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MORGAN OFFSHORE WIND PROJECTS: GENERATION ASSETS

Preliminary Environmental Information Report

Volume 4, annex 17.2: Climate change risk assessment technical report

Image of an offshore wind farm

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Prepared by:

RPS

Prepared for:

Morgan Offshore Wind Ltd.

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Acronyms

Acronym	Description
AfL	Agreement for Lease
BEIS	Department for Business, Energy and Industrial Strategy
CCRA	Climate Change Risk Assessment
CEA	Cumulative Effect Assessment
IPCC	Intergovernmental Panel on Climate Change
MHWS	Mean High Water Springs
PEIR	Preliminary Environmental Information Report
RCP	Representative Concentration Pathway

Units

Unit	Description
%	Percentage
km^2	Square kilometres
ºC	Degrees Celsius
m/s	Meters per second
Nm	Nautical miles

1 CLIMATE CHANGE RISK ASSESSMENT TECHNICAL REPORT

1.1 Overview

1.1.1.1 This Climate change risk assessment (CCRA) technical report assesses the potential significant effects of the Morgan Offshore Wind Project Generation Assets (hereafter referred to as the Morgan Generation Assets) in line with the UK's guidance on climate change risk assessments. The report will inform the assessment of climate change impacts reported in volume 2, chapter 17: Climate change of the Preliminary Environmental Information Report (PEIR).

1.2 Project description

1.2.1.1 For the purpose of the Climate Change Risk Assessment (CCRA), the Morgan Offshore Wind Project Generation Assets includes the offshore infrastructure, such as the wind turbines, offshore substation platforms, inter-array and inter-connector cables and will have a capacity of over 1,500MW.

1.2.1.2 The Morgan Array Area covers approximately 322.2km^2 and is located in the east Irish Sea, 58.8km (31.7nm) from the Anglesey coastline, 36.3km (19.6nm) from the northwest coast of England, and 22.3km (12nm) from the Isle of Man (when measured from Mean High Water Springs (MHWS)). The offshore infrastructure, such as the wind turbines, offshore substation platforms, inter-array and inter-connector cables will be located within the Agreement for Lease (AfL) area and is referred to as the Morgan Array Area throughout the PEIR.

1.3 Methodology

1.3.1.1 The scope of the CCRA is defined in accordance with the Climate Change Committee (2021) recommendations. This report considers the climate-related physical risks to identify the current and anticipated risks facing the Morgan Generation Assets throughout its 35 year project lifetime. This technical report evaluates the processes utilised for managing the risks through four key stages:

1. An assessment of the baseline climate to understand present-day vulnerability and assess current climate-related risks, opportunities and levels of adaptation
2. An assessment of future offshore climate projections, to understand future vulnerability and adaptation for England
3. Identify vulnerability of project components to climate change and undertake an assessment of their likelihood and severity
4. Review potential adaption and mitigation options.

1.4 Policy context

1.4.1 The Paris Agreement

1.4.1.1 The Paris agreement came into force on 4 November 2016 and has been adopted by 196 Parties, including the United Kingdom. The overarching aim of the agreement is to set long term goals to guide nations in substantially reducing global greenhouse gas emissions to limit the global temperature increase to 2 degrees Celsius, while pursuing efforts to limit the increase to 1.5 degrees (UN, 2015).

1.4.2 Climate Change Act 2008

1.4.2.1 The Climate Change Act 2008 sets a target for the year 2050 for the reduction of targeted greenhouse gas emissions, whilst providing for a system of carbon budgeting. The Committee on Climate Change was also established under the Act, alongside the requirement for the UK Government to publish a CCRA every five years to assess the risks for the UK from the current and predicted impacts of climate change.

1.5 Baseline climate

1.5.1.1 To understand the impact of the Morgan Generation Assets on climate change, the baseline environment must be considered. The Morgan Generation Assets is located in the east Irish Sea and necessitates the consideration of the offshore climate.

1.5.1.2 Baseline offshore climate conditions have been sourced from observational data collated within the UK Offshore Energy Strategic Environmental Assessment (BEIS, 2022) and Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Reporting of the physical science (IPCC, 2021).

1.5.2 Offshore baseline

1.5.2.1 Mean temperatures range from lows of 7°C in January to 14°C in July, with surface air temperatures exceeding sea surface temperatures during the spring and summer months and falling below sea surface temperatures during the autumn and winter months (BEIS, 2022).

1.5.2.2 Precipitation generally falls 18 days per month during the winter, and 10-15 days per month during the summer. Rainfall intensity and duration varies greatly from day to day (BEIS, 2022).

