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European Scalable Offshore Renewable Energy Sources

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Part 1

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Abbreviations

ALARP	As Low as Reasonably Practicable
ALOP	Advance Loss of profits
BI	Business Interruption
CAR	Construction All Risks
CER	Certified Emission Reductions
D&O	Directors & Officers
E&O	Errors & Omissions
EAR	Erection All Risk
EPC	Engineering, Procurement and Construction Contractor
LEG	London Engineering Group
MWS	Marine Warranty Survey
O&M	Operation and Maintenance
OAR	Operating All Risks
TPL	Third-Party Liability

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Executive summary

Maritime offshore energy presents challenges, either related to new technologies, processes or risks. One area significantly impacted by the rise of new offshore energy farming methods, particularly in renewable energy, is the insurance sector.

By covering renewable projects, risks and operations, insurers may be vulnerable due to immature practices and technologies, which can reduce their willingness to get involved in the current market.

This deliverable aims to provide a transparent overview of key aspects to strengthen the position of insurers and offer a comprehensive perspective on project challenges. It includes recommendations and outlines the steps towards achieving insurability for offshore renewable energy projects.

This deliverable identifies the key areas of focus for brokers and insurers during the underwriting process for renewable offshore energy projects. It covers topics ranging from the analysis of the involved actors to the underwriting steps, including specific offshore clauses and claims process.

When an insurance company is contracted to cover a renewable energy project, they will pay attention to the contractors involved and their experience, the procedures, the strategic verification process, and bodies engaged during the design and operation phases. Additionally, an essential element is a detailed risk assessment of the project across its various phases.

These elements should be anticipated and prepared to give the most comprehensive overview of the project. They will influence the types of insurance products offered, the premiums fixed, and the exclusion clauses applied.

Once the underwriting process is launched, an effective communication mechanism should be established to nurture the exchanges between the actors involved in the insurance scope. This will ensure that the latest changes and updates are shared, allowing for optimal adaptations with long-term visibility.

I. Introduction

Insurance plays a crucial role in ensuring the reliability of a project. It meticulously oversees project deployment practices in its defined environment and ensures to reap the benefits of project performance in the safest possible manner.

This report delves into the key actors and factors inherent in the insurance process, explaining the intricacies of underwriting and claims procedures. It aims to furnish a foundational understanding of the broader context, laying the groundwork for a comprehensive risk assessment specific to multi-source energy parks and their path to insurability.

Offshore multi-source energy parks are a new concept in their research and development phase. It looks to improve the efficiency and balance of the energy grid. They can combine different sources like wave and wind energy, as well as solar and wind energy. This combination in one site might be an unproven technology but they are more well-known and developed technologies, as offshore wind and much of the technology is based on legacy Oil and Gas developments.

Throughout each stage of the insurance process, emphasis is placed on the paramount significance of transparent and effective communication among all involved parties, coupled with fastidious attention to proper documentation.

The initial section expounds upon the involvement and significance of various stakeholders, including insurance companies, insurance brokers, contractors, and marine surveyors, within the insurance framework. It also examines diverse factors such as the complexities of the supply chain and the array of insurance offerings available. Subsequent chapters detail the underwriting process, delineating its stages and pertinent concepts. Finally, the report provides a comprehensive breakdown of the claims process, offering insights into its subtleties and procedures.

II. Insurance Main Actors and Factors

a. Insurance companies

Insurers, also known as insurance companies, are businesses that offer a range of financial services to protect individuals and organizations from potential risks and hazards. These services include insurance policies, which provide coverage for damage or loss to property, health, and life, as well as reinsurance. Reinsurance refers to the insurance of insurance companies. It helps insurers manage their own risk by transferring some of their potential losses to other insurers (the reinsurer). Insurers play a crucial role in providing financial security to their clients and promoting economic stability by mitigating the impact of catastrophic events.

The insurance industry operates on a delicate balance between the revenues generated from premiums paid by policyholders and the expenditures incurred in covering losses. This equilibrium, known as risk pooling, relies on the premise that only a small fraction of clients will actually file claims. Hence, it underscores the critical importance for insurers to conduct thorough and accurate risk assessments before issuing any insurance policy. By doing so, insurers can ensure the stability and reliability of their operations while providing essential financial protection to their clients.

b. Insurance offerings and products

Insurance coverage for renewable energy technologies is a combination of insurance products traditional used for offshore projects.

However, insurance companies that are active in the renewable energy industries have set up specific underwriting teams dedicated to renewable or alternative energy sources.

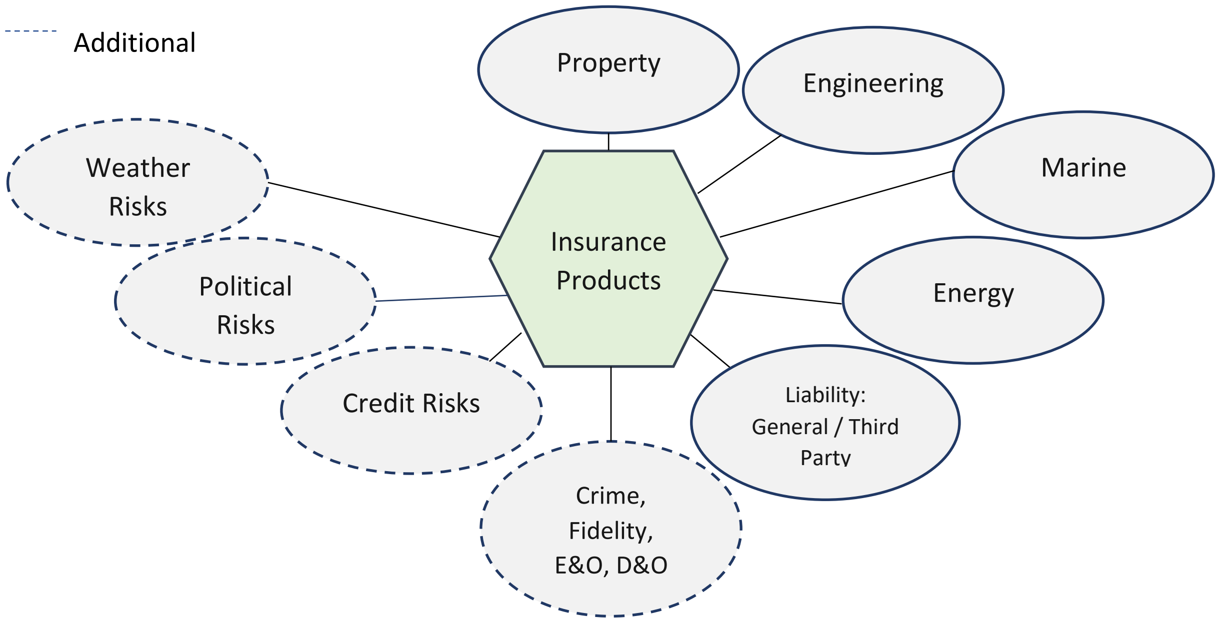

Figure 1 – Insurance traditional products

A brief description of insurance products (UNEP, 2008):

- Property insurance

Property insurance covers damage and loss to property.

Physical Damage / Operating All Risks (OAR) applies to losses from all accidental and unforeseen causes except for perils that are specifically excluded from the policy, later in this report the most common exclusion clauses are explained.

- Engineering insurance

Engineering insurance is specifically used to protect the construction phase and the works performed as part of it, as well as erection and operation of machinery and specialized equipment. It includes:

- Non-renewable coverage for projects under construction and/or erection.
- Renewable coverage for installations, equipment and machinery once they are ready for commercial operations.

- Marine insurance

Marine insurance provides coverage for hull and cargo:

- Hull covers all types of vessels that float.
- Cargo provides coverage for anything that is loaded in any type of vehicle or vessel for the purpose of being transported.

Marine coverage is used for transport to and from sites.

- Energy insurance

Energy insurance is traditionally for oil and gas platforms. It provides coverage for platforms and equipment in offshore oil operations and exploration, as well as for all supply vessels serving the offshore oil fields and offshore pipelines.

Renewable energy technologies might adapt with this class of insurance in energy underwriting, as they have their unique loss profiles and developments.

- Liability: General / Third Party

General liability insurance offers personal and commercial coverage for the financial consequences of damages claimed by third parties that are not included in property, employers, motor and marine liability.

Third-Party Liability (TPL) considers the impact of construction and operation work on third parties (visitors, neighbors) or employees that incur bodily or physical property damage.

- Crime, Fidelity, E&O, D&O

Crime, Fidelity, Errors & Omissions as well as Directors & Officers covers are additional special lines of insurance considered to be relevant for some renewable energy technology projects especially when there are many project stakeholders, complex ownership (owners, employers, developers) and new technologies involved.

- Credit Risks

Credit Insurance and Credit Delivery Guarantees offer protection against the payment risk resulting from the delivery of goods or services.

This is caused by the counterparty being unable to pay as a result of protracted default, insolvency or bankruptcy.

- Political Risks

Political Risk Insurance offers protection against losses due to political conditions such as political violence, governmental actions (expropriation, confiscation, repudiation of assets), currency inconvertibility or inability to repatriate funds.

- Weather Risks

Weather derivatives are instruments used to hedge against the risk of weather-related losses.

Underlying assets are measurable weather events and patterns such as rain, temperature or snow.

c. Brokers and leaders/advisors

Insurance brokers (also known as advisors) are specialized professionals who act as intermediaries between clients and insurance companies. Brokers represent the client and have knowledge of both the client's business and understand the particularities of the insurance industry and risk assessment. This allows the broker to advise on the insurance needed and negotiate the best policies with the insurers.

Working with an adequate insurance broker brings the following benefits (Marsh McLennan, 2024):

- They support the risk analysis and provide recommendations. As specialists in the field, brokers can help identify areas of cover that the client may have overlooked but that can potentially be a risk to the project.
- Brokers study the market, perform gap analysis and advise on the insurance that better adapts to the client's needs.
- The broker's job goes beyond the purchase of the insurance policy. Brokers keep monitoring the evolution of the market to guarantee that the optimal coverage is sustained with time.
- Brokers also keep close relationships with the insurance companies, this relation can be leveraged to ensure the best coverage and prices for their clients.
- In the case of a claim, the broker provides assistance in the whole process to settle the claim as quickly and efficiently as possible.
- Brokers act as advisors and consultants to support the decision-making process of the business.

Unlike insurance agents, insurance brokers are not linked to any insurance company. They don't sell insurance. Brokers work for the best interest of the client. Clear and open communication with the insurance broker is recommended.

When looking for an insurance broker, it is important to look for a broker who understands your field of work, the risks associated with it, can meet your contractual obligations, and complies with legal requirements.

It is recommended to get an insurance broker involved as soon as possible in the projects to foresee risks and be able to manage them promptly. This avoids delays, can reduce costs in the long run and helps with the insurability of the development.

d. Marine Warranty Survey

Marine warranty survey, MWS, is a specialized technical review performed by independent third-party professionals. The main responsibility of Marine Warranty Surveyors is to ensure the safety of offshore and marine operations.

Through inspections, they look to eliminate or mitigate the risk of personnel injury, damage to the environment or loss or damage to the interest of the insured.

The main activities requiring a MWS are the installation of offshore structures, cargo transport, cable laying, offshore decommissioning, towing operations, lifting operations, mooring installation and operation and maintenance (O&M).

MWS provide an independent assessment of the risk of a marine operation. They ensure that the operations are done safely, in accordance with the relevant regulations and standards and that the appropriate risk mitigation measures are adopted. Marine warranty surveys are required by insurance risk evaluator, also know as underwriters, as experts in the matter to provide coverage for marine operations.

It is important to clarify with the underwriters the operations in the project that would require the approval and presence of a marine warranty surveyor, many agreements are subject to this. In the case of an event, if a marine warranty surveyor was not present, or the operation was not approved by one, the coverage may lapse.

The services of a marine warranty surveyor cover:

- Reviewing calculations and engineering documentation.
- Verifying equipment's certificates and the equipment itself.
- Reviewing operation procedures.
- Attend marine operations.
- Report and document the operations executed.

Project developers must keep in mind that the main purpose of the surveyor is to keep the risk "As Low As Reasonably Practicable" (ALARP) and the surveyor should keep an unbiased position and avoid practices that could be perceived as "too safe". As with brokers, it is beneficial to the project to contact and get involved a marine warranty surveyor early in the project.

Also, if an already reviewed document or procedure is modified, the surveyor should be notified and the document reviewed again.

e. Contractors

In energy projects, many stakeholders are involved. Normally there is a main engineering, procurement and construction contractor (EPC) and several subcontractors for specific jobs. The developer of the project, as owner, is responsible for ensuring that its contractors have the appropriate insurance and coverage for the project. In the case of subcontractors, the contractor is responsible for confirming the corresponding insurance. During the tender for contractor selection, insurance must be an important part of the evaluation process.

e.1 Risk on relying solely on contractor insurance

During construction, it is a common mistake to establish the contractor's insurance as the main policy. This normally leads to the insurance overseeing the interests of the developer which can compromise the project. An example of this, is the loss of revenue due to delayed startup. For the EPC company, this is not relevant. Therefore, the developer must have insurance for these cases and not count in the EPC coverage.

Some of the risks of the EPC contractor policy might be that the latter is shared between several projects in which the said contractor is working simultaneously, risking that as a result of the aggregation of claims there is a lack of coverage for future ones concerning the project of interest to a given developer. Also, the coverage during the transition period from project to operation can be inadequate.

e.2 Developer oversight and responsibilities

The developer is the only part with a broad enough knowledge of the project. This makes it its responsibility to review the limits of each insurance policy concerning the project.

All of these aspects become more critical when considering renewable energy and new technologies projects. As many EPC contractors are expanding from other industries, such as oil and gas, to renewables or are new players in the business, the possibility of them not being completely familiar with or lacking a proper understanding of the complete project is higher. This is not only true for contractors but for insurance companies themselves. The project developer must take this into account and assume the responsibility of ensuring proper insurance.

e.3 Consideration for suppliers and operational phase

Suppliers must not be overlooked either, during the operational phase of the projects, the contractual liabilities in the maintenance and operational contracts must be carefully taken into account. A company can limit its legal responsibilities to control risk and ensure that its partners do not limit their liabilities. When doing this, it is important to understand the value of the contract, and the possible impact a failure or defect in the product can have on the project and its future.

e.4 Impact in project success and insurability

Poor insurance selection or overlooking the insurance of the contractors can result in the failure of a project and must not be taken lightly.

Contractors can also mean an insurability risk for renewable projects. The renewable energy industry requires qualified workers and contractors. Currently, especially in some markets, the talent pool is limited which increases the risk, therefore compromising the insurability of the project or increasing the price of insurance.

f. Supply chain

The supply chain is seen as a risk in terms of insurability. The manufacturing and delivery of materials and equipment depend on a wide range of factors, from trade policies and geopolitics to weather and technical difficulties. A disruption in any of these factors can translate into delays, price volatility or shortages directly impacting the availability and price of renewable energy projects.

Another important player in terms of the supply chain is the standards and regulations. Their variation between regions and countries can result in poor quality and low-performance parts or materials, which translates into safety risks and an increment in maintenance costs.

Market volatility can also have a major impact on the supply chain. The supply and demand are dependent on competition, policy changes, consumer preferences and new technologies. All these are very active when related to renewable energies, increasing the instability of prices and profitability.

For the solar industry, the supply chain risk is very present as raw materials are in short supply.

In the past, these risks have resulted in project delays, postponed installation or startup and in extreme cases cancellation. Many spare parts are custom, and replacements are hard to find in case of supply chain issues as compatibility with other parts or materials is not achieved.

Factory closures also lead to manufacturing backlogs, ending up in price increases and delays in shipping. The Covid-19 global pandemic was an extreme case of this, but more common causes can result in factory closures such as extreme weather, strikes, civil unrest and other geopolitical situations (The Travelers Indemnity Company, 2024).

