



Danish Energy
Agency

Invitation to Offshore Wind Market Dialogue for the Energy Island in the North Sea

Regarding the technical concept and the pro-
curement process of the Energy Island in the
North Sea



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1. Introduction

The Danish Energy Agency (DEA) hereby invites stakeholders in the Offshore Wind industry with an interest in providing input to the procurement process and technical framework conditions of the Energy Island in the North Sea to participate in a written market dialogue for the Energy Island from the perspective of offshore wind developers.

The result of the market dialogue will support DEA in defining the offshore wind developer's technical specifications of the interfaces to and land use on the Energy Island.

The outcome will be included in the optimization of the tender material for the Energy Island and later used in future offshore wind tenders related to the North Sea Energy Island.

Other market dialogues related to the North Sea Energy Island have been held regarding preliminary site investigations, procurement framework for the co-ownership of the Energy Island and need for deeper geotechnical data. Please refer to DEA's Energy Island website ([link](#)).

The market dialogue will take place in the period from March 31 to May 7, 2023, where the current invitation and background information will be published together with number of questions in an accompanying excel-file.

2. Purpose of the market dialogue

The purpose of the market dialogue is to consult with central offshore wind market stakeholders about the technological challenges and solutions that are imagined to affect the Energy Island technical concept.

In the market dialogue, questions are posed about technical elements as well as requirements for access to common service areas (including e.g. harbour and heli-pad) and O&M conditions.

The offshore wind market will thereby have the opportunity to influence the future framework for the procurement process of the North Sea Energy Island and the integration of offshore wind equipment and facilities on the Island.

3. Background

A broad political majority in the Danish parliament has agreed that an energy hub in the North Sea shall be located on an artificially constructed island located 80-100 km west of the coast of Jutland.

The Energy Island will as a minimum contain areas to support i) the electrical and transmission equipment of the connected offshore wind farms and ii) the Danish Transmission System Operator (TSO), Energinet, in order to facilitate and transmit the wind power onshore. This shall ensure that the power generation from the offshore wind farms as well as the interconnectors between Denmark and one or more neighbouring countries will be operational. The Energy Island will in a first phase have the capacity to facilitate and transmit 3-4 GW offshore wind power by 2033 with a target to increase the capacity of up to 10 GW by 2040.

The Energy Island will contribute to utilize the large amount of wind resources in the North Sea and act as an energy hub that collects electricity from the surrounding offshore wind farms and distributes the electricity between countries and other hubs connected via the electricity grid.

The Energy Island in the North Sea is an unprecedented construction project in terms of size, complexity and development potential. DEA would therefore like to invite offshore wind developers and other interested stakeholders who would like to impact the technical Energy Island concept, the areas expected to be utilized by the Offshore Wind Farm (OWF) concessionaires and the procurement process for the Energy Island in the North Sea. The OWF concessionaires are expected to get access to the Energy Island through a lease agreement covering the utilized areas for OWF equipment as well as accessibility to the service areas (harbour, helipad etc.).

It should be noted here that another marked dialogue related to the OWF procurement process is planned in the future after the publication of the Energy Island tender.

4. Form of the market dialogue

The electronic material (incl. this invitation with background information and assumed technical specifications as well as market dialogue questions in excel format) is published online on EU Supply/TED.europa.eu website. Furthermore, the material will be uploaded on DEA website ([link](#)).

Questions are divided into nine different themes, where some questions are marked High Priority (light green) and some are marked Lower Priority (light red).

High Priority questions are directly related to OWF requirements to the areas needed on the island, interfaces between OWF and the Energy Island with respect to OWF equipment on the island and cable interfaces to the Energy Island. Also OWF O&M framework conditions are addressed.

Lower priority questions are technical questions not directly related to the Energy Island construction and tender, but any information shared by the OWF stakeholders will be highly appreciated.

