

Safety and Operational Management

Haverigg II Wind Farm

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1 Introduction

1.1 Haverigg II Wind Farm

Haverigg II wind farm consists of four Wind World W4200 wind turbines, each with a rated capacity of 600kW, along with the associated access tracks, underground cabling and site substation. The turbines were installed in 1998.

The site is managed by Bridge Wind Management Ltd for the site owner, Thrive Renewables Plc. The turbines are maintained by independent wind turbine maintenance specialist, Cirrus Wind Services Ltd. The site high voltage electrical equipment is maintained and inspected by High Voltage (HV) specialist Freedom Group. The electrical equipment at the substation is the responsibility of the District Network Operator, Electricity North West, and is maintained by them along with the wider electricity distribution network.

There is no public right of access to the site or within proximity of the wind turbines. Land around the wind turbines is used for livestock grazing. Other activities take place on the site occasionally, with the landowner's permission including events associated with a motocross track.

1.2 Thrive Renewables Plc (Thrive)

Thrive was formed in 1994 with a mission to make investment in renewable energy widely accessible to the public – either directly by individuals or through likeminded institutional investors. Thanks to its 6,100 investors, Thrive has financed or built 21 wind farms and other renewable energy projects across the UK, including Haverigg II. The company take a direct interest in project operations and engages specialist contractors to manage safety, performance and longevity of its wind farms and other renewable assets.

1.3 Bridge Wind Management Ltd (BRIDGE)

BRIDGE has provided technical and asset management services to Thrive on the Haverigg II wind farm since 2012 and has been engaged by both Thrive and Windcluster (owner of the neighbouring Haverigg III wind farm) to consider and coordinate technical aspects of extending operational activities of both wind farms beyond their current respective consented planning permission.

BRIDGE is an independent, privately owned, pan European onshore and offshore wind asset manager. The group has a presence in both the UK and Germany and offers comprehensive financial, commercial and technical management. The team consists of engineers, financial professionals, IT specialists, accountants and internal legal.

BRIDGE currently provides technical, data analysis, corporate and financial services to twelve

UK onshore wind farm projects and is involved in the management of a total of over 400MW of generating capacity.

1.4 Purpose of this Document

This document provides an overview of the safety and operational management of the Haverigg II wind farm. It describes how the owner, Thrive, with the support of its appointed contractors, manages the safe and efficient operation of the turbines, and confirms that they will continue to do so.

2 Regulatory Context

2.1 Legislation and Regulation

The Haverigg II wind farm is operated in accordance with all relevant UK legislation and regulation.

The principal legislation relating to health and safety risks for onshore wind energy projects in England, Scotland and Wales is the *Health and Safety at Work etc. Act* (HASWA) 1974. It sets out general health and safety duties, without being specific to an industry sector.

The HASWA makes those who create risks in the course of work activity, for example employers, workers or those in control of premises, responsible for protecting workers and the public from the consequences of their activities. It also established the Health and Safety Executive (HSE) as the regulator and a system for more prescriptive regulations to be made to address specific activities and hazards. The Lifting Operations and Lifting Equipment Regulations 1998 (LOLER), which address lifting (work involving cranes, hoists etc) are an example of such regulations applicable to wind farms.

Such regulations are supported by Approved Codes of Practice (ACoPs), which provide further guidance on how to comply with regulatory requirements. For example, LOLER is supported by the *Safe Use of Lifting Equipment ACoP*.

In addition, industry-specific regulation on electricity generating, transmission and distribution equipment, the *Electricity Safety, Quality and Continuity Regulations* (ESQCR) 2002, is applicable to wind farms. These cover technical and reporting requirements on the safety of electrical equipment and place duties on the generator (wind farm owner) and on Distribution Network Operators, including periodic inspection of networks and provision of approved warning signage.

As a result of the above, a range of safety measures are applied at the wind farm by Thrive and BRIDGE, to comply with specific requirements set out in regulation and to fulfil their broader health and safety duties. These include

- Risk assessing the site and all work to be carried out;
- Regular inspection and maintenance (further detailed in Section 3.2 below);
- Ensuring all contractors engaged to work at the site are competent and adequately resourced to carry out their work;
- Putting plans in place to manage emergencies; and
- Displaying suitable warning signage and emergency contact information at the site.

