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14 Climate Change

14.1 Introduction

- 14.1.1 This chapter assesses the potential for likely significant environmental effects of the Project on the climate during the Construction, Operation and Decommissioning Phases of the Project. It also considers the impact of Climate Change on the Project and on Receptors in the surrounding environment as identified by the relevant technical disciplines in this PEIR.
- 14.1.2 In line with the requirements of the Infrastructure Planning (EIA) Regulations 2017, consideration has been given to the following aspects in this Climate Change assessment:
- **Lifecycle greenhouse gas (GHG) impact assessment** – the impact of GHG emissions arising over the Construction, Operational and Decommissioning Phases of the Project on the climate (Section 5(2)(c) and Schedule 4(4) and (5) of the EIA Regulations);
 - **Climate Change Risk Assessment (CCRA)** – the resilience of the Project to projected future Climate Change impacts, including damage to the Project resulting from Climate Change (Section 5(2)(c) of the EIA Regulations); and
 - **In-combination Climate Change Impact assessment (ICCI)** – An In-combination Climate Change Impact (ICCI) assessment identifies how the resilience of Receptors in the surrounding environment are affected by the combined impact of future climate conditions and the Project (Section 5(2) of the EIA Regulations). The Receptors have been identified by the relevant technical disciplines in this PEIR and include Receptors such as soil resources.
- 14.1.3 Cumulative effects (methodology set out in Chapter 2: Environmental Impact Assessment Methodology), which consider the combined effects of the Project with other Committed Developments (as defined in Chapter 18: Cumulative Effects) are distinct from the ICCI presented in this chapter.
- 14.1.4 An overview of relevant legislation and policy is included within Appendix 14-1.

14.1.5 A Climate Change Risk Assessment is presented at Appendix 14-2.

14.2 Baseline Conditions

Greenhouse Gas Emissions

Existing Baseline

14.2.1 The baseline condition for the lifecycle GHG assessment is a 'business as usual' scenario where the Project does not go ahead. The current land use within the PEIR Boundary and the local area consists predominately of grassland mainly used for grazing. The abundance of vegetation within the PEIR Boundary suggests the current land use may operate as a carbon sink. The current land use has relatively low levels of associated GHG emissions in the context of the overall emissions in the wider area as it is largely grassland used for grazing. Baseline agricultural GHG emissions are dependent on types of soil and vegetation present, fuel use for the operation of vehicles and machinery, and other inputs such as fertiliser and pesticide use.

14.2.2 Agricultural emissions displaced from the Project are not considered, as landowners will be able to continue grazing during the Operational Phase, should that align with their farm management plans. It is expected that there would be a slight reduction in GHG emissions associated with the lower intensity of grazing during the Project's operation, when compared to the baseline. However, under a worst-case scenario it is assumed that there would be no change in GHG emissions during operation. Furthermore, it is assumed that at the end of the Project's operating life, the land would revert to the pre-existing land use. The net lifetime land use change impact from the Project will therefore be negligible and not material to the overall assessment.

Future Baseline

14.2.3 The future baseline comprises existing carbon stock and sources of GHG emissions resulting from the existing activities within the PEIR Boundary as well as the existing emissions from the generation of grid electricity if the Project does not go ahead. GHG emissions associated with land use change within the PEIR Boundary (e.g., agricultural activity and carbon sequestration from vegetation) are expected to be minor. Therefore, for the purpose of the GHG assessment, GHG

emissions associated with land use change are considered zero in the future baseline. Given this, the future baseline, a 'Do nothing' scenario where the Project is not built, is compared against a scenario where the Project is delivered, with GHG impacts arising from the construction (including the embodied material carbon) and operation.

- 14.2.4 The contribution from renewable electricity projects such as the Project can only support ongoing grid decarbonisation if they displace existing higher carbon generating capacity. While recognising that National Policy Statement EN-1 requires all new combustion power stations with a capacity over 300MW to be constructed Carbon Capture Ready, the current marginal generating capacity (i.e. the generating technology that responds to changes in grid electricity demand) is provided by existing unabated, gas-fired combined cycle gas turbine (CCGT) power stations. As it is almost invariably CCGTs that provide dispatchable generation capacity, it is reasonable to assume that every kWh of electrical energy provided by a new renewable installation such as the Project is a kWh that does not have to be generated by an existing CCGT. On this basis, the GHG assessment assumes the emissions associated with the operation of existing combined CCGT capacity as the do-nothing counterfactual case for electricity generation.

Climate Change Resilience and Adaptation (CCRA) and In-combination Climate Change Impacts (ICCI)

Existing Baseline

- 14.2.5 The existing baseline condition is the historic and current climate as defined in terms of temperature, rainfall and other climatic factors. Historic climatic factors from the nearest climate station to the PEIR Boundary (Valley, Isle of Anglesey) for the 30-year baseline period of 1981 to 2010 (Ref 14-16) have been recorded and used to inform the baseline. The Met Office dataset covering 1981 to 2010 (Ref 14-16) provides the most relevant historic climate averages presented in a 30-year time slice. This dataset establishes the existing baseline and allows for comparison with the pre-defined 30-year periods in UKCP18, which serve as future baselines. The baseline data are presented in Table 14-1 Historic climatic data (1981 - 2010) at the nearest climate station (Valley, Isle of Anglesey) below.

Future Baseline

- 14.2.6 The future baseline is expected to differ from the present-day baseline described above. UK Climate Projections 2018 (UKCP18) (Ref 14-17) data provides probabilistic Climate Change projections for pre-defined 30-year periods for annual, seasonal and monthly changes to mean climatic conditions over the 25 km grid square within which the PEIR Boundary is located. For the purpose of the assessments in this PEIR chapter, UKCP18 probabilistic projections for pre-defined 30-year periods for the following average climate variables have been obtained:
- Mean annual temperature
 - Mean summer temperature
 - Mean winter temperature
 - Maximum summer temperature
 - Minimum winter temperature
 - Mean annual precipitation
 - Mean summer precipitation
 - Mean winter precipitation
 - Extreme weather events e.g. heat waves, storm surges etc.
- 14.2.7 Projected data is displayed in Table 14-1 below. These figures are expressed as temperature/ precipitation anomalies in relation to the 1981 to 2010 baseline as defined in Met Office dataset (Ref 14-16).
- 14.2.8 UKCP18 uses a wide range of possible scenarios, classified as Representative Concentration Pathways (RCPs), to inform differing future emission trends. These RCPs “... *specify the concentrations of greenhouse gases that will result in total radiative forcing increasing by a target amount by 2100, relative to preindustrial levels.*” RCP8.5 has been used for the purposes of this assessment as a worst-case trajectory adopted by the Intergovernmental Panel on Climate Change (IPCC) that is considered to be the high-emissions global scenario with the greatest concentration of GHGs in the atmosphere.
- 14.2.9 As the proposed Operational Phase of the Project is 60 years, the CCRA has considered a scenario that reflects a high level of GHG emissions at the 10th,

50th, and 90th percentile levels to assess the impact of Climate Change up to 2099.

14.2.10 Construction risks are assessed against the 2010 to 2039 UKCP18 projection data, while operation and decommissioning are assessed against 2040 to 2099 UKCP18 projection data as a conservative worst-case scenario.

