as complex operations, long travel times, and maritime safety considerations. Consequently, most developments have focused on demonstrating feasibility, as seen in chapter 1, and persistent barriers continue to hamper further progress. Consequently, no clear pathways currently exist for the industrial success of multi-use.

If we want multi-use to succeed, there is a need to facilitate development through a Maripark B.V.



RETHINK

The Maripark represents a new way of thinking and provides a clear pathway for succeeding with multi-use

The traditional approach of businesses operating within silos and focusing on their specific sectors will not enable the realization of the full value potential of the blue economy.

By adopting a flexible and sector-unspecific approach, businesses open doors for collaboration and innovation, as diverse industries converge to create and deploy the necessary technology and solutions. By sharing resources and infrastructure across sectors, companies can minimize their environmental footprint while maximizing the value derived from their operations.

The Maripark can facilitate the transition from sector-specific, single-use activities to sector-unspecific, multi-use business approaches.

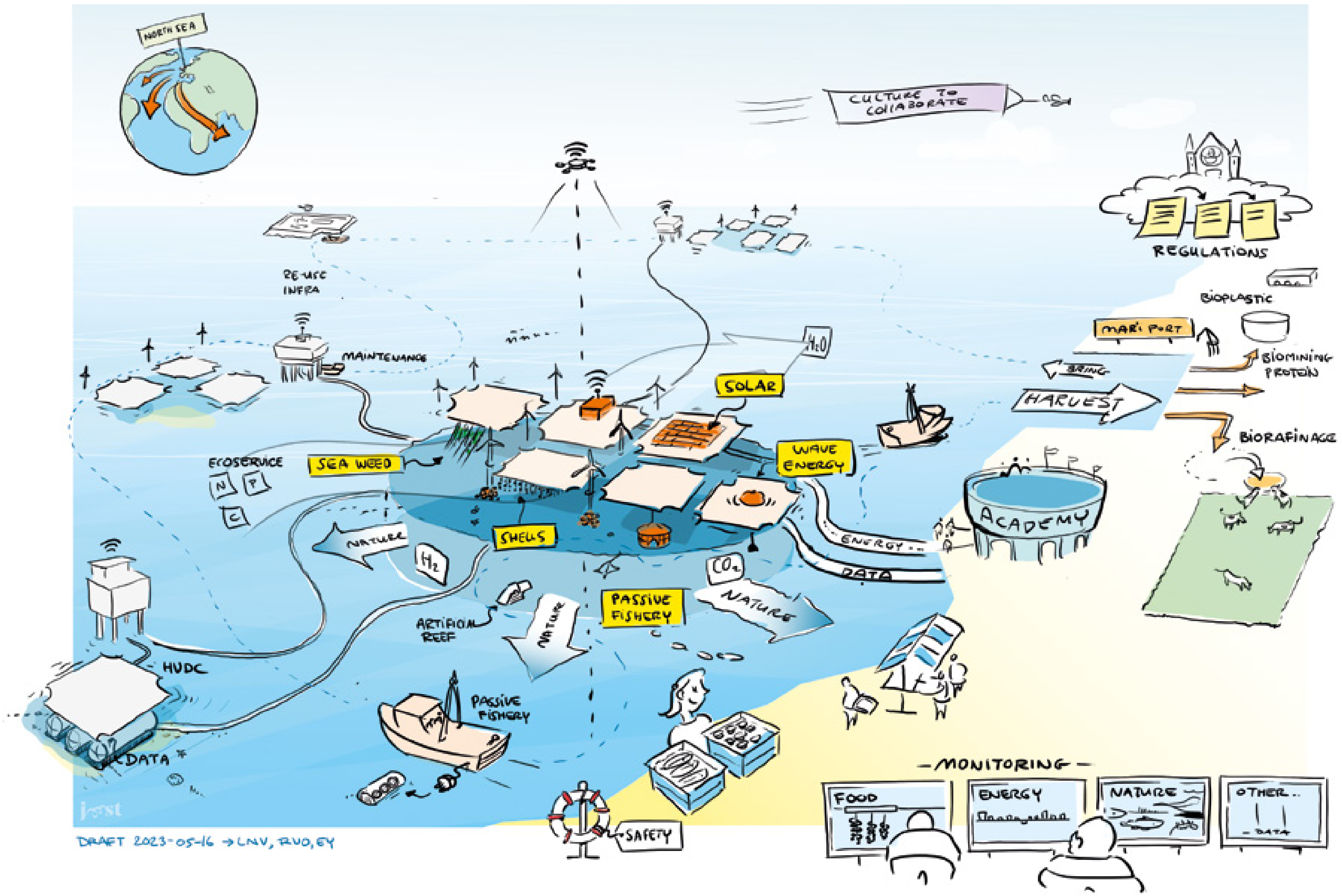
It can serve as an environment for collaboration, enable businesses to make the most of the available resources and space within windfarms, promote sustainable practices, and realize synergies. It will take concerted team effort to embrace this new mindset and to form a plan for multi-use realization.

MARIPARK 2050

Project Blueprint

OLD WAY

- Single use
- No / few synergies
- Financial / economic focus
- Sector specific considerations
- Every activity has its own framework for safety
- Linear process



NEW WAY

- Shared use (ecological, nature-based, food aspect)
- Realization of synergies
- Innovative and attractive for numerous activities
- Holistic and sector-unspecific
- Shared resources, infrastructure and safety by design
- Circular processes as a design principle

DEVELOPMENT

A stepwise approach to facilitate the transition

Start, 2024 – 2026, no regrets development
The initial focus should be on the development of a smaller area of around 1,000 ha. A manageable scale allows testing and optimization of the operational processes prior to expanding to a greater region. The priority should be to acquire mobile assets, such as ships and platforms. At the same time, efforts should be made to further develop the broader governance models of the Maripark B.V. and to navigate time-consuming political processes, such as spatial planning.

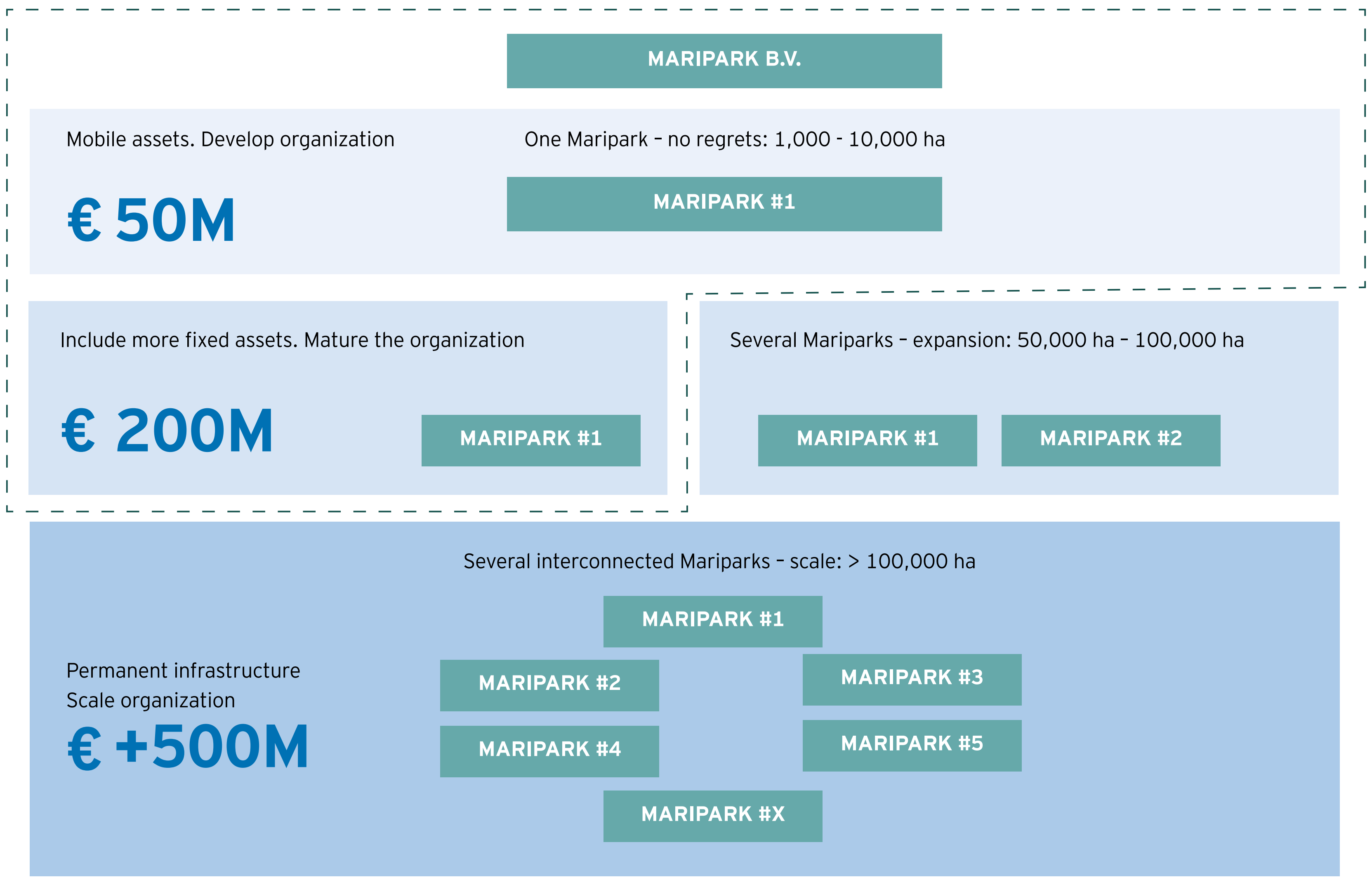
Expand, 2026 – 2028, expansion
The expansion will build upon the insights and data generated from the early operations to further expand the operations. This expansion will take advantage of the knowledge and experience gained from the first phase and use that to increase the size and impact of the operations. The organization should be scaled accordingly to handle the increased operational complexity.