2.2 Planning

The Haverigg II wind farm was granted planning consent by the Local Planning Authority in November 1995.

The consent does not contain any conditions which relate directly to the safe operation of the scheme, as this is properly addressed by the above legislation and regulation. However, it does stipulate a time limit of 25 years from first operation of the site, or November 2022, whichever is the earlier, which the site owner is now applying to vary. It also requires that any turbine that does not generate electricity for a continuous period of 6 months must be removed. This provides assurance that the turbines are not permitted to be left in an unserviceable condition for an extended period.

3 Site Operation and Maintenance

3.1 Wind World W4200 Wind Turbine

The turbines were supplied by Danish wind turbine manufacturer, Wind World A/S. The company was taken over by NEG Micon A/S in 1999 which subsequently became part of global wind turbine manufacturer, Vestas Wind Systems A/S in 2004. Whilst the Haverigg II turbines are the only Wind World turbines operating in the UK today, there is an extensive fleet across Europe, including over 40 turbines of the same model operating in Denmark. The longest running of these were installed in 1996. Previous Wind World models built as early as 1987 also remain in service in Denmark. Other Wind World turbines of the same age previously installed in the UK have been replaced with larger machines and the original turbines removed for refurbishment and re-use elsewhere.

The turbine design is characterised by a simple and robust construction, typical of wind turbines of this period, and based on the manufacturer's many years of experience with marine engines and heavy industry. It consists of:

- a conical tubular steel tower on a concrete foundation;
- gearbox, generator and other ancillary equipment in a nacelle with a steel base frame and glass fibre casing;
- 3 bladed upwind rotor (glass fibre blades and steel hub and blade extenders);
- control equipment; and
- a transformer, located in the tower base.

The turbine control system provides for automatic operation, monitors a range of parameters

to ensure safe operation (vibration, temperatures, hydraulic system pressure etc.), and shuts the turbine down in a safe manner should a fault occur. The wind turbines are equipped with a SCADA system that sends alerts to the operator when faults occur and allows access to various operational data and parameters.

The turbine is stall regulated. When the turbine requires to shut down, braking is achieved by blade tip aerodynamic brakes and a mechanical brake on the high-speed shaft.

3.2 Routine Inspection and Maintenance

Wind Turbines

The wind turbines are maintained by Cirrus Wind Services Ltd (Cirrus) in accordance with the Original Equipment Manufacturer's instructions. These set out a programme of one minor and one major maintenance each year, approximately 6 months apart. The maintenance includes a wide range of checks including (but not limited to):

- Visual checks of all major components
- Oil sampling and filter changes
- Lubrication
- Bolt tightness checks
- Electrical and control system checks
- Operational and safety system checks (yaw, emergency stop, brakes etc.)

BRIDGE also carries out periodic internal and external visual inspections of the turbines on behalf of Thrive, to confirm they remain in suitable condition.

Where any of the above checks indicate the turbines or equipment are not in the desired condition, repairs are carried out.

Statutory Inspections

Certain safety related equipment is subject to routine inspections defined by regulation. Such inspections are carried out by competent specialists. They include annual statutory inspections of anchor points, ladder fall arrest systems and emergency equipment (e.g. fire extinguisher, rescue kits).

High Voltage Equipment

All high voltage electrical equipment at the site, including the turbine transformers, is inspected on a six-monthly basis and more in-depth maintenance carried out every four years.

Other Site Infrastructure

Other site infrastructure such as gates, access tracks, signage and the substation building are routinely inspected by BRIDGE in its role as asset manager, typically 4 times per year.

Schedule

The site inspection and maintenance schedule is managed and monitored by BRIDGE to ensure that all necessary activities are carried out. A typical annual schedule is set out in Figure 1 below. Actual dates are defined and adjusted as necessary to allow for weather conditions and other non-routine activities at site.

Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Turbine Annual Service								■	■			
Turbine Semi-Annual Service		■	■									
Statutory Inspections										■		
Transformer Oil Sampling				■								
HV 6 Monthly Inspection				■						■		
HV 4 Yearly Maintenance				2021								
Site Manager Inspections		■			■			■			■	

Figure 1: Typical Planned Inspection and Maintenance Schedule

BRIDGE and Thrive work with Thrive’s other appointed contractors to follow industry good practice, ensuring that the routine maintenance programme and the scope of each maintenance activity carried out remains suitable and up to date.

3.3 Site Monitoring

As noted above, the wind turbines are equipped with a SCADA system that sends alerts to the operator should a fault occur and allows access to various operational data and parameters. The SCADA system will safely stop a turbine automatically for certain fault codes, allowing any anomaly to be properly investigated before the turbine is restarted.

As well as monitoring for alerts, the SCADA system is checked for correct operation four times per day. Faults are investigated by the operator remotely and either reset, where it is safe to do so, or a maintenance team dispatched to site to carry out further checks and repairs.

BRIDGE monitors turbine performance based on data from the SCADA and reports monthly to the owner, Thrive. Any issues identified are investigated and corrective actions progressed

where necessary.

A 24-hour control room provides additional ad hoc monitoring, manages safe access and egress to the site and co-ordinates an emergency response should it be required at any time of day or night.

In addition to the automatic and remote site monitoring arrangements, Thrive has a local site representative appointed who lives nearby and visits the site frequently. A part of their contracted role is to visually and aurally check turbine operations, reporting anything unusual to the site managers.

3.4 Non-Routine Maintenance

Should a fault be identified through routine inspections, maintenance or monitoring, action is taken to resolve it.

In the case of wind turbine faults, repairs are normally carried out by the turbine maintenance contractor, Cirrus. Additional specialist services are sourced where required, for example for glass fibre repairs to blades. Repairs to high voltage equipment are carried out by the owner's appointed HV contractor, Freedom Group. Repairs to other infrastructure such as tracks and buildings are procured from competent contractors on a case by case basis, using local providers where possible.

Any fault or issue considered to have a safety implication is prioritised and addressed as soon as reasonably practicable. Thrive has suitable arrangements in place with its turbine maintenance and HV contractors to ensure a prompt response.

Other repairs are scheduled according to contractor availability and may be undertaken alongside planned maintenance visits or in suitable weather windows. BRIDGE, as site manager, maintains records of all maintenance actions, to ensure they are closed out.

3.5 Additional Specialist Advice

In addition to the routine inspection and maintenance activities set out in Section 3.2, the wind farm owner commissioned detailed independent inspections of the wind turbines to inform its decision to consider extending operations. The inspections were carried out by energy and renewables industry specialist DNV GL between June and September 2019. They found the turbines to be in a broadly acceptable condition for their age and identified areas where action was required to assure the future ongoing operation. Thrive, supported by BRIDGE and Cirrus, is progressing the necessary actions.

Actions completed since the inspection include replacement of cable fixings in the turbine basements. Actions that are currently being planned include further inspection of a turbine rotor to properly assess areas of corrosion on the turbine hub and subsequently recoat the

affected areas.

Thrive will continue to engage specialist advice where this adds value to the normal maintenance regime or is deemed necessary to fulfil its safety obligations. This could, for instance, involve further detailed one-off inspections or additional analysis.

4 Summary

As a responsible owner, Thrive ensures that the Haverigg II wind farm is operated in accordance with all relevant UK legislation and regulation and the planning conditions applied when it was consented.

Thrive engages competent contractors to manage the site, monitor performance and carry out routine, reactive and proactive maintenance. Where necessary, it brings in third-party specialists to carry out inspections required by regulation or statute, make specialist repairs and provide additional advice.

Maintenance and inspection schedules and corrective actions are monitored by BRIDGE, as Thrive's appointed asset manager to ensure they are closed out.

The proper operational management of the site ensures it operates and can continue to operate safely and efficiently.

5 References

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