Table 14-1 Historic climatic data (1981 - 2010) at the nearest climate station (Valley, Isle of Anglesey)

Climate Variable	Baseline (1981-2010)	Climate Change Projection (2010-2039)	Climate Change Projection (2040-2069)	Climate Change Projection (2070-2099)	Projected Change in Likelihood	Climate Projection Source
Temperature						
Mean annual maximum daily temperature (°C)	13.21	0.6 (+0.2 to +1.1)	1.5 (+0.7 to +2.3)	3 (+1.5 to +4.4)	↑	UK Met Office (Ref 14-16), UKCP18 RCP 8.5 (Ref 14-17)
Mean summer maximum daily temp (°C)	18.23	0.8 (+0.2 to +1.5)	1.9 (+0.5 to +3.3)	4.2 (+1.6 to +6.8)	↑	
Mean winter minimum daily temp (°C)	3.51	0.6 (-0.1 to +1.3)	1.5 (+0.4 to +2.8)	2.8 (+1.4 to +4.9)	↑	
Number of days of air frost per annum	20.3	Reports have shown that the number of frost air and ground frost days have decreased since the 1960s. These long-term trends, combined with detailed studies, point to a long-term warming trend of the UK's climate and a reduction in cold events.			↓	
Highest temperature for baseline period (°C)	18.83 July	-	-	-	-	
Lowest temperature for baseline period (°C)	3.03 February	-	-	-	-	
Rainfall						
Mean annual rainfall levels (mm)	841.09	2.02% (-3.2 to +7.3%)	0.22% (-6.8 to +7.3%)	2.29% (-8.3 to +12.7%)	↑	UK Met Office (Ref 14-16), UKCP18 RCP 8.5 (Ref 14-17)
Mean summer rainfall (mm)	59.14	-2.84% (-16.3 to +10.9%)	-14.13% (-34.1 to +5.0%)	-30.13% (-52.9 to -5.0%)	↓	
Mean winter rainfall (mm)	73.64	3.14% (-4.5 to +11.3%)	8.31% (-2.9 to +21.5%)	16.82% (-1.4 to +38.4%)	↑	
Wettest month on average (mm)	103.53 November	-	-	-	-	
Driest month on average (mm)	48.36 May	-	-	-	-	

Climate Variable	Baseline (1981-2010)	Climate Change Projection (2010-2039)	Climate Change Projection (2040-2069)	Climate Change Projection (2070-2099)	Projected Change in Likelihood	Climate Projection Source
Other						
Mean monthly wind speed at 10m (knots)	12.19	The Met Office has projected an increase in near surface wind speeds over the UK for the second half of the 21st century for the winter season when more significant impacts of wind are experienced. However, the increase in wind speeds is modest compared to natural variability from month to month and season to season, so confidence is low.			-	UK Met Office (Ref 14-16)
Storms	The UKCP18 model suggest a small contribution from storm surges, however it is unclear if the frequency and severity of future storm surges is going to change. Although, rising sea levels due to climate change are expected to worsen the impacts of storm surges.				↑	UKCP18 RCP 8.5 (Ref 14-17)
Heatwaves	Under a high emissions scenario, it is estimated that by the end of the 21st Century, all areas of the UK are projected to be warmer with hotter, drier summers and heatwaves likely to become more common and intense.				↑	
Wildfires	Think Hazard has classified the wildfire hazard in Gwynedd classified as Medium, according to currently available information.					Think Hazard (Ref 14-18)

Assessment Methodology

Greenhouse Gas (GHG) Emissions

Assessment Scope

14.2.11 A GHG impact assessment is scoped in and covers emissions from all aspects of the Project, from raw materials and manufacture of components, through to construction, operation and maintenance, and decommissioning.

Guidance

14.2.12 The IEMA Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) (Ref 14-5) has been used to inform the baseline and assessment methodology.

Overview

14.2.13 The GHG assessment assesses the potential for adverse impacts on the global climate through emissions generated by the Project and the potential for beneficial impacts from any net carbon reductions achieved by the Project.

Assessment Approach

14.2.14 The Receptor for the GHG assessment is the global climate. The GHG assessment has followed a project lifecycle approach to calculate estimated GHG

emissions arising from the Construction, Operation and Decommissioning Phases of the Project to identify GHG 'hot spots' (i.e., emissions sources likely to generate the largest amount of GHG emissions). This enables the identification of priority areas for Mitigation in line with the principles set out in IEMA guidance (Ref 14-5).

14.2.15 In line with the World Business Council for Sustainable Development and World Resources Institute GHG Protocol guidelines (Ref 14-1), the GHG assessment has been reported as tonnes of carbon dioxide equivalent (tCO_{2e}) and has considered the six Kyoto Protocol gases:

- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous oxide (N₂O)
- Sulphur hexafluoride (SF₆)
- Hydrofluorocarbons (HFCs); and
- Perfluorocarbons (PFCs)

14.2.16 Expected GHG emissions arising from the construction activities (including embodied carbon in materials), operational and maintenance, and decommissioning activities for the Project, as well as baseline emissions, have been quantified using a calculation-based methodology as per the following equation, and aligned with the GHG Protocol:

$$\text{Activity data} \times \text{GHG emissions factor} = \text{GHG emissions}$$

14.2.17 Embodied carbon data from the Inventory of Carbon and Energy V3.0 (ICE) (Ref 14-2), Environmental Product Declarations (EPD) Library (Ref 14-3), Department for Energy Security and Net Zero (DESNZ, formally BEIS/DEFRA) (2024) Conversion Factors Database (Ref 14-4) have been used as the main data sources for calculating GHG emissions.

14.2.18 The UK carbon budgets (Ref 14-6, Ref 14-8 and Ref 14-9) are currently only available to 2037 (6th Carbon Budget). Where further carbon budgets are not available (7th, 8th and 9th Carbon Budget periods), the sectoral budgets for electricity generation have been projected by the Climate Change Committee

(CCC) for the Balanced Net-Zero Pathway (Ref 14-10). Totals for these periods have not yet been approved or ratified, and are not therefore legally-binding, but such indicative figures can provide valuable context at this stage.

14.2.19 GHG emissions from the Project have been put into context by comparing them with a likely alternative source of electricity generation. The assessment has therefore measured any savings in GHG emissions due to the generation of the electricity via PV Arrays relative to emissions generated from CCGT as the counterfactual case.

Study Area

14.2.20 The Study Areas for the assessment are:

- All direct GHG emissions arising from activities undertaken within the PEIR Boundary during the Construction, Operation and maintenance, and Decommissioning Phases of the Project;
- Indirect emissions embedded within the construction materials arising as a result of the energy used for their production, as well as emissions arising from the transportation of materials, waste and construction workers; and
- Activities that may be avoided or displaced as a result of the Project such as other grid electricity generation activities.

14.2.21 In accordance with the IEMA Guidance, all impacts of GHG emissions on the global atmosphere are inherently cumulative, so there is no basis to assess the Cumulative effects of GHG emissions of multiple projects within a particular geographic area. Therefore, the Cumulative effects assessment will not be carried out for climate change (note that this differs to ICCI which considers the impact of climate change on Receptors in-combination with impacts in other technical disciplines).

Determining Significance of Effect

14.2.22 For the purposes of this assessment, it has been considered that any increases in GHG emissions compared to the baseline has the potential to have an impact, due to the high sensitivity of the Receptor (global climate) to increases in GHG emissions. This is in line with the IEMA guidance (Ref 14-5), which states that the combined environmental effect of GHG is environmental degradation, and that

this degradation is reaching a defined limit. Therefore, any GHG emissions or reductions from a project might be considered to be significant.

