



# **Hywind Scotland Pilot Park Programme for Operation and Maintenance**

**C178-HYS-Z-GA-00004**

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## 1 Introduction

### 1.1 Background

Equinor ASA (formerly Statoil ASA) received a Marine Licence on the 30<sup>th</sup> October 2015 to develop the Hywind Scotland Pilot Park Project (“Hywind Scotland”). Five floating wind turbines (FWTs) were installed, each with a generating capacity of 6 MW giving a total generating capacity of 30 MW, approximately 25km off the coast of Peterhead. Each turbine is anchored to the seabed by a three-point mooring spread and connected by inter-array cables (figure 1). An export cable transports the generated electricity to shore. The application, Marine Licence decision documents and other documentation are placed on Marine Scotland’s web page.

Hywind Scotland first became operational in October 2017.



**Figure 1.** Graphical illustration of the Hywind Scotland Pilot Park Project

### 1.2 Document Objective

This document outlines the procedures and working practices for the operation and maintenance of the FWTs and cable network for Hywind Scotland Pilot Park. The purpose of the document is to provide the information which will enable the Licencing Authority to discharge consent conditions given in the Marine Licence for the Hywind Scotland Pilot Park Project (Licence number 05515/17/0) related to the operation phase of the project. Equinor has agreed with Marine Scotland to develop an Operation and Maintenance Programme, covering the relevant licence conditions

in one document, rather than preparing separate documents or plans for each condition. The issues covered are listed below, with reference to the relevant conditions to be discharged:

- Operation and Maintenance Programme – OMP, ref. condition 3.2.2.9, including cable maintenance and inspection (ref. condition 3.2.2.10 f) and g); Cable Plan);
- Vessel Management Plan – VMP, ref. condition 3.2.2.7.
- Navigational Safety Plan – NSP, ref. condition 3.2.2.8.
- Environmental Management Plan - EMP, ref. condition 3.2.1.2, including chemical usage (ref. condition 3.1.7) and environmental protection (condition 3.1.8).
- Emergency Response Co-operation Plans – ERCoP (including emergency response and HSE incidents reporting (brief description, conditions 3.2.1.7 and 3.2.1.10 to be discharged through separate documents)

Equinor has developed, in collaboration with the Maritime and Coastguard Agency (MCA), an Emergency Response and Co-operation Plan (ERCoP) following a standard template, to cover the duration of the operations phase. Emergency response and reporting of health and safety incidents (ref conditions 3.2.1.7 and 3.2.1.10) is therefore only briefly covered in this Operation and Maintenance Programme.

### 1.3 Target Group

The target group for this document is the Licensing Authority and statutory consultees such as JNCC, SNH, SEPA, MCA, NLB, AC and any such other advisors or organisations as may be required at the discretion of the Licensing Authority.

## 2 Operation and Maintenance Programme

### 2.1 Operation and Maintenance Principles

The Hywind Scotland operation and maintenance philosophy follows the same operation and maintenance principles as used for any other wind project in Equinor. This chapter aims to give a holistic overview of the operation and maintenance programme for Hywind Scotland.

The operation and maintenance of a wind turbine placed on a floating foundation using the Hywind concept is comparable to a bottom fixed turbine for all normal maintenance tasks. Operational experience from the Hywind Demo turbine has verified this assumption. Main component failures and work related to the substructure and mooring system will be different from a bottom fixed wind turbine. Inspection and maintenance of the substructures and mooring systems will be conducted on a campaign basis, using relevant competency within Equinor. Main component exchange requires further planning, and will, if necessary, be performed as a small stand-alone project. Further details of the main scopes of work are covered within this document.

### 2.2 Roles and Responsibilities

The Hywind Scotland (HYS) organisation, falls under Equinor’s [Renewables \(REN\)](#). The HYS organisation is fully responsible for the completion of safe and efficient operations. Figure 2 details the organisation tasked with achieving this.