Scale, 2028 – 2030, interconnect
As the concept matures and more parks become operational, the next stage is to connect them with permanent and fixed structures, such as islands or platforms. These connections and hubs will be made to further optimize and realize additional benefits from being interconnected and to form a network of business activities.

International expansion, 2030 ⟶
Use the blueprint and build upon the experience from ongoing operations to launch the concept to other high growth areas and emerging markets.

Proposed business development for the Maripark B.V.

Scope of this report



SUCCESS FACTORS

Realizing the goals and objectives requires the implementation of an effective business strategy

The Maripark business strategy takes a comprehensive approach to bridge the gap between business-as-usual and the necessary development required for multi-use.

It begins by outlining clear objectives and priorities, and defining the desired outcomes and impacts to be achieved at each stage. The strategy consists of two main parts: the foundational phase and the expansion phase.

During the foundational phase, the strategy focuses on establishing a solid framework that serves as the basis for further development. In the expansion phase, the strategy outlines a modular approach that enables successful scaling and expansion of the Maripark to other areas and regions around the world.

Proposed step-by-step business development for the Maripark B.V.

FOUNDATION PHASE

1. **Blueprint**
For the given geographical conditions, identify the highest potential opportunities that could support the overall blue growth goals.

2. **Engage stakeholders**
Consultation and engagement with key stakeholders, including potential business partners and investors (corporates, sovereign wealth funds, etc.), local communities, government agencies, NGOs, industry associations and the community of practice.

3. **Establish legal structure & governance**
Decide on a legal structure and develop a robust governance framework to ensure the development and use phases are managed efficiently and effectively. The framework should include regulatory policies, management plans, voting structure, monitoring, evaluation mechanisms, tax controls, and dispute resolution procedures.

4. **Develop Maripark B.V. business case**
The Maripark B.V. business case should include quantitative and qualitative analysis. It is based on the 'Handleiding publieke businesscase'.

SCALING & EXPANSION PHASE

5. **Secure funding**
Based on the business case defined in step 4, identify and secure funding from public and private sources.

6. **Build shared infrastructure**
The shared infrastructure should be developed in a modular way and adhere to the highest environmental and safety standards.

7. **Go-live and monitor**
Ongoing monitoring and evaluation of the economic, social and environmental impacts to ensure positive delivery to all stakeholders.

8. **Decommissioning**
Returning (part of) the area to its pre-Maripark condition and/or design a valuable second-life solution.

Six key success factors for the Maripark B.V. to reach the targets

The development of a Maripark is a multi-year process and requires detailed planning and high stakeholder involvement. The key success factors, as described in detail in the appendix, will make sure that the goals and targets are met.

ROADMAP

Transformation roadmap of the first Dutch Maripark (1/3)

2024 — H1 2024 — 2025

OUTCOMES

1 BLUEPRINT

For the given geographical conditions, identify the highest potential opportunities that could support the overall blue growth goals. Propose a legal structure, business case approach and transformation roadmap.

2 ENGAGE STAKEHOLDERS

Consultation and engagement with key stakeholders, including potential business partners and investors (corporates, sovereign wealth funds, etc.), local communities, government agencies, NGOs, industry associations, the community of practice and financial institutions, etc., to include them in the decision making process for the final structure of a Maripark.

3 ESTABLISH LEGAL STRUCTURE & GOVERNANCE

Build legal foundation and governance structure for a Maripark. Develop a robust governance framework to ensure the development and use phases are managed efficiently and effectively.

ACTIVITIES

BUSINESS DEVELOPMENT (CHAPTER 1 AND 2)

- From a long list of potential business opportunities, propose the ones for a shortlist, which are suitable for a Maripark.

TAX & LEGAL (CHAPTER 3)

- Propose a legal structure, considering tax implications
- Define a draft governance structure
- Identify tax enablers and disablers to be examined at a later stage

MARINE SPATIAL PLANNING (CHAPTER 4)

- Include concepts in decision making for business opportunity shortlist.

Finalized project steps, as of May 2024.

Chapter [...] Refers to the parts of this report, which further outline this topic and/or that provided a trigger to include the respective topic in the transformation roadmap.

BUSINESS DEVELOPMENT (CHAPTER 1 AND 2)

- Define core working group as part of an integrated project management organisation
- Conduct external meetings with key stakeholders to validate joint understanding of targets and roadmap
- Participate in roundtables and events to engage stakeholders
- Organize roundtables with participants from all the above mentioned sectors
- Continue 1:1 meetings with developers and entrepreneurs, who are active in the selected business opportunities to discuss their potential requirements for involvement
- Engage with government entities and discuss physical location of the Maripark
- Register Maripark B.V. entity at CoC
- Quantify the value added, social and financial, of multi-use in the first Maripark

MARINE SPATIAL PLANNING (CHAPTER 4)

- Create MSP working group
- Identify existing legal frameworks related to coast and ocean
- Set goals, mandate and boundaries of MSP
- Identify existing conditions (physical, biological, ecological, social, governance and economic characteristics of the marine plan area)
- Map key issues and conflicts of interest of all stakeholders

BUSINESS DEVELOPMENT (CHAPTER 1, 2 AND 3)

- Apply for government funding for basic floating infrastructure
- Create policies for:
  - Decommissioning
  - Tendering
  - Regulation
  - Management plans
  - Voting structure
  - Monitoring
  - Evaluation mechanisms
  - Dispute resolution procedures
- Hire board of directors and other key employees, set up teams

TAX & LEGAL (CHAPTER 3)

- Finalize tax and legal structure design, including physical location of the Maripark, if necessary: consult Dutch tax authorities
- Appoint supervisory board and sustainability council
- Foundation of Maripark B.V.
- Define missing supporting laws and regulations and examine identified tax enablers and disablers (based on Phase 2)
- Consider state aid consequences of incentives as discussed in Phase 2
- Tax control framework for Maripark entity

ENGINEERING (CHAPTER 4)

- Pre-FEED studies
- Technical analyses

ROADMAP

Transformation roadmap of the first Dutch Maripark (2/3)

2025

PROCUREMENT OF MULTI-PURPOSE ELECTRIC SHIPS AND OTHER FLOATING ASSETS <€5M

2026

OUTCOMES

4 DEVELOP MARIPARK B.V. BUSINESS CASE

The Maripark B.V. business case should include quantitative and qualitative analysis. It is based on the 'Handleiding publieke businesscase'.

5 SECURE FUNDING

Based on the business case defined in step 4, identify and secure funding from public and private sources for the shared infrastructure (Maripark B.V.) and tender the physical spaces allocated for the respective business opportunities.

ACTIVITIES

BUSINESS DEVELOPMENT (CHAPTER 1, 2 3)

- Develop financial model (incl. capex heavy, fixed infrastructure >€5m)
- Finalize public business case report
- Approve government financing for basic floating infrastructure
- Final decision on business opportunities

MARINE SPATIAL PLANNING (CHAPTER 4)

- Draft marine spatial plan (incl. geographic information systems), analyse the collected data to identify areas of conflict and synergies between different uses
- Conduct scenario analysis
- Scenario selection and definition of implementation process
- Establish a regular dialogue with energy/food/nature/other sectors and other stakeholders

ENGINEERING (CHAPTER 4)

- Collaborate with stakeholders of selected business opportunities on required shared infrastructure and synergies
- Start basic engineering of Maripark (e.g. shared infrastructure such as power lines, anchors) based on business opportunities that will operate in the Maripark

TAX & LEGAL (CHAPTER 3)

- Start umbrella permitting process to streamline permitting process for individual business opportunities
- Implement outcome of consultation with Dutch tax authorities (if any) in business case

BUSINESS DEVELOPMENT (CHAPTER 1, 2, 3)

- Meet with government institutions inside and outside the Netherlands and refine discussions with financial institutions, entrepreneurs and other private parties for investment discussions
- Set up and populate a data room for the tender of the physical space defined for each business opportunity and for raising financing for Maripark B.V. (shared infrastructure)
- Secure additional funding with government organizations and financial institutions for fixed shared infrastructure capex (>€5m) for Maripark B.V.
- Finalize tender process organization and send out tender letters to entrepreneurs etc.