- 14.2.23 The IEMA guidance describes five distinct levels of significance which are not solely based on whether a project emits GHG emissions alone, but how the Project makes a relative contribution towards achieving a science-based 1.5°C aligned transition towards Net Zero.
- 14.2.24 Table 14-2 presents the different significance levels as per the latest version of the IEMA guidance (Ref 14-5), which emphasises that “...*a project that follows a ‘business-as-usual’ or ‘do minimum’ approach and is not compatible with the UK’s net zero trajectory, or accepted aligned practice or area-based transition targets, results in a significant adverse effect. It is down to the practitioner to differentiate between the ‘level’ of significant adverse effects e.g. ‘moderate’ or ‘major’ adverse effects.*”

Table 14-2 Definition of levels of significance

Significance level	Effect	Description in the IEMA guidance	Example in the IEMA guidance
Significant	Major adverse	<p>A project that follows a 'business-as-usual' or 'do minimum' approach and is not compatible with the UK's Net Zero trajectory or accepted aligned practice or area-based transition targets, results in a significant adverse effect.</p> <p>It is down to the practitioner to differentiate between the 'level' of significant adverse effects; e.g., 'moderate' or 'major' adverse effects.</p>	<p>The project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards Net Zero.</p>
	Moderate adverse		<p>The project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards Net Zero.</p>
Not significant	Minor adverse	<p>A project that is compatible with the budgeted, science based 1.5°C trajectory (in terms of rate of emissions reduction) and which complies with up-to-date policy and 'good practice' reduction measures to achieve a minor adverse effect that is not significant.</p> <p>It may have residual emissions but is doing enough to align with and contribute to the relevant transition scenario, keeping the UK on track towards Net Zero by 2050 with at least a 78%</p>	<p>The project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards Net Zero.</p>

Significance level	Effect	Description in the IEMA guidance	Example in the IEMA guidance
	Negligible	<p>reduction by 2035 and thereby potentially avoiding significant adverse effects.</p> <p>A project that achieves emissions Mitigation that goes substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy compatible with that trajectory, and has minimal residual emissions, is assessed as having a negligible effect that is not significant. This project is playing a part in achieving the rate of transition required by nationally set policy commitments.</p>	<p>The project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or Net Zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards Net Zero and has minimal residual emissions.</p>
Significant	Beneficial	<p>A project that causes GHG emissions to be avoided or removed from the atmosphere. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect.</p>	<p>The project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds Net Zero requirements with a positive climate impact.</p>

- 14.2.25 While all new GHG emissions contribute to a negative environmental impact, some projects will replace existing developments or baseline activity that has a higher GHG impact. The significance of a project's emissions should therefore be based on its net impact over its lifetime, which may be positive, negative or negligible, considering its contribution to reduce GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050.
- 14.2.26 Net GHG emissions from the Project have been assessed through comparison with likely alternative sources of electricity generation if the Project is not built. As detailed in Paragraph 14.2.4, the assessment therefore has sought to quantify any emissions reduction due to the displacement of fossil fuel power generation, specifically existing unabated CCGT, as this currently provides the UK's marginal generating capacity. This is the generating capacity that must be replaced with low-carbon alternatives for the UK to achieve its net zero target. CCGT generating electricity have a representative carbon intensity of 354 gCO_{2e}/kWh (Ref 14-14).
- 14.2.27 New established renewable energy generation would displace the need for electricity production from existing CCGT power plants. Compared to a 'do nothing' scenario where the Project does not go ahead, the Project's operational electricity generation in MWh would displace electricity that would otherwise need to be generated by an existing CCGT power plant. The associated reduction in emissions can be quantified by multiplying the lifetime generation in MWh by a representative carbon intensity for an existing CCGT.
- 14.2.28 The level of significance associated with the GHG impact of a project is to be contextualised and assigned through the professional judgement of the appropriate practitioner in accordance with the IEMA guidance. The GHG impacts of the Project have been put into context on the UK's five-year carbon budgets (Table 14-3), which set legally binding targets for GHG emissions. GHG impacts have been put into context for the sub-sectoral budgets for electricity generation (Table 14-4).

Table 14-3 UK Carbon Budgets and indicative carbon budgets

Carbon budget	UK Carbon Budget (MtCO ₂ e)	Indicative Carbon Budget totals based upon the CCC's Balanced Net Zero Pathway (MtCO ₂ e)
3 rd (2018–2022)	2,544	-
4 th (2023–2027)	1,950	-
5 th (2028–2032)	1,725	-
6 th (2033–2037)	965	-
7 th (2038–2042)	-	526
8 th (2043–2047)	-	195
9 th (2048–2050)	-	17

Table 14-4 Sector specific electricity generation carbon budgets based upon the CCC's Balanced Net Zero Pathway

Carbon budget period	Recommended Carbon Budget (MtCO ₂ e)
2020–2022	105.45
2023–2027	189.16
2028–2032	92.56
2033–2037	35.74
2038–2042	23.22
2043–2047	12.36
2048–2050	4.03

Assumptions and Limitations

14.2.29 The preliminary assessment in this chapter has been based on available design information at the time of preparation as set out in Chapter 5: Project Description, the Parameter Plans (Figures 5-1 to 5-6), and analysed using the methodology outlined above. Further assessment is being undertaken as part of the EIA and will be reported in the ES to be submitted with the DCO Application. Where data were unavailable, reasonable assumptions have been made based on professional judgement, the details of which are outlined in this section.

- 14.2.30 At this stage of design, and consistent with the preliminary nature of this assessment, a fully quantified GHG impact assessment of the Project has not yet been carried out. As stated in the latest IEMA guidance (Ref 14-5), where specific activity data are currently unavailable, an alternative approach is to use publicly available information of comparable developments that best represents the Project. As detailed project specific design and material data of some of the non-major components, e.g. cabling, fencing and concrete foundations, will not be available until the design is further developed, the assessment has been based on a combination of key project specific data, and other data with a scaling factor applied. The scaling factor was generated based on the comparison of key project specific data point with the relevant data point of the from other comparable schemes being brought forward in the UK. The benchmarked schemes used within the assessment are based on the solar NSIPs submitted to the Planning Inspectorate (PINS) which have been assessed and verified by the author of this chapter.
- 14.2.31 The scaling factor was derived from the total generating capacity in MW of the benchmarked schemes. The factor was applied to model the quantities and mass of the essential construction products and materials required, where project specific information was not available. The scope of each scheme was reviewed to maintain consistency.
- 14.2.32 The largest sources of GHG emissions from the Project are likely to result from the manufacture, transport and replacement of PV panels and the Battery Energy Storage System (BESS) throughout its lifecycle. The generating capacity of the Project will be in excess of 350 MW and is currently estimated to be 360MW and the storage capacity of the BESS of the Project has been estimated as 1.6GWh. This data was used to estimate the embodied carbon for PV panels and BESS by applying relevant emission factors. The project specific products have not been confirmed and therefore, for the purposes of estimating the GHG impact of the Project, a conservative estimate has been to assume that the PV Arrays and BESS will be sourced from China (or a country of similar distance from the UK), as the country dominates global PV production and exports. This will increase the embodied and transport emissions compared to panels being sourced from

Europe. The panels will likely be procured from shorter distances with the Applicant making a commitment to procure from the EU or UK, where practicable.