Hywind Scotland [has](#) a dedicated Plant Manager and O&M Engineer. In the context of this Programme for Operation and Maintenance, [Plant manager and O&M Engineer](#) the Plant Manager is accountable and responsible for:

- Responsibility and accountability for the offshore wind farm operations, reporting to the Board of Directors, including profit and loss
- Ensuring safe, reliable and profitable operations
- Stakeholder management for wind assets
- Ensuring necessary reporting to UK authorities and stakeholder engagement and follow up
- Support for future business development opportunities
- Services in accordance with the Operator Agreement and governing documents
  - Equinor’s Technical integrity of the wind assets, including necessary studies and modifications
  - Maintenance program development and execution, including contract management, project-based maintenance, and turnaround management planning
- Safe and efficient base, marine and logistics operations
- Experience and knowledge transfer to Equinor BD and REN.
- Reducing the cost of energy through technology and asset development, optimal commercial models and lean operations
- Adoption, implementation and use of the management system

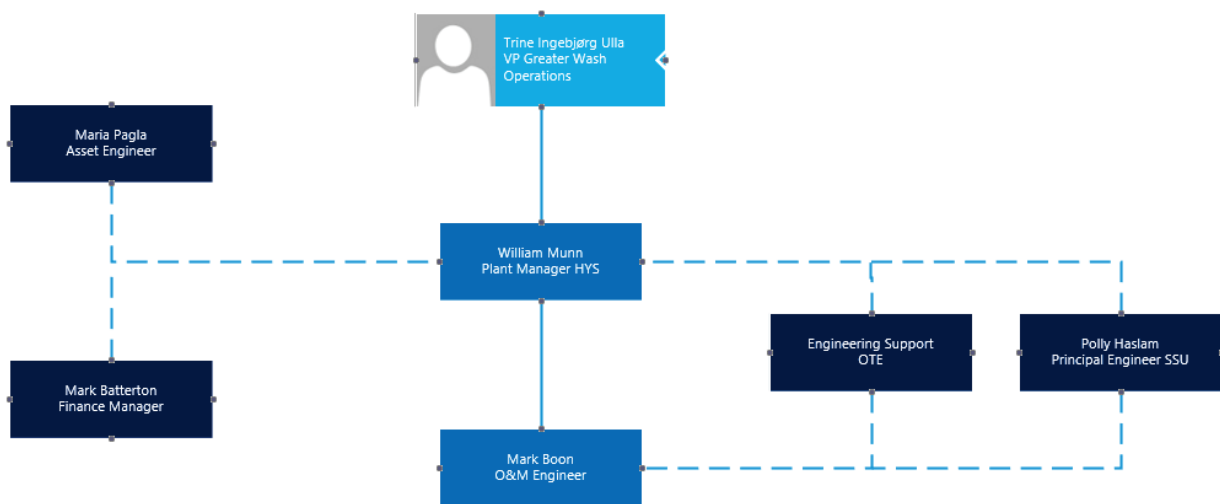


Figure 2: Hywind Scotland Operations Organisation

Requirements for follow-up, reporting and interfaces towards stakeholders and governmental bodies will be the same for HYS as for any other wind farm.

### 2.3 Operation and Maintenance Strategy

The planning assumptions for a SWT6.0-154 turbine is five days scheduled maintenance and on average ten days unscheduled maintenance per year; which totals up to about 75 days of maintenance for Hywind Scotland per year. In addition, there will be visits for the completion of statutory inspections to ensure compliance with relevant Approved Codes of Practice (ACoP).

Furthermore, a bi-annual inspection of the subsea equipment shall be completed to verify the technical integrity of these components. Depending on the findings from such surveys, the periodicity and scope of inspection shall be subject to review.

The ambition is to schedule operations and maintenance activities as efficiently as possible, to minimise the amount of time spent on the turbines.

The resource strategy for Hywind Scotland is to have an initial 5-year period covered by a Maintenance, Service, Operations and Warranty (MSOW) Agreement with Siemens Gamesa Renewable Energy (SGRE). As per the MSOW Agreement, SGRE technicians shall have a regular presence in Peterhead to perform the scheduled and unscheduled maintenance requirements. Access to site, is via a dedicated Crew Transfer Vessel (CTV) which is permanently stationed in Peterhead.

This organisation will be ready to work on the turbines every day when the weather allows sailing and safe access to the turbines available, in doing so reducing the likelihood of harming people, the environment and or the assets. Various weather monitoring systems are available for the collaborative decision to be made as to whether operations can be completed on any given day.

SGRE shall be able to handle normal operations without Equinor's physical presence. SGRE can also handle the daily interface towards the vessel provider. Equinor shall therefore not be permanently present at the operational base in Peterhead.

All of the maintenance and inspection activities completed at Hywind Scotland, and defined within the following sections, shall be planned, managed, and recorded in a Computerised Maintenance Management System (CMMS); SAP. Both Equinor and SGRE shall work within SAP.

