

# MORGAN OFFSHORE WIND PROJECT GENERATION ASSETS

## Greenhouse Gas (GHG) Reduction Strategy

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**MORGAN OFFSHORE WIND PROJECT GENERATION ASSETS**

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### Glossary

Term	Definition
Applicant	Morgan Offshore Wind Limited.
Avoided emissions	The greenhouse gas emissions that have been 'avoided' by using a specific product or service, comparing it to a situation where the product or service had not been used.
Climate change	A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.
CO <sub>2</sub> e	'carbon dioxide equivalent.' Used to measure and compare emissions from greenhouse gases based on how severely they contribute to global warming.
Emissions	An amount of a substance that is produced and sent out into the air that is harmful to the environment, especially carbon dioxide.
Greenhouse Gas (GHG)	A gas that absorbs and emits radiant energy within the thermal infrared range, causing the greenhouse effect. Examples include carbon dioxide and methane.
Life Cycle Assessment	The systematic analysis of the potential environmental impacts of products or services during their entire life cycle.
Marginal generation	The generation source that will be the first to be shut off when energy demand reduces.
Morgan Offshore Wind Project: Generation Assets	This is the name given to the Morgan Generation Assets project as a whole (includes all infrastructure and activities associated with the project construction, operations and maintenance, and decommissioning).
National Policy Statement(s)	The current national policy statements published by the Department for Energy Security and Net Zero in 2023 and adopted in 2024.
Net zero	A target of completely negating the amount of greenhouse gases produced by human activity either worldwide or by a country or organisation, to be achieved by reducing emissions and implementing methods of absorbing carbon dioxide from the atmosphere.
Renewable energy	Energy from a source that is not depleted when used, such as wind or solar power.

### Acronyms

Acronym	Description
CO <sub>2</sub>	Carbon Dioxide
CO <sub>2</sub> e	Carbon Dioxide equivalent
DCO	Development Consent Order
DESNZ	Department for Energy Security and Net Zero
EPD	Environmental Product Declaration
GHG	Greenhouse Gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change

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Acronym	Description
LCA	Life Cycle Assessment
NPS	National Policy Statements
OSP	Offshore Substation Platform
PCFs	Product Carbon Footprints
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute
WTG	Wind turbine generator

## Units

Unit	Description
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> e	carbon dioxide equivalent
km	Kilometres
kg	Kilograms
kWh	Kilowatt Hours
m <sup>2</sup>	Meters squared
MW	Megawatts
MWh	Megawatt Hours
g	Grams
t	Tonnes
knots/hr	Knots per hour

# 1 Greenhouse Gas Reduction Strategy

## 1.1 Introduction

1.1.1.1 This Greenhouse Gas (GHG) Reduction Strategy is prepared for the Morgan Offshore Wind Project: Generation Assets (hereafter referred to as the ‘Morgan Generation Assets’).

1.1.1.2 This document provides a strategy to minimise emissions in line with the requirements of National Policy Statement (NPS) EN1 (DESNZ, 2023). It sets out how whole life carbon emissions will be managed and reduced to ensure that best practice is followed.

### 1.1.1 Project overview

1.1.1.1 Morgan Offshore Wind Limited (‘the Applicant’), a joint venture between bp Alternative Energy Investments Ltd. (bp) and Energie Baden-Württemberg AG (EnBW), is developing the Morgan Generation Assets, a proposed wind farm in the east Irish Sea.

1.1.1.2 The Applicant is seeking a single consent for the Morgan Generation Assets, which will be connected to the grid by the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (subject to a separate consent).

1.1.1.3 This GHG Reduction Strategy has been developed for the Morgan Generation Assets, the key components of which include the following:

- offshore wind turbine generators (WTGs);
- offshore substation platforms (OSP);
- scour protection;
- inter-array cables; and
- interconnector cables.

1.1.1.4 The Morgan Generation Assets intend to be fully operational by 2030. Therefore, it is likely that all elements of the Morgan Generation Assets will need to be completed by this time.

1.1.1.5 Details of the activities and infrastructure associated with the Morgan Generation Assets are set out in Volume 1, Chapter 3: Project description (APP-010).