1.5.2.3 High wind speeds can be expected at the Morgan Generation Assets due to the lack of obstructions (both man-made and natural) in open water. Wind conditions are generally westerly and south-westerly throughout the year. During the winter, winds occasionally exceed 14m/s (with 20% probability) in the Irish Sea to the east of the Isle of Man. During the summer the chance of these higher wind speeds drops to 2% chance (BEIS, 2022).

1.5.2.4 Mean sea level (MSL) is a crucial element of climate change related risks for wind farms – global MSL rose by 0.2m between 1901 and 2018, and continue to rise (IPCC, 2021). The North West coast of England has been identified as high risk of coastal flooding (GOV.UK, 2022).

1.6 Offshore climate projections

1.6.1.1 Probabilistic local climate projections consistent with those referenced above and used to illustrate future possible onshore climate trends are not available for offshore regions. As such, the results of marine climate projections detailed within the UKCP18 Marine Report (Palmer et al. 2018) and interrogated within the UK Climate Risk

Independent Assessment (CCRA3), Chapter 4: Infrastructure (Jaroszweski et al. 2021) have been used to examine future trends for wind speed, wave height and sea levels. The projections are based on Representative Concentration Pathway (RCP) 8.5, with data largely available for the end of the 21st Century. Whilst this is outside of the initial lifetime of the Morgan Generation Assets, these projections display climate trends that will begin to be felt throughout this century.

1.6.1.2 The RCP scenarios (four scenarios presented in the IPCC fifth Assessment report which are included within the UKCP18 database) describe different climatic futures, all of which are considered possible depending on the volume of GHG emitted. These provide the basis for future assessments of climate change and possible response strategies, thereby giving a low-high range in potential global GHG reduction initiatives and resulting rate of climatic effects over a given time period.

1.6.1.3 It is virtually certain that sea surface temperatures will continue to increase in the 21st Century, with global mean sea surface temperatures predicted to increase by approximately 2.9°C by 2100 under RCP8.5. It is anticipated that the north Atlantic will warm at a slower rate in comparison to other oceans (IPCC, 2021).

1.6.1.4 The average wave height is predicted to decrease around much of the UK at a factor of about 10% to 20% over the 21st Century, with average wave heights in the Irish Sea decreasing by approximately 0.1m. However, maximum wave heights in the Irish Sea are anticipated to increase, with projections showing a change in elevation of the height of maximum waves of up to 2m to the end of the century.

1.6.1.5 Given the close relationship between wave heights and wind speeds, average changes in wind speed are predicted to follow similar patterns to those predicted for average wave height, with a reduction in average wind speeds projected for the west and southwest of Ireland. Changes in maximum wind speeds associated with storm surges vary regionally, with changes in the order of +/- 1.5m/s. However, there is little consensus between models regarding the extent and pattern of such winds in relation to climate change (Palmer et al. 2018). As such, conservatively an increase in maximum wind speed should be anticipated.

1.6.1.6 Global MSL will continue to rise throughout the 21st Century, a change that is projected within all future climate change scenarios. Under RCP8.5, the UK can expect to see sea level rise of approximately 1m by 2100. This change is regionally variable, with a lesser impact anticipated in the north of the UK. The northwest coastline can expect to see a MSL rise of approximately 0.6m by 2100 (Palmer et al. 2018).

1.7 Climate risk and resilience scoping

1.7.1.1 Based on the information available for the Morgan Generation Assets, a high-level risk assessment has been undertaken, considering the hazard, potential severity of effect on the development and its users, probability of that effect, and level of influence the development design can have on the risk. The severity of effect score considers the potential consequences of the hazard and the sensitivity of the receptor(s) affected. Each element of the risk assessment has been scored on a scale of one to three, representing low, medium or high; the scores are then summed to give a total risk score. Table 1.1 defines each of these terms.

1.7.1.2 Given the variability in the nature of the potential effects of climate change on the development, receptors have been identified on a risk-specific basis, whereby all receptors relate to the continued safe and effective operation of the Morgan Generation Assets. In line with IEMA (2020) guidance, the vulnerability and susceptibility have been considered in determining the severity of risk.

1.7.1.3 A combined risk score of five or more of the elements listed in Table 1.1 has been defined as a risk that could lead to a significant effect on the development, prior to mitigation, as this is the minimum score where at least two elements of the risk assessment score are above 'one'. This is presented in the column significance before mitigation.

1.7.1.1 By considering the measures adopted as part of the Morgan Generation Assets (primary mitigation), professional judgement is used in determining whether the potentially significant effects would result in significant adverse or beneficial effects, or non-significant negligible effects in EIA terms. This is demonstrated in the 'significant after mitigation' column.