Written answers to the questions and comments raised in this paper must be submitted by e-mail to the DEA at Energyislands-NEI-OWF@ens.dk no later than **Sunday 7 May, 2023 at 16:00 CET**.

The individual answers will be treated as confidential. However, a general anonymized summary will be published on the DEA website and distributed to the participants after finalization of the market dialogue.

Further information on Denmark's Energy Islands can be found here ([link](#)).

We look forward to receiving your feedback.

Danish Energy Agency

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Disclaimer and use of inputs from the dialogue

The information, including the written Q&A's, provided by the DEA during the market dialogue in the spring of 2023 is non-binding to the DEA. The binding information will be the published Energy Island tender material. The Q&A's from this market dialogue, are therefore without any legal status during the Energy Island procurement process.

5. Offshore Wind Farm area on the Energy Island – Technical Specifications

The current section outlines assumptions for the technical specifications that the offshore wind farm developers are expected to require to the construction, installation and operation of their electrical equipment and facilities concerning the first phase of the Energy Island in the North Sea.

The assumed technical concept of the Offshore Wind Farm (OWF) Plant is presented as well as O&M requirements and interdependencies between other stakeholders and should be used as background information for answering the questions posed in the attached market dialogue questionnaire.

The conceptual layout of the OWF Plant presented in this section is the layout as currently proposed by the DEA. However, the layout is developed in close collaboration with the Energy Island Contractor (Hereafter named Contractor) and depends on negotiations with relevant stakeholders and the expected available technologies.

5.1 Conceptual Layout and Design Prerequisites for the OWF Plant on the Energy Island

A conceptual layout of the OWF Plant on the Energy Island has been developed based on the prerequisites of facilitating the direct connection of up to 4 GW offshore wind power to the Energy Island in a first phase, and an additional 6 GW wind power connected to the Energy Island via HVDC converter platforms.

For illustration, the proposed OWF Plant layout of 1 GW¹ presented in Figure 1 and Figure 2 has been developed under the consideration of the installation concept and sequence of the components, but does not otherwise account for limitations, restrictions or other implications that the specific layout will cause for the Energy Island layout. The final Energy Island layout including the OWF Plant layout shall be based on thorough risk, logistical and emergency preparedness analyses of each phase of the Energy Island that incorporate all relevant aspect of permanent and temporary works on the Energy Island.

The layout based upon all connections are established as cables or Gas Insulated Lines (GIL) and Operation & Maintenance (O&M) considerations, installation methodology, and fire and safety strategy have been considered. However, it is emphasized that the final design of the OWF Plant on the Energy Island is expected to be developed in close collaboration with the Contractor during the design and construction phases of the island.

¹ 1 GW layout is for illustration purpose only. The size of the offshore wind capacities to be tendered out by the DEA is not decided.

