






Hydrogen Turbine 1

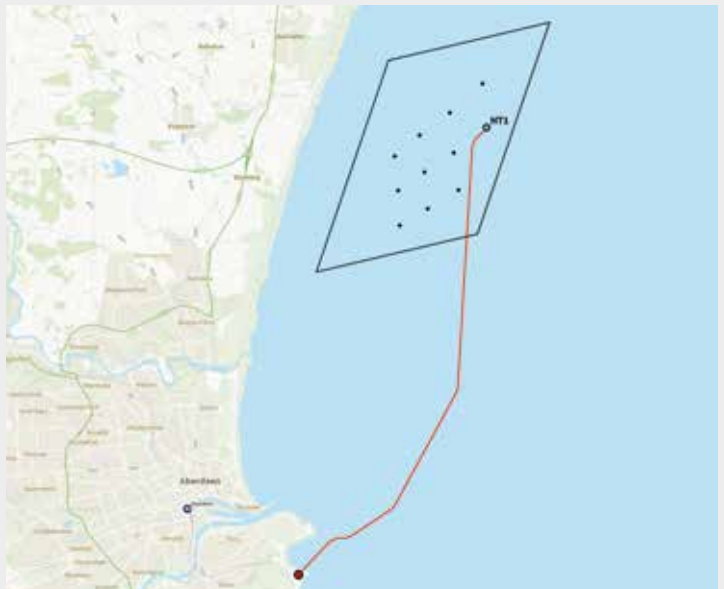
Aberdeen Offshore Wind Farm



Location of the proposed HT1 project

Legend:

-  Hydrogen Turbine 1 (HT1)
-  Aberdeen Offshore Wind Farm Turbines
-  Aberdeen Offshore Wind Farm Area
-  Proposed HT1 Pipeline Route
-  Proposed HT1 Onshore Facility



Who is Vattenfall?

Vattenfall is one of Europe's largest producers and retailers of electricity and heat with approximately 19,000 employees.




For more than 100 years we have electrified industries, supplied energy to people's homes and modernised our way of living through innovation and cooperation. We are determined to enable fossil-free living within one generation. To succeed we must become fossil-free ourselves. But that's not enough. We are looking beyond our own industry to see where we can really make a difference. Together with our partners, we are taking on the responsibility to find new and sustainable ways to enable electrification

and green energy production for transportation, industries and heating.





Vattenfall is a key partner in enabling the UK to reach net zero. As well as our existing onshore and offshore wind farms, we are co-developing the Muir Mhòr offshore wind farm in Scotland, and we'll shortly start construction on the Norfolk offshore wind farms. We're on track to help save eight million tonnes of CO₂ every year by 2030, the same as taking 4,000,000 cars off the road.

Vattenfall in the UK - at a glance

Technology type

-  Battery
-  Offshore wind
-  Onshore wind
-  Solar
-  Heat networks
-  Hydrogen
-  Renewable energy park

Project status

-  Operational
-  Construction
-  Development
-  Vattenfall office location





Aberdeen Offshore Wind Farm (AOWF)

The AOWF comprises eleven 8.8 MW turbines and is located off the coast of Aberdeen. The turbines were the most powerful in the world when built. Vattenfall employs an Aberdeen based team to look after the turbines.

The project started producing electricity in July 2018 and annually displaces over 134,000 tonnes of CO₂, which is the equivalent of removing approximately 35,000 fossil-fuel cars from UK roads. The wind farm has an installed capacity of 96.8 megawatts: enough to power

around 80,000 homes. The wind farm has been awarded up to €40m of European Union funding and is supported by Aberdeen Renewable Energy Group.

In May 2022, Vattenfall was awarded £9.3m in innovation funding from the Net Zero Innovation Portfolio Low Carbon Hydrogen Supply 2 fund, by the UK's Department for Business, Energy and Industrial Strategy. The funding will be used to develop the world's first hydrogen-producing offshore wind turbine (HT1) at the AOWF.

Unlock our Future Fund

The Unlock our Future Fund in Aberdeenshire and the City of Aberdeen invests in projects that look to the future, clearly demonstrate a lasting impact and contribute to a climate smarter world. Our aim is to continue to benefit the local area. Vattenfall invests £150,000 every year in the Unlock our Future Fund. This annual payment will continue for the life of the wind farm.