Transport is another key factor in the supply chain. Some of the scenarios that can lead to transport slowdowns are (The Travelers Indemnity Company, 2024):

- Labour shortages: a wide range of causes has led to a shortage of workers in many steps of the supply chain, from truck drives to rail and maritime workers.
  According to projections of the American Trucking Associations, just in the USA, the truck drivers deficit in 2030 could surpass 160000 workers (American Trucking Associations, Inc., 2021).
- Cargo theft: This is a growing issue, the rates of cargo theft keep increasing yearly. The most impacted transport is ground transport, mainly trucks. When planning routes cargo theft data must be considered.
- Ports congestion: most of the world's commerce is linked to a limited number of ports. This can result in long-time traffic to enter or leave ports, including customs clearing. Ports are working in critical equilibrium and a small problem can result in a major disruption.

- Containers shipping shortage: as a consequence of labour shortage and port congestions, the downloading of containers is taking longer, causing the containers to be less available. Also, this scarcity of containers can translate into a lack of containers in certain ports at particular times.
- Shipping backlogs: From the global pandemic and a Suez Canal blockage the backlog increased to levels that 3 years after the industry has not been able to fully recover.

In the planning of projects, buffers for possible supply chain delays are always recommended to minimize possible impacts. Also, ensure proper insurance of in-transit cargo, know your routes and stay up to date with freight news to anticipate possible problems.

These risks affect projects as well in the operational phase as many operations and maintenance providers' supply chains are also impacted.

III. Underwriting Process

Underwriting is the process used by insurers to determine the risks of insuring a client's business and ultimately make a decision over providing insurance or not and to what price. This is a complex and time-consuming process. To facilitating navigation, nowadays this process has well-established guidelines and involves the usage of data analytics to aid in the decision-making process.

During the underwriting process, information will be collected and analysed. Based on this data a risk assessment will be undertaken and the risk rated. The interests of the insured will be selected and the available insurance offerings or custom offers will be studied. Following, the coverage and conditions as well as exclusions are chosen. After this, the pricing is agreed and accumulations control is set. In the following sections of this document, each of these phases of the underwriting process is better explained.

a. Risk assessment

To perform the risk assessment, data about the project must be collected. This data should be enough to understand the risk exposure of the project. Insurers will define the elements and data required for the project to engage with clients as advisors and exchange information. Using this information, a risk engineer will analyse the mechanism of the risk to be insured. Therefore, the more the risk engineer understands the technology, the better the quality of the risk assessment.

The risk assessment studies the information allowing for the identification, description, estimate and evaluate the various risk factors that are relevant in the context of the technology, environment and others. With this, a generic risk rating is issued for technologies such as 'prototype', 'proven', and 'unproven'.

Risk assessment depends on historical data to predict possible claim scenarios and their likelihood. Technologies and projects rated as prototypes are usually hard to ensure as a consequence of the many uncertainties attached to them because of the lack of historical data.

The key challenge for insurers is to balance the risk appetite and the risk tolerance in a sustainable way. The risk appetite is defined as the additional amount of risk the client is willing to accept to gain a business benefit. On the other hand, risk tolerance is the maximum exposure level the insurance company is willing to accept to meet all of its obligations.

A good risk assessment is a determining criterion that insurers and advisors examine in the underwriting process.

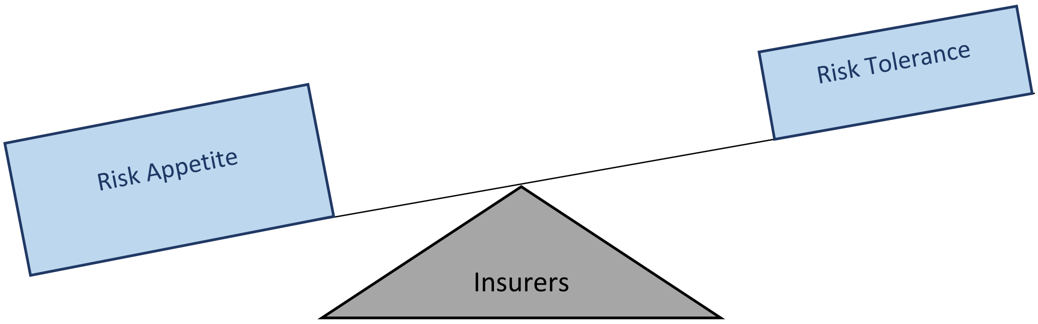

Figure 2 – Risk balance

b. Insurable interests

The interest insured corresponds to the property values (such as machinery and facilities), liability values (responsibility over damage to third parties' interests), the value of the business generated (profit, revenue or rent) and other interests that the insured has in the subject matter of the policy under evaluation.

The insured looks to protect itself from the destruction, damage or loss of value of its project. During the underwriting process, the type of interest must be clarified, and the client must demonstrate the existence of this interest. The clear definition of the insurable interest is vital to prevent fraudulent claims in the future as well as having a party profiting from the undesired event.

This importance of demonstrating that the insurer has a legitimate insurable interest in the project lies in protecting the insurance industry from fraud and ensuring that the entity established as beneficial in the case of a claim is the entity directly affected by the loss event. It prevents strangers to the project from taking insurance over it. Insurable interest verification also safeguards that the insurance policy doesn't become a wager.

The verification of the insurable interest doesn't end with the underwriting process, the insurable interest of a project changes as it evolves. In the moment of a claim, it is important to establish that the insured interest existed at the moment of the event that generated the claim.

The assessment of the level of insurable interest a client has in the insured project before offering coverage will determine the likelihood of a claim being submitted and also evaluate whether the insurer has an applicable reason to take an insurance policy.

Based on the interest to ensure, the insurer can offer different types of products to indemnify the risks assessed during the risk assessment of the project.

The most common products are standardized but for more complex or innovative projects customized offerings can be issued. The section about Insurance offerings and products recalls some of them.

c. Coverage agreements

Following the underwriting process, the subsequent step involves determining coverage. This entails selecting the specific terms and conditions of the policy, which may include decisions regarding deductibles and their respective amounts. Additionally, limits and exclusions are carefully analysed during this phase. Exclusions, in particular, are further elaborated upon in subsequent sections of this report.

In instances where there are important levels of uncertainty, insurers may choose to offer coverage agreements with numerous limitations and exclusions rather than outright denial of insurance. This strategic approach aims to safeguard the insurer from potential over-exposure while still providing some degree of coverage to the insured party.

d. Risk accumulation

During the underwriting process, the insurer will look at the potential risk accumulation of the project. Risk accumulation refers to the aggregation of different risks within a project or geographical area that in the case of an event causes multiple policies to be activated and the losses to compound. Risk accumulation can be related to natural catastrophes or industrial accidents and is an unwanted scenario for the insurers as the risk can easily become bigger than the insurer can take.

When talking about accumulated risk, the risk inspection plays a key role. An experienced risk engineer with knowledge of the industry and technology can make a significant difference. During the assessment of the facilities or project, the risk engineer will be able to document and assess the accumulation of risk and provide pertinent advice on how to control or mitigate these risks. Good documentation of the risks with the corresponding action plan for control, transfer or mitigation will increase the insurability of a facility.

The location of the project will also be relevant in the evaluation of risk accumulation. Many high-risk projects together are prejudicial when it refers to insurability under the possibility of risk accumulation.

The approach of insurance companies to deal with accumulated risk is to cap it or avoid it completely. Establishing open communications with brokers, insurers and neighbouring projects is always wanted as it reduces the uncertainty.

For new technologies, the assessment of accumulated risk can be challenging as the risk of interactions or interdependencies of systems can be unknown and hard to predict and can become a challenge for the insurability of the projects.

e. Premium and pricing mechanisms

Once the details of coverage, terms, and conditions have been agreed upon, the insurer defines its insurance capacity. It refers to its ability to underwrite and provide coverage for risks without jeopardizing its financial health. It is driven by the insurer's limits set to manage its exposure to potential losses and maintain financial stability.

The insured transfers a defined risk of loss in exchange for an insurance rate, which is used to determine the amount to be charged for a certain level of insurance coverage.

The premium results to the addition of the amount for risk coverages, coverages for claims being made against the policy, and administrative costs.

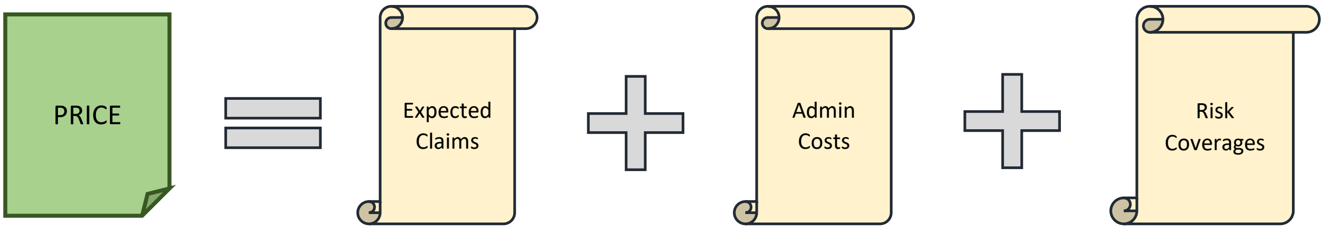

Figure 3 – Insurance Premium

f. Exclusion clauses

Exclusion clauses are terms in the insurance policy that look to restrict the rights of the parties of the contract (THOMSON REUTERS, 2024).

The most common types of clauses are (LawTeacher by Business Bliss Consultants FZE, 2024):

- Clauses that exclude liability for some contractual obligations.
- Clauses that exclude liability over consequences regarding something in the contractual obligations.
- Clauses that limit the remedies available by setting limits or exclusions.

In the insurance exclusion, clauses are used to define the boundaries of the risk to be insured and establish what will not be covered under the insurance.

In the beginning, construction projects were under property insurance. Property underwriters aimed to give the same coverage to construction to completed buildings. Constructions were under total exclusion, all losses arising from defective design, workmanship or material were excluded and they were viewed as business risk for the contractor.

As the market matured, the covers evolved, and coverages increased. The defects were excluded but the resultant damage was not. The wording of this in the policies became a challenge as the legal interpretation varied between the versions even if the intent was the same. In the early 1980's the Design Exclusion (DE) clauses were drafted by a group of insurers to standardize the interpretation of the exclusion classes. These clauses were perceived as drafted to suit the construction of all risk exposures, CAR, (construction of static structures (London Engineering Group, 2024)).

In the 1990s, The London Engineering Group (LEG) drafted the LEG clauses to be more suitable for equipment related to all risk exposures, EAR, (projects that primarily involve the erection and/or installation of machinery and equipment (London Engineering Group, 2024)) and the LEG1 to LEG3 were adopted by the industry (Green, 2024).

The LEG exclusion clauses offer standardised wording and a clear legal interpretation of the coverage. They focus on the root cause of the loss, and if it is a design defect (Simmons & Simmons, MDD, CCI, 2017). Each of the LEG clauses from 1 to 3 gives an increase in the coverage.

In the following section, each clause is explained.

London Engineering Group (LEG) clauses

LEG 1/96

It states: "*The Insurer(s) shall not be liable for loss or damage due to defects of material workmanship design plan or specification*".

This wording excludes all losses or damages due to a defective material, workmanship, design, plan or specification. It is the more conservative of the coverage offer.

Innovative and research projects with non-proven technologies usually get at best LEG1 coverage. Therefore, this is the level of coverage commonly obtain by demonstration projects.

LEG 2/96

"*The Insurer(s) shall not be liable for all costs rendered necessary by defects of material workmanship design plan specification and should damage occur to any portion of the Insured Property containing any of the said defects the cost of replacement or rectification which is hereby excluded is that cost which would* *have been incurred if replacement or rectification of the Insured Property had been put in hand immediately prior to the said damage.*"

This clause starts with exclusionary wording, but the conditions stated in the second part of the clause preserves cover for damage caused as a consequence of the defect but not the defective part.

The coverage offered when applying the LEG 2 clause is considerably higher than the one offered by a LEG 1 clause.

Once a project passes the certification phase a LEG 2 coverage can be obtained.

LEG 3/06

"*The Insurer(s) shall not be liable for all costs rendered necessary by defects of material workmanship design plan or specification and should damage (which for the purposes of this exclusion shall include any patent detrimental change in the physical condition of the Insured Property) occur to any portion of the Insured Property containing any of the said defects the cost of replacement or rectification which is hereby excluded is that cost incurred to improve the original material workmanship design plan or specification.*

For the purpose of the policy and not merely this exclusion it is understood and agreed that any portion of the Insured Property shall not be regarded as damaged solely by virtue of the existence of any defect of material workmanship design plan or specification."

LEG 3 covers the defective property and the consequential damage, but it does not cover the costs of improvements to the original design, plan, specification, workmanship or material. This means that the cost covered will be the one of replacing the equipment that failed with one of the same characteristics, if improvements are required the price difference must be covered by the owner.

Matured technologies, where the risks are known and understood, normally obtained LEG3 coverage.

IV. Claims process

A claim is the formal request of the policyholder to the insurer to compensate for a loss suffered and under coverage by the policy agreement between the parties. To prevent fraud and guarantee the correct use of the policy, insurers conduct an investigation process. This process is known as the claim process. Figure 4 shows a flow chart of this process which is explained later.

The claim process starts after a loss event. Following an event, the insured must start communication with its broker, the broker will kick off the process with the insurer and the other parties involved. The correct handling of the claim must be assured as it can impact the outcome of the claim.

Once the claim is submitted, the insurer will appoint a loss adjuster to coordinate the claim process. Is good practice for the loss adjuster to be a professional independent from the insurance company with experience in the type of loss in place. The main objective of the loss adjuster is to ensure a fair and efficient settlement of the claim.

The loss adjustment process will start with the investigation of the event, origin and causes, in this part of the process specialized professionals might be involved, also the potential business interruption (BI) is estimated assuring evidence protection during this process must not be forgotten.

Following the investigation, the determination phase starts. In the determination phase, the cause must be determined as well as the scoping of the damages. Salvage options will be analysed. The loss adjuster will also monitor the repair jobs, if these are or might be covered by the policy. At this stage, the loss adjuster must confirm if there is a policy liability over the event and actions to mitigate business interruptions are implemented.