ENGINEERING (CHAPTER 4)

- Finalize engineering and procure external technical due diligence to enhance bankability
- Provide input for technical aspect tender
- Grant construction contract

TAX & LEGAL (CHAPTER 4)

- Provide input for tender process
- Engage with potential investors for legal contracts
- Implement new/broadened tax incentives in relevant legal framework (if Commision has cleared them)
- Implement tax consequences of acquired funding in the business case taking current legislation into account

◆ Major milestones.

Chapter [...] Refers to the parts of this report, which further outline this topic and/or that provided a trigger to include the respective topic in the transformation roadmap.

ROADMAP

Transformation roadmap of the first Dutch Maripark (3/3)

2026 [...] [...] [...]

OUTCOMES

6 BUILD SHARED INFRASTRUCTURE

The shared infrastructure should be developed in a modular way and adhere to the highest environmental and safety standards. It should consider potential risks (e.g. sea level rises) as defined in the worst case scenario of the IPCC reports.

7 GO-LIVE AND MONITOR

Ongoing monitoring and evaluation of the economic, social and environmental impacts to ensure positive delivery to all stakeholders. Addition / removal of business opportunities, subject to technical developments.

8 DECOMMISSIONING

Returning (part of) the area to its pre-Maripark condition and/or design a valuable second-life solution.

ACTIVITIES

6 BUILD SHARED INFRASTRUCTURE

BUSINESS DEVELOPMENT (CHAPTER 1 & 2)

- Engage with the general public to increase public sentiment
- Monitor comparable global developments, initiatives and research

TAX & LEGAL (CHAPTER 3)

- Monitor tax compliance requirements and new relevant regulations

MARINE SPATIAL PLANNING (CHAPTER 4)

- Continuous monitoring, involvement of stakeholders and adaptation

ENGINEERING (CHAPTER 4)

- Supervise shared infrastructure construction
- Tender O&M party (with tax & legal workstream)

7 GO-LIVE AND MONITOR

BUSINESS DEVELOPMENT (CHAPTER 1 & 2)

- Monitor activities within Maripark and manage relations with stakeholders active in Maripark
- Regular exchange and knowledge sharing with community of practice

TAX & LEGAL (CHAPTER 3)

- Throughout the entire life cycle of the Maripark:
- Monitor tax compliance requirements and new relevant regulations
- Monitor tax incentives/subsidies necessary for the users and modify if appropriate

MARINE SPATIAL PLANNING (CHAPTER 4)

- Continuous monitoring, involvement of stakeholders and adaptation

ENGINEERING (CHAPTER 4)

- Contract O&M party (with tax & legal workstream)
- Monitor regular and heavy maintenance

8 DECOMMISSIONING

BUSINESS DEVELOPMENT (CHAPTER 1, 2 & 3)

- Assess whether (part of) the infrastructure can be used as a second-life solution, taking into account social value as well
- Tender/procure decommissioning of remaining infrastructure

TAX & LEGAL (CHAPTER 3)

- Develop contracts to hand over remaining assets to new party if needed
- Before decommissioning: assess tax consequences of decommissioning for the Maripark entity and the users; if necessary, consult the tax authorities

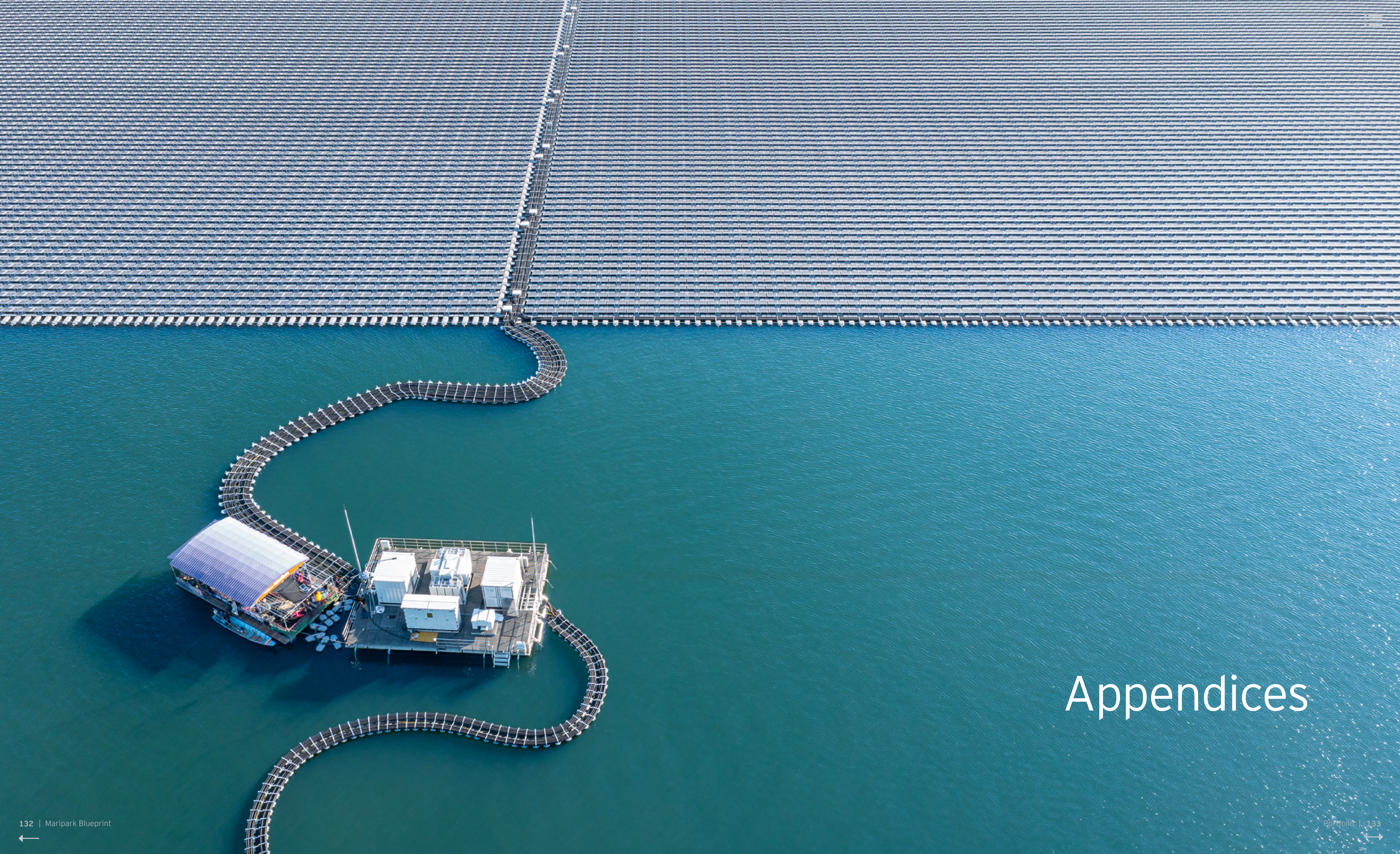
MARINE SPATIAL PLANNING (CHAPTER 4)

- Continuous monitoring, involvement of stakeholders and adaptation

ENGINEERING (CHAPTER 4)

- Tender & contract decommissioning party for remaining infrastructure, to be conducted in an environmentally-friendly way

Chapter [...] Refers to the parts of this report, which further outline this topic and/or that provided a trigger to include the respective topic in the transformation roadmap.



Appendices

Blue economy business opportunity overview

	FEASIBILITY					FINANCIAL VALUE		STAKEHOLDER VALUE		
Business opportunity	**Fit for economic zone**	**Environmental impact**	**Technology readiness[1]**	**Political strategy fit**	**Social acceptance***	**Financial potential**	**Maripark synergy potential**	**Key socio-economic factors[2]**	**Other factors**	**Potential scope Maripark**
Green offshore H_2 production	🟠 Fresh water ✅ Green energy ❌ Storage limitations	✅ CO_2 ❌ Nature impact	🟠 Moderate	✅ NL net zero strategy ✅ EU H_2 strategy	🟠 Mostly neutral	🟠 Not yet reached (c. 2030s)	✅ Capex synergies 🟠 Opex synergies	✅ Job creation ✅ GDP impact 🟠 Innovation	✅ OH&S ❌ Nature synergies	✅
Offshore green ammonia / green methanol production	❌ Dependent on green hydrogen ✅ Green energy ❌ Captured CO_2	✅ CO_2 ❌ Nature impact	🟠 Moderate	✅ EU 2050 strategy	🟠 Unknown	🟠 High capex	✅ Capex synergies 🟠 Opex synergies	✅ Job creation ✅ GDP impact	❌ More suitable on land	❌
Offshore wind energy	✅ Sea depth ✅ Favorable wind	✅ CO_2 🟠 Nature impact	✅ High	✅ EU 2050 strategy ✅ NL net zero strategy	✅ Mostly positive and neutral	✅ Ready 'without' subsidy	✅ Capex synergies ✅ Opex synergies	✅ Job creation ✅ GDP impact ✅ Innovation	🟠 Nature synergies	✅
Thermal energy / hydropower	✅ Use existing O&G infrastructure	✅ CO_2 🟠 Nature impact	🟠 Moderate	✅ Geothermal Heat Action plan	✅ Mostly positive and neutral	✅ High ✅ Reduced cost of decommissioning	✅ Capex synergies ✅ Opex synergies	✅ Job creation ✅ Cost reduction of decommiss. ✅ Innovation	🟠 Most likely dependent on existing O&G platforms	🟠
Salinity energy	✅ Salinity gradients	❌ Nature impact	🟠 Moderate	🟠 TBD	✅ Mostly positive and neutral	🟠 Est. 1.5 GW potential in Netherlands	🟠 N/A	✅ Job creation ✅ GDP impact	🟠 Best suited for river mouths	❌
Floating solar	🟠 Waves 🟠 Solar irradiance 🟠 Wind	✅ CO_2 🟠 Nature impact	🟠 Moderate	✅ NL net zero strategy	🟠 Mixed, but mostly neutral	🟠 Subject to insolation & wind drag	✅ Capex synergies 🟠 Opex synergies	🟠 Job creation ✅ GDP impact ✅ Innovation	🟠 Can disrupt sea life	✅
Carbon capture and storage (CCS)	✅ Re-use of oil and gas platforms	✅ CO_2	✅ High	✅ North Sea Programme	🟠 Mixed, but mostly neutral	🟠 Depends on CO_2 price	🟠 Capex synergies 🟠 Opex synergies	✅ Paris Agreement	❌ Location limitation	🟠