To find out more about the Fund and how to apply, please scan the QR code.



Unlock our Future Fund Community Project

Project overview

Scotland was one of the first countries in the world to declare a climate emergency and has reduced greenhouse gas emissions by half in the last 30 years. The Scottish Government has set a world-leading target to reach net zero emissions by 2045 as part of its ongoing commitment to protect people and our planet.

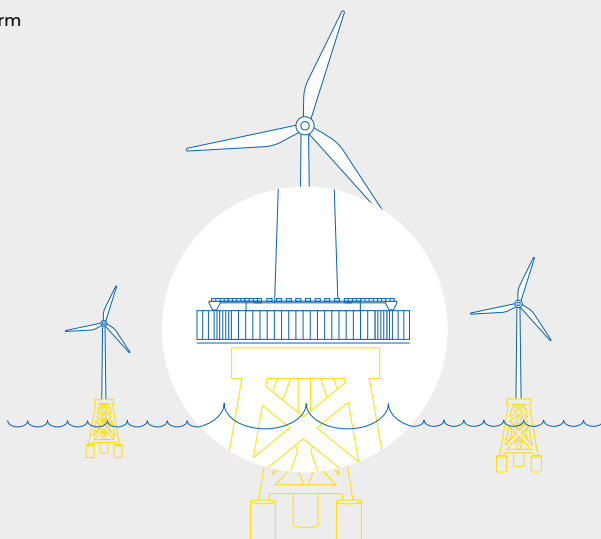
In recognition of this ambition, Vattenfall is developing the world's first green hydrogen-producing offshore wind turbine at its existing Aberdeen Offshore Wind Farm (AOWF - sometimes also called the European Offshore Wind Deployment Centre). The hydrogen generating equipment will be installed on one of the existing 8.8 MW turbines; it will be known as Hydrogen Turbine 1 (HT1).

By installing hydrogen production equipment on an extended platform on the turbine, Vattenfall will be able to use seawater and electricity from the

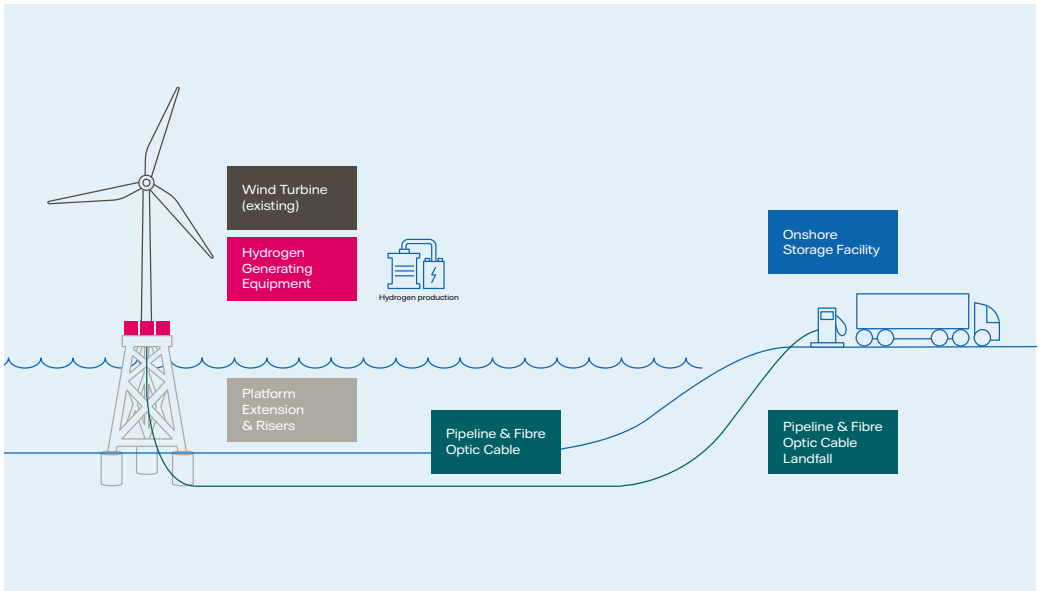
wind turbine to create green hydrogen through a process called electrolysis. The hydrogen will be transported to shore via a subsea pipeline where it can be used as a source of sustainable energy. The HT1 project will be able to produce enough hydrogen every day to power a hydrogen bus to travel 15,000 miles, which is the equivalent of 50 return trips from Aberdeen to Glasgow.