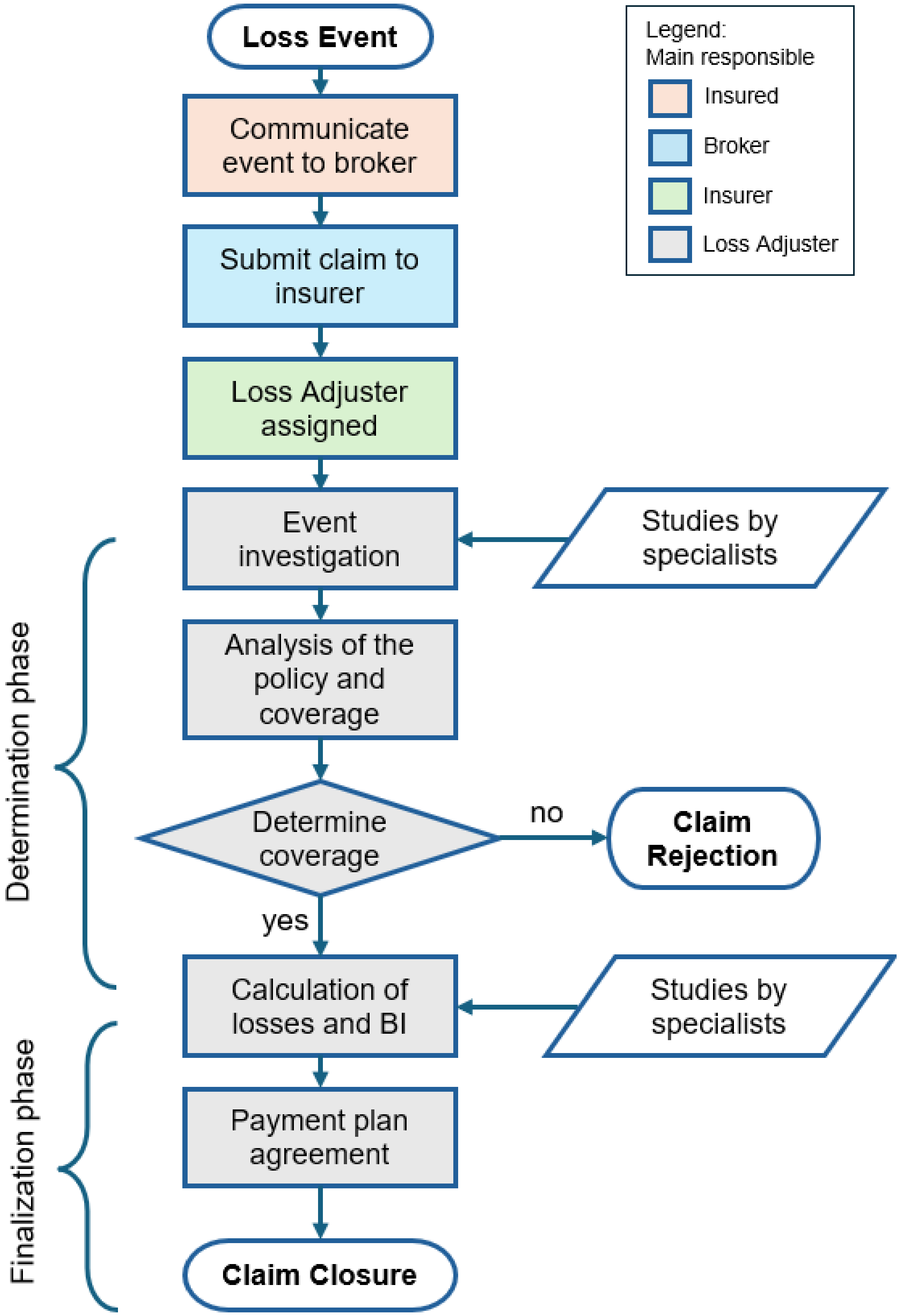

Figure 4 – Claim Process Flowchart

The claim coverage analysis is a key part of the claim process. This is done by the insurer based on the reports from the claim adjuster and other experts. The claim coverage analysis determines whether the event is covered by the policy and to what extent.

The calculation of business interruption or advance loss of profit (ALOP) is done by the loss adjuster. It is a challenging part of its job, as the mitigation actions and recommendations for the recovery works are given to the client before the coverage of the event is assured. Naturally, this usually creates discomfort for the insured. A clear claims interdependency model must be created keeping the insured always involved to preserve the trust between the client, insurer and the loss adjuster.

Finally, the last phase of the claim process takes place. In the finalization phase, the business interruption must be assessed, the settlement negotiations must be carried out, and a payment schedule must be agreed upon. In the case a third party is involved a subrogation is appropriate, and it is in this final phase where it takes place. Subrogation is the legal pursuit of the third party that caused the insured loss. It is done by the insurer as a recovery measure and does not endanger the fulfilments of the claim payment to the insured part.

It is in the interest of the insured to maintain a trustful and cooperative front. If the monetary loss is important, miscommunications will only be against the interest of the insured.

If there are fatalities during the event, this will add complexity to the claim process as the area of the event will be sequestered by the authorities for an undetermined length of time.

European Scalable Offshore Renewable Energy Source (EU-SCORES)

D7.1 'Evaluate the insurability and risks of multi-source parks'

Part 2

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Contents

Figures and Tables

Abbreviations

AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
BOP	Balance of Plant
CAPEX	Capital Expenditure
CAR	Construction All Risks
CAT	Catastrophic
CPL	Contractor Pollution Liability
D&O	Directors and Officers
DSU	Delay in Start-Up
EAR	Erection All Risks
E&O	Errors and Omissions
EPC	Engineering, Procurement and Construction
ERP	Emergency Response Plan
ESL	Site Liability
FMEA	Failure Modes and Effects Analysis
FOW	Floating Offshore Wind
FPV	Floating Photovoltaic
FTA	Fault Tree Analysis
HAZID	Hazard Identification Study
HAZOP	Hazard and Operability Study
IP	Intellectual Property
LCOE	Levelized Cost of Energy
MCC	Marine Coordination Centre
MoC	Management of Change
MRE	Marine Renewable Energy
MWS	Marine Warranty Surveyor
NatCat	Natural Catastrophe
OAR	Operating All Risks

O&M	Operation and Maintenance
OWF	Offshore Wind Farm
PV	Photo Voltaic
RBI	Risk-Based Inspection
TSO	Transmission System Operator
UXO	Unexploded Ordnance
VHF	Very High Frequency
WP	Work Package

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Executive summary

Multi-source renewable energy parks are founded on the idea of combining offshore wind, wave and solar energy. This concept of unification of several marine sources energy into a single park leads to an efficient use of the maritime space and ensures an optimal and resilient electricity production.

Such projects provide a durable scheme dealing with problematics related to the intermittence of energy, grid availability, and even storage by considering the inclusion of electricity conversion.

Even though they are promising projects, they also pose challenges to insurers, by bringing new specific scenarios linked to the co-location, the implementation of emergent technologies, and the allocation of coverages between the partial owners and common assets.

This deliverable gives recommendations to evaluate and achieve efficiently the insurability of a multi-source project, considering either a project owner joining an existing renewable offshore park and becoming a user, or the realization of a co-located park on purpose with several actors involved from the beginning.

The risk assessment, a fundamental component requested for the underwriting process, is broadly exposed from design to decommissioning project phases with sections exploring offshore renewable co-located projects. The mutual risks and their impact on co-located assets need to be assessed correctly to determine the optimal insurance coverage achievable.

Then a general guidance is proposed to anticipate and offer a range of solutions to the problematics that might arise from such innovative projects. The underwriting process should be approached with a careful attention aimed to the elements underwriters and insurers will analyze. Contractors experience, technology certifications, project phases procedures, maintenance strategy and communication mechanisms with key actors of the project, such as Marine Warranty Surveyors, should be exposed with clarity and enough time prior project's milestones, to give room for changes and adaptations.

As the several assets are subjected to be in a shared space, users should be aware of the coverages options available from an insurance perspective to avoid over-insuring assets and optimize the insurance products. This requires constructive discussions around the topics specific to the co-location with the different users, actors and insurers. This can lead to mutual indemnity agreements or specific ones, as the knock-for-knock indemnity for claims.

Practically, a generic case study of the EU-SCORES project is presented, giving examples of underwriting elements requested, an overview of project co-located risks, and some fictional risks coverages scenarios. A generic roadmap for future co-location projects is proposed, showcasing the recommended steps to prepare and obtain the adapted insurance coverages along the project's different phases.

V. Introduction

Images of capsized or drifting oil and gas structures continue to evoke concern among lenders and insurance experts, underscoring the critical need for rigorously engineered solutions in the energy sector. This caution is particularly relevant for serial-installed floating wind assets, which, unlike single-instance oil and gas structures, require careful consideration in their design, sourcing, and installation processes. The challenges associated with co-location projects—where multiple energy technologies are integrated at a single site—demand robust engineering and risk management strategies.

The energy sector is poised for transformation through innovation and the adoption of innovative technologies. These advancements are expected to address various challenges, drive down costs, and enhance the industrialization of electricity production and deployment. For instance, the use of synthetic ropes is expected to replace traditional chains and wires, presenting new opportunities and challenges. Innovations, while promising, also bring risks, particularly due to a lack of established records and the potential for unforeseen failure mechanisms.

To illustrate the complexity of the risk landscape and highlight the need for comprehensive risk management strategies. Subsea cables can be taken as an example of the many factors that must be considered. Effective risk mitigation in the design, manufacture, and installation of these cables is essential. Although current standards may not fully address higher voltage requirements or floating wind specifications, it is critical to prove thorough risk management practices. Insurers are particularly concerned with the readiness of cable systems, given past issues with bottom-fixed wind farms. Cable failures, which make up a sizable portion of insurance claims, can incur substantial repair costs and lead to significant revenue losses due to project downtime.

The insurance landscape for floating offshore wind projects is becoming increasingly challenging. Developers are facing a hardening market with tighter terms and conditions, limited coverage options, and rising rates. This is compounded by the risks associated with novel technologies and the increased pressure to improve mooring systems. The potential for serial defects and issues with supply chain readiness further complicates the insurability of these projects. All of these must be considered when planning an offshore co-location project.

Co-location projects can either be designed from the outset as multi-source systems or integrate other energy sources into previously single-source designs. Each approach affects the project's insurability differently. For converted projects, a well-managed change control system is crucial to address the complexities introduced by adding new energy sources.

As we delve into the specifics of insurability for co-location energy projects, it is imperative to follow industry standards, design with higher levels of robustness, and address emerging risks with initiative-taking strategies. This approach will not only support effective risk management but also enhance the project's insurability in an evolving market landscape.

Methodology

To gather the information contained in the EU-SCORES deliverables for the Work Package 7.1, a bibliographic review has been performed first.

The basic underwriting principles and insurance applications to offshore energy projects have been explored through available documents, from public sources, insurance companies' websites, online conferences regarding offshore insurance organized by the World Forum Offshore Wind (WFO) Insurance subcommittee.

The first part of the deliverable contains the main information focused on during this phase.

In a second time, interviews have been conducted with three insurers/brokers, Michael Bullock, Rhys Newland, and Simon Markussen, respectively from Renewable Risk Advisers Ltd., Miller Insurance and NIORD Club.

The following questions have been addressed, which can be sorted in 4 categories:

A – Underwriting requisites

- A1 – What factors should be considered when evaluating insurability during the Design, Procurement, O&M and T&I phases of a project?
- A2 – What are the main criteria for determining the types and levels of insurance coverage required during a project, particularly with respect to certifications and warranties?
- A3 – What key information do insurers and advisors look for during the underwriting process to assess the insurability of a project?
- A4 – What is the current approach foreseen for wave energy projects and offshore floating solar projects?

B – Communication

- B1 – In the context of a similar project, such as an OWF, how do clients interact with insurers, brokers, and advisors? Can you provide an example of a typical interaction loop?
- B2 – How is formulated/presented a typical client case ?

C – Risks and mitigations

- C1 – When assessing risks related to mooring and dynamic cables, how can failure rates and fatigue damages be properly evaluated?

- C2 – Is there a need to couple risks at a certain point in multi-source parks, specifically in cases where only the connection to the grid is shared?

- C4 – What methodology or good practice(s) would you advise to follow in the project exercise to evaluate risks in a realistic manner ?

D – Coverages

- D1 – How can the LEG (Limitation of Liability) clauses be effectively covered in multi-source parks?

- D2 – What other references, similar to LEG clauses, should be considered in the evaluation of project insurability?

- D3 – What are the major insurance cost drivers for projects of this nature?

- D4 – What are the current challenges in the insurability process for offshore wind projects, including BF and Floating systems, as well as other marine renewable energy systems?

- D5 – How to deal with hard-to-quantify risks (catastrophic, unpredictable) , how are they considered / covered ?

- D7 – Do you foresee any particular challenges related to energy production technology co-location?

Lastly, the insurability aspect has been tackled in the point of view of the EU-SCORES project, by evaluating the risks linked to the co-location of the technologies within an existing wind farm, considering bottom-fixed and floating offshore farm types.

VI. Risk Assessment and Rating

The risks associated with new energy technologies and their co-location can vary widely, encompassing technical failures, environmental impacts, and other challenges throughout the project's lifecycle. Prioritizing safety and sustainability are essential when addressing these risks. Responsibly advancing renewable technologies involves balancing the benefits of clean energy with the imperative to ensure public safety.

A thorough risk assessment serves as a crucial guide for making informed decisions about implementing innovative technologies and developing strategies to mitigate identified risks. Early identification of risks facilitates easier and more effective mitigation. Therefore, it is vital to conduct risk assessment sessions involving all relevant stakeholders and specialists as early as possible in the project. Engaging stakeholders—such as investors, community members, environmental groups, and government agencies—helps in understanding their concerns and working collaboratively to find acceptable solutions. This approach minimizes potential negative impacts and enhances the project's insurability, as risk assessment is a key part of the underwriting process.

Several techniques are available for finding and assessing risks, each suited to different project stages and goals. The most common methods include:

1. Failure Modes and Effects Analysis (FMEA)
2. Fault Tree Analysis (FTA)
3. Hazard and Operability Study (HAZOP)
4. Hazard Identification Study (HAZID)
5. Monte Carlo Simulations
6. Agent-Based Modelling
7. Dynamic Risk Assessment
8. Prospective Sustainability Assessment
9. Simultaneous Operations review (SIMOPS)

Selecting the proper technique depends on the project's stage and the intended use of the assessment outcomes. In some cases, using a combination of techniques may be beneficial. Consulting with a risk assessment expert is advisable to decide the best approach.

While innovative technologies inherently carry risks, they also present opportunities for innovative risk mitigation solutions. To minimize the likelihood of accidents or environmental damage, it is important to explore advancements in safety features, monitoring systems, and materials. Collaboration among engineers, scientists, and other experts is encouraged to foster technological innovation that prioritizes risk management without impeding progress in renewable energy.

Maintaining thorough records and documentation throughout the project is crucial for showing compliance with regulations. Insurers will require information on spare parts, major part exchanges, and emergency response plans during the underwriting process, based on the risks found in the assessment.

A comprehensive Hazard Identification study was conducted to find potential risks and their causes during the development of the co-location project. This assessment, informed by the EU-SCORES project and experience with single-source offshore renewable energy projects, offers valuable insights. However, it is important to view these findings as a guide rather than definitive results, as each project has unique characteristics that call for detailed analysis.

The following sections will present the main findings for each project phase, outlining key risks and their primary causes. Additionally, a summary of the typical insurance coverage obtained by developers during the construction and operational phases will be provided. This information aims to guide the choice of comprehensive and proper insurance coverage throughout the project lifecycle.

g. Design Phase

This chapter primarily addresses projects designed from the outset as multi-source systems. For projects transitioning from single source to multi-source, the risks and causes outlined here can serve as a valuable guide for conducting a management of change risk assessment.

Decisions made during the design phase have a profound and lasting impact on the entire project lifecycle. Therefore, it is crucial to integrate risk assessment and insurability considerations early in this phase. Doing so can significantly reduce potential challenges, optimize time, and cost savings when securing insurance coverage for the project.

Main risks

The main risks identified for offshore co-location projects during the design phase are listed and explained below.

1. Failure to obtain grid access

Focusing solely on the internal aspects of a project can lead to overlooking critical external factors, such as securing grid access. Since the economic viability of the project heavily depends on grid access, maintaining close and proactive communication with relevant stakeholders should be a top priority. Ensuring early and consistent engagement can help mitigate the risk of delays or failures in obtaining necessary grid connections.

This risk is mitigated by local policies and procedures in some countries, as the interface and responsibilities between the energy producer and the Transmission system operator (TSO) are established during the site allocation.

2. Tight schedule, revenue loss due to delay in the commercial operation date

The initial project planning must incorporate sufficient margins to prevent potential losses and ensure that the quality of the project and future insurability are not compromised. Energy sale contracts typically include clauses that impose penalty fees if energy delivery is delayed beyond a specified date or a set period after a milestone. Significant delays during the design phase can trigger these penalties, which may, in turn, affect the project's eligibility for certain insurance coverages. Therefore, careful planning and adherence to timelines are critical to maintaining the project's financial and insurable standing.

3. Failure to obtain all required licenses and permits

Given the new nature of co-location projects and the necessary licenses and permits, there is a risk that additional studies may be required to obtain the licenses compared to single-source projects. Also, energy and environmental policies can be volatile. Close attention must be given to government changes in the region.