- 14.2.33 The embodied carbon factors on which these figures are based, are subject to considerable uncertainty, with there being no industry-standard emissions factors for many of the parts.
- 14.2.34 There is limited data available from Environmental Product Declarations (EPDs) for PV Modules. To derive the embodied carbon emissions for PV panels, an estimation of 286 kgCO₂e/kWp was taken as an average of published EPD data from manufacturers Jinko and SunPower (see a.Ref 14-20 and a.Ref 14-21). This is inclusive of the associated accessory equipment (i.e. support, wiring, Inverters and optimisers). The estimation is based on PV Modules that would meet the requirements of the Project.
- 14.2.35 The replacement period of PV panels and BESS are estimated based on the anticipated life span of key project components as set out in Chapter 5: Project Description. The assessment of the embodied carbon of replacement materials assumes a conservative worst-case scenario. With the actual operational emissions likely to be reduced over the 60 year lifetime of the Project, no assumptions on the decarbonisation of materials' embodied carbon was applied in the GHG assessment to estimate emissions from the replacement of parts in a worst-case scenario. The latest standard published by the Royal Institution of Chartered Surveyors (RICS) (Ref 14-11) suggests an ambitious decarbonisation scenario of materials in operation stage. It is also suggested by a recent study on EPD that the embodied carbon of PV panels would be expected to come down over time (Ref 14-12).
- 14.2.36 Emissions from the transportation of construction workers assume 650 workers (based on the assumption of peak number of jobs) onsite each day, with each worker driving to the Project in their own vehicle an estimated 25km each way and 12 shuttle trips of 25km each way per day. Emissions from construction fuel and water usage have been estimated by applying the same assumption on number of workers and fuel required. Assuming 650 workers each consuming 12 litres per day, 150 litres of water required for every cubic meter of concrete used and three

cubic meters of water required for cleaning PV panels of each MWp during the Construction Phase.

- 14.2.37 Emissions from the transportation of workers during the operation phase assumes 12 workers onsite each day, with each worker driving to the Project in their own vehicle an estimated 25km each way. The DESNZ emissions factor for an average petrol car is applied (Ref 14-4). This figure is considered a conservative worst-case scenario, with the actual operational transport emissions likely to be much lower with the transition to electric vehicles (EV) combined with the ongoing decarbonisation of UK grid electricity.
- 14.2.38 Emissions from water use during the operation phase have been estimated based on 12 workers each consuming 12 litres per day and three cubic metres of water required for cleaning PV panels of each MWp per year. This is also a conservative assumption, as the carbon intensity of water supply is expected to fall over time due to improving technologies. Visits from other, non-permanent staff are not considered to have a material effect on emissions due to their limited expected frequency. The latest DESNZ emissions factor of water supply is applied (Ref 14-4). Emissions from energy use during operation phase have been estimated based on the projection of emission factor of grid electricity. The latest DESNZ grid projection emissions factor is applied (Ref 14-13).
- 14.2.39 Sulphur hexafluoride (SF₆) is an extremely powerful GHG with a global warming potential (GWP) of 23,900. Fugitive emissions of SF₆ from certain electrical items such as gas-insulated Switchgears have historically been a significant source of emissions. Manufacturers of such equipment are now increasingly able to offer SF₆-free components, and those components that do continue to use SF₆ are sealed-for-life units with extremely low leakage rates. While sealed-of-life units are becoming more commonly available, the Applicant cannot guarantee that they will be applied across the Project. A full assessment of the full impact of SF₆ leakage will be carried out based on data provided by the Applicant and presented in the ES. It is not anticipated that this will have material impact on overall lifecycle emission and significance of the Project.

- 14.2.40 Operation of the Project relies on a suitable grid connection to allow electricity generated to be exported to the National Electricity Transmission System. The phasing of the Project is currently being developed in response to evolving technical requirements including, but not limited to, Grid Connection timescales. The Project could be delivered in up to two phases. Under a two-stage schedule, which represents a worst-case position for this assessment, 240 MW of grid connection will be available for Project in 2028, with a further 120 MW becoming available in 2037. The final programme will be described in detail in the ES.
- 14.2.41 Under this scenario, there would be no change to the embodied emissions associated with the construction and operation of the Project, relative to a single-phase construction, but overall lifetime generation emissions may be lower, with consequent implications on the net overall benefit of operating the Project instead of sourcing the power generated from an existing unabated CCGT. The GHG assessment to be included in the ES will take into account delivering the Project in up to two phases.
- 14.2.42 The land within the Project would be returned to the landowners control and use in accordance with a Decommissioning Environmental Management Plan (DEMP). The DEMP will be subject to the approval of the local planning authority, the IoACC. Emissions from the decommissioning process at the end of the Operational Phase are very difficult to estimate due to the uncertainty surrounding decommissioning methodologies and approaches so far in the future. It has been assumed in the PEIR that the weight and quantity of material waste for decommissioning will be equivalent to or less than the amount required for construction. The latest DESNZ emission factor for waste is applied (Ref 14-4). This is considered to be a worst-case scenario, as future developments in methodologies and technological advances are likely to reduce the carbon impact of decommissioning.
- 14.2.43 For this assessment, a worst-case scenario has been assumed that decommissioning emissions from the use of plant, worker travel, water and wastewater consumption would be set at 100% of the corresponding emissions during the Construction Phase. Emissions from the disposal and recovery of

materials at the end of the Project's design life have been estimated based on an assumption that all materials will be going to landfill. This is a worst-case, conservative estimate as it is expected that a proportion of materials will be recycled. As the economy decarbonises over the coming years in line with national policy, emissions from sources such as worker transport and waste disposal are anticipated to be lower. Therefore, this is very likely to be an estimate which overestimates emissions during the Decommissioning Phase of the Project.

- 14.2.44 The IEMA guidance (Ref 14-5) states that a comparable baseline must be used as a reference point against which the impact of a new project can be assessed, which may be "*GHG emissions arising from an alternative project design for a project of this type*". Currently, marginal load-following generation capacity is generally provided by existing unabated CCGT. One of the benefits of any renewable electricity scheme is to displace the use of fossil fuelled power sources. It is reasonable to assume that as additional renewable energy generation capacity becomes available, such as from developments like the Project, it will reduce demand for the marginal generator, i.e., directly displace the use of existing CCGT. As stated in Paragraph 14.2.4, the GHG assessment has used the operational emissions of an existing CCGT as the future baseline.

Climate Change Resilience and Adaptation (CCRA) and In-combination Climate Change Impacts (ICCI)

Assessment Scope

- 14.2.45 The CCRA considers the vulnerability of the Project to extreme weather events and changes in temperature, precipitation and wind patterns. The ICCI assessment identifies the impact of the Project, in combination with climatic changes, on Receptors identified by other environmental disciplines.
- 14.2.46 As agreed by PINS in their Scoping Opinion (Appendix 2-2), sea level rise is scoped out as the Project is not in an area susceptible to sea level rise based on the Flood Risk Assessment Wales Map.

Guidance

- 14.2.47 The IEMA Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) (Ref 14-5) has been used to inform the baseline and assessment methodology.