The HT1 project will examine how fossil-free hydrogen can be produced and piped to shore safely and efficiently and identify what needs to be done to enable large-scale commercial production. By proving that it is possible to efficiently produce hydrogen at industrial volumes, HT1 will provide generators, consumers and investors with the confidence to apply this game-changing technology for the decarbonisation of industrial processes which cannot be electrified.

Wind turbine platform



Hydrogen Turbine 1 (HT1)



Schematic of HT1 hydrogen process

The figure illustrates the various components of the project which include:

- extending the platform on one of the existing AOWF wind turbines and adding risers (vertical pipes) to the foundation, including for intake of seawater. The turbine proposed for the hydrogen production equipment is BO6, the furthest turbine from shore
- installing hydrogen production equipment in containers on the extended platform
- laying around 12 km of pipeline under the seabed to bring the hydrogen to the shore
- laying a fibre optic cable on the pipeline so that the equipment at the turbine can be controlled remotely
- building an onshore facility including compression and storage near the new Aberdeen South Harbour for use in the local area

Green hydrogen

How it works

Green hydrogen is a source of clean energy where water is split into hydrogen and oxygen. It is proposed that seawater, one of the most abundant resources on earth, will be taken from the sea, desalinated, treated and then electrolysed to create hydrogen using power from the wind. The hydrogen will be transported to shore by subsea pipeline.

Why generate hydrogen?

Green hydrogen does not emit polluting gases when it is produced or used and is relatively easy to store. It is a key way of reducing greenhouse gas as it does not have a negative effect on the climate.

Uses:

Traffic & transport

Hydrogen can be used to power hydrogen fuel cell vehicles. It can be used in heavy-duty vehicles such as buses, heavy goods vehicles, trains and ships. Shifting our dependence from fossil fuels to such alternatives would help reduce carbon dioxide (CO₂) emissions from traffic and help us to protect the planet.

Heavy industry

Hydrogen can be used within heavy industry environments, such as steel manufacturing. Heavy industry is traditionally reliant on fossil fuels, such as coal. Energy use from industry currently accounts for 24.2% of global greenhouse gas emissions. However, Vattenfall has been working in collaboration with European partners through projects such as HYBRIT to replace traditional fossil fuels used within heavy industry with fossil-free electricity and hydrogen. The outcome of this is the world's first fossil-free steelmaking technology.

Safety aspects

Similar to other fuels such as natural gas, hydrogen is flammable and must be properly handled in line with relevant safety requirements. Vattenfall is drawing on lessons and solutions from the offshore oil and gas industry to help ensure the safe production, transportation and storage of the hydrogen.

The most important aspect of hydrogen safety is the capacity to depressurise the hydrogen system in an emergency situation. By so doing, the potential risk posed by the hydrogen is significantly reduced. For the HT1 project, we are proposing an automatic safety system which will depressurize the system and bring it to a safe state in the unlikely event of an emergency.

Vattenfall has a high standard when it comes to safety. We use modern international safety standards from the process industry (where raw materials are extracted, transported and processed to create end products using a formula or recipe). We also demand that our suppliers and contractors maintain these same high standards.

We are discussing the design of the offshore and onshore parts of the project with the safety authorities in the UK to make sure that all concerns and potential hazards are addressed and that the protection level is the best in the industry. Discussions with environmental regulators are helping us to ensure that all necessary environmental permits and consents are also in place.

To find our more about the HYBRIT project, please scan the QR code.





Aberdeen Offshore Wind Farm

Hydrogen & climate change

Hydrogen policy

The Scottish Government has set out short, medium and long term goals and when they are to be achieved by in the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019.

In 2020 the Scottish Government set a vision for Scotland to become a leading hydrogen nation and help move the country away from fossil fuel reliance. This will help to achieve 'net zero' of 'greenhouse gas' emissions by 2045.

The Scottish Government published its Hydrogen Policy Statement in December 2020 which recognises the importance

of hydrogen in a decarbonised energy system. Within this document, an initial ambition of generating 5 Giga Watts (GW) of renewable and low-carbon hydrogen by 2030 was announced. (A GW is equal to one billion watts which could power around 725,000 homes, equivalent to more than the number of homes in Glasgow, Edinburgh and Aberdeen combined.