### **2.3.1 Wind Turbine Maintenance**

Hywind Scotland extended the MSOW Agreement with SGRE from November 2022 for a further five years with the next review due in Q4 2027. The scope of this contract covers the maintenance of the turbines, tower internals, high voltage switchgear, SCADA and instrumentation and the statutory certification of lifting equipment, anchor/rescue points, fall arrest and pressurised systems. SGRE technicians will be ready to work every day when the weather allows for safe access to the turbines. The ambition is that SGRE service will handle the maintenance for the majority of equipment located on the turbine. SGRE will during this service agreement period also do the monitoring and alarm handling for the wind turbines from their centralised control room in Newcastle.

Some of the installed equipment on the turbines, is not covered under the requirements of the MSOW, in which case Equinor shall hold separate service agreements. This includes, but is not limited to the davit cranes, lidars and blade inspections.

In the case of blade inspections, an Unmanned Aerial Vehicle (UAV) shall be used to acquire images of the blades to verify their integrity. These inspections will be completed from the Hywind CTV during periods of favourable weather conditions. This shall be planned to coincide with other operations so as to reduce turbine downtime.

### **2.3.2 Electrical Infrastructure Maintenance**

The maintenance of the electrical infrastructure in Peterhead is currently provided by a local service provider. This contract is monitored by Equinor.

### **2.3.3 Maintenance and Monitoring of Substructure, Mooring System and Subsea Cables**

Inspection and maintenance of the substructure, mooring systems and subsea cables shall be campaign based and completed according to Equinor's internal procedures. The current strategy is that the inspections will be completed bi-annually, however, the periodicity and scope shall be subject to review assuming no major findings.

The relevant competence areas in Equinor shall be involved in the planning and execution of foundation, mooring system and subsea cable inspection and maintenance. These competence areas have decades of relevant experience from subsea inspections of foundations, mooring systems and subsea cables for offshore oil and gas installations.

The subsea surveys shall be scheduled in summer months, to minimise the amount of weather downtime, and therefore time spent in the field. Furthermore, the inspections shall be planned to reduce the effects on any fisherman.

In the event of accidental discovery of cultural remains, this shall be reported in line with The Crown Estate (2014) Protocol for Archaeological Discoveries.

### **2.3.4 High voltage switching**

Equinor is responsible for providing this service. This will cover both HV switching on the turbines and on the onshore substation. All high voltage switching, and works will be conducted in accordance with Equinor wind safety rules, with operational switching conducted remotely from Equinor's Wind Control Centre in Great Yarmouth. Senior Authorized Persons will put local safety measures into place prior to high voltage works.

### **2.3.4 Heavy Component Exchange**

The turbine crane and the crew transfer vessel are designed to handle all standard components and spare parts, with a maximum limit of 2 tonnes. This will cover everything, excluding the main components, i.e. transformer, generator/main bearing, yaw bearing, blade bearing, blades and hub.

Transformer exchange will be carried out using a standard DP offshore service vessel. The transformer will be lowered externally from the nacelle to the platform before being lifted off using the service vessel crane.



In the event of a Davit crane defect that requires removal of the crane this will be done similar to the transformer exchange. A standard DP offshore service vessel will remove the crane from the platform using the service vessel crane.

For the other main components, the lifting operation will be at nacelle height (about 100 m). The water depth is too great for jack-up vessels, meaning that the lift will have to be between two floating structures. This operation is very sensitive to motions and is not feasible in offshore environment outside of Peterhead. The turbines will therefore have to be towed back to sheltered waters for such components to be exchanged. The most likely location for major component exchange is the Norwegian fjords.

In the event that a turbine is subject to a major component exchange, there is a requirement to install a diesel generator and associated fuel storage tank temporarily so that there is power provision for navigational aids and other critical safety systems. There will be a requirement to periodically bunker fuel from the CTV to the storage tank; this shall be managed by a robust operating procedure, the use of well-maintained and certified equipment and the utilisation of suitably trained and competent personnel.

In the event of a major component exchange, this shall be treated as a separate project.

### **2.3.5 Deballasting**

It is anticipated that during the operational life of Hywind Scotland, deballasting of the substructure shall be required.

Due to marine growth on the substructure, it is anticipated that the turbines will site lower in the water over time, with respect to mean sea level. There are engineering requirements relating to the air gap between mean sea level and the blade tips, which if no longer met, shall require that the turbines are subject to deballasting.