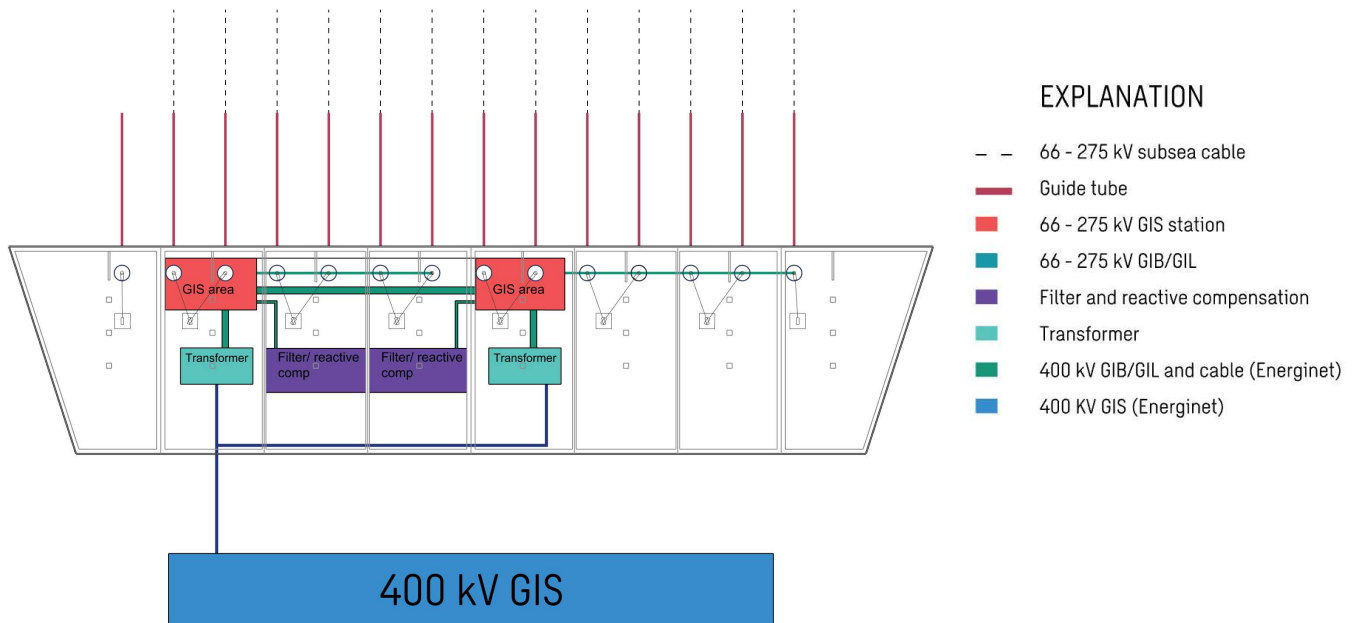


Figure 1 - Illustrative layout of 1GW OWF substation on the perimeter section on the island. Point of Connection at HV-side of transformer

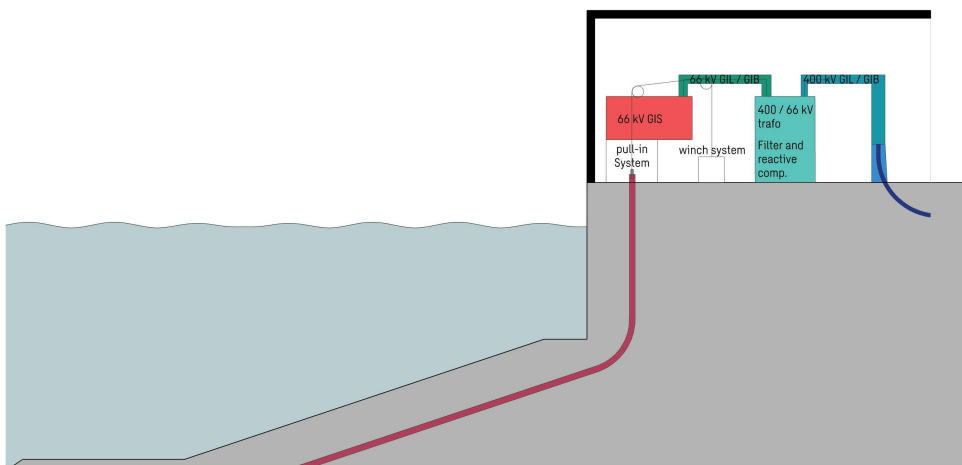


Figure 2 - Side view of illustrative layout of OWF substation on the island. Colour coding of components refers to legend in Figure 1.

The expected dimensions of the OWF Plant components presented in Table 1 are based upon modules encapsulated in a climate screen to protect the electrical equipment from the harsh environmental conditions present at the Energy Island, and to ensure the correct climate condition and safe operation of the electrical

equipment. Also, the modules are assumed to be placed with physical separation between components in order to secure fire safety, installation, operation & maintenance and replacement of equipment into consideration.