4. Poor design or parts of design becoming obsolete

The innovative nature of collocating energy technologies, combined with the complexities of planning, can lead to risks such as design obsolescence — particularly if there is a prolonged gap between the design and construction phases — or poor design due to tight deadlines or overly conservative approaches. These risks highlight the importance of ensuring that the design phase is both flexible and forward-looking to accommodate potential changes and to avoid compromising the project's effectiveness and viability.

5. Conflict regarding intellectual property (IP)

Co-location projects typically involve multiple parties and diverse technologies, which can lead to potential conflicts over the sharing of confidential or sensitive data. To mitigate these risks, it is essential to establish a clear legal framework for managing intellectual property and data-sharing concerns during the initial stages of design. This proactive approach helps prevent disputes and ensures that all parties are aligned on IP rights and responsibilities throughout the project.

6. Budget-related conflict

Given the involvement of multiple stakeholders in co-location projects, it is crucial to establish a clear and well-defined budget, along with an equitable distribution of financial responsibilities. This approach helps to mitigate potential conflicts and ensures that all parties are aware of their financial commitments from the outset. Additionally, it is recommended to implement a legal framework for conflict resolution to address any disputes that may arise, ensuring a smooth and cooperative project execution.

7. Limited computation capacity to run required studies

Co-location projects often demand more extensive computational resources than single-source energy projects due to their complexity. Therefore, it is essential to carefully plan and allocate a sufficient budget for the necessary computational capacity. Ensuring the availability of these resources in advance will support the accurate and timely execution of required studies, thereby facilitating a more effective design process.

8. Insufficient environmental data (geotechnical, solar, current, wind, waves)

Incorporating environmental data, such as wind, geotechnical, solar and current and wave information, into the design process is crucial for accurate design and energy yield calculations used in financial assessments. This data must be adequate, representative, and of high quality. Since co-location projects involve multiple parties, variations in data quality and resolution from different contributors can impact the overall design and performance. Therefore, implementing a comprehensive data management plan is recommended to ensure consistency, reliability, and accuracy of the environmental data used throughout the project.

Main causes of risks

To effectively mitigate risks associated with co-location energy projects, it is essential to identify their underlying causes. Below are the most common risk factors during the design phase, which serve as a guide to preventing issues that may impact the insurability of such projects:

1. Multiparty work and coordination

   The involvement of multiple stakeholders (contractors, developers, regulators) can lead to communication gaps, delays, and increased complexity, elevating the risk of misalignment in objectives and execution.

2. Inexperience of the developer or contractors

   Lack of experience in offshore energy projects or co-location systems can result in poor decision-making, leading to design flaws, inefficiencies, or safety hazards.

3. Lack of site knowledge

   Insufficient understanding of site-specific factors such as geology, weather patterns, the social and political environment and environmental constraints can cause unanticipated issues. This can result in delays, increased costs, or even design modifications, impacting the project's success and insurability.

4. Poor Planning

Failure to conduct detailed risk assessments, create contingency plans, or account for potential challenges can jeopardize timelines, budgets, and overall project viability.

5. Lack of resources (time, economic, computational)

Inadequate allocation of essential resources, such as budget, skilled personnel, or technical tools, can delay decision-making and lead to compromises in quality.

6. Government or policy changes

Sudden shifts in regulations, environmental policies, or political support can force redesigns, delays, or increased costs, impacting the overall risk profile and insurability of the project.

7. Poor quality input data

Inaccurate or incomplete data used in the design phase, such as outdated weather patterns, improper site surveys, or erroneous equipment specifications, can lead to suboptimal design choices.

8. Not fulfilling environmental requirements (material, noise)

Failing to meet rigorous environmental regulations regarding materials, waste, noise pollution, and emissions can result in costly penalties, delays, or even project shutdowns.

9. Unclear or inadequate agreements

Ambiguity in contracts or partnerships can lead to disputes over scope, timelines, or responsibilities, potentially causing delays or financial losses.

Identifying and addressing these causes early on can help mitigate risks, enhance project efficiency, and improve insurability throughout the project's lifecycle.

h. Construction phase

This chapter focuses on the construction phase of energy projects, whether they were initially designed as multi-source systems or transitioned from single-source to multi-source configurations. For projects evolving from single-source to multi-source, the insights and risk factors discussed here will provide valuable guidance for effective management of challenges and risk assessment during the construction phase.

The construction phase is critical, as the decisions and actions taken during this period directly affect the project's progress, quality, and overall risk profile. Effective risk management during construction is essential to prevent delays, cost overruns, and potential safety issues. It is vital to address risk assessment and insurability considerations proactively during this phase to mitigate potential challenges and ensure that the project meets both operational and regulatory requirements.

By integrating comprehensive risk management practices and considering insurance implications early in the construction phase, project stakeholders can better navigate the complexities of construction, minimize risks, and secure appropriate insurance coverage. This approach helps to safeguard the project's success and long-term viability while optimizing time and cost efficiencies.

Main risks

During the construction phase of a co-location project, many risks can exist. Next, the top eleven risks identified are listed and a mitigation plan is offered. For more details and more risks refer to the complete analysis.

1. Unexpected Weather Delays (Weather Stand-by)

Planning operations that depend on weather conditions is inherently challenging, and even with the best preparation, unexpected weather events can still pose significant risks to a project. In offshore projects, such delays can be particularly damaging, and for co-location projects involving multiple simultaneous operations, the consequences of these delays can be even more severe.

To proactively address this risk, it is crucial to engage a contractor with extensive experience in managing operations within weather windows and a strong understanding of weather forecasting. Additionally, developing a comprehensive mitigation plan is essential. This plan should include constructing the system in wave-protected zones, maintaining flexibility in site rental agreements, and scheduling offshore installation activities during periods with more favourable weather windows. These measures help to minimize the impact of weather-related delays and ensure the project's success.

2. Higher-than-Budgeted Capital expenditure (CAPEX) Due to Inflation in Material and Fabrication Costs

Co-location energy projects are highly CAPEX-intensive, and it is not uncommon for initial planning and design to be overly optimistic. This can jeopardize the project's viability during the construction phase, particularly when compounded by unstable markets and supply chain disruptions.

To mitigate these risks, it is recommended to adopt a conservative approach when estimating the budget, especially regarding inflation. Constant monitoring of market conditions and potential inflationary pressures is essential. Additionally, contracts should include strategies to manage significant CAPEX increases, ensuring the project's financial stability and reducing the likelihood of cost overruns.

3. Opposition of local communities to the project

While renewable energy projects enjoy broad public support, individual projects can face significant delays or even cancellations due to local opposition. Research indicates that public perception of such projects often changes depending on proximity to the project site. Additionally, the political environment plays a crucial role in shaping local attitudes toward renewable energy initiatives (Christopher R. Jones, 2010).

To mitigate this risk, it is essential to engage with and maintain a close relationship with the local community throughout the project's lifecycle. This includes proactive involvement with local industries, social groups, and politicians to build trust, address concerns, and foster support for the project. Effective community engagement can help alleviate opposition and contribute to the project's successful implementation.

This risk is significantly lower in the case of an existing project incorporating a second energy source.

4. Vessel unavailability

The growing demand for vessels is creating a significant shortage, particularly for specialized vessels such as cable-laying, foundation installation, wind turbine installation, anchor and mooring handling, trenching, accommodation, and offshore supply vessels. This shortage is exacerbated by increasing industry requirements for larger, more advanced vessels that meet higher safety and capacity standards. Competing with the offshore oil and gas industry, which typically offers higher rates, adds further pressure on renewable energy projects, especially innovative ones like co-location projects (H-BLIX, 2022).

To mitigate the risk of vessel unavailability, timely and strategic planning is essential. Collaboration among project partners to jointly contract vessels that can be used for the installation of multiple technologies can enhance the appeal to vessel suppliers. Additionally, factors such as unscheduled maintenance or expired certifications must be carefully managed.

Risk mitigation strategies include using classed vessels with proven track records, extending invitations to a wide range of suppliers during the tender process, drafting contracts that secure vessel availability, and identifying backup options in case the primary vessel becomes unavailable.

5. Unsuccessful Change Implementation

This risk is particularly critical for projects that were originally designed as single-source energy systems but later converted into co-location projects. It also presents a significant challenge for projects undergoing multiple redesigns. In such cases, improper or poorly managed changes can jeopardize project success.

For converted projects, it is essential to use up-to-date data that accurately reflects the current state of equipment and systems. Additionally, a standardized management of change (MoC) process must be established at the outset, ensuring that all changes are properly defined, approved, and reviewed through this procedure before implementation. Strict adherence to this process will help mitigate the risks associated with unsuccessful change management, ensuring smoother transitions, and maintaining project viability.

6. Planning constraints for installation

The location of a project can impose significant planning constraints, especially when work is restricted during peak tourism seasons, such as summertime. This can conflict with the more favourable weather conditions often required for weather-sensitive operations. Proper scheduling of these operations, alongside the strategic use of permitted timeframes for other tasks, is crucial to ensure optimal use of time and resources.

In addition to tourism, military operations may also affect project timelines, as these activities often take priority over construction and can cause conflicts, particularly in off-peak seasons.

To mitigate these risks, initiative-taking coordination with the military and other stakeholders is essential. Maintaining continuous communication with relevant authorities can help prevent delays and ensure the smooth progression of the project, even when operating within restrictive timeframes.

7. Delays in major equipment (floaters, generators, turbine) availability on site

The delivery date of major equipment must be planned carefully, and a buffer must be added to account for unseen delays. Major parts suppliers can be affected by the unstable supply chain as well as other design fabrication issues. Let us not forget that the supply contracts are signed many years in advance from the delivery date and in cases for products that are still in the design phase.

Apart from difficulties from the manufacturer's side, customs time must be accounted for with an adequate buffer.

To manage this risk is recommended to maintain regular updates with suppliers from contract signing to be able to mitigate any delay as soon as possible. Also, carefully draft the clauses related to delayed delivery in the contract.

8. Cable damage

Cable damage is the leading cause of insurance claims in the offshore wind industry, with causes ranging from poor design and inadequate procedures to uncalibrated equipment, dropped objects, and unsecured freight. In co-location projects, where multiple energy sources often share export cable infrastructure, the risk is amplified. Damage to a shared cable can severely impact the entire project, resulting in costly repairs and prolonged downtime.

To mitigate this risk and ensure insurability, it is critical to maintain thorough documentation of all cable safety designs and procedures. Insurers will likely require detailed records, including pulling designs, load monitoring data, safety distances, surveys, installation procedures, cable routing analyses, and burial or protection strategies. The reputation and track record of the cable manufacturer and installation contractors also play a pivotal role in determining insurability and managing risk. Proper planning and execution of cable protection measures will reduce the likelihood of damage and help secure comprehensive insurance coverage.

It is important to keep in mind that getting insurance of cables is one of the biggest challenges of renewable energy projects. This obstacle comes from the difficulty of determining the liability between the cable manufacturer and the insurer in case of cable-related claims.

9. Necessary permits for the deployment not received

During the construction phase of co-location energy projects, obtaining the required permits is critical to ensuring the project proceeds as planned. The absence of even a single permit can halt operations and compromise the entire project's development. Given the complexity of the permitting process, it is recommended to have a dedicated team that manages all permit-related tasks. This team should be continuously informed about any design changes in the co-location project to ensure that permit applications remain accurate and relevant.

Additionally, keeping track of potential regulatory changes and shifts in government policy is essential. Regulations can change unexpectedly, and staying ahead of these changes can prevent delays. Since the permitting process can be lengthy and intricate, it should be initiated as early as possible, and frequent updates on the government's and public's perception of the project should be gathered to anticipate any obstacles that could arise.

10. Unexpected delays due to the extension of the exclusion zone

While the modification of exclusion zones is rare, it can still occur due to policy changes or specific developer requests. Such changes can pose significant risks to project timelines, as exclusion zones impact multiple sectors beyond offshore project development. Any request to alter an exclusion zone involves numerous stakeholders and requires a long, and complex approval process.

To mitigate this risk, developers should avoid proposing exclusion zone changes unless necessary, particularly after the initial design phase. Regular reviews of exclusion zone boundaries following any design updates—especially regarding mooring systems—are crucial to ensure compliance. Additionally, maintaining close monitoring of regulatory changes and political shifts is essential to anticipate and respond to potential policy changes that could trigger exclusion zone modifications.

11. Unexpected technical problems encountered in the ocean deployment, resulting in project delays and/or additional cost

The innovative nature of co-location energy projects, coupled with the complexities of shared infrastructure, increases the likelihood of encountering technical challenges during ocean deployment. These issues can result in significant project delays and unforeseen costs.

To mitigate this risk, thorough preparation and well-defined deployment procedures are essential. Rigorous testing should be conducted prior to deployment to refine and validate operational plans. Leveraging the expertise of an experienced crew, familiar with offshore installations, and incorporating lessons learned from similar projects are also critical steps to reduce the potential for unforeseen technical issues. By adopting these proactive measures, project delays and additional costs can be minimized, ensuring smoother execution during the deployment phase.

Main causes of risks

Effectively managing risks begins with addressing their root causes, which, in many cases, can lead to the elimination of those risks altogether. Below is a list of the most significant causes of risk, given their potential impact on offshore co-location energy projects:

1. Environmental conditions

   Unpredictable weather and ocean conditions can disrupt operations and damage equipment.

2. Changes in scope

   Shifting project requirements can lead to design flaws or delays, affecting timelines and costs.

3. Contractor experience

   Inexperienced contractors may struggle to meet complex offshore requirements, increasing the likelihood of errors or delays.

4. Designer experience

   A lack of familiarity with offshore projects can result in poor designs that may not withstand harsh ocean conditions.

5. Staff skill level

   Inadequate skills among the workforce can lead to inefficiencies or mistakes during installation and operation.

6. Familiarity with local conditions

   Poor understanding of local regulations, geography, or environmental factors can cause delays or compliance issues.

7. Poor design

Flaws in the initial design can lead to system failures or costly modifications later in the project.

8. Poor geological Survey

Insufficient surveys can result in unanticipated challenges during installation, such as unstable foundations.

9. Changes in the regulations

Regulatory changes during the project can introduce new requirements, forcing redesigns or halting operations.

10. Inadequate procedures

Poorly developed procedures increase the risk of operational inefficiencies or accidents.

11. Poor procurement planning

Delays or mismanagement in procurement can disrupt project timelines and inflate costs.

12. Geopolitics

Global political events, such as conflicts or sanctions, can affect supply chains and project viability.

13. Inappropriate tools

Using inadequate or outdated tools can lead to inefficiencies and potential equipment failure.

14. Limited market

A shortage of suppliers or specialized equipment can cause delays and drive-up costs.

For insurance purposes, it is essential to document the steps taken to mitigate each of these risk causes. Comprehensive records will support claims and demonstrate initiative-taking risk management throughout the project's lifecycle.

Construction Phase Insurance

This section outlines the typical insurance coverages available to projects during their construction phase (MarshMcLennan, 2024). Additionally, the main risks associated with each type of coverage are discussed, along with the key documentation required to assess the insurability under each specific coverage. As with the identified risks, this list is not exhaustive. It is recommended that each project be evaluated on an individual basis, considering the specific circumstances and that a thorough analysis of the insurance market at the time be conducted to ensure optimal coverage.

1. Construction All-Risk (CAR)

A Construction All-Risk policy provides comprehensive protection against various risks associated with civil construction work, covering all stakeholders involved, including owners, contractors, and subcontractors. This type of policy is well-suited for projects where machinery constitutes no more than 20% of the total project value. If the machinery value exceeds this threshold, an Erection All-Risk (EAR) policy is more appropriate (Howard, 1997).

To secure a CAR policy, a detailed and updated programme of works is required, with updates necessary whenever significant changes are made to the original plan. Additionally, the experience and reputation of both contractors and staff play a critical role in the underwriting process, as a substantial number of CAR claims arise from human factors.

The underwriter's initial focus often lies on the developer's risk management practices. As such, establishing robust and transparent risk management procedures within the developer’s organization is crucial for obtaining favourable insurance terms. This ensures that the project is viewed as well-managed and less risky, improving the chances of securing appropriate coverage.