Table 1.1: Severity, probability and influence factor definitions.

* A combined risk score of five or more of the elements has been defined as a risk that could lead to a significant effect on the development

Factor	Score definitions
Severity: the magnitude and likely consequences of the impact should it occur.	**1 =** unknown or low impact: for example, low-cost and easily repaired property damage; small changes in occupiers' behaviour.
	2 = moderate impacts with greater disruption and/or costs
	3 = severe impact, (e.g. risk to individual life or public health, widespread property damage or disruption to business)
Probability: reflects both the range of possibility of climatic parameter changes illustrated in CP18 projections and the probability that the possible changes would cause the impact being considered	**1 =** unknown or low probability of impact; impact would occur only at the extremes of possible change illustrated in projections
	2 = moderate probability of impact, plausible in the central range of possible change illustrated in projections
	3 = high probability of impact, likely even with the smaller changes illustrated as possible in the projections
Influence: the degree to which design of the proposed development can affect the severity or probability of impacts	**1 =** no or minimal potential to influence, outside control of developer, (e.g. reliance on national measures or individuals' attitudes/actions; or hypothetical measures would be impracticable)
	2 = moderate potential to influence, (e.g. a mixture of design and user behaviour or local and national factors; measures may have higher costs or practicability challenges)
	3 = strong potential to influence through measures that are within the control of the developer and straightforward to implement

1.7.1.2 Table 1.2 shows the climate change risks to the Morgan Generation Assets that have been identified prior to any mitigation and the risk scores assigned, following the approach set out in Table 1.1. Risks associated with the Morgan Generation Assets have been identified as necessary and appropriate mitigation detailed to accordingly reduce the risk to an acceptable level and mitigate a potential significant effect.

Table 1.2: Risk scores for Morgan Offshore Wind Project Generation Assets.

Risk Offshore	Potential Consequences	Severity	Probability	Influence	Total Score	Significant before mitigation	Mitigation	Significant after mitigation
Increases in average and extreme temperatures, both in winter and summer.	• Heating/overheating of turbine mechanisms may result in failure of electrical equipment and gear boxes. • Heating/overheating may inhibit power infrastructure performance and export. • Expansion of turbine materials leading to degradation. • Operating conditions could be impacted, leading to a shut down of turbines resulting in decreased electricity generation.	2	2	2	6	Yes, adverse	Safety margin within the turbine design to be fitted with automatic shutdowns/lockdowns with regards to spinning too fast	No
Increase in sea surface temperatures and ocean acidification	• Increased temperatures and ocean acidification may lead to accelerated corrosion of submerged structures, including export cables.	1	2	2	5	Yes, adverse	Application of anti-corrosion protective coatings.	No
Changes to rainfall patterns, leading to increased annual precipitation.	• Increased wear and tear resulting in erosion and degradation of blade surfaces, increasing drag and thereby decreasing energy production.	1	1	2	4	No	Regular inspections be carried out to assess turbine condition.	No
Increased frequency and intensity of extreme weather (i.e. storms)	• Increased wear and tear of mechanical systems from high wind speeds. • Damage to turbines from fatigue and erosion as a result of the impact force of rain and hail. Results in degradation of blade surfaces, increasing drag and thereby decreasing energy production. • Increased loading from ice build up.	2	1	2	5	Yes, adverse	Turbines to be fitted with automatic shutdowns/lockdowns with regards to spinning too fast from storms.	No
Increased wind speeds and changes to wind patterns.	• Increased occurrence of wind speeds beyond the cut-off point of the turbines leading to a more frequent shut down of turbines • Increased wear and tear of mechanical systems from high wind speeds.	1	1	2	4	No	Regular inspection routine. Turbines to be fitted with automatic shutdowns/lockdowns with regards to spinning too fast from storms.	No
Increase in mean sea level	• Additional loading on turbine structure, resulting in structural stress and additional corrosion.	1	2	1	4	No	Application of anti-corrosion protective coatings.	No
Increased wave height	• Degradation of turbine structures and foundations due to additional loading. • Degradation to turbine foundations and undersea cabling due to scour from sediment transfer. Failure at cable joints may also result.	1	1	2	4	No	Regular inspection routine. Integrated scour protection.	No
Changes in the tidal range	• Degradation to turbine foundations and undersea cabling due to scour from sediment transfer. Failure at cable joints may also result.	1	1	1	3	No	Integrated scour protection.	No

1.7.1.3 When considering the proposed mitigation within the above Table 1.2 the potential risk posed to the Morgan Generation Assets would be reduced to an acceptable and non-significant level.

1.8 References

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