Overview

- 14.2.48 The climate assessment comprises elements of assessment with different Receptors:
- CCRA: potential effects on the Project as a result of climate change; and
 - ICCI: the effect of climate change on the effects assessed within the other technical assessments (e.g. the consideration of increased flood risk due to climate change within the Water Resources assessment).
- 14.2.49 Climate parameters to be considered in the CCRA and ICCI during the Construction, Operation and Decommissioning Phases of the Project include the following:
- Extreme weather events
 - Wind
 - Temperature change; and
 - Precipitation change (frequency and magnitude of precipitation events and droughts).
- 14.2.50 The assessment has considered Climate Projections over a 60-year period from the Project's commissioning.
- 14.2.51 The current baseline has been established by understanding the historic/current climate in the location of the Project by reviewing historic climate data obtained from the Met Office website (Ref 14-16). The climate baseline has been developed using historic Met Office data obtained from the meteorological station closest to the PEIR Boundary (Valley, Isle of Anglesey), located approximately 15km to the southwest.
- 14.2.52 The future baseline has been established using UKCP18. UKCP18 data for the 25km grid cell where the Project is located have been used to examine future climate parameters. This climate projection data provides a probabilistic indication of how global climate change is likely to affect the location of the Project using defined climate variables and time periods.

Climate Change Resilience and Adaptation (CCRA)

- 14.2.53 A detailed assessment of climate change projections has been conducted for the PEIR Boundary. The CCRA review qualitatively assesses the Project's resilience to climate change considering climate parameters based on UKCP 18 projections. This has been completed by considering the climate change projections for the geographical location and timeframe of the Project phases. The CCRA review identifies potential climate change impacts and considers the potential consequence and likelihood of occurrence of the impacts, taking account of the measures incorporated into the design of the Project.
- 14.2.54 The Receptor for the CCRA is the Project itself, including workers and infrastructure, throughout its Construction, Operation and maintenance, and Decommissioning Phases.
- 14.2.55 The CCRA includes all infrastructure and assets associated with the Project. It covers resilience against both gradual climate change, and the risks associated with an increased frequency of extreme weather events as per the UKCP18 projections.
- 14.2.56 The review of potential impacts and the Project's vulnerability considers the embedded Mitigation measures that have been designed into the Project, and is discussed in Paragraphs 14.4.26 to 14.4.34.

In-combination Climate Change Impacts (ICCI)

- 14.2.57 The Receptors for ICCI are Receptors within the surrounding environment that will be impacted by the Project in combination with future climatic conditions. Baseline conditions for the ICCI assessment are the future climatic conditions determined using the climate change projections data in the Project's geographical location and assessment timeframe.
- 14.2.58 The assessment will identify the extent to which Receptors in the surrounding environment are potentially vulnerable to and affected by ICCI. The impacts will be assessed in the ES in liaison with the technical specialists responsible for preparing the relevant technical chapters in the PEIR and the ES.

Study Area

- 14.2.59 The Study Area for CCRA is the land within the PEIR Boundary.

14.2.60 The ICCI assessment reflects the Study Areas of relevant technical assessments within the PEIR including all environmental Receptors identified within all of the other relevant technical assessments.

14.2.61 In accordance with the IEMA Guidance, climate change resilience and adaptation effects are specific to the Project, so Cumulative effects with other Committed Developments are not anticipated. Therefore, as assessment of Cumulative effects relating to climate change resilience and adaptation has not been included in this PEIR.

Determining Significance of Effect

Effects of Climate Change on the Project

14.2.62 The methodology for the CCRA has used a combination of quantitative information on climate change projections and qualitative information related to potential impacts. The overall risk of different impacts has been assessed both initially, then after additional Mitigation and resilience measures are accounted for. In accordance with the IEMA guidance, a risk assessment process has been adopted to assess project resilience to climate change impacts. An initial risk profile is developed to assess the risks due to climate change in the Project’s lifetime. Table 14-5 and Table 14-6 show the methods and criteria used to assess the likelihood, magnitude and overall climate change resilience risk for the assessment.

Table 14-5 Likelihood criteria for risk assessment

Likelihood term	Qualitative	Quantitative
Rare	Highly unlikely to occur	5%
Unlikely	Unlikely to occur	20%
Moderate	As likely to occur as not	50%
Likely	Likely to occur	80%
Almost certain	Very likely to occur	95%

Table 14-6 Magnitude of consequence for risk assessment

Risk Areas	Magnitude of Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Asset damage, engineering, operational	Impact can be absorbed through normal activity	Adverse event that can be absorbed by taking business continuity actions	A serious event that requires additional emergency business continuity actions	A critical event that requires extraordinary / emergency business continuity action	Disaster with the potential to lead to shut down or collapse or loss of the asset / network
Health and safety	First aid case	Minor injury, medical treatment	Serious injury or lost work	Major or multiple injuries, permanent injury or disability	Single or multiple fatalities
Environment	No impact on baseline environment. Localised in the source area. No recovery required	Localised within site boundaries. Recovery measurable within one month of impact	Moderate harm with possible wider effect Recovery in one year	Significant harm with local effect Recovery longer than one year. Failure to comply with environmental regulations / consent	Significant harm with widespread effect. Recovery longer than one year. Limited
Social	No negative social impact	Localised, temporary social impacts	Localised, long-term social impacts	Failure to protect poor or vulnerable groups. National, long-term social impacts	Loss of social licence to operate. Community protests
Financial	x % IRR < 2% of turnover	x % IRR 2-10% of turnover	x % IRR 10-25% of turnover	x % IRR 25-50% of turnover	x % IRR > 50% of turnover
Reputational	Localised, temporary impact on public opinion	Localised, short-term impact on public opinion	Local, long-term impact on public opinion with adverse local media coverage	National, short-term impact on public opinion. negative national media coverage	National, long-term impact with potential to affect the stability of the government

Risk Areas	Magnitude of Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Cultural Heritage and cultural premises	Insignificant impact	Short term impact. Possible recovery or repair.	Serious damage with wider impact to tourism industry	Significant damage with national and international impact	Permanent loss with resulting impact on society

14.2.63 To identify the level of significance, the likelihood of a climate impact occurring is considered along with the consequence of the impact. Table 14-7 presents how the significance is determined.

Table 14-7 Identification of significance (“S” Significant “NS” Not Significant)

		Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Rare	Low (NS)	Low (NS)	Medium (NS)	High (S)	Extreme (S)
	Unlikely	Low (NS)	Low (NS)	Medium (NS)	High (S)	Extreme (S)
	Moderate	Low (NS)	Medium (NS)	High (S)	Extreme (S)	Extreme (S)
	Likely	Medium (NS)	High (S)	High (S)	Extreme (S)	Extreme (S)
	Almost certain	High (S)	High (S)	Extreme (S)	Extreme (S)	Extreme (S)

In-combination Effects of Climate Change and the Project on Environmental Receptors

14.2.64 The ICCI and the Project’s effects on the environmental Receptors will be qualitatively assessed for the Construction, Operation and maintenance, and Decommissioning Phases of the Project, within the ES. The Receptors will be identified, and the significance of effect will be assessed by other ES technical specialists when undertaking this assessment.

Assumptions and Limitations

14.2.65 At this stage in the Project design, and consistent with the preliminary nature of this assessment, a full assessment of the Climate Change risks to the Project has not yet been carried out. This chapter presents an assessment of Climate Change risk based on experience of other similar schemes, with a strong understanding of the specific location of the Project.

14.2.66 The assessments will be updated for the ES based on updated Project information.

14.2.67 The design life of the Project is proposed to be 60 years. For the purposes of the Climate Change assessments presented in this chapter it is assumed that the Project is decommissioned 60 years after initial commissioning.

14.2.68 Given the nature of ICCI, ongoing surveys and monitoring by the contributing technical disciplines must be complete before the influence of Climate Change combined with potential impacts from the Construction, Operation (including maintenance), and Decommissioning Phases of the Project on sensitive Receptors can be assessed. An assessment provided of the likely ICCIs will be updated at the ES stage.