✅ Criteria met 🟠 Criteria partially met ❌ Criteria not met

Note The selected business opportunities are described in more detail in the main part of this report. OH&S is defined as occupational health & safety.
Sources of business opportunities that were not selected are listed in the appendix.
1/ Low = concept stage, moderate = pilot launched / demonstration stage, high = fully implemented.
2/ Includes impact on entire value chain within the Dutch area, and in a multi-year context.

* Based on a social media analysis in the Netherlands, January 2023

Blue economy business opportunity overview

1 2 3

	FEASIBILITY					FINANCIAL VALUE		STAKEHOLDER VALUE		
Business opportunity	**Fit for economic zone**	**Environmental impact**	**Technology readiness[1]**	**Political strategy fit**	**Social acceptance**	**Financial potential**	**Maripark synergy potential**	**Key socio-economic factors[2]**	**Other factors**	**Potential scope Maripark**
Wave energy	✓ Wave heights	✓ Renewable energy ◑ Noise	◑ Moderate	◑ Not in North Sea Programe	◑ Neutral	◑ Depends on energy price, but higher LCOE than OWE	✓ Capex synergies ✓ Opex synergies	✓ GDP impact	✓ Provides baseload energy supply	✓
Sustainable feed (microalgae)[3]	✓ Sea depth ◑ Temperature	✓ Transport	◑ Moderate	◑ Not in North Sea Programe	◑ Mixed, but mostly positive/neutral	◑ Depending on green premium and technology development	✓ Capex synergies ◑ Opex synergies	✓ Job creation ✓ GDP impact	◑ Depends on other business opportunities in Maripark	◑
Offshore fish farm	✓ Temperature ✗ Shallow	✗ Pollution ✗ Escaping	◑ Moderate	◑ Not in North Sea Programme	◑ Unknown, but expected mixed	◑ High capex ◑ High opex	✓ Capex synergies ✓ Opex synergies	✓ Job creation ✓ GDP impact		✗
Seaweed	✓ Nutrition ✓ Temperature ✓ Phosphorus ✓ Nitrogen ✓ Salinity	✓ Expected positive impact	◑ Moderate	✓ North Sea Programme	◑ Mixed, but mostly positive/neutral	◑ Depends on technology, scalability and use case	✓ Capex synergies ✓ Opex synergies	✓ Job creation ✓ GDP impact		✓
Passive fishing for fish	✓ Temperature ✓ Sea depth ✓ Nutrients ◑ Unknown effects of wind turbines	✓ Less CO_2 emitted ✓ Low soil disturbance ✓ Low bycatch	◑ Moderate	✓ Sustainable, nature-friendly ✓ North Sea Programme	✓ Unknown, but expected positive	◑ Depends on scalability	✓ Capex synergies ✓ Opex synergies	✓ Job creation ✓ GDP impact	✗ Low TRL for passive fishing of flatfish ✗ Governance issues[4]	◑
Mineral extraction from the seabed	✓ Already present at large-scale	✗ Landscape destruction ✗ Particle creation	✓ High	✓ Securing metal supply	✗ Mixed, but mostly negative	✓ Already a commercial industry	◑ Unknown	✓ Job creation ✓ GDP impact		◑

✓ Criteria met ◑ Criteria partially met ✗ Criteria not met

Note The selected business opportunities are described in more detail in the main part of this report.
Sources of business opportunities that were not selected are listed in the appendix
1/ Low = concept stage, moderate = pilot launched / demonstration stage, high = fully implemented
2/ Includes impact on entire value chain within the Dutch area, and in a multi-year context
3/ Grown in tanks
4/ Pilot in Borssele cancelled due to misalignment between fishers and government

Blue economy business opportunity overview

1 2 3

	FEASIBILITY					FINANCIAL VALUE		STAKEHOLDER VALUE		
Business opportunity	**Fit for economic zone**	**Environmental impact**	**Technology readiness[1]**	**Political strategy fit**	**Social acceptance**	**Financial potential**	**Maripark synergy potential**	**Key socio-economic factors[2]**	**Other factors**	**Potential scope Maripark**
Lobster cages and/or hatchery (P. elephas & H. Gammarus)	✓ Temperature ✓ Sea depth ✓ Nutrients ✗ Hard substrate	✗ No CO_2 / No_x capture ✗ No filtration Indigenous species	~ Moderate	✓ Biodiversity ✓ North Sea Programme	✓ Unknown, but expected positive	~ Dependent on scalability ✓ High financial value	✓ Capex synergies ✓ Opex synergies	✓ Job creation ~ GDP impact	N/A	~
Bivalves, oysters / blue mussels[3]	✓ Temperature ✓ Sea depth ✓ Nutrients ✓ Resilient species	✓ No_x capture ✓ Water filtration ✓ Indigenous species	✓ High	✓ Biodiversity ✓ Climate positive ✓ North Sea Programme	✓ Expected positive from general public ✗ Negative from mussel industry	✓ High scaling potential ~ Possible too high to meet demand	✓ Capex synergies ✓ Opex synergies	✓ Job creation ✓ GDP impact	N/A	✓
Develop farming of new species and plants[4]	~ Temperature ~ Sea depth	✗ Invasive species	~ Moderate	✓ Biodiversity ~ Restore old nature	~ Unknown, but expected mixed	~ Depending on type of species and market	~ Capex synergies ~ Opex synergies	~ Job creation ✓ GDP impact	~ Less risk of invasive with CRISPR	✗
Sustainable tourism	✓ Presence of attraction ~ Sailable water	~ Nature impact	✓ High	~ Attract foreign tourism ✓ Educational purposes	✓ Mixed, but mostly neutral/positive	~ Depending on form of tourism	✓ Capex synergies ~ Opex synergies	✓ Job creation ✓ GDP impact	N/A	✓
Subsea data centers	✓ Foundation ✓ Water temperature	✓ No freshwater use ~ Nature impact ~ Excess heat	✓ High	✓ Datacenter sustainability targets	✓ Unknown, but expected positive	✓ More reliable circumstances ✓ Less energy for cooling	~ Capex synergies ~ Opex synergies	✗ Job creation ~ GDP impact	~ Can disrupt ecosystem	✓
Green power stations[5]	~ Old infrastructure ✗ Space for cargo ships	~ CO_2 ~ Nature impact	✗ Low	✓ Climate-neutral shipping in 2050	✓ Unknown, but expected positive	~ Early stage	✓ Capex synergies ✓ Opex synergies	✓ Job creation ✓ GDP impact	✗ Commercialization requires scale, not suitable for Maripark	✗

✓ Criteria met ~ Criteria partially met ✗ Criteria not met

Note The selected business opportunities are described in more detail in the main part of this report.
Sources of business opportunities that were not selected are listed in the appendix
1/ Low = concept stage, moderate = pilot launched / demonstration stage, high = fully implemented
2/ Includes impact on entire value chain within the Dutch area, and in a multi-year context
3/ Covers re-introduction of old species
4/ Covers only the introduction of [completely new species]
5/ Only distribution of energy or H_2, not creation