### 1.1.2 Purpose of the GHG Reduction Strategy

1.1.2.1 This document sets out a strategy to minimise its emissions in line with the requirements of the NPS EN 1 (DESNZ, 2023) which states:

*‘Steps taken to minimise and offset emissions should be set out in a GHG Reduction Strategy, secured under the Development Consent Order. The GHG Reduction Strategy should consider the creation and preservation of carbon stores and sinks including through woodland creation, hedgerow*

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*creation and restoration, peatland restoration and through other natural habitats*. [Paragraphs 5.3.6 – 5.3.7 of NPS EN-1]

- 1.1.2.2 This Strategy should be read in conjunction with Volume 2, Chapter 12: Climate change (APP-016) as supporting information.
- 1.1.2.3 Volume 2, Chapter 12: Climate change (APP-016) details the commitment to exploring options to reduce construction related emissions as further mitigation associated with the impact of emissions arising from the manufacture and installation of the Morgan Generation Assets. This document supports this commitment, providing a strategy to minimise emissions where reasonably practicable, setting out how whole life carbon emissions will be managed and reduced to ensure that best practice is followed.
- 1.1.2.4 This Strategy will inform the design evolution, procurement processes and decisions throughout the Morgan Generation Assets' life cycle in order to minimise emissions, where reasonably practicable. The Strategy is a framework for exploring viable emission reduction opportunities throughout the design process.

## 1.2 Emissions assessment

- 1.2.1.1 As part of the Environmental Statement, an assessment of emissions associated with the construction, operation and maintenance, and decommissioning stages of the Morgan Generation Assets has been completed and reported within Volume 2, Chapter 12: Climate Change (APP016).
- 1.2.1.2 Morgan Generation Assets will be offshore energy infrastructure constructed to generate renewable energy, contributing to:
- the United Kingdom (UK) Government's ambition to deliver 50 GW of offshore wind by 2030;
  - delivering much needed investment and securing construction and operations jobs in the UK;
  - securing our energy supply; and
  - the UK's response to the climate change crisis.
- 1.2.1.3 Therefore, the gross GHG emissions total is dominated by avoided emissions associated with the displacement of projected marginal generation of the UK Grid. Given the nature of the Project it is not anticipated that offsets would be significant considerations. Remaining emissions arise from embodied carbon emissions associated largely with the construction stage, which will be focused on within this GHG Reduction Strategy.
- 1.2.1.4 This GHG Reduction Strategy considers the emissions reported within the Environmental Statement, and outlines possible emission reduction measures. Focus will be placed on elements that contribute the greatest amount to project emissions.
- 1.2.1.5 The renewable energy generated by the Morgan Generation Assets will be delivered to the National Grid via the Transmission Assets (consented separately, see Volume 1, Chapter 1: Introduction and overarching glossary

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(APP-008) for further details). Given their purpose, the Morgan Generation Assets would never operate in isolation. As such, the cumulative impacts of the Morgan Generation Assets with the Transmission Assets on the global atmospheric mass of carbon dioxide (CO<sub>2</sub>) have been considered within section 12.13 of Volume 2, Chapter 12: Climate change (APP-016).

### 1.3 Scope

- 1.3.1.1 The GHGs considered in this GHG Reduction Strategy are those in the 'Kyoto basket' of global warming gases expressed as their CO<sub>2</sub>-equivalent (CO<sub>2e</sub>) global warming potential (GWP), listed within Annex A of the Kyoto Protocol (an international treaty to limit and reduce GHGs). This is denoted by CO<sub>2e</sub> units in emissions factors and calculation results. GWPs used are typically the 100-year factors in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (IPCC, 2013) or as otherwise defined for national reporting under the United Nations Framework Convention on Climate Change.
- 1.3.1.2 The GHG Reduction Strategy illustrates the design considerations made by the Applicant to date to reduce GHG emissions, along with further potential opportunities which can be considered through the next stages of the Morgan Generation Assets lifecycle.