Consultation

14.2.69 A summary of Scoping Opinion responses relevant to this topic is provided within Appendix 2-2. No formal engagement outside of the scoping stage has been undertaken with statutory bodies to date.

14.3 Embedded Mitigation

Greenhouse Gas (GHG) Emissions

Design

14.3.1 As the design of the Project develops measures to mitigate greenhouse gas emissions will be embedded into the design. This will include:

- Where reasonably practicable, designing, constructing and implementing the Project in such a way as to minimise the creation of waste and maximise the use of alternative materials with lower embodied carbon, such as locally sourced products and materials with a higher recycled content where feasible.

Construction and Decommissioning

14.3.2 Embedded measures relevant to the Construction and Decommissioning Phase (and any additional Mitigation measures, should they be required) will be secured through the outline Construction Environmental Management Plans (oCEMP) and outline Decommissioning Environmental Management Plan (oDEMP) that will be submitted as part of the DCO Application. Measures to be included in the oCEMP and oDEMP could include the following:

- Increasing recyclability by segregating construction waste to be re-used and recycled where reasonably practicable
- Constructing and implementing the Project in such a way as to minimise the creation of waste and maximise the use of alternative materials with lower embodied carbon, such as locally sourced products and materials with a higher recycled content where reasonably practicable
- Reusing suitable infrastructure and resources where possible to minimise the use of natural resources and unnecessary materials (e.g. reusing excavated soil for fill requirements)
- Liaising with construction and decommissioning personnel for the potential to implement staff minibuses and car sharing options
- Implementing an outline Construction Traffic Management Plan (oCTMP) (Appendix 9-7 of this PEIR) to reduce the volume of construction and decommissioning staff and employee trips to the Project, while encouraging the use of lower carbon modes of transport by identifying and communicating local bus connections and pedestrian/cycle access routes to/ from the Project to all construction and decommissioning staff, and providing appropriate facilities for the safe storage of cycles
- Conducting regular planned maintenance of the construction and decommissioning plant and machinery to optimise efficiency
- Adopting the CCS (or its equivalent) to assist in the reduction of pollution, including GHG, from the Project by employing industry best practice measures. The ES will include further details of the maintenance activities and appropriate controls will be developed as part of the DCO Application.
- Prevent idling vehicles by switching vehicles and plant off when not in use and ensuring that all construction and decommissioning vehicles conform to applicable EU emissions standards
- Increasing recyclability by segregating construction and decommissioning waste to be re-used and recycled where reasonably practicable
- Disposing of decommissioning waste locally where reasonably practicable to reduce emissions associated with transportation; and

- Reusing site-won materials to minimise the use of natural resources and unnecessary materials where reasonably practicable (e.g. reusing excavated soil onsite).

14.3.3 The oCEMP and oDEMP will be reviewed and updated as the Project progresses to ensure all assessed potential impacts and residual effects are considered and addressed as far as practicable, in keeping with available good practice at that point in time.

14.3.4 As appropriate, the suppliers of main equipment and site contractors are audited from an ESG (Environment, Social & Governance) perspective as part of the pre-qualification process. In these audits, the expectation is that they have proper calculations, goals and methods of improvement in place relating to their carbon footprint and emissions.

Operation

14.3.5 The following control measures could be included in the outline Operational Environmental Management Plan (oOEMP) to mitigate greenhouse gas emissions:

- Routine maintenance and servicing activities of the Project to optimise efficiency of the Project
- Increasing recyclability by segregating waste to be re-used and recycled where reasonably practicable
- Operating the Proposed Development in such a way as to reduce the creation of waste and increase the use of materials with lower embodied carbon such as locally sourced products and materials with a higher recycled content
- Implementing a Travel Plan to encourage the use of lower carbon modes of transport by identifying and communicating local bus connections and pedestrian and cycle access routes to/from the Project to all staff, and providing appropriate facilities for the safe storage of cycles
- Implementing a Travel Plan to liaise with operational personnel for potential to implement car sharing options

- Switching off vehicles and plant when not in use and ensuring vehicles conform to applicable EU emissions standards; and
- Monitoring fugitive emissions of SF₆ from electrical items such as gas-insulated Switchgears.

Climate Change Resilience and Adaptation (CCRA) and In-combination Climate Change Impacts (ICCI)

Design

- 14.3.6 The Project has been designed to be resilient to a 1 in 100-year fluvial flood event through sequential design. PV Arrays have been removed from areas at risk of flooding during a 1 in 100-year rainfall event and are raised to a minimum height as described in Chapter 5 Project Description. All solar infrastructure is proposed to be located outside Flood Zone 2 and 3. This accounts for increases in rainfall and fluvial flows associated with climate change.
- 14.3.7 In addition, adaptation measures to reduce the effect of projected temperature increases on electrical equipment over the course of the Project's design life have been taken into account. The PV panels, Inverters and Transformers will be in a wide range of acceptable operation temperatures, which the increasing temperatures will not adversely affect their operation.

Construction and Decommissioning

- 14.3.8 The following Mitigation will be embedded into the Project through the oCEMP and oDEMP:
- Named person(s) will be responsible to be familiar with the climate change risks and remains vigilant to news reports relating to extreme weather events, Environment Agency flood warnings and water levels of the local waterways. Weather forecasts and Environment Agency flood alerts will be monitored to allow works to be planned and carried out accordingly to manage extreme weather conditions, such as storms and flooding
 - Health and safety plans developed for construction activities will be required to account for potential climate change impacts on workers, such as flooding and heatwaves. To include measures such as toolbox talks on raining on dangers of extreme weather conditions; and

- Storing materials outside of flood extent as far as reasonably practicable.

Operation

14.3.9 The following control measures could be secured through the oOEMP to mitigate the adverse effects of climate change on the Project:

- Monitoring of weather forecasts to anticipate extreme temperatures and ensure cooling or heating plant are operating effectively. In the event that cooling or heating plant are anticipated to fail then plant will be temporarily shutdown until maintenance has taken place; and
- Monitoring and maintenance of infrastructure to ensure it remains in adequate condition to provide resilience against the increased frequency and severity of extreme weather events associated with climate change. For example, ensuring that Mounting Structures continue to be capable of withstanding maximum force wind speeds and ensuring PV panels to be capable of withstanding hailstorms.

14.3.10 The following measures could be implemented to ensure safety of staff from increased flood risk onsite due to climate change:

- Health and safety plans that account for potential climate change impacts on workers, such as flooding and heatwaves
- Storing materials outside of flood extent as far as reasonably practicable; and
- Appointing a designated Flood Warden who is familiar with the risks and remains vigilant to news reports, Environment Agency flood warnings and water levels of the local waterways.

14.4 Preliminary Assessment of Likely Significant Effects

Greenhouse Gas (GHG) Emissions

14.4.1 The GHG effects (both beneficial and adverse) associated with the Construction, Operation (including maintenance), and Decommissioning Phases of the Project are outlined in the sections below.