The height to which the modules need to be raised is to be defined by the Contractor in order to assure no harm during flooding due to extreme events. The configuration presented in Figure 1 allows for corridors of free space in between each module for the cable conduits, O&M, and fire segregation purposes.

Table 1 - List of proposed components for OWF Plant on the Energy Island including a preliminary estimate of each component structural footprint

Component	Preliminary number per 1GW	Preliminary estimates on dimensions (l x w x h) in m	Preliminary weight ranges [tonnes]
66 kV GIS with pull-in chamber	2	10 x 18 x 10	Up to 100
Filter	2	15 x 15 x 6	Up to 10
Reactive compensation	2	6 x 5 x 5	Up to 60
Transformer	2	7 x 14 x 10	Up to 450

The Cable Conduits and electrical connections between OWF Plant and Energinet Plant are to be routed in pre-installed Cable Conduits on the Energy Island.

5.2 Electrical Systems

5.2.1 Point of Connection

The Point of Connection (PoC) is located on the 400kV busbar outside of the lighter blue area of the AC substation depicted in Figure 1.

The transformers are part of the OWF Plant and the 400kV GIS is included in the Energinet Plant.

5.2.2 Emergency power supply

Emergency power supply is expected to be provided by Energinet.

5.2.3 HVAC substation

On the Energy Island a 66(-275) kV/400kV HVAC substation will be constructed and installed. The substation will contain a SF6-free GIS and the HVAC switchgear will be installed indoor.

HVAC connections may be made with cables or GIL or a combination of both, depending on the availability and development of SF6 free solution. The HVAC connections are to be installed in the Cable Conduit system.

5.2.4 Transformers

The OWF step-up transformers to 400kV shall be of oil-immersed single- or three phase two-winding design.

The exact components depend on the specific transformer and its design and layout.

All transformers shall be protected by supervisory equipment.

5.2.5 Harmonic Filters and Compensation equipment

To be able to fulfil the required grid-code, harmonic filters and/or compensation equipment could be needed and would preferably be connected to the HVAC Substation.

All equipment should be installed indoor due to the harsh environment at the Energy Island.

5.3 Cables

Cable requirements contain requirements which are relevant for all cable routings on and near the Energy Island. Also requirements for Cable Conduits and Cable Entry System are considered.

In general, the Contractor is considered responsible for construction of all Cable Conduits and Cable Entry Systems (not limited to pipe, tubes, ducts, structures, cable hang offs, etc.) necessary for cable connections with, to and from the Energy Island.

5.3.1 Requirements

Requirements relevant for both the Cable Conduits and Cable Entry System, comprise of (but not limited to) the following:

- The Contractor shall demonstrate the suitability of the Cable Entry System and Cable Conduits in terms of installation and operation as well as maintenance during the lifetime of the Energy Island.
- The Contractor shall detail and adequately document the suitability and operability of the Cable Entry Systems and Cable Conduits by providing a detailed method statement, risk assessment and detailed cable pull-in engineering and engineering that confirms that the Cable Entry Systems and Cable Conduits do not compromise the integrity of the Energy Island and the integrity of the cables during the installation and design lifetime.
- It is required that the cable route, Cable Entry System and Cable Conduits are designed, installed and maintained in such a way that the cables can be replaced in case of cable damage during installation or operation.

5.3.2 Cable Conduit Requirements

Cable conduits designed by the Contractor for fulfilling requirements for (but not limited to) maintainability, thermal conductivity, sufficient separation between cables to facilitate no faults (e.g. fire), sufficient area for the installation and repair of joints, cables not being exposed to direct sunlight, etc.

5.3.3 Cable Entry System Requirements

The Cable Entry Systems provided by the Contractor shall include Cable Entry Systems for all OWF cables, expected to be as listed in below Table 2 dependent on the type of cable connection.