2. Erection all-Risk (EAR)

Erection All-Risk policies are similar in structure to Construction All-Risk policies but are specifically tailored for projects where construction work represents only 10 to 20% of the total project value. EAR policies are particularly suitable for projects involving significant machinery installation and cover the testing and commissioning phases of the machinery (Howard, 1997).

Because the testing and commissioning processes are integral to EAR coverage, insurers will closely scrutinize the procedures and justifications for each test before issuing the policy. A thorough and well-documented testing plan is essential to demonstrate the risk mitigation strategies in place.

One important limitation of EAR coverage is that it does not extend to machinery still in its prototype phase. This is crucial for developers to consider, especially when working on innovative projects that may involve cutting-edge technologies. Underwriters will require evidence that all equipment used has moved beyond the prototype phase and is proven to function reliably.

As with CAR policies, the experience and reputation of contractors and staff play a critical role in determining the terms of an EAR policy. A demonstrated history of successful project management and expertise will be viewed favourably by underwriters and can lead to more favourable insurance terms.

3. Delay in Start-Up (DSU)

Delay in Start-Up coverage typically addresses delays caused by physical damage covered under a Construction All-Risk or Marine policy. While it is commonly attached to CAR policies, DSU can also be obtained as a stand-alone policy. However, it is essential to note that DSU does not cover delays due to poor contractor performance, late equipment delivery, redesigns, fines or penalties, or inadequate project funding.

For a successful DSU claim, it is critical to provide evidence of the project's status at the time the event causing the delay occurred. A best practice is to submit regular progress reports to the insurer to demonstrate an accurate and up-to-date account of the project's timeline (London Engineering Group, 2012).

Several coverage extensions can be added to a DSU policy to address specific risks, which can be valuable to the client under certain conditions. The wording of these is usually very restrictive to protect the insurer. Some key DSU policy extensions include (Bommeli, 2003):

a. CAT perils inclusion: This extension covers catastrophe-related perils but is typically capped and subject to the insurer's exposure in the region.

b. Supplier's extension: Provides partial protection for delayed equipment deliveries, specifically covering delays caused by damage to a designated supplier's premises.

c. Customer extension: Especially critical for energy projects with a single customer. This extension covers lost revenue from delays in the completion of take-off facilities and is governed by the contractual agreements between the parties.

d. Marine perils: There is a risk of overlap with marine cargo policies, so the coverage of the marine policy should be carefully reviewed before adding this extension.

Most DSU claims arise from events during the final phases of construction and commissioning, so insurers scrutinize activities on the critical path of the project schedule before issuing coverage. Delays in weather-dependent operations or mobilization of spare parts, as well as damage during testing, are examples of events that may trigger a project interruption evaluation.

In co-location projects, analysing the critical path is particularly important as certain equipment, such as heavy-lifting machinery, might be used across both technologies. Delays in these shared assets could cause broader project delays.

The reputation and track record of contractors are significant factors in determining insurability under DSU policies. Project developers must also provide certifications of skilled labour, evidence of adequate infrastructure, and a detailed analysis of the project's schedule feasibility to support the underwriting process.

4. Marine cargo/equipment transit

Marine cargo and equipment transit insurance provides coverage for the transportation of goods and equipment, typically offering protection against a variety of risks. These risks may include natural disasters, vehicle accidents, cargo abandonment, customs rejection, acts of war, piracy, and accidental damage during transit (e.g., theft, non-delivery, fire, explosion, collision, overturning, sinking, and stranding). Coverage typically extends to damage that occurs during loading and unloading operations as well.

To maximize protection, it is recommended that the coverage begins at the origin point—even if land-based—and extends to the destination warehouse, encompassing every mode of transport involved (e.g., road, rail, sea, or air). Engaging the insurer early in the planning process, including vessel selection and transportation methods, is advisable to ensure the most suitable coverage and pricing. Insurers can also provide valuable insights and recommend corrective actions based on their experience, which can reduce risk during transit and improve insurability.

5. Owner's liability

Owner's liability insurance is designed to protect employers from claims made by employees for injuries sustained during work for which the employer is legally responsible. While workers' compensation typically covers an employer's basic legal liability, it may not fully address the financial needs of an employee's family in the event of severe injury or death.

This coverage bridges the gap by offering protection against claims that exceed what standard workers' compensation policies provide. Employers should carefully evaluate the limitations of their workers' compensation policy and consider supplemental or extended liability insurance to ensure comprehensive financial protection for both employees and their families. This can reduce the risk of expensive legal actions and help maintain compliance with local laws and regulations.

6. Workers' compensation

Workers' compensation provides coverage for workers in the event of injury, disability, or death during project-related activities. The specifics of this coverage, including minimum requirements, are typically governed by local legislation.

The benefits of a workers' compensation insurance policy include:

a. Medical Expense Coverage: Covers medical costs related to injuries sustained due to accidents that occur during employment.

b. Employer's Legal Liability: Protects employers from legal claims arising from accidents that occur during working hours, whether on project sites or within office premises.

c. Occupational Disease Coverage: Compensates for illnesses or diseases caused by prolonged exposure to workplace-specific hazards inherent to the employer's industry.

This coverage is critical in offshore co-location projects, where the risk of accidents is heightened due to the harsh working conditions and potential for injury. Ensuring compliance with local laws and regulations, while maintaining a strong safety culture, is key to minimizing both risks and insurance costs.

7. Professional Liability/Errors and Omissions (E&O)

Professional liability, also known as Errors and Omissions insurance, provides coverage for claims arising from negligence, errors, or omissions in the services provided by a business, even if subcontractors were involved. It protects businesses from financial losses due to lawsuits resulting from professional mistakes or failures that cause clients to suffer economic losses.

This type of insurance is especially critical in cases where a company acts as the agent, representative, or lead contractor, as it extends to cover subcontracted services. In addition to claims arising from breach of contract, E&O insurance offers broader protection against other liabilities, such as misrepresentation or failure to deliver services as expected. This coverage is essential for businesses to safeguard against the financial risks associated with legal actions stemming from professional negligence or errors.

It is important to not mistake the owner's liability for professional liability insurance as they differ in various points. Professional liability insurance does not cover bodily injury or property damage and on the other hand, professional liability insurance covers economic losses because of professional errors.

8. Environmental Insurance: Site Liability (ESL) or Contractor’s Pollution Liability (CPL)

Environmental insurance, specifically Site Liability or Contractor’s Pollution Liability, provides coverage for pollution incidents or remediation costs resulting from a contractor’s work. These policies can extend to cover third-party claims for bodily injury, property damage, or environmental harm caused by pollution-related events.

In renewable energy projects, such as solar farms or offshore wind installations, contractors may handle materials or engage in activities that pose environmental risks. CPL policies protect against claims from accidental spills, improper waste management, or contamination of natural resources like air, water, and soil. They ensure financial coverage for cleanup, legal defence, and compensation for any damages caused by environmental incidents, which is crucial for maintaining compliance with environmental regulations and safeguarding project viability.

From reviewing the coverages offered it can be seen that regulatory risks are not insurable. Nevertheless, risk advisors can usually help avoid and mitigate this type of risk.

i. Operational phase

Offshore co-location energy projects are extraordinarily complex projects that require expertise across multiple domains. Learning from past losses is crucial to improving the industry's resilience and promoting sustainable growth. A comprehensive understanding of the technology and a holistic risk assessment of the entire marine spread are key to mitigating potential issues. Risk identification must encompass a range of critical factors, including independent verification processes, quality control, safety procedures, and structural health monitoring. Effective interface management and clear communication among all project stakeholders are essential to the overall success of these complex operations.

Main risks

1. Anchor failure due to highly cyclic loading

Anchor failure is a significant risk in offshore energy projects, particularly in floating offshore wind (FOW) or floating photovoltaic (FPV) installations. Typically, failures occur at the interface between different components of the mooring system, such as the fairlead, chain or rope, connectors, and anchors. Anchor failure may result from mechanical failure mechanisms or due to issues with geotechnical interaction.

A notable example of this risk is the Yamakura Dam incident in the FPV industry, where mooring failure occurred during a typhoon with wind speeds exceeding the design limits. The anchors experienced stress concentrations, leading to the pullout of some anchors, which in turn reduced the overall strength of the system.

To mitigate this risk, an As-Built Survey should be performed according to API-RP-2I standards and integrated into a Risk-Based Inspection (RBI) program. This survey, conducted after the mooring system is hooked up and the lines are tensioned to design values, provides a baseline for comparing subsequent inspections throughout the asset's lifecycle. The survey ensures the mooring system is installed as designed, checks for potential installation damage, and verifies that the twist in the mooring lines is within design tolerances. These surveys should be meticulously documented to allow for accurate monitoring over time (Gordon, 2014).

In co-location projects, the consequences of anchor failure are especially severe. The failure of a shared anchor could trigger a cascade effect, resulting in the loss of station-keeping for multiple floating structures, even of different technologies. This underscores the importance of rigorous inspection, design verification, correct definition of safety factors and redundancy in shared systems.

2. Trespassing from unwanted visitors on the offshore farm

Vessel trespassing on offshore energy farms poses a significant risk, potentially leading to vessel collisions with critical infrastructure such as foundations, J-tubes, blades, cables, and anchor chains. The severity of damage depends on the size of the trespassing vessel. Larger vessels can cause major damage to offshore structures, while smaller ones may be at greater risk of damage to the vessel itself.

In addition to physical damage, trespassing vessels can create hazardous situations for crews working onsite, compromising safety and potentially disrupting operations.

Mitigating these risks requires proactive monitoring and intervention. Systems like Automatic Identification System (AIS) and radar should be employed to detect and track approaching vessels. Very High Frequency (VHF) radio communication can be used to alert trespassers and issue warnings. Additionally, clear procedures should be in place for overseeing intrusions, including coordination with the Coast Guard or corresponding organization when necessary, ensuring rapid and effective responses to unauthorized access.

It is also recommended to indicate system hazards visibly and clearly.

3. External or internal cable damage

External cable damage poses a significant risk during the operational phase of offshore co-location energy projects. This damage can stem from various sources, including manufacturing defects in cable insulation that may take years to surface or external physical threats such as trawling fishing activities, anchor dragging, sinking ships, and object drop. Fishing operations, particularly trawling, can inadvertently damage subsea cables, leading to costly repairs and downtime. Additionally, such incidents can also result in damage to fishing equipment, escalating the impact.

Insurers closely scrutinize the risks associated with subsea cabling during the underwriting process. In addition to examining the types of technology used, insurers will request detailed information on the project's scale, scope, and timeline. They will assess the qualifications of contractors responsible for repairs and how well the client manages coordination with these contractors. Key considerations include the type of cables, vessels employed for maintenance and repairs, and the frequency of risk engineer visits to the site. By ensuring robust project oversight and proactive risk management, project developers can better mitigate the potential risks of external cable damage, enhancing both project stability and insurability.

The impact of cable failure can be significant, potentially disabling an entire network of turbines. (Allianz, 2023).

4. Damages due to natural hazards

Natural hazards pose a significant and increasing risk to offshore energy projects due to the rising frequency and intensity of natural catastrophes (NatCat). Rising sea surface temperatures are known to intensify the strength of storms such as hurricanes, heightening the potential for damage to offshore infrastructure. While few major losses have been reported so far in connection with NatCat events, this trend could shift as more projects are developed in regions with higher exposure, such as the U.S. and Asia.

Though natural hazards are beyond the control of project developers, the impact of such risks can be mitigated through careful design and planning. Incorporating extreme load cases in the design phase ensures that equipment and infrastructure are better equipped to withstand severe weather events. Additionally, securing comprehensive coverage under a NatCat insurance policy is crucial, although such coverage can come at a higher cost due to the universal nature of the risk across offshore projects.

Insurers assess the project's exposure to natural hazards, factoring in the location, historical weather patterns, and preparedness for extreme events. Ensuring that projects are resilient against natural hazards not only safeguards infrastructure but also helps manage the escalating costs associated with this growing risk.

5. Vessel unavailability

Vessel unavailability remains a critical risk in the operational phase of offshore co-location energy projects, as it does during construction. The growing size of turbines, coupled with an increasing number of offshore projects, has led to a scarcity of specialized vessels. This shortage poses challenges not only in securing the required vessels when needed but also in maintaining contingency plans in case of unforeseen issues with the vessels currently in use.

Mobilizing a vessel from a distant location can be an expensive and time-consuming process, potentially resulting in lengthy delays. These delays may be further compounded by extended transit times and increased exposure to environmental risks during transport. Additionally, delivering repair or replacement components to an offshore site without available support vessels becomes more difficult, further impacting project timelines and costs.

To mitigate this risk, developers should ensure that vessel contracts are carefully planned, include contingencies for unavailability, and engage in integrated planning with other industry stakeholders to optimize vessel utilization and reduce delays.

6. Sabotage, terrorism and theft risk

Offshore co-location energy projects are often situated in remote areas with limited on-site personnel, making them vulnerable to theft, vandalism, and sabotage. Materials such as scrap metals and valuable components can be targeted for theft, while acts of sabotage pose an even greater risk, especially with rising international political tensions and threats of terrorism.

To mitigate these risks, three critical themes emerge:

a. Best Practice Implementation: Establishing and adhering to industry best practices in security can significantly reduce vulnerabilities. This includes robust physical security measures, enhanced surveillance, and rigorous protocols for personnel access and monitoring.
b. Clear Security Roles and Responsibilities: Effective coordination between project developers, contractors, and local authorities is essential. Defining clear security roles and responsibilities ensures a rapid and organized response to any threats, improving overall security management.
c. Integration of Physical and Cyber Security: As offshore projects increasingly rely on digital systems; the convergence of physical and cyber security becomes paramount. Cybersecurity threats can affect physical infrastructure, so coordinated efforts to protect both digital and physical assets must be a priority.

By addressing these areas, developers can reduce the risk of sabotage, terrorism, and theft, ensuring more resilient offshore operations.

7. Cybersecurity risk

The integration of advanced technologies in offshore co-location energy projects enhances operational efficiency and innovation but also introduces significant cybersecurity risks. These risks are heightened by the reliance on third-party vendors, which extends the threat landscape beyond the direct control of the project developers.

Potential consequences of cyberattacks include:

a. Financial Loss: Data breaches or disruptions to digital infrastructure can lead to costly downtime, loss of revenue, and expensive remediation efforts.
b. Reputational Damage: A security breach can erode trust with stakeholders, investors, and the public, potentially impacting future project opportunities.
c. Operational Disruption: Attacks targeting control systems, data networks, or communication lines can severely disrupt energy production, leading to prolonged delays or shutdowns.

To mitigate these risks, a robust cybersecurity risk management strategy is essential. This strategy should include stringent vetting of third-party vendors and avoiding reliance on fourth-party subcontractors, whose cybersecurity practices may be out of the developer's control. Additionally, continuous monitoring, system updates, and implementing best practices for securing critical infrastructure will help reduce vulnerabilities and ensure project resilience against cyber threats.

8. System failures at open sea

System failures are a significant risk in offshore co-location energy projects, with wind turbine losses accounting for 20% of offshore wind claims over a six-year period. Common causes of these failures include issues with rotor blades, main bearings, gearboxes, and generators (Allianz, 2023). Failures in these components can lead to costly repairs and operational downtime.

Routine maintenance plays a vital role in mitigating the risk of system breakdowns. This typically includes inspections, securing bolted joints, and replacing worn components. Blade inspections are especially important, as leading-edge erosion is a common issue that can compromise performance and reliability.

Manufacturing defects can exacerbate these problems, increasing both the frequency of failures and the associated maintenance costs. This, in turn, impacts the insurability of the project, as underwriters will carefully assess the equipment's maintenance requirements. A key consideration is whether major repairs involve towing equipment back to port or if interventions can be performed on-site. The availability of specialized facilities or support vessels for these operations also plays a critical role in determining project insurability. Ensuring the reliability of equipment and having robust maintenance plans in place can help reduce system failures and ensure smoother operations at sea.