Construction

- 14.4.2 The greatest GHG impacts would occur during the Construction Phase (approximately up to 24 months) from the manufacture of the materials and components required for the Project. The manufacture of the BESS and PV panels will carry the greatest embodied carbon impact. These components are assumed to be manufactured abroad and therefore also have associated transportation emissions that reflect this.
- 14.4.3 Other sources of emissions during construction within the scope of the GHG assessment include the manufacture of other components, water, energy, and fuel use for construction activities including fuel consumed by construction plant and machinery, fuel use for the transportation of construction materials for the Project, transportation of construction workers to and from the Project, and the transportation and disposal of waste.
- 14.4.4 As detailed in 14.2.2, impact from land use change is assumed to be negligible as the land within the Project would be returned to the landowners control at the end of the 60-year Operational Phase.
- 14.4.5 Total GHG emissions from the Construction Phase are estimated at 313,912 tCO₂e. Table 14-11 summarises the overall construction emissions from various emissions sources.

Table 14-8 Emissions resulting from the Construction Phase

Emissions source	Embodied emissions (tCO₂e)	Proportion of total embodied emissions
Product embodied	280,113	89.2%
Product transport	31,509	10.0%
Worker transport	1,436	0.5%
Fuel use	852	0.3%
Water use	0.77	< 0.1%
Waste	0.36	< 0.1%%
Construction total	313,912	100%

14.4.6 GHG emissions from construction have been assessed to identify the significance of their effect. Table 14-12 presents the estimated construction emissions against the carbon budget period during which they are expected to arise (the 4th UK carbon budget).

Table 14-9 UK carbon budgets relevant to construction period

Relevant UK Carbon Budget	Annualised UK Carbon Budget (tCO ₂ e)	Construction Emissions During Carbon Budget Period (tCO ₂ e)	Construction Emissions as a Proportion of Carbon Budget
Construction Yr1: 2023 to 2024 4 th Carbon Budget (2023 to 2027)	390,000,000	156,956	0.04%
Construction Yr2: 2024 to 2025: 5 th Carbon Budget (2028 to 2032)	345,000,000	156,956	0.05%

Operation

14.4.7 The Operational Phase of the Project is assumed to be up to 60 years. For the assessment, the assessed effects that either endure for a substantial period beyond construction or represent an extended Cumulative effect of construction or decommissioning activity. This includes the effects of the physical presence of the energy infrastructure, and its operation, use and maintenance.

14.4.8 GHG emissions sources within the scope of the operational emissions include operational energy use (i.e. for auxiliary services and standby power) and fuel used for the transportation of workers to the Project and maintenance activities. Maintenance and transportation cover the following:

- Embodied carbon in replacement parts (including PV panels and BESS)
- Plant and machinery requirements
- Electricity, fuel and water use during maintenance activities
- Transportation of materials and waste to and from the Project; and
- Waste management activities.

14.4.9 As presented in Table 14-10 the operational emissions over the design life of the Project are estimated at 719,434 tCO₂e under the worst-case scenario. A total of 99.2% of this figure results from the supply of replacement components, with the remaining 0.8% the result of ongoing operational emissions. This is considered to be a conservative worst-case as carbon impact of both materials and utility consumptions are expected to be reduced over time as discussed in Paragraph 14.2.35.

Table 14-10 Emissions resulting from the operation phase

Emissions source	Embodied emissions (tCO₂e)	Proportion of total embodied emissions
Maintenance (Embodied carbon in replacement parts, including PV panels and BESS)	713,342	99.2%
Water use	10	0.002%
Grid electricity	3,315	0.46%
Staff transport	2,766	0.38%
Operation total	719,434	100%

14.4.10 The Project is expected to be operational by no earlier than 2029, therefore operational emissions up to 2037 (the end of the 6th UK Carbon Budget) will fall under the 5th and 6th UK Carbon Budgets, beyond which point no Carbon Budgets have yet been legislated for. Table 14-11 presents the estimated operational emissions against the carbon budget periods during which they arise.

Table 14-11 UK carbon budgets relevant to operational period (up to 2037)

Relevant UK Carbon Budget	Annualised UK Carbon Budget (tCO₂e)	Annualised Operational Emissions During Carbon Budget Period (tCO₂e)	Operational Emissions as a Proportion of Carbon Budget
5 th Carbon Budget, excluding the construction year 2028	345,000,000	11,991	0.003%

Relevant UK Carbon Budget	Annualised UK Carbon Budget (tCO ₂ e)	Annualised Operational Emissions During Carbon Budget Period (tCO ₂ e)	Operational Emissions as a Proportion of Carbon Budget
(2029 to 2032)			
6 th Carbon Budget (2033 to 2037)	193,000,000	11,991	0.006%

Decommissioning

14.4.11 GHG emissions from the Project during decommissioning are subject to a very high degree of uncertainty, as the conditions that will apply over 60 years into the future. However, Table 14-12 summarises the worst-case scenario for the emissions expected to result from the Decommissioning Phase.

Table 14-12 Emissions resulting from the Decommissioning Phase

Emissions source	Embodied emissions (tCO ₂ e)	Proportion of total embodied emissions
Fuel Use	852	32.1%
Worker transport	1,436	54.0%
Water Use	0.88	0.03%
Waste	368	13.9%
Decommissioning total	2,658	100%

Carbon Intensity of the Project

14.4.12 Renewable energy generation from the Project during the first full year of operation (2029) is estimated to be 424,800 MWh based on a 360MW capacity of the Project, anticipated yield of 1,180 kWh/kWp/yr (kilowatt hour per kilowatt-peak per year), and a 2% reduction in PV panel performance during the first year. A 0.45% degradation factor has been applied for each subsequent year, resulting in an estimated energy generation figure of 365,264 MWh in the final year of operation, and a total energy generation figure of approximately 23.4 TWh over the 60-year Operational Phase. Tracking panels have the potential to achieve a higher efficiency, so this scenario represents a conservative estimate for generation during the Operational Phase and the GHG savings from the Project.

The phasing of the Project is currently being developed in accordance with technical requirements. The final programme will be described in detail in the ES.

- 14.4.13 A carbon intensity value represents how many grams of CO₂ are released to produce a kilowatt hour (kWh) of electricity. Dividing the lifetime total energy generation figure into the lifetime emissions total of 1,036,004 tCO₂e gives a total carbon intensity value of 0.044 kgCO₂e/kWh (kilograms of carbon dioxide equivalent per kilowatt hour), where the lifetime emissions is estimated under a worst-case scenario with conservative estimation on future carbon impact from replacement materials. While the total energy generation of the Project is expected to be higher with better efficiency of panels, the carbon intensity of each kWh of electricity is anticipated to be lower.
- 14.4.14 The current UK grid carbon intensity is 0.207 kgCO₂e/kWh; however, these figures cannot be directly compared as the published UK grid carbon intensity figure only takes into account operational emissions from the generation of electricity, overwhelmingly from the fossil fuels used to power gas-fired and occasionally coal-fired power stations. For a meaningful comparison to be made between the Project and the UK grid, the operational carbon intensity of the Project must only include emissions from the ongoing operations of the Project and exclude emissions from construction and decommissioning. Combining lifetime generation figures and operational emissions figures gives an operational carbon intensity value of 0.031 kgCO₂e/kWh.
- 14.4.15 Comparing the Project against an existing gas fired CCGT generating facility (currently the most carbon-efficient fossil-fuelled technology available), a representative figure for the carbon intensity of a CCGT is 354 gCO₂e/kWh (Ref 14-14). The operational intensity of the Project is therefore 84% lower than that of the counterfactual CCGT. Each kWh of electricity generated by the Project will emit 323g CO₂e less than if it was generated by an existing gas fired CCGT generating facility.
- 14.4.16 Combining this figure with the estimated lifetime output from the Project indicates an overall lifetime carbon reduction, relative to the counterfactual CCGT, of over 7 million tCO₂e. Figure 14-1 below presents the comparison of estimated lifetime

emissions over the operational years with the same level of electricity generation between CCGT and the Project. The referenced carbon intensity of CCGT covers only Scope 1 emissions of gas consumed. In comparison, the operational carbon intensity for the Project has taken into account energy required to operate the Project, as well as the embodied emissions from maintenance and component replacement.