## **2 Guidance and standards**

### **2.1 Overview**

2.1.1.1 The following standards and guidance have been used to inform the preparation of this GHG Reduction Strategy:

- PAS 2080 – Carbon Management in Buildings and Infrastructure (BSI, 2023);
- Institute of Environmental Management and Assessment (IEMA) Guide: Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2022).

### **2.1.2 PAS 2080**

2.1.2.1 There are multiple technical requirements in the PAS 2080:2023 technical standard when considering GHG reduction in infrastructure projects. Key considerations including:

- following the PAS 2080 carbon reduction hierarchy;
- implementing a carbon management process to help an organisation meet the requirements of PAS 2080 when delivering assets and/or programmes of work;
- quantifying, assessing and reporting a scheme’s carbon emissions to inform scheme development and overall asset management;
- engaging with other value chain members, as early as possible, in a collaborative way to identify whole life low carbon solutions, including the selection of relevant low carbon materials and products, innovative design solutions and construction methods;
- defining the specific carbon management actions to be undertaken, and the key strategies and approaches to implement the culture and behaviour changes necessary for delivering carbon reduction, specifically:
  - collaborative working across the value chain;
  - implementing the carbon reduction hierarchy when identifying potential opportunities to reduce carbon; and
  - raising major carbon challenges to design development and construction planning, where key carbon risks are identified.

2.1.2.2 This GHG Reduction Strategy follows a data collection and analysis methodology which adheres to the requirements of the PAS 2080 standard. The Strategy assesses carbon use for the whole lifecycle of the project and promotes embodied carbon management and aspirations to achieving carbon reductions.

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### **2.1.3 IEMA guidance on greenhouse gas emissions and evaluating their significance**

- 2.1.3.1 The ability to effect change to achieve GHG emissions reduction for the project naturally reduces over time. This makes it important that the emissions reduction measures are considered from the outset or at the earliest practical point.
- 2.1.3.2 The need to ensure that GHG mitigation measures are implemented does not end at the pre-application Environmental Impact Assessment (EIA) stage, but extends after consent has been granted for the proposed project, in addition to throughout the project lifetime.
- 2.1.3.3 The IEMA GHG Management Hierarchy provides a structure set out as eliminate, reduce, substitute and compensate.

## 3 Calculated emissions

### 3.1 Overview

- 3.1.1.1 An assessment of emissions associated with the Morgan Generation Assets has been completed and reported within Volume 2, Chapter 12: Climate (APP-016), considering a maximum design scenario that represents a conservative assessment of associated emissions. The assessment therefore likely presents an overestimate of emissions associated with the construction, operation and maintenance, and decommissioning of the Morgan Generation Assets. Such emissions represent a business-as-usual scenario with no emissions reduction measures.
- 3.1.1.2 GHG emissions caused by an activity are often categorised into ‘scope 1’, ‘scope 2’ or ‘scope 3’ emissions, following the guidance of the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) Greenhouse Gas Protocol suite of guidance documents (WRI and WBCSD, 2004) where:
- Scope 1 emissions: direct GHG emissions from sources owned or controlled by the Applicant, e.g., from combustion of fuel at an installation.
  - Scope 2 emissions: caused indirectly by consumption of purchased energy, e.g., from generating electricity supplied through the national grid to an installation.
  - Scope 3 emissions: all other indirect emissions occurring as a consequence of the activities of the Applicant, e.g., in the upstream extraction, processing and transport of materials consumed or the use of sold products or services.
- 3.1.1.3 Emissions associated with the construction, operation and maintenance, and decommissioning phases are detailed within sections 3.2, 3.3, and 3.4 below. Each stage of a project can be attributed to the following life cycle analysis (LCA) stages, which have been referenced throughout the sections below:
- Materials and construction: LCA stages A1-A5;
  - Operation and maintenance: LCA stages B1-B5; and
  - Decommissioning: LCA stages C1-C4.
- 3.1.1.4 As the Morgan Generation Assets are currently in the relatively early stages of design and development, data related to specific metrics for site-specific design details (including chosen manufacturer of wind turbines, offshore substations and cable designs) are currently unavailable. As such, emissions associated with the Morgan Generation Assets have been calculated via a range of methodologies, including published material carbon intensities and LCA literature, and the application of material or fuel emission intensities to material or fuel quantities. Detailed methodology for the assessment of emissions resulting from the Morgan Generation Assets can be found within Volume 4, Annex 12.1: Greenhouse gas assessment (APP-046).