9. Actual power delivery being lower than expected, resulting in less attractive levelized cost of energy (LCOE)

One of the key risks faced by offshore co-location energy projects is the possibility that actual power delivery may fall short of expectations, leading to a less attractive LCOE. Accurately modelling energy resources is critical to estimating energy production realistically. Both resource availability (wind, solar, or wave conditions) and equipment efficiency must be correctly modelled to mitigate this risk. Continuous calibration of models using test data from tank, dry, and wet testing helps improve accuracy. When uncertainties are high, conservative settings should be used to avoid overly optimistic projections.

Technological innovations in control systems are expected to improve the energy production of offshore energy systems, further helping to reduce this risk. However, defective equipment can delay projects, extend the time needed to reach planned production capacity and cause unanticipated costs. Equipment failures can create bottlenecks in power output, directly affecting financial performance and investor confidence.

The variability of natural resources adds another layer of complexity, potentially making it difficult to consistently meet energy demand. This can introduce uncertainties in revenue streams, especially in markets where energy production is expected to be stable. Moreover, the irregularity of renewable energy generation can pose challenges for energy storage, further increasing operational costs. While co-location projects offer diversification by integrating multiple energy sources, they have the ability to counter the trend of rising costs in capital expenditures by expending their capacity, due to mutual assets such as export cables or the offshore substation.

Paradoxically, the revenues of multi-source parks can also be reduced by this same increase of installed capacity, diminishing the average electricity yearly prices and reducing the capture rates. The simultaneity of multiple renewable offshore energy production leads to abundant supply during favourable weather conditions. In a more general view, it generates a downward trend on the electricity prices, the market price becomes near zero (EIFO, 2023). Hence, if more installed renewable capacity is built, the more often the market price becomes low.

In a financial point of view, revenues should be simulated over the entire service life of the system, incorporating the increasing installed capacities of solar, wind, wave devices, and their correlation with the market prices. This also adds financial pressure to meet production targets.

Despite these challenges, co-location projects have the advantage of spreading risk across multiple energy sources, potentially reducing the impact of any single energy source underperforming.

Main causes of risks

In the operational phase of offshore co-location energy projects, several factors can undermine performance, safety, and overall success. It is crucial to identify and address the root causes of potential risks to ensure long-term reliability and insurability. Below are the key causes of operational risks that can lead to system failures, inefficiencies, or increased maintenance costs if not effectively managed.

1. Poor workmanship

   Inadequate attention to detail during construction, installation, or maintenance can lead to suboptimal system performance during the operational phase, increased wear, and even system failures, particularly in harsh offshore environments.

2. Poor testing procedures

   Insufficient or ineffective testing of equipment, software, and operational systems may result in undetected defects that emerge during operation, leading to unexpected downtimes and increased costs.

3. Poor design

   Flaws in the initial design of infrastructure or systems can compromise the long-term reliability and safety of the project, leading to increased failure rates and costly retrofits or replacements.

4. Poor cable route selection

   Incorrect routing of subsea cables, such as crossing areas with high marine activity or natural hazards, can expose cables to a greater risk of damage, leading to operational disruptions and expensive repairs.

5. Inadequate operational procedures

Lacking or ineffective operational processes can impede system functionality, increase human error risk, and create inefficiencies that raise operational costs and insurance risks.

6. Poor IT infrastructure

Weaknesses in the digital infrastructure of the project, such as data collection, communication, and control systems, may lead to increased susceptibility to cyberattacks and hinder real-time monitoring and efficient operations.

7. Lack of maintenance and planning

Poor maintenance practices and inadequate planning for long-term equipment upkeep can result in more frequent breakdowns, increased wear on critical components, and extended downtimes.

8. Unclear security standards

A lack of well-defined or enforced security protocols may expose offshore installations to increased risks of sabotage, theft, or unauthorized access, potentially resulting in significant operational and financial losses.

Operation Phase Insurance

Statutory inspections focus on ensuring that all the health and safety requirements relevant to an offshore wind farm are available and kept “up to date”. Examples of such obligations include access to advanced communication systems, different medical/survival kits, fire extinguishers, and landing points, among others. These safety-critical items are subject to a statutory inspection regime, and compliance checks are undertaken frequently.

The following coverages are generally available for the operation phase of a project (MarshMcLennan, 2024):

1. Property all-risks insurance

This insurance coverage is intended to cover the cost of repairing project property damage from breakdown to natural disasters. It is like the EAR and CAR from the construction phase in intent with the difference that coverage is of the complete project and not caped by the completeness level of the project at the moment of the loss. In the case of a natural catastrophe, the insurer might set a cap depending on their exposure in the area. A normal exclusion of this policy is the damages that are covered by a supplier warranty. Other common exclusions are terrorism, pandemic, or national emergency. (Hunton Andrews Kurth LLP, n.d.)

Property all-risk usually includes the following coverages:

a. Property damage and machinery breakdown coverage

This coverage safeguards against losses or damages due to equipment breakdowns, which are excluded from basic property all-risk policies unless this extension is added. In some cases, specific losses may be recoverable if the affected equipment remains under warranty and under predefined conditions. However, warranty coverage typically excludes business interruption, leaving projects vulnerable to revenue losses when breakdowns occur.

For example, in the case of micro-cracking in PV panels—a frequent claim for renewable projects—proof must be provided that the micro-cracks resulted from a covered event rather than a manufacturing defect, as the latter often leads to claim rejections.

b. Extension to the O&M contract

Operation and maintenance activities are the most common and important during the operational phase of a project. This add-on typically ensures that additional coverage is available for risks that arise during the operational phase, particularly those tied to maintenance responsibilities like risks related to operational inefficiencies, delays in maintenance, or failures to meet key performance indicators, and coordination between Engineering, procurement and construction (EPC) and O&M contracts. It can also cover unforeseen maintenance needs or emergency repairs.

2. Business interruption insurance

Business interruption insurance covers the loss of income that occurs when a plant cannot operate as planned due to unforeseen circumstances. These circumstances include natural disasters, supply chain disruptions, equipment failure, or regulatory delays. In renewable energy projects, such interruptions are particularly impactful, as these operations often depend on consistent and predictable revenue streams.

For renewable energy projects, this coverage typically extends to downtime caused by the unavailability of substations and interconnection facilities located downstream from the project. This ensures that the budgetary impact of such disruptions is minimized.

Policies are often designed to cover up to 12 months of gross revenue, providing a critical safety net during recovery periods. However, coverage limits, exclusions, and conditions vary, so it is essential for project developers to carefully review the policy terms to ensure alignment with operational risks and financial expectations.

3. Commercial general liability insurance

This provides coverage for property damage or bodily harm to third parties due to activities related to the project. It normally includes:

a. Coverage for third-party exposures.

b. Appropriate coverage to meet all operational, leasing, and permitting requirements.

c. Workers' compensation policies to provide wage replacement and medical benefits to employees injured in the course of their employment.

4. Environmental liability insurance

Even if renewable projects have a lower risk for pollution relative to other projects, this coverage is important. Especially in areas that could have been identified as sensible. This insurance can be also called pollution liability and typically covers cleanup, property damage, bodily damage and costs related to defence because of an environmental pollution event, sudden or gradual.

5. Executive risk policies, such as directors and officers (D&O) liability, fiduciary liability, and crime insurance

Executive risk policies, including Directors and Officers liability, fiduciary liability, and crime insurance, play a vital role in offshore co-location energy projects. These projects involve complex governance and significant investment, exposing executives to legal and financial risks.

D&O liability insurance protects executives against claims arising from decisions made in their capacity as directors, such as mismanagement, regulatory non-compliance, or breaches of fiduciary duties. Fiduciary liability covers risks associated with managing employee benefit plans, ensuring compliance with evolving regulations. Crime insurance safeguards against financial losses due to fraud, theft, or embezzlement, particularly relevant in projects involving large monetary transactions and remote operations.

Given the multifaceted nature of offshore energy projects, these policies provide essential protection, enabling leadership teams to focus on operational and strategic goals without undue personal financial exposure.

6. Weather hedge insurance

Weather hedge insurance is an essential risk management tool for offshore co-location projects, aimed at reducing revenue losses caused by inadequate natural resources, such as wind or sunlight. These projects rely heavily on stable renewable energy production to maintain their financial viability. Weather hedge policies offer financial compensation during times when energy generation drops below agreed-upon thresholds due to unfavourable weather conditions, such as low wind speeds or insufficient solar irradiation.

This coverage guarantees stable revenue, even during unfavourable weather conditions, and supports the project's long-term profitability by offering a financial buffer against variability in natural resources. For offshore energy projects that require significant capital investment, weather hedge insurance provides an essential layer of financial resilience.

7. Catastrophic (CAT) event insurance, depending on the location of the project

Catastrophic (CAT) event insurance is an important consideration for offshore co-location projects located in areas prone to natural disasters such as hurricanes, earthquakes, or tsunamis. This specialized insurance offers financial protection against significant physical damage and losses resulting from these extreme natural events.

With the increasing frequency and intensity of such disasters due to climate change, CAT insurance is essential for safeguarding significant investments in offshore infrastructure. The coverage typically includes repairs to damaged turbines, floating platforms, or subsea cables, as well as compensation for business interruptions that may occur due to these events.

By accurately assessing regional risks and securing adequate CAT event insurance, project owners can ensure financial stability and long-term operational resilience for offshore energy projects.

j. Decommissioning phase

Decommissioning is generally underestimated and evaluated late as it is the last phase of a project, nevertheless, it is a critical part of assessing the feasibility and sustainability of the project over its complete life. Being a phase as important as the others, it shouldn't be neglected but integrated from the design phase.

Due to its importance and high impact, brokers will pay particular attention to its anticipation in all the different phases of the project, including the strategy planned for handling unforeseen changes in design, methods and operations.

Areas of focus for optimal decommissioning risk assessment, both for single projects and multi-source projects, include environmental impacts, regulatory considerations, vessels availability and planning management (Eva Topham et al 2019 J. Phys.: Conf. Ser. 1222 012035, 2019).

A robust environmental impact study from design to operation and installation methods is essential for a sustainable project plan. This can be demonstrated by studies assessing the project's suitability to meet environmental awareness criteria.

During the design phase, the materials selected for the different parts of the technological devices should best pre-determine a recyclable circuit, so that the project integrates principles of circular economy to its development. This will provide a better understanding of the future of materials in the removal phase, as well as potential debris and remnants generated during installation and operation.

Decommissioning risks are often similar to those encountered in construction, such as: simultaneous operations, vessel unavailability, permitting issues and weather constrains; but they come with additional complexities. It is not safe to assume that decommissioning can simply follow a reverse installation process; experience from offshore oil and gas facilities has demonstrated that this approach can result in significant challenges. Environmental considerations, such as the removal of foundations that attract marine life, also need to be addressed.

The environmental impact of decommissioning activities can be assessed through an environmental impact assessment, which helps project actors to select and implement the correct measures to mitigate the environmental impact throughout the life of the property. It is also a relevant initiative that will support the project's sustainability criteria response to brokers and various stakeholders.

In the oil industry, partial withdrawal is a practice that is often adopted as it tends to cause less environmental disturbance. In the case of planned scaling, the strategy should demonstrate that materials are considered in the scaling scenario or that they are being reused.

Depending on the project location, regulations will influence the decommissioning strategy due to country jurisdiction, material recyclability specifics and environmental operating processes. Modern regulations require assets to be designed with decommissioning in mind, including dismantling procedures and waste management strategies. Alternative end-of-life scenarios, such as life extension or partial/full repowering, may also be considered.

It is also an exercise to anticipate and provide solutions for harder recyclable materials that are currently challenging industries, such as fabrics and solar panels. This plan for decommissioning will have an impact on approval of the projects.

The key to best covering the regulatory area is early search for adequate information on the regulations of the country that should host the project and integration of its implications into the project plan, according to the different phase scales.

The decommissioning plan should also include a description of the appropriate vessels required to conduct operations. Their characteristics and equipment must be chosen according to the nature of the activities, as a complementary phase to be studied from the installation strategy.

- What are the solutions to disassemble the devices that will be installed?
- What strategies and design choices can be made to integrate decommissioning in a feasible, sustainable and cost-effective manner?

Once this framework is defined, contractual arrangements with ship contractors can be discussed, keeping in mind the competitive aspect that the future will bring to them in terms of availability for other installation and decommissioning activities on projects, and the demand from the other competing industries, like oil and gas.

Cost overruns are a major risk during this phase. Even when funds are allocated during the leasing phase, initial estimates can underestimate actual expenses after decades of operation. Vessel costs—making up 60–80% of decommissioning budgets—are particularly impactful. Flexible decommissioning timelines can help mitigate costs by avoiding periods of peak vessel demand, though predicting future vessel availability remains a challenge (Spyroudi, 2021).

The decommissioning planning phase is more difficult than it seems and therefore requires careful construction. Project characteristics must be considered in an overall view, such as distance to operating ports, water depth, device size and the specifics of related assets. One point of interest is the mobilization of vessels and operations plans to assess offshore working time, decommissioning method and costs related to the number of ships requested.

The difficulties arise from unplanned aspects, such as weather, adaptation to technical changes throughout the life of the project, new decommissioning procedures implemented or obsolete in the meantime, unforeseen situations due to limited overall experience of decommissioning activities for offshore renewable energy assets.

For co-location projects, it is essential to maintain a strong management of change system throughout the project lifecycle. Changes made to one technology or installation can affect shared infrastructure or other production technologies, increasing decommissioning risks.

Regularly reviewing the decommissioning process in a flexible framework is a general recommendation to adjust plans for time and refine the economic plan.

While this phase shares significant overlap with construction-phase insurance, project owners should still ensure their coverage adequately addresses the unique environmental and logistical challenges of decommissioning.

VII. Insurability for a multi-source offshore park

a. General guidance

The following part aims to provide general guidance for the insurability of co-user projects with the objective of integrating an existing offshore wind farm project.

These guidelines can also be applied to the context of the development of complete multi-source parks.

These steps have been used as a basis for the roadmap for future multi-source parks.

Underwriting requisites

1. First overview

To begin with, when reaching out to insurers they will first look at:

a. The experience and relevance with the environment, the implied installation, repair & operational phases.

b. The maturity of the technology used, third-party design verification.

c. Contractors' installation methodology: Towing, lifting plans, equipment used.

d. Maintenance, repair strategies

e. Site specific underwriting considerations.

The reason is that a majority of claims are related to installation errors by contractors. As a result, insurers will focus on selecting reputable installation contractors. To evaluate this aspect, they will analyse the contractors' track records to assess their credibility for the project.

The broker also reviews the risk assessment conducted for the technology, the risks associated with co-location alongside other technologies, and the overall organization of the different phases of the project.

According to insurers and brokers during interviews, as any MRE technologies one major concern is the maintenance strategy, especially regarding the following questions:

- How costly the repairing operations will be?
- How strong is the supply chain strategy?

2. Sources other than wind

Regarding wave, tidal and offshore solar, insurers will tend to have a limited appetite for these projects as they are in the current times small size project. However, some insurers are specific to some types of projects, which keeps opportunities open for these markets. In the long-term, wave, tidal and offshore solar projects will aim for larger project sizes, which will nurture the experience, improve technology requirements, standard processes, and surely consolidate the involvement of insurers with time.

For both prototypes and commercial projects, a key consideration for insurance feasibility is evaluating the potential future of the project. Selling the vision of its future can make the project more appealing to insurers..

Communication

1. First contact

The selection of the insurance broker is important. It is critical to ensure that a sufficient technical understanding is reached among experts to establish a good communication flow project stakeholders and insurance companies.

The first interactions mainly rely on the ability to convey credibility, and provide relevant arguments that will draw the project in a realistic way in the insurer's mind. The key quality for a good relationship here is by giving early transparent information, and outlining the processes expected throughout the engagement.