Blue economy business opportunity overview

	FEASIBILITY					FINANCIAL VALUE		STAKEHOLDER VALUE		
Activity	**Fit for economic zone**	**Environmental impact**	**Technology readiness[1]**	**Political strategy fit**	**Social acceptance**	**Financial potential**	**Maripark synergy potential**	**Key socio-economic factors[2]**	**Other factors**	**Potential scope Maripark**
Inspection and monitoring	✓ Applicable in most environments	✓ Less resources	~ Depends on other multi-use	✓ Resource use ✓ Safety North Sea	✓ Unknown, but expected positive	✓ IaaS ✓ MaaS ✗ Potential unknown	~ Capex synergies ✓ Opex synergies	✓ GDP impact ✓ Job creation	✓ Business case for government	✓
Digital governance & surveillance	✓ Applicable in most environments	✓ Higher efficiency ✓ Contribution to science	✓ High	✓ Supported	✓ Mixed, but mostly neutral	~ Testing needed ✓ Existing infrastructure ✗ Potential unknown	✓ Capex synergies ✓ Opex synergies	✓ Attracts R&D	✓ Basis for future exploration	✓
Artificial reefs	✓ Applicable in most environments	✓ Can support coral and fish communities, ecosystems	✓ High	✓ Blue Sustainable Ocean Strategy	✓ Mixed, but mostly neutral/positive	~ Mostly indirect from increased fisheries and tourism ✗ Potential unknown	✓ Fish abundance ✓ Tourism ✓ Nature restoration	✓ Indirect value creation	~ Uncertain impact if large-scale deployment	✓
Blue carbon / eco service	~ Seagrass water - ≤58m deep ✓ Kelp water - Cool temp. - 15-40m deep	✓ CO_2 ~ Nitrogen ✓ Nature impact	✓ High	✓ EU Green Deal	✓ Unknown, but expected positive	✓ Carbon credits ✗ Potential unknown	✓ Capex synergies ✓ Opex synergies	✓ Job creation ✓ GDP Impact ✓ Paris Agreement	✓ Business case for government	✓
Bio-based phosphorus and nitrogen recycling	✓ Both elements available	✓ Water quality	~ Moderate	✓ European Critical Raw Materials Act	✓ Unknown, but expected positive	✓ Market for phosphorous ✗ Potential unknown	~ Potential opex synergies	✓ Job creation	✓ Securing critical raw materials	✓

✓ Criteria met ~ Criteria partially met ✗ Criteria not met

Note The selected business opportunities are described in more detail in the main part of this report.
Sources of business opportunities that were not selected are listed in the appendix.
1/ Low = concept stage, moderate = pilot launched / demonstration stage, high = fully implemented.
2/ Includes impact on entire value chain within the Dutch area, and in a multi-year context.

Portfolio: Additional sources library

Business opportunity	Sources
Offshore green ammonia / green methanol production	1) Nicholas Salmon, René Bañares-Alcántara, A global, spatially granular techno-economic analysis of offshore green ammonia production, Journal of Cleaner Production, Volume 367, 2022, 133045, ISSN 0959-6526, https://doi.org/10.1016/j.jclepro.2022.133045. 2) Methanol as fuel | Bureau Veritas Marine & Offshore
Geothermal energy	Offshore Engineer (2021) Geothermal Energy: A New Life for Old Offshore Oil Wells? Offshore Magazine (2018) Geothermal power: an alternate role for redundant North Sea platforms? Think GeoEnergy (2021) Repurposing North Sea oil platforms for geothermal energy
Salinity energy	1) Post, J. W. (2009). Blue Energy: electricity production from salinity gradients by reverse electrodialysis. Wageningen University and Research. 2) Hussain, A., Arif, S. M., & Aslam, M. (2017). Emerging renewable and sustainable energy technologies: State of the art. Renewable and Sustainable Energy Reviews, 71, 12-28. 3) https://www.esteem-tool.eu/fileadmin/esteem-tool/docs/CASE_27_def.pdf.
Carbon capture and storage (CCS)	Mapping the cost of carbon capture and storage in Europe – Clean Air Task Force (catf.us)
Sustainable feed (microalgae)	Microbial Cell Factories (Benedetti et al.), Reviews in Environmental Science and Bio/Technology (Ras, Steyer & Bernard)
Offshore fish farm	Expert interviews
Passive fishing	• Expert interviews • Rijksoverheid, "Het effect van wind op zee op de visserij", Accessed Mar. 2023 • Rijksoverheid, "Windenergie op zee en de effecten op natuur en milieu", Accessed Mar. 2023 • Van den Boogaart, L., et al. "Geschiktheid zeewindparken voor maricultuur en passieve visserij; Een kwantitatieve beoordeling van geschiktheid van windparklocaties voor voedselproductie", Feb. 2019 • Van den Boogaart, L., et al. "Geschiktheid zeewindparken voor maricultuur en passieve visserij; Een kwalitatieve beoordeling van geschiktheid van windparklocaties voor voedselproductie", Jun. 2019 • WaterProof Marine Consultancy & Services B.V. & Bureau Waardenburg, "Potential effects of electromagnetic fields in the Dutch North Sea, Phase 2 – Pilot field study", Jan. 2020
Mineral extraction from the seabed	de Vrees, Leo. "Adaptive marine spatial planning in the Netherlands sector of the North Sea." Marine Policy 132 (2021): 103418.
Develop farming of new species and plants	Expert interviews, IPBES (2019): Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
Green power stations	Zhan, H. et al. (2022). Modelling and analysis off offshore energy hubs. Energy, 261. Jansen, M. et al. (2022). Island in the Sea: The prospects and impacts of an offshore wind power hub in the North Sea. Advances in Applied Energy, 6. https://northseaenergyisland.dk/en.

Business opportunity	Sources
Inspection and monitoring	Expert interviews
Digital governance & surveillance	Expert interviews
Artificial reefs	European Investment Bank (2019) Blue Sustainable Ocean Strategy
Blue carbon / eco service	Nature (Santos et al.; Macreadie et al.) Science (Unsworth, Cullen-Unsworth, Jones and Lilley), Blue Carbon Initiative, Blue Carbon Nederland, Intergovernmental Oceanographic Commission, European Commission
Bio-based phosphorus and nitrogen recycling	European Commission (2023) Critical Raw Materials: ensuring secure and sustainable supply chains for EU's green and digital future Dutch Phosphate Value Chain Agreement (2011)

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THE NORTH SEA

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The main legal characteristics of the private limited liability company and the cooperative

1

	Dutch private limited liability company (B.V.)	Dutch cooperative ('coöperatie')
Main characteristics	‣ Private (closed) legal form ‣ Flexibility (e.g. regarding governance structure design) ‣ Has legal personality, meaning that the company is tantamount (equal) to a natural person, unless the contrary results from law. As a result, the company has its own rights and obligations, is the owner of its assets and liabilities and its shareholders' liability is limited ‣ Commercial purpose, i.e. making profit for the shareholders	‣ Private (closed) legal form ‣ Flexibility (e.g. regarding governance structure design) ‣ Has legal personality, meaning that the cooperative is tantamount (equal) to a natural person, unless the contrary results from law. As a result, the cooperative has its own rights and obligations, is the owner of its assets and liabilities and its members' liability may be limited ‣ A collective purpose based on commercial needs of the members. Members work together to achieve collective advantages (e.g. cost reductions, negotiation power, etc.)
Governing law	‣ Governed by Book 2 of the Dutch Civil Code, its articles of association and regulations ‣ Sector-specific (governance) laws and regulations may apply ‣ Ability to adhere to a governance code (e.g. the Dutch Corporate Governance Code)	‣ Governed by Book 2 of the Dutch Civil Code, its articles of association and regulations ‣ Sector-specific (governance) laws and regulations may apply ‣ Ability to adhere to a governance code (e.g. the Dutch Corporate Governance Code)
Incorporation	‣ Notarial deed required ‣ Incorporated by at least one (1) founder	‣ Notarial deed required ‣ Incorporated by at least two (2) founders
Objects	‣ In principle a commercial object, i.e. making profit for its shareholders	‣ To meet certain material needs of the cooperative's members based upon agreements (other than insurance agreements) that the cooperative has concluded with them in the business it conducts or causes to be conducted for the benefit of its members
Capital	‣ Public and/or private funding possible ‣ No minimum share capital requirements ‣ The articles of association or shareholders' agreement may contain provisions regarding additional funding obligations of the shareholders	‣ Public and/or private funding possible ‣ No minimum capital requirements. The initial capital consists of what has been contributed by the cooperative's members. The articles of association determine the amount of the contributions ‣ The articles of association may contain provisions regarding additional funding obligations of the members
Profit distribution	‣ Profits may be distributed to the shareholders	‣ Profits may be distributed to the cooperative's members
Liability	‣ Liability of the shareholders is limited to the amount of their share capital contributions	‣ Liability of the cooperative's members can be limited or even excluded. In case a member's liability is excluded, the member's liability is limited to the amount of its capital contributions
Corporate bodies (mandatory)	‣ Board of directors ‣ General Meeting of Shareholders (consisting of at least one (1) shareholder)	‣ Board of directors ‣ General Meeting of Members (consisting of at least one (1) member)