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### 3.2 Construction

3.2.1.1 The maximum estimated GHG emissions anticipated to arise from the consumption of materials and fuels to construct the Morgan Generation Assets are presented in Table 3.1. These values are presented in Volume 4, Annex 12.1 (APP-046) and Volume 2, Chapter 12 (APP-016). Additional details on the data, calculations and methodology can be sought from both documents.

**Table 3.1: Estimated construction stage Morgan Generation Assets GHG emissions**

LCA Stage	Item	Morgan Generation Assets emissions (tCO <sub>2</sub> e)	Percentage contribution to construction-stage emissions for the Morgan Generation Assets
A1-A5	Wind turbines (blades and tower)	591,343	31%
	Wind turbines (foundations)	1,067,040	55%
	OSP (topsides)	49,400	3%
	OSP (foundations)	59,280	3%
	Inter-array cables	24,741	1%
	Interconnector cables	11,419	<1%
	Scour and cable protection	60,849	3%
	Substations (transformers)	9,662	<1%
	Vessel and helicopter movements	53,718	3%
	<b>Total</b>	<b>1,927,452</b>	

3.2.1.2 Emissions arising from embodied carbon associated with the materials used to construct the Morgan Generation Assets have been assessed to comprise the majority of construction stage GHG emissions. Emissions resulting from the use of fuel (i.e., from helicopter and vessel movements) have also been assessed as a contribution to construction phase emissions.

3.2.1.3 Specifically, emissions associated with the following items comprise the largest contributors to construction stage emissions:

- wind turbine foundations, and their towers and blades, comprise the largest contributors to construction stage emissions, totalling 55% (foundations) and 31% (towers and blades), respectively.
- Emissions arising from the remaining elements of the Morgan Generation Assets (i.e. OSP topsides and foundations, inter-array cables, interconnector cables scour and cable protection, substations, vessel and helicopter movements) total 14% of construction stage emissions.

3.2.1.4 These elements are the key emission sources that should be focused on when looking to implement GHG reductions, as these have the greatest potential to

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impact construction phase emissions. Reduction opportunities are further outlined within section 4.

- 3.2.1.5 The impact of the construction of the Morgan Generation Assets on the existing sea bed has also been addressed within Volume 2, Chapter 12: Climate change (APP-016). This accounts for the offshore habitat and sea bed change within the Morgan Array Area associated with the installation of WTGs, OSPs and offshore cables. It is not considered that the benthic habitat and sea bed is a significant carbon store, further it is anticipated that the decommissioning process will restore the existing baseline habitat. Therefore, the quantity of change in tCO<sub>2e</sub> owing to sea bed change across the Morgan Generation Assets' whole life is considered to be negligible. As such, emissions arising from changing land use have not been considered further.

### 3.3 Operation and maintenance

- 3.3.1.1 The maximum estimated GHG emissions that are anticipated to arise from the replacement and maintenance of materials and consumption of fuels throughout the operational lifetime of the Morgan Generation Assets (which has been assumed to be 35 years for the purpose of the climate change assessment) are presented in Table 3.2. These values are presented in Volume 4, Annex 12.1: Technical greenhouse gas assessment (APP-046) and Volume 2, Chapter 12: Climate change (APP-016). Additional details on the data, calculations and methodology can be sought from both documents.

**Table 3.2: Estimated operation and maintenance stage Morgan Generation Assets GHG emissions**

LCA Stage	Item	Morgan Generation Assets emissions (tCO <sub>2e</sub> )	Percentage contribution to O&M-stage emissions for the Morgan Generation Assets
B1-B5	OSP electrical plant replacement	9,855	10%
	Inter-array cable material replacement	6,090	6%
	Interconnector cable material replacement	41,101	42%
	Offshore transport	18,212	18%
	Third Party Route Deviation	23,736	24%
	Land use change	Negligible	n/a
	<b>Total</b>	<b>98,995</b>	

- 3.3.1.2 The majority of emissions associated with the operation of the Morgan Generation Assets can be attributed to those associated with material replacement of infrastructure elements, totalling 58% of operational emissions. This can be broken down into those associated with interconnector cables, OSP electrical plant, and inter-array cables, totalling 42%, 10% and 6% respectively. As such, these material replacements over the duration of the

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Morgan Generation Assets' lifetime are key emissions sources that should be focused on when looking to implement GHG reductions.