The Scottish Government published a more detailed 5-year Draft Hydrogen Action Plan in November 2021. The plan recognised that demonstration projects like HT1 would play a key role in this green energy transition.

Hydrogen and Aberdeen

Aberdeen is already home to the world's first hydrogen powered double decker buses which emit water from their exhausts, helping to reduce air pollution. The forthcoming Aberdeen Local Development Plan will include other initiatives, including an Energy Transition Zone, to encourage renewable energy and support the transition towards a more sustainable future. These will help ensure the continued economic success of the city.

The proposed onshore elements of the HT1 project are expected to be located in the region of Aberdeen's new South Harbour, which welcomed its first vessel in July 2022. The project will also help support the transition from oil and gas to a renewable energy future with Aberdeen's highly skilled workforce supporting the project and benefiting from its delivery.



Dolphin and Aberdeen Offshore Wind Farm (image: Ian Hastie/AREG)

Consenting

All new projects need appropriate planning approvals and consents. These requirements are different for the elements that are on the land and those offshore.

Offshore consenting

Projects in Scotland that are within inshore waters (12 nautical miles of the shore) are primarily consented on behalf of the Scottish Ministers by Marine Scotland. Consents may also be required from other organisations such as the Scottish Environment Protection Agency (SEPA).

Developers like Vattenfall (helped by advisors like RSK Environment Ltd) apply for relevant development consents supported by environmental assessment reports. The reports are based on surveys carried out of the area and assessment of any impacts that the project may have on the environment.

As Vattenfall already holds consents to operate their existing wind farm, they

intend to apply to vary the agreements in place to include any new elements related to the hydrogen aspects of the project. Additional consents (including a marine licence) will also be obtained for the construction, operation and decommissioning of HT1.

Onshore consenting

The onshore elements of the hydrogen project also require consent. A planning application for the hydrogen storage site in the region of Aberdeen South Harbour and any ancillary infrastructure will be submitted under the Town and Country Planning (Scotland) Act 1997 (as amended).



Gannets (*Morus bassanus*)

Environmental assessment

Environmental Impact Assessment (EIA)

Environmental Impact Assessment (EIA) is a process which identifies and assesses the potential environmental effects of a development. It informs the design of the project from an environmental perspective and identifies mitigation measures to minimise and manage the impacts of the project on the surrounding environment. Through the EIA process, there is also an opportunity to identify amendments to project proposals to make the project more locally appropriate.

Under current legislation, not all projects require an EIA and it is up to the consenting authority (Marine Scotland or the local planning authority) to decide whether an EIA is required. Sometimes other forms of environmental assessment are considered more appropriate, depending on the scale and nature of the proposals.

Managing Impacts

Several offshore environmental assessment studies already have been undertaken. These have improved understanding of what animals and plants may be present in the area and what impact the project might have on them. Mitigation measures to reduce or remove any impacts will be identified throughout the assessment process.

These will include:

Environmental Management Plan

Marine Mammal Mitigation Protocol

Navigation Risk Assessments

Exclusion Zones



Offshore assessments

Screening Report

Vattenfall submitted an EIA Screening Report to Marine Scotland in November 2021 to ask them if they or their principal advisors considered that an EIA would be required for the marine elements of the project. Given the minor nature of the proposed changes, they did not think that a full EIA would be needed. Vattenfall still proposes to submit a detailed environmental assessment report with all licence and consent applications. This report will be available for anyone to read. Please scan the above QR code.



Aberdeen Offshore Wind Farm

Assessment topics

Vattenfall has been collecting information about the presence of plants and animals below and above the waves, including marine mammals (dolphins, seals, whales, etc.) and sea birds at the site since before the original marine licence was granted in 2014. In particular, the following factors will be assessed as part of the HT1 project:



Offshore Physical Environment

- Water quality
- Sediment quality
- Hydrodynamics²

² The scientific study of the motion of fluids, for example, water.