Insurers will define the necessary elements and data for the co-location project, and exchange information with clients such as advisors. The developer will then create a marketplace by soliciting and communicating with insurers. This begins with setting up a basic project brief, addressing technical aspects, site-specific details and ongoing studies.

In this phase, a market presentation is a good recommendation to be used for insurers review. The method employed to establish smooth communication may vary depending on individuals and organisations involved.

At the end, the goal is to develop a regular communication pattern between insurers, MWS, project co-users as needed. This ensures timely feedback on data, proper documentation exchange, and the ability to anticipate and address the latest updates.

2. Agreement and involvement

Once an insurance company is partly satisfied with the information shared, they will issue an indicative quote along with firm order terms.

The involvement of multiple insurers justifies the total premium amount. Typically, a share of the coverage is allocatedbetween the lead insurer and the followers. The lead underwriter is generally recognized for their expertise in the specific type of risk being insured and is responsible for maintaining communications throughout the project, ensuring warranties are executed in accordance with the insurance schedule (JNRC & SOMWS, 2023).

The lead insurers are selected based on their technical risk expertise, and they often provide engineering support for the project. For example in bottom-fixed projects, a reasonable amount of insurers is between 5 and 10.

It can be considered that these communication interactions can take up to 6 months, for the whole process until the obtention of the quote for a full scale floating wind.

It is recommended that project developers or future co-users engage brokers, potential lead insurers, MWS early in the process, ideally before finalizing the design. These stakeholders should also be consulted during critical phases such as design innovation / changes, O&M, supply chain strategy decisions.

As the trend is to favor floating offshore wind and other marine technologies like wave energy and offshore solar, some insurance companies have begun to make this sector their specialties. It is relevant to identify the primary renewable energy areas of focus by the insurance companies at the earliest opportunity.

3. Multi-source offshore park

In the case the owner of a bottom-fixed or floating wind farm is already involved in a multi-source project, they may have obtained a specific level of coverage, exclusions and clauses that differ from those typically expected by offshore solar, wave or tidal technology developers, primarily, due to the differing maturity level of these technologies.

Once the project of integrating another source of marine renewable energy into the existing farm begins to take shape, it is advisable to initiate discussions at the insurance level as early as possible. These discussions should focus on understanding the types of coverage each user currently benefits from or anticipates for their assets. Special attention should be given to addressing third-party liabilities, shared risks, and gap coverages to ensure comprehensive risk management.

The future co-users should communicate early with the project's owners or users already involved to seek for possible mutual coverages contractually and agreements in case of claims. Another path worth exploring is oriented toward government subventions which may support such innovative projects.

Risks and mitigations

1. Failure issues

From an insurance perspective, the risks associated with physical damages are primarily driven by:

a. Problems of failure

b. The time required for repair in the event of a failure

c. The cost of repair

According to general feedback from insurers, approximately 75% of claims are related to marine cables, and 70% of the total claims amount is attributed to marine operation costs, including repair expenses, vessel deployment delays, and revenue losses caused by these delays.

As an example, "The ORE Catapult ELECTRODE project concluded that in the UK, cable failures make up 75-80% of insurance claims while only making up 5-10% of the project cost [...] In the UK, the average downtime for a bottom-fixed wind farm inter-array cable repair is approximately 40 days and for an export cable approximately 60 days. Inter-array cable damage costs between $1.8M to $12M, and export cable damage costs between $10M and $30M (ORE Catapult, 2021)" (WFO, February 2024).

The risks associated with the failure of dynamic cables are also carefully assessed. Based on current expectations, it can be anticipated that dynamic cables will likely fail two to three times over the course of an entire offshore project. It is then strongly recommended to place focused attention on dynamic and mooring cables, especially when the site is shared with other users' marine energy devices.

In the context of a collocated project such as EU-SCORES, a failure in a mooring line could trigger additional risks, including:

- Possible loss of other mooring lines
- Drift and potential collision with other assets
- Loss of inter-array cable
- Loss of export cables
- Loss of revenue

Repair operations often lead to delays, which in turn result in revenue losses for the owner. Consequently, repeated or serial damage cases can have severe financial consequences. To mitigate risks and minimize disruptions, the general organization of the co-location should prioritize reducing the repercussions on the other assets in the park in case of a failure in technical components.

The owner and co-users will gain in control of repercussions over assets in case of risks happening by reinforcing the coordination interfaces and procedures. Operationally, this would translate into a clear definition of the site areas, trainings and reviews of the site ERPs with relevance to co-location emergency conditions, the involvement and feedback of marine coordination centres, the constant watch of regulatory orders and fluid communication with sea-users and authorities.

When evaluating potential repair scenarios, the following factors must be taken into account:

a. Accessibility of assets

Assess how easily damaged components can be reached for repair.

b. Strategic choice of vessels and installation contractors

Selecting the right resources is critical for efficient and timely repairs.

c. Average weather conditions at the site

Weather patterns and site conditions may influence repair timelines and operational risk. The choice of repair vessels must consider specific technical and operational factors, including:

- Anchoring points for lifting

  Ensuring anchoring capabilities are suitable for repair operations.

- DP (Dynamic Positioning) Class for accurate positioning

  Selecting vessels with appropriate DP class to maintain stability and positioning during repair

- Lift Capacities and Crane Technical Specifications

  Verifying that lifting and crane capacities are adequate for the specific asset being serviced.

These parameters have an influence over the potential size of the claims if they are not adequately selected, checked.

2. MWS expertise

To anticipate potential challenges and optimize the decision-making process, insurers should be engaged early in the project lifecycle. Similarly, the Marine Warranty Surveyors should be integrated as early as possible to enhance visibility on the operations courses and receive prompt, informed feedbacks.

Through their methodology, the MWS involvement in the earliest stages possible would positively influence the design phase, streamline the feasibility process and prevent last-minute issues.

In the field, MWS play a key role in approving initial iterations of O&M procedures. Their expertise is essential to ensuring asset safety, particularly during offshore operations. So they should be engaged early in the project to provide recommendations for improving design safety and functionality, advisory input on operational considerations, feedback on potential O&M challenges.

3. Supply chain

When assessing design failure, insurers will closely examine the supply chain relevance strategy, particularly regarding the availability of spare parts and their proximity to the site, to make a rough estimation of potential delays and transit routes.

Availability of spare parts is a key factor for the insurability assessment of a project. The rationale is simple: if spare parts are readily available, then repairs can be carried out more quickly minimizing downtime and associated costs.

If these considerations are neglected, failures of co-user assets in a co-location project — where mutual objectives depend on shared functionality — can have significant business impacts. Building a part from scratch will cause significant delays, and at the stage of the project evaluation will make insurers less confidents in coverage for Business Interruptions. This will likely have repercussions on partners results through the overall project consideration.

For instance, for mooring lines and cables a relevant point is to justify extra lengths of spare parts and designs for potential failure, to sell the problem with its maintenance solution

4. Insurance considerations

In multi-source projects, there are critical areas of mutual risks that must be carefully assessed to ensure comprehensive risk management. Key examples include:

- Risks associated with neighbouring structures such as floating solar platforms, wave energy converters, and offshore wind turbines.
- Aggregation risks for shared assets, focusing on the extent of exposure to shared failures.
- Shipping lanes and the cumulative risks due to navigational activities.
- Cable export from the OSS: if it becomes non-operational due to an asset failure, this could result in a total loss of revenue.
- Business Interruption risks and their potential impact.

Based on recommendations from an online conference organized by the WFO Insurance subcommittee on February 2023, the following methodology can be applied to assess the impact of risks in multi-source offshore parks.

For a spotted failure event:

a. Evaluate the probability of occurrence of the risk
b. Estimate the potential downtime resulting from the failure
c. Calculate the repair costs associated with the event

From an insurance perspective, assess the coverages provided by the contract and the insurance, taking into consideration the deductibles:

a. The eligible indemnification
b. The liquidated damages provisions
c. The estimated coverage for property damages
d. The business interruption balance

This approach helps stakeholders to identify specific coverages needs, and to anticipate failure scenarios to mitigate risks and minimise financial exposure.

Coverages

1. Certifications and warranties

Certification and warranties are critical factors in assessing the insurability of technologies and projects, influencing both the design aspect and construction phases as well as the ongoing operations.

While certifications are valuable, they are not a sufficient alone to convince insurers, especially for technologies at the prototype stage. Due to low readiness levels, insurers often provide limited or no coverage for technical defects ; e.g. no more than LEG 1 coverage.

To secure broader insurance coverage, technologies must demonstrate significant operational reliability. As an example, it can be recommended a minimum of 1 year or 11'000 operational hours without damage, along with comprehensive claims and loss history documentation during this period. Meeting these criteria can encourage insurers to provide higher levels of coverage, such as **LEG 2** or **LEG 3**, over time. This leads to the conclusion that even with certification, a device may still be considered a prototype unless it has undergone extensive real-world testing conditions.

Regarding warranties, insurers may hesitate to offer Business Interruption coverage unless robust warranties are in place. Because of the technology maturity levels, currently some floating offshore wind projects have obtained LEG 1 and LEG 2 coverage for floaters, mooring legs, and dynamic cables. For bottom-fixed offshore wind projects, some are qualify for up to LEG 3 for foundations, cables.

2. CAR coverage for future co-users

CAR coverage for offshore renewable projects often originates from practices in the O&G sector. The WELCAR 2001 (WELCAR 2001 - Offshore construction project policy) is the one mostly applied in the marine construction environment as a basis.

The CAR policy mentions also special conditions for other assureds by the principal ones under this coverage. For instance, it implies especially that the conduct of any operations under this coverage by other assureds should ne in accordance with the quality assurance and control policies put in place by the principal insured.

As offshore wind continues to evolve, it is anticipated that customized coverages specifically tailored for offshore wind and multi-source projects will be developed.

3. Protection and Indemnity

P&I liability insurance is specifically designed to address the unique needs of the marine industry. It covers practically all maritime liability risks associated with the ownership and operation of a vessel.

These include third-party risks for damage caused to the marine asset during transit, damages to fixed and floating objects, risks of environmental damage, war and political risks.

The P&I insurance is often provided by P&I clubs, which are essentially mutual insurance associations offering risk pooling among members, information sharing, representation and risk mitigation.

In this context, the insurance policy, underwriting process and premium definition within P&I clubs are distinct but depend on similar factors as standard marine insurance including the nature of planned operations, the organisational strategy and implementation, the experience and reputation of the company and contractors involved, the financial strength of the stakeholders (SKULD).

The exclusions must be carefully analysed to understand the range of this coverage and adapt the insurance needs.

Future co-users entering offshore wind parks with new marine renewable technologies (such as wave and offshore solar technologies) can potentially secure third-party liability coverage through P&I insurance by applying for appropriate extensions and coverages specific to the co-location context.

4. Hull & Machinery

H&M liability insurance provides marine property coverage initially for the owner's vessel, machinery and equipment. It protects against losses caused by loss or damage to the vessel and its equipment. Under certain conditions, this insurance can also cover certain liabilities resulting from collisions including : Running Down Clause liability for collisions with other vessels, and Fixed and Floating Objects liability for damage caused to other structures.

The exclusions must be carefully analysed to understand the range of this coverage and adapt the insurance needs.

Future co-users of an offshore park can achieve broader scope and more effective coverage by carefully combining CAR, P&I, and H&M insurance policies. This strategy, minimizes gaps in coverage while avoiding over-insurance for certain operations and assets, optimizing risk management and financial efficiency.

5. Mutual Agreement between users

An early communication with the different parties involved ease to understand what strategies can be put in place for mutual coverages and contractual agreements. The future co-user will likely aim for residual risks coverage and claims management agreements, as per example of knock-for-knock indemnity, which indemnify the responsible party for damages with regards to the other one.

Discussions between co-users can be oriented around mutual indemnity agreements, under the NOGEPA standards, to have a better insurance repartition, avoid assets over-indemnities and optimize the obtention of relevant coverages (Marstrat - Adriaen Winckers, November 2023).

b. Roadmap to insurability of multi-source parks

EU-SCORES case study

The following section outlines the key information likely to be required for the underwriting process of the multi-source parks part in the EU-SCORES project.

These tables can serve as a reference to help prepare and organize the necessary information. While not exhaustive, they summarize essential details based on typical underwriter requirements. Additional project-specific information may also be needed.

The input included in these tables have been compiled from underwriters forms publicly available on insurance companies websites (AXIS Renewable Energy).

Case study	1	2
Location	Atlantic coast of Ireland	North Sea
Wind farm type	Floating	Bottom-fixed
Total wind farm power	300 MW	500 MW
Single unit power output	15 MW WTG	8 MW WTG
Number of units	20	62
Co-user device type	Wave energy converter	Offshore solar
Total co-user power	25 MW	100 MW
Single unit power output	300 kW	50 kWp
Number of units	83	200
Layout	Uniformly / Peripherally	Uniformly / Peripherally

Table 1 – EU-SCORES case studies

Underwriting information	1	2
Coverage effective	27 years	27 years
Owner insured	WEC developer	Offshore solar developer
T&I Contractor for asset X	T&I contractor 1	T&I contractor 1
T&I Contractor for asset Y	T&I contractor 2	T&I contractor 2
O&M Contractor	O&M contractor	O&M contractor

Table 2 – Underwriting information

Details – Case study 1 or 2	Information
Technology Certifications	-
Warranty Description	-
Time of technology operability	-
Number of projects involving technology	-
Loss History (< 5 years, Date/Description/Amount)	-
On-site substation	Y
Substation owned by project	Y
Number of transformers in substation	-
Battery storage system	N
Preventive maintenance program	-
Spare parts details and availability	-
First substation distance from project	-
Types of transit for installation	Marine
Expected transportation duration	-
Maintenance requirements	Tow-to-port / Site
Length of transmission lines within project	-
Length of transmission lines outside project	Co-users might not be concerned
Security details on site	-
Contingency plans for crit. equip. failure	-
Onsite Crane	-
Port of origin	-
Distance between port and site / substation	-

Table 3 – Underwriting requirements

Insurance coverage	From	To	Deductibles
Construction All Risk	-	-	-
Operating All Risk	-	-	-
Marine Cargo	-	-	-
Advance Loss of Profits	Number of months		-
Business Interruption	Number of months		-
Delay in Start-up	Number of months		-
P&I extensions	-	-	-
Hull & Machinery	-	-	-
Mutual Indemnity agreement	Description		-

Table 4 – Insurance coverages

The information outlined above should be completed wherever possible to compile and convey a comprehensive overview of the project during the underwriting phase. This will facilitate clear and effective communication with brokers and potential future project co-users

1. Risk assessment

A preliminary risk assessment is proposed focusing on the aspects mentioned in this document that require a careful attention in the case of collocating multi-source energy devices within a park. While this assessment does not encompass all possible risks and categories that co-users might face, it provides an overview.

The basis of this list has been taken from an overview of main risks established by the Work Package 1 of the EU-SCORES project, whose objectives concerned the project management and general topics.

For each situation, risks have been evaluated based on their likelihood and severity, following the weighting methodology outlined in Figure 5 .