3.3.1.3 Emissions arising from fuel use by offshore transport movements have been assessed to comprise 18% of operation and maintenance stage GHG emissions arising from the Morgan Generation Assets.

3.3.1.4 The operation of Morgan Generation Assets would result in an indirect increase in emissions attributed to the deviation of ferry and cargo vessels. It has been calculated that such route deviations would result in 23,736 tCO<sub>2e</sub> over the Morgan Generation Assets' lifetime. Given such emissions are outside of the Applicants' control, they are unable to have a direct impact on reduction measures associated with such emissions. Therefore, emissions reduction opportunities focus on those arising from material and fuel consumption arising from maintenance activities.

3.3.1.5 Emissions reduction measures are detailed within section 4, and are closely linked to those detailed for the construction phase given the similarity in emissions sources.

### 3.4 Decommissioning

3.4.1.1 The maximum estimated GHG emissions anticipated to arise from the decommissioning stage of the Morgan Generation Assets are presented in Table 3.3.

3.4.1.2 Volume 2, Chapter 12: Climate change (APP-016) states that throughout the decommissioning process it is anticipated that the existing baseline environment, which is not currently believed to be a significant carbon store, would be restored.

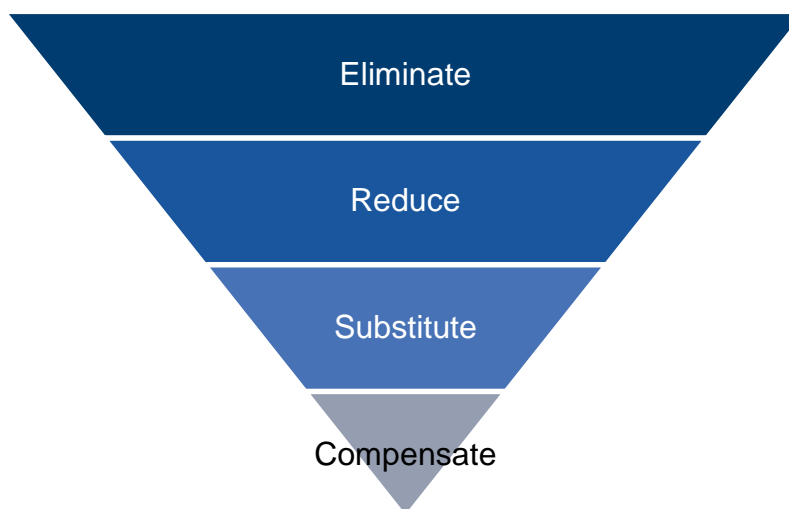
**Table 3.3: Estimated decommissioning stage Morgan Generation Assets GHG emissions**

LCA Stage	Item	Morgan Generation Assets emissions (tCO <sub>2e</sub> )	Percentage contribution to decommissioning-stage emissions for the Morgan Generation Assets
C1-C4	Vessel and traffic movements	53,718	100%
	Land use (sea bed) change	Negligible	n/a
	<b>Total</b>	<b>53,718</b>	

## 4 Reduction opportunities

### 4.1 Overview

4.1.1.1 As outlined in section 2.1.3, GHG reduction opportunities identified in Figure 4.1 follow the GHG management hierarchy (i.e., eliminate, reduce, substitute, and compensate). Priority should be given to emissions removal, followed by carbon and energy reductions (through the optimisation of project design), and then to substitution measures (through the procurement of low carbon products and engaging with supplies with a low carbon footprint). Finally, having considered and implemented the above steps, compensation (i.e. offsetting) is recommended as a final point of emissions reduction.