Offshore Biological Environment

- Habitat and biodiversity
- Disturbance and accidental injury to marine mammals
- Water quality and sediment quality



Human Environment

- Commercial fisheries
- Shipping and navigation
- Marine archaeology
- Visual sight lines
- Infrastructure and tourism



Developments along coastal path around Greg Ness (image: RSK)

Onshore assessments

Screening Report

Vattenfall will also submit an EIA Screening Report to Aberdeen City Council (ACC) with a request to provide an EIA Screening Opinion to determine whether an EIA is required. Should an EIA be required, then an EIA Scoping Report will be submitted to agree with statutory consultees on the scope and methodology of surveys and assessments. An EIA Report will then be submitted with the planning application to allow ACC to take the environmental information into account in their planning decision. Regardless of whether an EIA

is required, Vattenfall will carry out a proportionate environmental assessment and have discussed likely supporting information requirements with ACC and statutory advisors.

Vattenfall's consultants have undertaken feasibility studies to choose an area of study that is less environmentally sensitive. The Area of Study is currently a construction area around Greg Ness and ecology surveys have indicated that there is no evidence of protected habitats or species on site. Supporting information required to be submitted with the planning application is likely to include:



Onshore Physical Environment

Drainage Impact Assessment

Flood Risk Assessment



Onshore Biological Environment

Ecological Appraisal Report



Human Environment

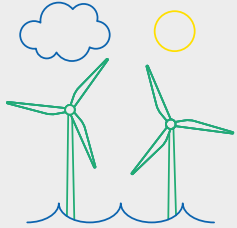
Noise Impact Assessment

Transport Statement

Landscape Visual Impact Assessment

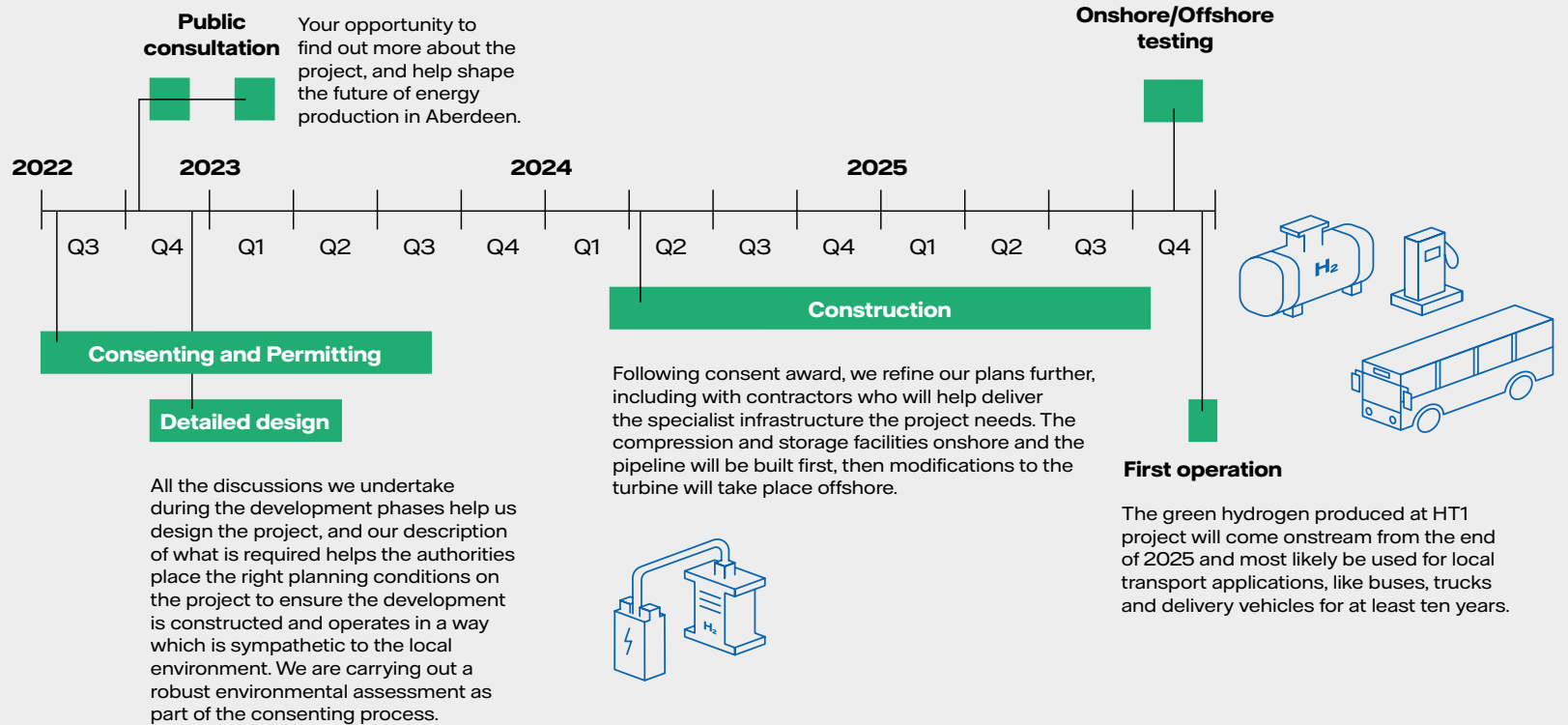
The project timeline is indicated below. Environmental studies commenced in 2021 with the goal of first hydrogen production as early as 2025:

HT1 Project - Indicative Timeline



Project development, in dialogue with national, regional and local stakeholders - from statutory bodies, to landowners to marine users and local residents - we are preparing a project that is technologically innovative and efficient, environmentally sensitive and works in the local setting, contributing to the socio-economic aspirations of the region. The route to getting all the correct consents and permits is something the project is pioneering, and this in itself is part of its value as a pathfinder project. We anticipate being awarded relevant permissions in Q3 2023.

The pathway to consent should be even quicker for subsequent projects seeking to follow a similar process, or even new offshore wind developments that want to generate "energy molecules" rather than electrons.





Aberdeen Offshore Wind Farm

Stakeholder engagement

Good dialogue with people interested in our proposals, including local residents and businesses, is the best way to deliver a sustainable project that maximises economic and environmental benefits. Vattenfall is committed to building long-term relationships based on mutual understanding and transparent communication. Whilst a key objective is to obtain relevant consents with minimal delays, our main aim is to create the best possible project by securing local insights and views alongside expert technical knowledge.

Vattenfall has a long track record of listening to and involving a broad range

of people and organisations to deliver successful projects such as the Aberdeen Offshore Wind Farm. As we've been talking with relevant people in the region since around 2002 when the AOWF was first conceived, this has given us a strong basis for discussing and agreeing the topics for environmental assessment.

Vattenfall is now keen to meet with local communities to share information about the proposals and find out your views. We have prepared a Community Engagement Plan outlining our approach to engaging with local communities and you can read this on our website.

Stakeholder groups



Hydrogen Turbine 1

Landowners

- Crown Estate Scotland
- Aberdeen City Council
- Port of Aberdeen

Strategic

- Commercial fisheries
- BEIS
- Marine ornithology
- Ports, shipping & navigation
- Scottish Enterprise
- Lobbying groups

Regulators

- Marine Scotland Licensing Operations Team (MS-LOT)
- Department of Business & industrial Strategy (BEIS)
- North Sea Transition Authority (NSTA)
- Aberdeen City Council
- Scottish Environment Protection Agency (SEPA)
- Health and Safety Advisors/Regulators

Political

- Members of UK Parliament
- UK Hydrogen Champion
- UK Hydrogen Advisory Council
- UK Hydrogen Regulators Forum
- Scottish Government
- Aberdeen City Council

Community

- Local residents
- Community interest groups
- Community Councils
- Wider community
- Media

EIA Consultees

- Historic Environment Scotland
- NatureScot
- Commissioners of Northern Lighthouses
- Maritime and Coastguard Agency
- Aberdeen City Council

Supply chain & skills

- Supply chain
- Skills & training (colleges/ training providers)
- Government agencies/ NGOs
- Local businesses



How to get involved

We are very interested in hearing your views and would encourage you to complete our community questionnaire. Please ask a member of the team for a copy or scan the QR code. You can also contact us directly using the details below.

Contact us

Email: HT1info@vattenfall.com

Post: Freepost FCHANGE

Phone: 01786 820 111

<https://www.vattenfall.co.uk/HT1>



Note: As a marine licence/planning application has not yet been submitted, written comments should be made by 28th November 2022. Comments made to Vattenfall Wind Power Ltd are not representations to Scottish Ministers or the Planning Authority.

Representations to Marine Scotland and/or the local Planning Authority can be made when formal marine licence and/or planning applications are made.