2

	Dutch private limited liability company (B.V.)	Dutch cooperative ('coöperatie')
Corporate bodies (optional)	‣ Supervisory board (optional unless the large company regime applies); one-tier and two-tier allowed; only natural persons can be appointed as members of the supervisory board ‣ Other bodies and committees, such as an audit committee, selection and appointment committee, remuneration committee, or scientific advisory board; - Pursuant to best practice 2.3.2 of the Dutch Corporate Governance Code 2022, the supervisory board that consists of at least five members should appoint from among its members (i) an audit committee (ii) a remuneration committee and (iii) a selection and appointment committee	‣ Supervisory board (optional unless the large company regime applies); one-tier and two-tier allowed; only natural persons can be appointed as members of the supervisory board ‣ Other bodies and committees, such as an audit committee, selection and appointment committee, remuneration committee, or scientific advisory board; - Pursuant to best practice 2.3.2 of the Dutch Corporate Governance Code 2022, the supervisory board that consists of at least five members should appoint from among its members (i) an audit committee (ii) a remuneration committee and (iii) a selection and appointment committee
Composition of the Board of Directors	‣ There is no minimum or maximum number of directors; thus the board of directors must consist of at least one director ‣ Natural persons as well as legal entities, whether resident or non-resident, Dutch or non-Dutch, may be appointed as directors ‣ Shareholders and non-shareholders may be appointed as directors of the company	‣ There is no minimum or maximum number of directors; thus the board of directors must consist of at least one director ‣ Natural persons as well as legal entities, whether resident or non-resident, Dutch or non-Dutch, may be appointed as directors ‣ The board of directors is appointed from amongst the members. However, the articles of association may provide that non-members may also be appointed as directors of the cooperative
Rights and obligations of the Board of Directors	‣ The board of directors is charged with the day-to-day management of the company, subject to restrictions under the articles of association (and possibly the shareholders agreement) ‣ The board of directors represents the company towards third parties. The articles of association may stipulate that the directors are authorized either individually or jointly ‣ The authority to represent the company is unlimited and unconditional, which means that any restriction under the articles of association (for example, a provision stipulating that certain resolutions of the board of directors require prior approval from the General Meeting of Shareholders) cannot be invoked against third parties	‣ The board of directors is charged with the day-to-day management of the cooperative, subject to restrictions under the articles of association ‣ The board of directors represents the cooperative towards third parties. The articles of association may stipulate that the directors are authorized either individually or jointly ‣ The authority to represent the cooperation is unlimited and unconditional, which means that any restriction under the articles of association (for example, a provision stipulating that certain resolutions of the board of directors require prior approval from the General Meeting of Members) cannot be invoked against third parties ‣ Unless the articles of association provide otherwise, admission to the association as a member shall be decided upon by the board of directors. If a person or legal entity is denied by the board of directors, the General Meeting of Members may nevertheless resolve to admit such person or legal entity

Benchmark companies' organization & structure Comparable entities and initiatives: North Sea Farmers, OOS SMF, SolarDuck and Energy Island

1

	Recommended governance model #1 Dutch cooperative ('coöperatie')	Recommended governance model #2 Dutch private limited liability company (B.V.)	Comparable company #1 North Sea Farmers (Stichting Noordzeeboerderij)
Legal form	Dutch cooperative	Dutch private limited liability company	Dutch foundation (Stichting)
Governance structure	Mandatory corporate bodies: ‣ Board of directors ‣ General Meeting of Members Optional corporate bodies: ‣ Supervisory board (optional unless the large company regime applies); one-tier and two-tier allowed ‣ other bodies and committees, such as an audit committee, selection and appointment committee, remuneration committee, or scientific advisory board.	Mandatory corporate bodies: ‣ Board of directors ‣ General Meeting of Shareholders Optional corporate bodies: ‣ Supervisory board (optional unless the large company regime applies); one-tier and two-tier allowed ‣ other bodies and committees, such as an audit committee, selection and appointment committee, remuneration committee, or scientific advisory board.	Mandatory corporate bodies: ‣ Board of directors Optional corporate bodies: ‣ Supervisory board (two-tier)
Composition of the General Meeting	‣ Consisting of at least one member	‣ Consisting of at least one shareholder	‣ Not applicable, the foundation cannot have members (prohibition on having members by law ('ledenverbod'))
Composition of the Board of Directors	‣ Natural persons as well as legal entities, whether resident or non-resident, Dutch or non-Dutch, may be appointed as directors. ‣ The board of directors is appointed from amongst the members. However, the articles of association may provide that non-members may also be appointed as directors of the cooperative.	‣ Natural persons as well as legal entities, whether resident or non-resident, Dutch or non-Dutch, may be appointed as directors. ‣ Shareholders and non-shareholders may be appointed as directors of the company.	‣ Consisting of two natural persons. ‣ Both directors are authorized to act independently ('alleen/zelfstandig').
Composition of the Supervisory Board	‣ Only natural persons can be appointed as members of the supervisory board	‣ Only natural persons can be appointed as members of the supervisory board	‣ Consisting of two natural persons.
Additional remarks	‣ None	‣ None	‣ Stichting Noordzeeboerderij is the sole shareholder of Noordzeeboerderij B.V. (private limited liability company). ‣ Noordzeeboerderij B.V. has obtained a permit for - in short - a pilot installation for seaweed cultivation in the North Sea (a sustainable seaweed farm). This permit enables Noordzeeboerderij B.V. to install various pilot installations, among other things intended to check whether seaweed cultivation is possible at sea. Noordzeeboerderij B.V. does not carry out any test projects itself. This is done by Stichting Noordzeeboerderij. ‣ In view of the above bullet, we suspect that the commercial activities are performed in Noordzeeboerderij B.V.. Any profits of Noordzeeboerderij B.V. will be distributed to its sole shareholder: Stichting Noordzeeboerderij.

2

	Comparable company #2 OOS SMF B.V.	Comparable company #3 SolarDuck Holding B.V.	Comparable initiative #4 Denmark's Energy Island
Legal form	Dutch private limited liability company	Dutch private limited liability company	Limited partnership company ('Partnerselskaber' or 'P/S') *
Governance structure	Mandatory corporate bodies: ‣ Board of directors ‣ General Meeting of Shareholders Optional corporate bodies: ‣ Not applicable	Mandatory corporate bodies: ‣ Board of directors (one-tier, with executive and non-executive directors) ‣ General Meeting of Shareholders Optional corporate bodies: ‣ Not applicable	Currently unknown *
Composition of the General Meeting	‣ Consisting of one shareholder, i.e. a legal entity (Holding OOS-International Group)	‣ Consisting of two or more shareholders. ‣ From the publicly available information, it is unclear who the shareholders of SolarDuck Holding B.V. are.	‣ Currently unknown * ‣ However from the publicly available information we understand that the General Meeting shall consist of two or more shareholders: - the Danish State will hold at least the majority (≥50.1%) of the shares - private partners will holds the minority (<50%) of the shares
Composition of the Board of Directors	‣ Consisting of one natural person ‣ The director is authorized to act independently ('alleen/zelfstandig vertegenwoordigings')	‣ Two executive directors (i.e. legal entities) ‣ Four non-executive directors (i.e. natural persons) ‣ The executive directors are authorized to act independently ('alleen/zelfstandig vertegenwoordigings-bevoegd') ‣ The non-executive directors are authorized to act jointly, i.e. all executive and non-executive directors collectively ('gezamenlijk vertegenwoordigings-bevoegd')	Currently unknown *
Composition of the Superisory Board	Not established	‣ No separate supervisory board (two-tier) established. However the board (one-tier) includes non-executive directors that, among others, supervise the executive directors.	Currently unknown *
Additional remarks	‣ Holding OOS-International Group B.V. is the sole shareholder of OOS SMG B.V. ‣ From the publicly available information, it is unclear who the shareholders of Holding OOS-International Group B.V. are. ‣ OOS SMF B.V. has obtained a permit for – in short – the execution of a pilot project innovative offshore mussel farm within a wind energy area that is primarily designated for the generation of wind energy.	‣ SolarDuck Holding B.V. is the sole shareholder of SolarDuck B.V. ‣ We suspect that the commercial activities are not performed in SolarDuck Holding B.V., but in its subsidiary SolarDuck B.V. Any profits of SolarDuck B.V. will be distributed to its sole shareholder: SolarDuck Holding B.V.	* As far as we can ascertain, the legal entity (including its governance structure) has not yet been incorporated. At the time of writing, the tendering procedure is expected to be launched in spring 2023. It is expected that the tendering documents contain more information regarding the intended governance structure of the legal entity.