**Figure 4.1: IEMA and PAS 2080 GHG Management Hierarchy**

4.1.1.2 The GHG reduction opportunities identified within the following sections can be applied largely to both the construction, and operation and maintenance phases of the Morgan Generation Assets, with some also applicable to the decommissioning phase. To avoid repetition, the GHG reduction opportunities have not been separated into those applicable to each phase.

### 4.1.2 Measures incorporated into the Project Design

4.1.2.1 To date, the Applicant has undertaken preliminary work which seeks to minimise GHG emissions, as far as practicable. Measures which have been incorporated into the design to avoid or prevent GHG emissions include the routing of the inter-array and interconnector cables to ensure they are as short as feasible within reasonable endeavours through the array area, which thereby reduces the associated materials required and subsequent GHG emissions.

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### 4.2 Carbon reduction hierarchy

4.2.1.1 Emissions are mitigated by applying the carbon reduction hierarchy set out above in section 4.1. Those opportunities at the top of the hierarchy have a greater potential to reduce emissions and are prioritised where practicable. The following reduction opportunities will be considered through subsequent stages of the project lifecycle, where feasible and practicable, with the aim of reducing emissions associated with the Morgan Generation Assets.

#### 4.2.2 Eliminate

4.2.2.1 Explore alternative lower carbon options to deliver the project objectives, as part of the series of measures outlined in section 4.1.

#### 4.2.3 Reduce / substitute

4.2.3.1 Where practicable, the project teams will be offered carbon management training, covering the carbon management principles. Such training would raise awareness and engagement within project design teams, upskilling and empowering team members to seek carbon reductions during project design and procurement.

4.2.3.2 Apply low carbon solutions (including technologies, materials, and products) to minimise resource consumption during the construction, operation, decommissioning phases of the Morgan Generation Assets, such as integrated scour protection to offshore equipment where this is considered necessary and appropriate.

4.2.3.3 Seek to procure materials locally, where possible, to minimise transportation emissions.

4.2.3.4 Construct efficiently using techniques (e.g., during construction and operation) that reduce resource consumption over the life cycle of the project.

4.2.3.5 Circular economy considerations would be explored during detailed design stage. Opportunities for potential re-use and recycling of all material assets and waste will be promoted and material use will be managed in order to maximise the re-use of materials associated with the Morgan Generation Assets.

4.2.3.6 Vessel movements will be managed through the Vessel Traffic Management Plan (which was submitted in Outline and the latest version is REP2-017), which has the potential to keep emissions as low as possible.

#### 4.2.4 Compensate

4.2.4.1 As outlined in paragraph 4.1.1.1, offsetting (or compensating) is recommended as a final point of emissions reduction following the implementation of all other measures to reduce absolute emissions arising from the construction, operation and maintenance, and decommissioning of the Morgan Generation Assets, as outlined above.

4.2.4.2 The Morgan Generation Assets generates renewable energy and contributes to national electricity decarbonisation. By facilitating the expansion of



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renewable energy supply, the Morgan Generation Assets would assist the UK Government target of achieving a fully decarbonisation power system by 2035 and aim to become net zero by 2050.

- 4.2.4.3 The assessment of emissions arising from the Morgan Generation Assets, (see Volume 2, Chapter 12: Climate change (APP-016) identifies that the magnitude of calculated avoided emissions over the life-time of the Morgan Generation Assets results in significant avoided emissions, which exceed emissions arising from the construction, operation and maintenance, and decommissioning of the Morgan Generation Assets.

## **5 Summary**

- 5.1.1.1 The climate change assessment presented within Volume 2, Chapter 12: Climate change (APP-016) and supporting technical reports has detailed the initial quantification of GHG emissions associated with the early design considerations of the Morgan Generation Assets.
- 5.1.1.2 As detailed in paragraphs 1.1.2.3 - 1.1.2.4, this GHG Reduction Strategy is a framework for exploring viable emission reduction opportunities during the design evolution process. As such, the project would continue to explore opportunities in line with this Strategy to maximise reduction opportunities where reasonably practicable.

## **6 REFERENCES**

British Standards Institution (2023) PAS 2080 – Carbon Management in Buildings and Infrastructure.

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