Equipment to perform this task was procured during the project phase and remains available during operations. Specific considerations for completing this task shall be required due to the ballast water having a pH of 10.5. The primary consideration shall relate to the safe transfer of the water from the ballast tank to shore, and safe disposal. The process shall be managed by a robust operating procedure, the use of well-maintained and certified equipment, and the utilisation of suitably trained and competent personnel.

When deballasting is required, this shall be treated as a separate project.

## **2.4 Location of Offices**

### **2.4.1 Local Base – Peterhead**

A local office is established in Peterhead, offering office facilities for maintenance planning, preparation and reporting, as well as spares storage.

In close proximity to the offices, a dedicated quayside facility is available for the CTV from which personal can safely board the the vessel, and materials can be safely loaded/unloaded.

The facilities utilised for Hywind Scotland, are also utilised for the purposes of storing spares for the Mariner Project.

## 2.4.2 CTV Quay

Hywind has a dedicated CTV berth in Peterhead harbour, at Seagate Quay. This berth sits within the port and offers suitable protection from adverse weather conditions and therefore prevents the likelihood of damage to the vessel.



Figure 3: Hywind Scotland CTV Berth

## 2.4.3 Back Office Organisation

Back-office functions such as the follow-up of O&M activities, monitoring of asset integrity, production forecasting and following up service contracts will be shared with other Equinor wind farms within the Equinor UK wind organisation. This allows the use of existing competence and capacity.

### Control Room – Great Yarmouth

Hywind Scotland uses services from the control room that currently is established in Equinor's offices located in Great Yarmouth. This control room will handle:

- Work permit activation/deactivation
- 24/7 function – grid connection requirements
- HV switching
- Personnel and vessel tracking – marine surveillance
- Alarm and performance follow-up towards SGRE
- Monitoring and alarm handling of the WTGs (after the contract with SGRE expires)
- Monitoring turbine alarms e.g. turbine position

### Emergency Response

This shall be described in section 5 of this document.

### 3 Vessel Management Plan

#### 3.1 Operation and Maintenance Vessel

A single CTV is available 365-days a year in Peterhead, for 12-hours a day to support operations and maintenance activities. The vessel is primarily used for transporting technicians, spares and equipment to the turbines.

Equinor is responsible for the vessel contract and shall aim to have a vessel that maximises the opportunity to access site.

#### 3.2 Adhoc Vessels

During operations at Hywind Scotland, there shall be a requirement to contract vessels on an in-frequent or adhoc basis. The activities that require the use of vessels less frequently are as follows:

- Subsea Survey – to fulfil the requirements for inspecting the substructure, mooring systems and cable systems, a suitably equipped and sized vessel shall be required;
- Major Component Exchange – vessels suitably equipped and sized shall be required to electrically and structurally disconnect turbines, and to tow them to a suitable location for major component exchange; and

As per the requirements of Equinor's management system, all vessel operators and vessels shall be subject to regular audits and inspections. This shall be to ensure, as a minimum, adherence to local and international requirements, as well as operating according to safe systems of work.

### 4 Navigational Safety Plan

Mariners and aircraft will be made aware of Hywind Scotland through navigational lights and markings. Furthermore, Equinor will ensure that local mariners, fishermen's organisations, UK Hydrographic Office ("UKHO") and the HM Coastguard (National Maritime Operation Centre) are made fully aware of site-specific details above and below water through local Notice to Mariners and other means as appropriate. The site will also be charted on the Kingfisher Information Service – Offshore Renewable & Cable Awareness project (KIS-ORCA).

The Hywind turbines differ from traditional bottom fixed wind turbines with its floating concept and floating power cables running from the turbines down to the seabed. This was communicated to local users of the Buchan Deep Area.

#### 4.1 Notice to Mariners

During periods of ad hoc work, a notice to mariners will be issued to notify other sea users of the planned works. The scenarios that will require a notice to mariners to be issued are as follows:

- Subsea Surveys;
- Turbine black; and
- Major Component Exchange.

The Notice to Mariners shall provide suitable detail and notice so as to reduce the likelihood of incidents.

When completing significant scope of work, HM Coastguard will be asked to support by issuing MSI notifications.

#### **4.2 Notice to Airmen**

Notice to Airmen (NOTAM) will be needed when there is an occurrence that poses an increased risk to other uses of the air space above Hywind Scotland.

The main scenarios that will require a NOTAM to be issued are as follows:

- Blade Inspections.
- Turbine black
- Main component exchange / towing.

The NOTAM will provide suitable detail and notice so as to reduce the likelihood of incidents.