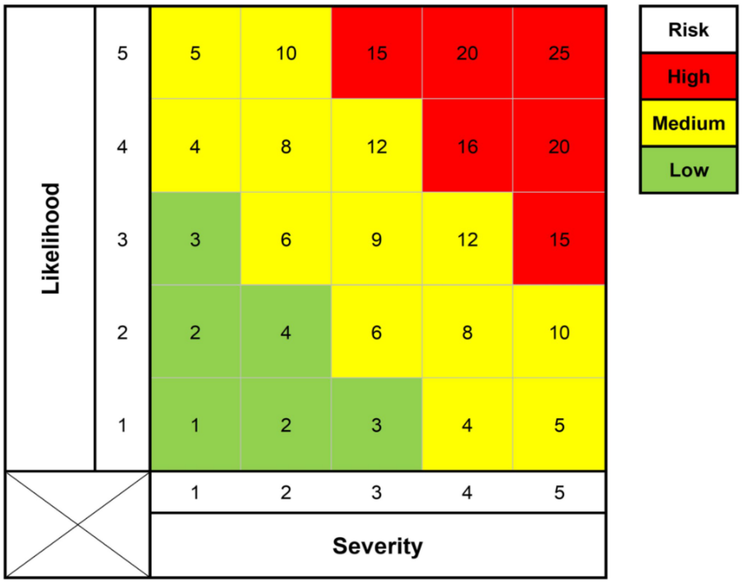

Figure 5 – Risk assessment through probability and severity weights

LOW RISKS					
N°	Situation	Type	Phase of project	Root causes	Recommendations
1	Local stakeholders and policymakers does not support the project.	Regulatory	Design	A poor familiarity with the local conditions and communication plan can make harder the support for local actors, especially if the project is of a new type such as multi-source.	Give stakeholders and policy makers the opportunity to voice their issues and needs. Provide real-life demonstration of the technologies. In the case of a conversion from a single to multi-source park, highlight the benefits that can be expected. Making it open publicly is further expected to generate traction.
2	Environmental impact of novel technologies is higher than expected.	Technical	Design	Consequences of installation measures required for the technologies on the environment, the introduction of possible new materials and methods. A lack of resources and communication can increase the risks in the business case and production estimation, as it involves several technologies and users in the farm.	Agree on the detail level of the data needed and communicate it to the different stakeholders involved. Solicit relevant authorities during the quest of data. A clear site assessment helps in the estimation of the operations and avoid adaptability delays. Demonstrate the viability of the technologies in the environment and their implementation measures. Evaluate similar technologies adaptation measures.

3	Co-financing not achieved.	Financial	Design	Developers or contractors with low experience can make harder the co-financing process, it can impacts the co-use project. Especially in this case where small companies are involved.	All technology developers should provide as best as possible a good track record on financed projects and have private investors secured.
4	Design plans and parts becoming obsolete.	Technical	Design	Long delays between design and construction can affect the design relevancy, and so the planning of the co-location project.	Early engagement with the other parties regarding design and anticipation of future changes if possible. Effective communication with the parties. Planning of installation should be modelled to reduce as much as possible the delays between the end of fabrication of design parts and the beginning of the construction.
5	Regulatory issues	Organizational	Design	Changes in country's regulations, license and policies.	Check the compliance of the project with the country's regulatory context. Follow and anticipate the political context of the country hosting the multi-source project.
6	Simultaneous operations, interference between construction and local vessels.	Operational	Installation / O&M	Operational downtimes, local vessel navigation, site maintenance required can be a source of conflict in the wind farm area, especially with several users and technologies.	Estimate the potential vessel traffic in the site area, especially around the mooring zones. Ensure the clear passive communication with vessels by giving visibility of the restricted and risks areas.

					Establish procedures to be integrated to the ERP. Make a clear communication about the permanent navigational lanes, discussing with institutions to issue regulatory orders, and temporary via navigational warnings. Ensure the watch service is sufficient enough to cover the different activities, MCC personnel, guard vessels.
7	Insufficient cable production capacity.	Supply chain	Installation / O&M	Delays and production unavailability for export and dynamic cable components at required quality and volume, to meet the project timescales in the construction phase; or repair in the shortest delays in the O&M phase.	Perform a market study and maintain good follow-up of the supply market.

Table 5 – Overview of low risks

MEDIUM RISKS					
N°	Situation	Type	Phase of project	Root causes	Recommendations
1	A conflict regarding IP, budget or other topics arise throughout the project.	Organizational	All	The causes can be various due to the nature of the project involving several actors, technology owners and engaging a multi-party work.	Establish a legal framework for handling those issues. All procedures, including conflict resolution, must be in place.
2	Unexpected technical problems encountered in the technologies marine deployment.	Technical	Installation	The new technologies can be subject to this situation due to insufficient trial periods regarding to different environmental conditions, non-adapted procedures.	Anticipate the concerned technology deployment by having rigorous tests with similar conditions. Plan and practice the offshore operations in details, maintain up to date the procedures that will be followed. Solicit experienced offshore installation companies for advisory and/or the installation phase. This situation can increase the risks on the co-user's assets in the farm.
3	Emergency response difficulties due to unfamiliarity to the co-use system.	Operational	O&M	When an emergency arise, an unforeseen situation or a non-clear definition of the needs, roles and	Due to the co-location, new scenarios will need to be anticipated and integrated to the wind farm emergency response plan.

				responsibilities may generate high costs. A co-location project will have several assets that can be a source of domino's effect if the correct actions are not taken in case of emergency.	Perform trainings and emergency response simulations with the MCC and wind farm site coordination personnel. Establish clear procedures to follow and ready to share in case of emergency.
4	Operations cannot be executed or are delayed due to interference with other operations in the park.	Operational	O&M	Simultaneous operations on the same site already taken by co-users.	Ensure a clear communication and operational planning between the co-users and site control for the scheduled operations, to avoid any business interruptions and last minutes delays. Anticipate the permit processes by informing the MCC and having a follow-up on the regular site operations meetings.
5	Potential failures of grid connections, through inter-array or dynamic cables	Technical	O&M	Requirements for cable design are different from standard offshore power cables and not mature enough.	Anticipate this situation through a preventive maintenance strategy involving cable monitoring and inspection. Design cables as close as possible to industry standards. Ensure checks are performed regarding all failure modes with mitigation measures. Seek for advisory and feedback regarding suitability and impact on insurance through MWS and lead broker.

Table 6 – Overview of medium risks

HIGH RISKS					
N°	Situation	Type	Phase of project	Root causes	Recommendations
1	Anchor failure	Technical	O&M	This situation can happen due to a lack of information regarding the environmental conditions, a poor design, defective equipment and materials, contractors inexperience.	Perform sufficient studies on the design phase iterations to increase the safety of the technology. Choose carefully the contractors that will perform the installation, with the consultancy of MWS and after the approbation of the appointed lead broker for this risk area.
2	Data exchanges between partners is inhibited due to confidentiality issues	Organizational	Design / Insurability	This situation can be a result of unclear or inadequate agreements, confidentiality policies that can restrict the information required from the co-user.	Ensure that enough clarity on topics such as grid parameters, energy management, electrical layouts, insurance agreements, will be available between the future co-users before hand, if not discuss about the data that can be exchanged to provide the safety of the co-location project.
3	Vessel unavailability	Operational	Installation / O&M	Apart for project-related causes, a vessel owner can have an impact on the installation and O&M planning for reasons of unscheduled vessel maintenance, certifications renewal, limited market ; especially if the discussions have been taken early in the project.	Look for information related to performance and maintenance records when selecting vessel owners. Do not neglect the regular communication with them through the project phases, to anticipate unscheduled events.

5	High insurance costs for small companies	Financial	Insurability	The high costs in insurance can be justified by the unfamiliarity with the technology risks that can generate unpredicted emergency response events, and the high potential claims.	The worst consequence of this risk could thrive to the bankruptcy of small companies. To mitigate this risk, start with the involvement of an offshore-related broker as possible, going through the discussions, give information about the co-use project, the company technology concerned, and track record. So the broker will be able to have a realistic estimation of the coverages and lead to appropriate directions. The idea is to reach the maximum indemnities for the co-use implementation and project. An alternative can be to have a knock-for-knock co-user agreement combined with a residual risk coverage and a mutual indemnity agreement.
6	Warranties and certification not achieved for new MRE technologies.	Technical / Financial	Design / Insurability	The technology is at low level readiness, prototype phase. The cable and floating systems sector expertise is not sufficient enough. Requirements for innovative energy systems are new for manufacturers, flexibility and risks related to inner cable	Involve early engineering companies related to the design sector, i.e. cable, moorings, … Work with the design standards for floating systems, cable engineering. Perform cable tests when possible prior to installation phases.

				wear are currently hard to balance for optimum performance.	Provide details that can support credibility and demonstrate the correct operability of the technology when discussing with brokers, such as operating hours, maintenance and failures track records. Communicate the planned tests, design improvements, standards followed.
7	Interface management for multi-source parks	Organizational / Management	All	The environment of multi-source parks involves different MRE users with their technologies in co-location. Some situations can emerge and harden the interactions due to unclear procedures, disagreements between parties on decisions, unfamiliarity with the co-use and multi-source parks.	Have a dedicated focus on the interface management of the multi-source project. Ensure to communicate clearly an overview of the risks involved by the co-location. Set minimal requirements to manage the interface between the parties involved.

Table 7 – Overview of high risks

EXAMPLES OF FICTIONAL RISK SCENARIOS REGARDING INSURANCE COVERAGES											
RISK SCENARIO					CONSEQUENCES			CONTRACTUAL		INSURANCE	
N°	Device	Situation	Cause	Likelihood	Impact on collocated assets	Repair costs	Downtime	Cost & liability clause	Consequential damage & LDs	Property damage	Business interruption
1	WEC	Device disconnection	Anchoring failure Late emergency response	MEDIUM	Damages to the WTG foundation Damages to boat landing Media visibility – Project reputation	WTG foundation WTG boat landing WEC Power Take-Off Anchors and mooring lines Tow-to-port Spare parts transport Vessel mobilization Logistics	WTG: 3 weeks WEC: 2 months – Spare parts available	Indemnification under the defect liability clause for WTG. Mutual indemnity Loss of revenue	Available LDs according to contract	OAR / Cargo / P&I Third-party liability clauses LEG 1 Minus deductibles	70% Minus deductibles
2	Of. solar	Mooring line failure	Defective material after severe weather conditions	HIGH	Rupture of inter-array cable Power generation unavailable from partial solar devices (10%) No collision	Mooring line Inter-array cable Vessel mobilization Logistics	IAC: To be determined after survey Of. Solar: 1 month – Spare parts available	Mutual indemnity Loss of revenue	Available LDs according to contract	OAR Third-party liability clauses LEG 1 Minus deductibles	60% Minus deductibles

Table 8 – Examples of fictional risks scenarios

Roadmap for future co-users

The following part aims to propose a generic roadmap for the EU-SCORES project and multi-source projects, in order to optimize the underwriting process, obtain the best coverages and premiums. It will gain in relevance and clarity by collecting the constant feedback from EU-SCORES first, then future multi-source parks.

The roadmap presented in Figure 6 gives an overview of the different steps required for future co-users to ensure an optimal insurability of their co-location project. The blocks vertical axis aspect do not communicate a hierarchy between the steps, they can be simultaneous or rearranged.

The following color code has been applied to the roadmap:

- During the design and development phase
    - In green, for technical and preliminary information required for the underwriting process.
    - In blue, for the underwriting and insurance agreement phase.

Iterations and exchanges will likely happen between the steps highlighted in blue and green, due to the communication loops, feedback, and changes that may be required during the design and development phase.

- In orange, for the installation phase
- In grey for the O&M phase
- In light green for the scaling-up phase
- In yellow for the decommissioning phase

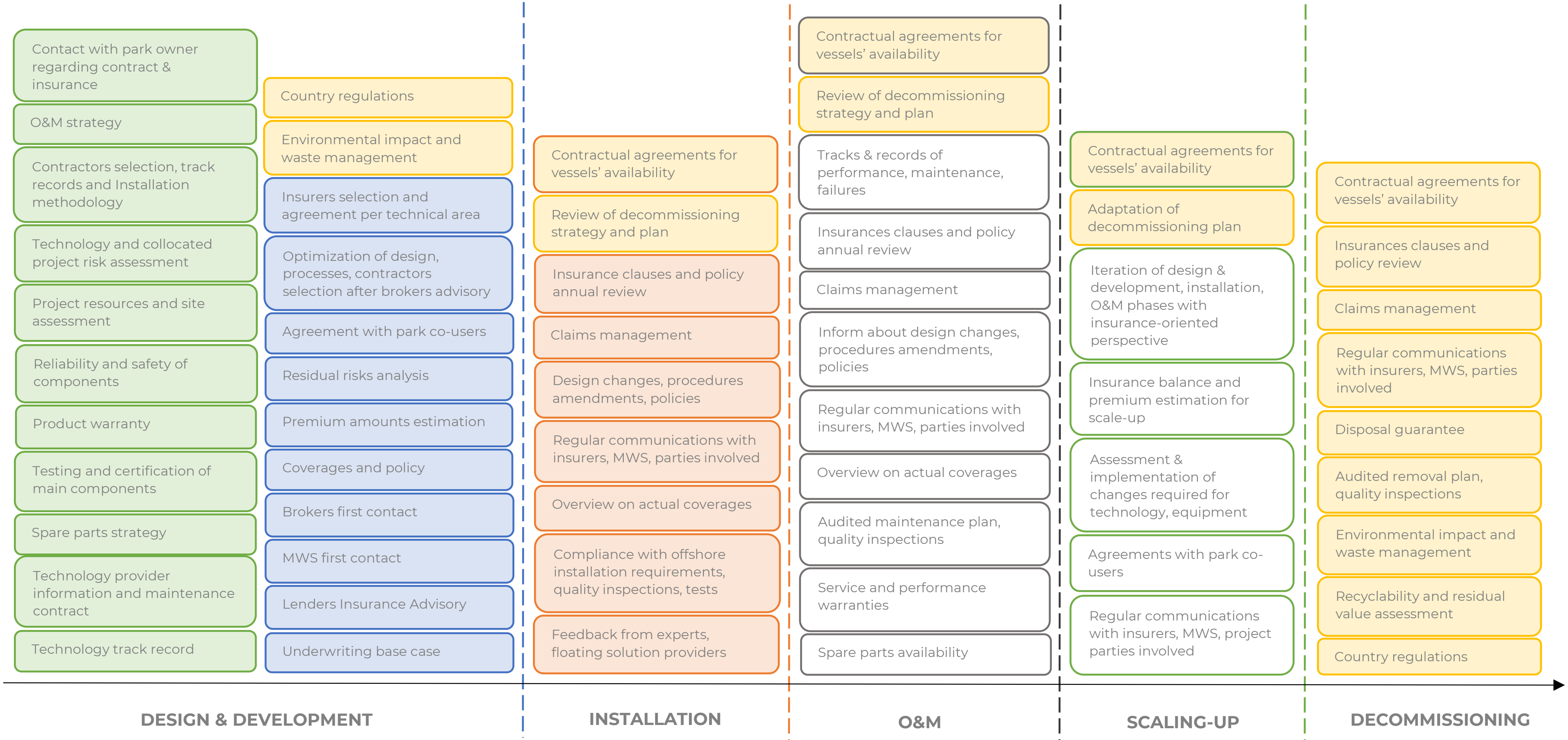

Figure 6 – Roadmap proposition to insurability

Conclusion

Multi-source energy projects introduce the complexity of collocating different technologies, which must be carefully addressed when considering the insurability of the project. This complexity arises from the involvement of multiple stakeholders and diverse technologies.

To improve this process and optimize the quality of insurance wind farm operators can reduce their own risk exposure in activities related to co-use within the farm.

Future co-users, will face challenges due to the nascent nature of multi-source parks. These challenges include limited technology maturity, insufficient track records, and constrained financial capacities, which make securing comprehensive insurance coverage difficult.

However, a practical solution involves establishing a contractual insurance agreement between co-users and the wind farm operator. With a robust risk assessment provided by co-users for the co-location of the technologies, both parties can share residual risk coverage through a mutual indemnity agreement.

Alternatively, to secure maximum indemnification from insurers, it is essential to anticipate and integrate the underwriting phase into the project lifecycle. This includes providing details on the technologies involved, progress in design verification, installation and operational procedures, project organization, the qualification of key actors solicited for the project phases and insurance advisory, the third-party verification and the interactions with co-users.

For smaller companies, a strategic combination of insurance products may be necessary to address gaps in coverage.

Multi-source parks demand heightened coordination and communication among stakeholders. Establishing and adapting procedures to mitigate the risks associated with the co-location will directly impact the insurability and overall success of such projects.