Information management

PROCESS LEVELS

L1	INFORMATION MANAGEMENT					
L2	**1.1. Data infrastructure**	**1.2. Information products**	**1.3. Collect data and quality controls**	**1.4. Analysis**	**1.5. Internal reporting & external sharing**	**1.6. Data forecasting**
L3	1.1.1. Design infrastructure	1.2.1 Information products	1.3.1. Design products	1.4.1. Organize data	1.5.1. Regular internal reporting & external sharing	1.6.1. Prediction analysis
	1.1.2. Maintenance	1.2.2. Maintenance	1.3.2. Secure data	1.4.2. Analyze & process data	1.5.2. Ad-hoc internal reporting & external sharing	1.6.2. Simulation
			1.3.3. Quality control			

Data analysis for research purposes, to facilitate decision-making, collaboration and compliance

Procurement

PROCESS LEVELS

L1	PROCUREMENT AND CONTRACT ADMINISTRATION		
L2	**1.1. Supplier Management**	**1.2. Service levels**	**1.3. Contract Management**
L3	1.1.1. Specify need	1.2.1 Establish KPIs	1.3.1. Contract suppliers
	1.1.2. Select suppliers	1.2.2. Monitor KPIs	1.3.2. Safeguard contract
	1.1.3. Announce		1.3.3. Renew contract
	1.1.4. Attract new parties		1.3.4. Handover contracts

Monitoring

PROCESS LEVELS

L1	MONITORING			
L2	**1.1. Observation**	**1.2. Measurement**	**1.3. Monitoring**	**1.4. Analysis**
L3	1.1.1. Signaling	1.2.1. Measure data	1.3.1 Signaling	1.4.1. Organize data
	1.1.2. Alarm		1.3.2. Alarm	1.4.2. Analyze & process data

HSE

PROCESS LEVELS

L1	HEALTH, SAFETY & ENVIRONMENT							
L2	**1.1. Compliance**	**1.2. Risk assessment**	**1.3. Incident investigation**	**1.4. Training & education**	**1.5. Emergency response**	**1.6. Environmental management**	**1.7. Health & wellbeing**	**1.8. Continuous improvement**
L3	1.1.1. Update on relevant laws, regulations and standards	1.2.1 Conduct risk assessments	1.3.1. Investigate incident	1.4.1. Prepare trai-ning materials	1.5.1. Develop an emergency response plan (e.g. fire, tsunami etc.)	1.6.1. Estimate impact on environment	1.7.1. Develop programs for employees	1.8.1. Monitor effectiveness of programs
	1.1.2. Estimate impact on own organization	1.2.2 Estimate risk (value at risk and probability)	1.3.2. Determine the root cause	1.4.2. Conduct regular trainings	1.5.2. Implement plan	1.6.2. Implement measures to reduce impact	1.7.2. Implement measures to improve health & wellbeing	1.8.2. Evaluate effectiveness
		1.2.3 Implement measures to mitigate risks	1.3.3. Identify measures to prevent incidents					1.8.3. Implement improvements

Facility and IT

PROCESS LEVELS

L1 FACILITY AND IT

- **L2 1.1. Facility management**
  - L3 1.1.1. Oversees the overall management of the facilities
  - L3 1.1.2. Day-to-day maintenance, repair, and upkeep of facilities
  - L3 1.1.3. Responsible for the asset management strategy
- **L2 1.2. IT support, network and infrastructure**
  - L3 1.2.1. Provide technical support to employees
  - L3 1.2.2 Manage the network infrastructure
  - L3 1.2.3 Oversee systems administration
  - L3 1.2.4 Database management and cybersecurity
- **L2 1.3. IT project management**
  - L3 1.3.1. Oversees IT projects
- **L2 1.4. Data management**
  - L3 1.4.1. Data analysis
  - L3 1.4.2. Data visualization
  - L3 1.4.3. Risk management
  - L3 1.4.2. Technology & innovation

Communications & public affairs

PROCESS LEVELS

L1 COMMUNICATIONS & PUBLIC AFFAIRS

- **L2 1.1. Communication strategy**
  - L3 1.1.1. Defining external & internal communication plan
  - L3 1.1.2. Role descriptions
  - L3 1.1.3. Functions & responsibilities
- **L2 1.2. Stakeholder management**
  - L3 1.2.1. External & internal stakeholder analysis
  - L3 1.2.2. Stakeholder analysis & definition
  - L3 1.2.3. Stakeholder management
- **L2 1.3. Communications means and channels**
  - L3 1.3.1 Defining suitable comms. channels
  - L3 1.3.2 Defining suitable communication means
  - L3 1.3.3 Set up communications plan
- **L2 1.4. Information systems**
  - L3 1.4.1. Selection and implementation of CRM system
  - L3 1.4.2. Design communication channels
- **L2 1.5. Marketing**
  - L3 1.5.1. Defining external & internal marketing strategy
  - L3 1.5.2. Define house style
  - L3 1.5.3. Define Tone of Voice
- **L2 1.6. Discussion group Social Living**
  - L3 1.6.1. Set up discussion group structure
  - L3 1.6.2. Optimize discussion group structure
- **L2 1.7. Roll-out communication**
  - L3 1.7.1. Define communications calendar
  - L3 1.7.2. Share communication
  - L3 1.7.3. Press relations
- **L2 1.8. Monitoring & Reporting**
  - L3 1.8.1 Regular reporting
  - L3 1.8.2. Evaluate effectiveness

Audit

PROCESS LEVELS

L1 AUDIT

- **L2 1.1. Quality management**
  - L3 1.1.1. Defining quality demands
  - L3 1.1.2. Defining quality strategy
  - L3 1.1.3. Defining KPIs
  - L3 1.1.4. Quality guarantees
  - L3 1.1.5. Quality reporting
  - L3 1.1.6. End reporting
- **L2 1.2. Information security management**
  - L3 1.2.1. Defining information security strategy
  - L3 1.2.2. Defining security demands
  - L3 1.2.3. Guarantee personal data security (GDPR)
- **L2 1.3. Cybersecurity management (CSM)**
  - L3 1.3.1. Design CSM tooling
  - L3 1.3.2. Design log monitoring (technical)
  - L3 1.3.3. Identify cyber risks
  - L3 1.3.4. Security network and information systems
  - L3 1.3.5. Comply with norms (ISO/IEC)
  - L3 1.3.6. Monitor, register and deal with incidents
  - L3 1.3.7. Scale up CSM activitures
  - L3 1.3.8. Scale up tekst activities
- **L2 1.4. Risk management**
  - L3 1.4.1. Defining role model
  - L3 1.4.2. Limit risks
- **L2 1.5. Audit trail management**
  - L3 1.5.1. Execute SLAs/KPIs audits

Legal, tax and grants & incentives

PROCESS LEVELS

L1 LEGAL AND NOTARIAL

- **L2 1.1 Legal governance**
  - L3 1.1.1. Entity design
  - L3 1.1.2. Legal advice
- **L2 1.2. Legal risk management**
  - L3 1.2.1. Identify legal risks
  - L3 1.2.2. Control legal risks
- **L2 1.3. Compliance**
  - L3 1.3.1. GDPR
  - L3 1.3.2. Laws and regulations sea, food, energy
- **L2 1.4. Insurance**
  - L3 1.4.1 Liability insurance
- **L2 1.5. Permissions**
  - L3 1.5.1 Applications support

HR

PROCESS LEVELS

Level							
L1	PERSONNEL AND HR						
L2	**1.1. HR Planning & Policy**	**1.2. Selection and implementation IT systems**	**1.3. Training & Onboarding**		**1.4. Recruitment**	**1.5. Payroll**	**1.6. Offboarding**
L3	1.1.1. Determine need for people and means	1.2.1. Selection HR management system	1.3.1. Onboarding plan	1.3.2. Design onboarding kit	1.4.1. Attract people and means	1.5.1 Salary administration	1.6.1. Stop accounts
	1.1.2. Strategic personnel planning	1.2.2. Implement HR management system	1.3.3. Design trainings and educational material	1.3.4. Onboard parties for operations	1.4.2. Staffing		1.6.2. Delete personal details
	1.1.3. Terms of employment		1.3.5 Onboard parties for organization				
	1.1.4. Absenteeism process						

Finance

PROCESS LEVELS

Level								
L1	FINANCE							
L2	**1.1. Financial planning & control**	**1.2. Budget management**		**1.3. Performance management**	**1.4. Business Intelligence**	**1.5. Financial administration**	**1.6. Treasury**	**1.7. Internal audit**
L3	1.1.1 Formulate KPIs	1.2.1. Budget planning	1.2.2. Budget	1.3.1. Scenario analysis	1.4.1. KPI guarding	1.5.1. Debtors	1.6.1 Cash & debt management	1.7.1 Internal audit
	1.1.2. Costs optimization	1.2.3. Forecasting	1.2.4. Safeguard budget	1.3.2. Integral planning	1.4.2. Dashboards/ visualization	1.5.2. Creditors	1.6.2 Risk management	
	1.1.3. Efficient improvement	1.2.5. Reporting	1.2.6. Hand over budget management	1.3.3. Prediction analysis	1.4.3. Event analysis	1.5.3. Actives	1.6.3 Corporate finance	
	1.1.4 Handover Planning & Control			1.3.4 End reporting & handover	1.4.4 End reporting & handover	1.5.4. Ledger	1.6.3 Corporate finance	
						1.5.5. Handover financial administration	1.6.4 Treasury operations	

Project management, planning and monitoring

PROCESS LEVELS

L1	PROJECT MANAGEMENT, PLANNING AND MONITORING						
L2	**1.1. Project Management Office**		**1.2. Planning and timelines**	**1.3. Project management tooling**	**1.4. Monitoring and reporting management**	**1.5. Risk management**	**1.6. Quality Assurance management**
L3	1.1.1. Design master planning (incl. dependencies)	1.1.2. Design PMO	1.2.1. Define planning & timelines	1.3.1. Select and implement project management tooling	1.4.1. Define regular (progress) reports	1.5.1. Risk log & reporting	1.6.1. Quality Assurance
L3	1.1.3. Design scale-up strategy and planning	1.1.4. Collaboration facilities	1.2.2. Update / keep up planning		1.4.2. Archiving		
L3	1.1.5. Information systems operations	1.1.6. Manager master planning (top-level and per domain)	1.2.3. Communicate timelines		1.4.3. Progress reporting directive-organization		

Business case

This report acts as a starting point for a business case based on 'Handleiding publieke businesscase'.