### **3 Environmental Management Plan – EMP**

As a company, Equinor has a clear goal to ensure sustainable development and is committed to minimising environmental impacts. The Equinor management system is fully compatible with recognised environmental management standards, including ISO 14001. Furthermore, our contractors are required to meet the ISO 14001 standard. A commitment register including all commitments made during the Environmental Impact Assessment phase was included in the Environmental Statement, supplemented by requirements given in the marine licence.

Equinor will ensure that all vessels and their crew are made aware of and are required to adhere to the Scottish Marine Wildlife Watching Code. Equinor will also ensure that all vessels involved in the installation works adhere to relevant IMO guidance on ballast water and transfer of non-native marine species (ref. MGN 81, Guidelines for the Control and Management of Ship's Ballast Water to Minimise the Transfer of Harmful Aquatic Organisms and Pathogens).

Equinor do have internal waste handling procedures which all projects and contractors have to adhere to. These requirements build on a strategy where priority is on avoiding waste generation. Where waste generation cannot be avoided, technical and operational measures, including separation, collection, and disposal solutions for different classes of waste, shall be implemented to optimise the reuse, material recycling or energy recovery of the waste. Waste shall be stored and transported in such a way that accidental releases are prevented.

In the Hywind Scotland Pilot Park Project no waste generation issues are foreseen, and vessels involved are expected to primarily bring any household waste or other waste to their home port for disposal. Should there be a need to bring any waste ashore in Scotland, this will be done in consultation with SEPA, and only licenced carriers will be used to handle any waste.

Equinor will be responsible for following up environmental management during operation. For specific environmental monitoring it is referred to the Environmental Management Plan (EMP).

## 5 Emergency Response and HSE Incidents

Equinor have a well-established companywide system for emergency response upon which a specific emergency response and reporting procedures will be established also for Hywind Scotland, as well as a stringent safety management system.

Equinor uses SYNERGI for recording and reporting any incidents, and our contractors are required to use this system as well. If any serious health and safety incidents occurs on the site, Equinor shall report this to the Health and Safety Executive as well as notify Marine Scotland within 24 hours of the incident occurring. Further details on the emergency response and reporting of HSE incidents during operation, will be given in the separate ERCoP, and is not included in this document.

An ERCoP has been prepared for Hywind Scotland to ensure that the emergency services have a clear overview of the equipment installed, the resources available to support the response to an Emergency / HSE Incident, and so that Equinor personnel also responding to an Emergency / Incident understand the support that can be offered by the MCA.

Pre-determined Defined Situations of Hazards and Accidents (DSHAs) have been identified for Hywind Scotland. These are documented within the Equinor Great Yarmouth Incident Management Plan (IMP). To support the IMT in dealing with an emergency situation, guidance is provided within the IMP to support the team in providing an appropriate and efficient response. Furthermore, an independent response plan has been prepared in the event of a Mooring Line Failure.

In the event of an emergency / HSE Incident, Equinor UK has the responsibility for Equinor's UK wind operations and shall also cover Hywind Scotland. There are three levels of emergency response provided within the Equinor structure:

Level 1 – Emergency Response Team (ERT) – Located at site

Level 2 – Incident Management Team (IMT) – Located at Equinor office, Great Yarmouth

Level 3 – Crisis Management Team (CMT) – Located in Norway

The levels of emergency response are defined within the IMP, including, but not limited to, the roles and responsibilities for each level. The purpose of this is to ensure that an appropriate and efficient response to any emergency / HSE incident is achieved.

## 6 Additional information

### 6.1 Definitions and abbreviations

AcoP            Approved Code of Practice

CMMS           Computerised Maintenance Management System

CMT	Crisis Management Team
CTV	Crew Transfer Vessel
DP	Dynamic Positioning
ERCoP	Emergency Response and Co-operation Plan
ERT	Emergency Response Team
FWT	Floating Wind Turbine
HSE	Health, Safety and Environment
IMP	Incident Management Plan
IMT	Incident Management Team
Km	Kilometres
MCA	Maritime and Coastguard Agency
MSOW	Maintenance, Service and Operations Warranty
MW	Mega Watt
NOTAM	Notice to Airmen
O&M	Operations & Maintenance
OMP	Operations and Maintenance Programme
SCADA	Supervisory Control and Data Acquisition
SGRE	Siemens Gamesa Renewable Energy
<a href="#">REN</a>	<a href="#">Renewable</a>
UAV	Unmanned Aerial Vehicle

## 6.2 Changes from previous version

Document updated from project phase document to an operations phase document.