Table 2 - Estimated number of OWF cable entries

Type of cable connection	Assumed number of power cable entries per 1 GW	Number of Fibre Optical cable entries
66 kV HVAC	13	Assumed none
132 kV HVAC	7	Assumed none
275 kV HVAC	4	Assumed none
Spare cable entries	1	Assumed none

5.3.4 Fibre Optic Cables and Related Facilities

The Contractor will prepare the fibre infrastructure on the Energy Island for the OWF Concessionaires to connect to.

5.3.5 Earthing and Lightning Protection

Earthing and lightning protection is provided by the Contractor.

5.3.6 Utilities

Utilities are generally provided by the Contractor.

6. Offshore Wind Farm - Operation and Maintenance

6.1 General

The OWF Concessionaires shall have access to the area reserved for OWF equipment, facilities as well as Cable Conduits in the areas reserved for transmission in case of preventive maintenance campaigns and unpredicted maintenance interventions of the OWF Concessionaire's cables.

Access to the Transmission areas on the island is expected to be granted by Energinet and the Energy Island Operator (Hereafter named Operator) to the OWF Concessionaries so as to ensure access to oil containment structure attached to the transformers during maintenance campaigns. The OWF Concessionaries is expected to have access to cable joints for inspections, maintenance, repair and replacement.

The OWF Concessionaries is expected to have access to their own facilities on the island and common facilities and services on the island including, but not limited to, harbour, helipad, logistics, warehouses, lifting capacity, temporary accommodation, catering, etc.

6.2 Personnel on the Energy Island

Based on the current assumptions encompassing the O&M phase, the OWFs will not have permanent personnel on the island, and will perform periodical maintenance activities deploying specialised personnel temporarily located on the island. In addition, each OWF concessionaire shall have access to the island for trouble shooting tasks.

6.3 Logistics

The priority for transportation of personnel and goods to the Energy Island is expected to follow the list below.

1. Authorities (Emergency)
2. TSO
3. OWF Concessionaires
4. Authorities (non-emergency)
5. Other stakeholders

Personnel transport will take place by helicopter or by CTVs. Joint coordination of transport and other logistics to and from the Energy Island will be attempted, between all stakeholders present on the island. The Operator shall coordinate this. The infrastructure on the Energy Island shall be suitable and available for transporting components to and from the Berth facilities to the OWF Plant components. The OWF developers shall have access with vehicles, lifts and other necessary equipment required for any tasks related to the OWF O&M schedules.

6.4 Energy Island Facilities

For the OWF developers to operate and maintain the OWF Plant, access to necessary facilities shall be ensured by the Operator.

6.4.1 Berth Facilities

The Contractor shall establish berth facilities for CTVs and Ro-Ro/cargo vessels, which the OWF Concessionaires can use for the transport of personnel and components to the Energy Island.

6.4.2 Storage Facilities

The OWF Concessionaires is expected to require climate controlled storage facilities made available on the Energy Island for critical spare parts. In case of shared facilities with other parties, the OWF Concessionaires shall have restricted access to the specific Concessionaires' personnel only.

6.4.3 Accommodation and Welfare Facilities

Throughout the service campaigns, the OWF Concessionaires is expected to require access to accommodation and welfare facilities on the island.

6.5 Helipad

The helipad on the Energy Island is expected to be able to accommodate a helicopter sized for transport of up to 15 persons. Further, the helipad shall be approved for *Localiser Performance with Vertical Guidance* (LPV) Approach.

The OWF Concessionaires shall have access to the helipad throughout the year, when conditions for landing are suitable, in order to be able to access the OWF facilities and equipment for service and maintenance.

6.6 Daily Operation

The Operator shall ensure that any O&M tasks/activities the OWF Concessionaires plan to perform are possible. Hence, ice, snow and surface water may not affect or hinder the OWF Concessionaires from performing O&M tasks on the Energy Island. The Operator shall aim for that other activities on the Energy Island do not prevent OWF Concessionaires from being able to carry out any tasks regardless of them being scheduled or urgent.