The manual describes how a public business case within the government should be written. According to the 'Handleiding publieke businesscase', the business case should consist of four milestones.

This report, outlining the Maripark and its governance structure, can act as a major first step for developing this public business case. Nevertheless, further research must be done to write a complete business case.

A public business case can be used to develop legislation and as such, it is key to make sure the business case for the first Maripark is sound, as it will act as a blueprint for future Mariparks.

Milestone 1

According to the 'Handleiding publieke businesscase', milestone 1 should consist of two parts. In the first part the substantive aspects of the project are named, such as the problem statement, scope, duration, alternatives, non-financial considerations, and required success factors. In the second part of this milestone, it is indicated how the public business case will be implemented.

Milestone 2

The qualitative analysis consists of the high level envisioned investments, costs, and revenues whereby all risks need to be identified. This qualitative analysis will be used for the quantitative analysis in milestone 3.

Additional research is required to cover the qualitative analysis of milestone 2. The qualitative analysis will be conducted to determine the high level envisioned investments, costs, risks, and revenues.
After having described the scope in milestone 1, the output, in terms of products or services, needs be described. Important here is to describe the type of expenditures, revenues and risk but also when in time they are expected to take place. All of this will be implemented into a cash flow statement (milestone 3).

The qualitative analysis should also consist of a risk analysis. The risk analysis can be performed within the business case team but can also be conducted by experts outside of the business case team. The risks can be clustered (e.g. financial implications and risk categories such as economical, technical or safety). Finally, they can also be ordered by expected impact, such as low, average, or high.

Milestone 3

In milestone 3 the envisioned revenue streams, investments and costs from milestone 2 should be quantified in a simplified financial model. Sensitivity analyses with the effects on the project of changes in key estimates and assumptions will be developed. The financial model includes considerations for potential funding initiatives.

Additional research is required to cover the quantitative analysis of milestone 3. The identified expenditures, revenues and risk in milestone 2 should be financially quantified into a financial model. This financial model should be a cash flow statement that at least covers the cash flow from operating activities, cash flow from investing activities and cash flow from financing activities. As the governance structure and required number of FTE has been determined in this report, several cost items are already identified. However, a deep dive into the operational and capital expenditures of a Maripark should be conducted. Next to this, research into the possibilities for available subsidies and suitable lease fees for the companies that will populate the Maripark should be conducted. There are several ways in which the expenditures and revenues of the Maripark can be determined. This however will only be possible with the help of subject matter experts. This can be done through brainstorming sessions with stakeholders and experts, interviews with other internal or external experts or by reviewing other comparable projects.

When drawing up the cash flow statement, it is important to be alert when it comes to the difference between expenditures and costs, that the cash flow should be in nominal terms, that taxes should be excluded and that efficiency discounts should be carefully considered.

Milestone 3 should also consist of a risk analysis. This means that the risks that are identified in the second milestone should be financially quantified. The risks should distinguish between pure risks and risks that can be spread. This report already identified several risks in Chapter 2 and 3 which can have possible financial implications. However, a thorough risk identification process is essential to show the feasibility of the Maripark and to show decision makers and potential lenders/investors the attainability of a Maripark. This can only be done after the Maripark structure has been confirmed.

When the expenditures, revenues and risks are quantified, project-outcomes should be measured. This information should then be compared and analyzed. In order to do so, net present value, discount rate and sensitivity analyses can be used.

Milestone 4

During milestone 4, the finalization phase occurs, during which the final report is prepared. In this report, all aspects of the public business case come together, such as problem definition, project scope, preconditions, assumptions, non-financial, high level legal and tax considerations, project alternatives and the results of the analyses performed. Based on this, conclusions are drawn and recommendations are made.

After all required additional research as described in milestone 2 and 3 has been done, the business case can be finalized. Next to the above mentioned subjects in the different milestones, in milestone 4 an executive summary, report of research activities, results, and a difference analysis should be written.

BUSINESS CASE FOR MARIPARK B.V.	COVERED IN THIS REPORT?
Milestone 1: Preparation	
1.1: Substantive aspects of the public business case	✓
1.2: Process based aspects of the public business case	✓
Milestone 2: Qualitative analysis	
2.1: Identifying expenditures and revenues	✗
2.2: Identifying risks	✗
Milestone 3: Quantitative analysis	
3.1: Quantifying expenditures and revenues	✗
3.2: Quantifying risks	✗
3.3: Testing for sustainability	✗
3.4: Calculating, comparing and analyzing project outcomes	✗
Milestone 4: Completion	
Deliver final report	✗

To accomplish the objectives outlined in the roadmap, it is essential to meet certain key criteria for success.

Clear regulatory framework

Considering the difficulties of offshore operations and the extended time needed for activities to become profitable, a comprehensive and clear governance and regulatory framework will be at the core of any Maripark development. Essential components for success are:

- Policy, planning, and consenting specifically designed to advance symbiosis between the different sectors, activities, and actors.
- Public-private governance structures.
- Ensure alignment of activities through holistic sector integration.
- Exercise sea stewardship in order to sustain the ocean's health and safeguard marine life.
- Focus on minimizing waste, lowering emissions, and use sustainable practices.
- Make sure that environmental concerns are monitored and efficiently handled by the proper institutions.

Integrated tax strategy

Tax is important throughout the whole life cycle of the Maripark, for the entity itself as well as the users and the State. Some of the keys steps to succeed are:

- Weigh tax consequences when deciding where the Maripark will be physically located.
- Assess with the stakeholders which tax incentives/subsidies are in place, if these suffice and if not, which tax incentives/subsidies should be broadened in scope and/or created.
- If the state aid rules apply, get into contact with the European Commission as soon as possible.
- Implement Tax Controls to make sure that the compliance requirements are met.
- Assess tax consequences before every stage/decision in the Maripark development and, if needed, contact the Dutch Tax Authorities for certainty in advance.

Effective financing structures

The successful implementation of a Maripark relies on strategic planning and collaborative efforts. Within the area of financing structures some of the key aspects involve:

- Put in place financial structures and programs that are designed to accommodate the needs of both larger and smaller players; it can help to foster innovation and create a more inclusive environment.
- Encourage the formation of consortia consisting of various stakeholders, such as businesses, governments, and NGOs, to jointly apply for sustainable financing projects. Combining forces makes the project more likely to succeed, increases the chance for larger funding, and encourages knowledge sharing.
- Consider the use of funding mechanisms that promote and support the development of sustainable and innovative solutions such as grants and impact investments, that generate positive, measurable social and environmental impact alongside a financial return.

Engage with stakeholders

The development of a Maripark depends upon a wide range of stakeholders and interested parties ranging from businesses, governmental institutions, research institutes, local communities, insurance and classification companies. This means that communication and stakeholder management must be intrinsic in the Maripark operation. Some of the key aspects involve:

- Ensure efficient mechanisms for involved parties to provide input into the processes.
- Effectively communicate and disseminate results and knowledge.
- Identify win-win solutions between potentially conflicting activities through open and transparent communication.
- Build a new, shared culture that fosters beneficial resolutions to be made, minimizes conflict, and builds trust among the various stakeholders.
- Represent an objective third party that can address and handle stakeholder concerns and reduce misunderstandings.
- Stakeholders must remain involved, knowledge must be exchanged, and new actors and business activities must be integrated.

Collaborative planning

The different and unique characteristics of the Maripark activities means that it requires careful joint planning and integration. Some of the key aspects include:

- Ensure that the Maripark development is aligned with the diverse range of activities.
- Make sure that development is aligned with marine spatial planning
- Make sure that the Maripark is constructed in a scalable and modular way to be able to integrate future technological developments.
- Understand and effectively communicate information and expectations regarding environmental changes, such as sea level rise, and their potential impact on park activities.
- Foster collaborative planning for administrative efficiency and reduce the time from planning to operation.
- Ensure holistic ESG impact assessments that benefit all business activities.
- Plan for shared infrastructure development across sectors and activities.

Ensure safety measures and monitoring

Ensuring effective communication and stakeholder management is essential in the context of safety and monitoring because the successful development and operation of a Maripark depends upon the involvement of a range of stakeholders, including businesses, governmental institutions, research institutes, and insurance companies. Some of the key aspects involve:

- Establish and adhere to a common framework that provides safety guidelines and standards for all activities within the Maripark.
- The framework should ensure that safety measures are consistently applied in all operations, reducing the potential for accidents or incidents.
- Make sure there is shared safety related to the combination of several activities.
- The robust governance practices should be enforced across the Exclusive Economic Zone (EEZ).

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