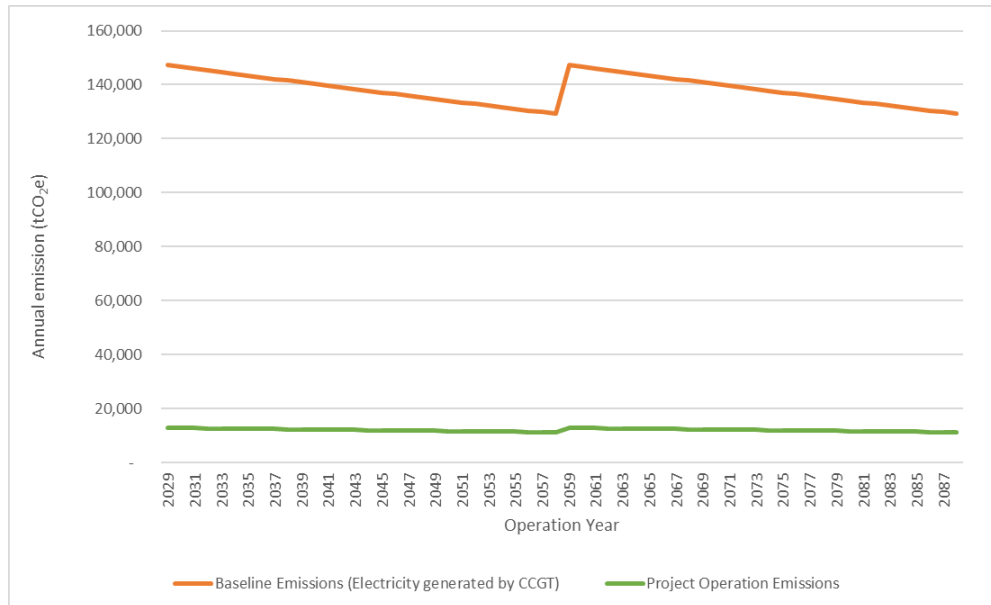


Figure 14-1 Comparison between Baseline and Project operational emissions

14.4.17 A range of other low-carbon electricity generation technologies are available, such as on- and offshore wind, biomass and nuclear power. These technologies have different carbon intensities in terms of total emissions per kWh of electricity generated. With a range of carbon intensity figures for each power source, it is challenging to directly compare the carbon impact of a specific installation, such as the Project, with data for a broad generation technology. As the UK electricity sector continues to decarbonise, a range of different low-carbon generation technologies will be required to support an electricity generation system that can balance emissions reductions, security of supply and affordability.

Overall GHG Impact and Significance

14.4.18 In light of UK’s climate objective to achieve Net Zero carbon by 2050, and in line with IEMA guidance for assessing GHGs, the UK’s Fourth, Fifth and Sixth Carbon Budgets have been used to contextualise emissions from the Project.

- 14.4.19 Construction emissions from the Project (and their magnitude) are compared to the significance definitions outlined in Table 14-2. It is assumed that the Project will be constructed using the best available techniques (Section 14.3) and aligned to applicable existing and emerging policy requirements to achieve the UK's net-zero targets. Therefore, in line with IEMA guidance (Ref 14-5), the Project's GHG impact across construction has been determined to be Minor Adverse and not significant.
- 14.4.20 Operational emissions from the Project are associated with maintenance, including the replacement of PV panels and BESS, and worker travel. However, the benefits of generating renewable energy from the Project far outweigh the associated emissions as demonstrated in paragraphs 14.4.12 to 14.4.17. The Project directly supports the emerging policy environment of decarbonising electricity generation by upscaling the role of solar in power sector, as laid out in the CCC's Sixth Carbon Budget (Ref 14-10) the Carbon Budget Delivery Plan (Ref 14-19). The National Electricity Transmission System cannot and will not decarbonise without investments in low-carbon electricity generation projects such as the Project. The Project's Operational Phase indirectly causes a reduction in atmospheric GHG concentration compared to the without-project baseline and aligns with a trajectory towards Net Zero. The GHG impact of the Operational Phase is therefore considered to be Beneficial and **significant** when compared to the future baseline.
- 14.4.21 While there are expected to be GHG emissions associated with the Decommissioning Phase of the Project, actual emissions are anticipated to be lower as the assessment presents a robust worst-case scenario. Therefore, the magnitude of impact is considered to be low. GHG emissions from the Decommissioning Phase are therefore considered to have a Minor Adverse effect on climate change which is not significant effect.

Conclusion

- 14.4.22 The GHG impact of construction and decommissioning are anticipated to result in Minor Adverse and non-significant effects on climate change. The impact of operations is considered to have a beneficial, **significant** effect due to the

operational carbon intensity remaining substantially below that of an existing CCGT generating facility throughout its lifetime, its role in achieving the rate of transition required by nationally set policy commitments and supporting the trajectory towards Net Zero.

- 14.4.23 The GHG savings achieved throughout the Operational Phase of the Project demonstrate the role solar energy generation has to play in the transition to, and longer-term maintenance of, a low carbon economy. Without low-carbon energy generation such as the Project, the average grid GHG intensity will not decrease as is projected, which would adversely affect the UK's ability to meet its carbon reduction targets. This statement is consistent with the position taken in paragraph 150 of the Supreme Court Judgement in the case of *Finch, on behalf of the Weald Action Group (Appellant) v Surrey County Council and others (Respondents)*.
- 14.4.24 This case reiterated the need for the relevant planning authority to consider the beneficial indirect effects of a project on the climate, as well as adverse effects, as a material planning consideration: *"Just as beneficial indirect effects of a project on climate - for example, the "green" energy that would be generated by a project to develop a wind farm or solar farm - are clearly a relevant matter for the planning authority to consider, so corresponding adverse effects are also a material planning consideration"* (paragraph 150, a.Ref 14-19).

Climate Change Resilience and Adaptation (CCRA) and In-combination Climate Change Impacts (ICCI)

- 14.4.25 Potential climate risks to the Construction, Operation and Decommissioning Phases, including the likelihood, consequence and significance, are summarised as follows and the detailed assessment is presented in Appendix 14-2.

Effects of Climate Change on the Project

Construction

- 14.4.26 The risks assessed in the CCRA at the Construction Phase of the Project predominantly cover workforce exposure to dangerous working conditions and damage to physical structures/asset damage.
- 14.4.27 Major climatic variables contributing to these risks include, but are not limited to, precipitation and extreme weather events.

14.4.28 As a result of the embedded climate change Mitigation measures, it is concluded that all climate change risks during the Construction Phase have been identified to be low and not significant.

Operation

14.4.29 The risks assessed in the CCRA at the Operational Phase of the Project predominantly encapsulate asset damage from extreme weather conditions and changes in annual precipitation and temperatures, as well as workforce exposure to dangerous working conditions.

14.4.30 Major climatic variables contributing to these risks are temperatures, precipitation, and extreme weather events.

14.4.31 As a result of the embedded climate change Mitigation measures, it has been concluded that all climate change risks during the operation phase have been identified to be low and not significant.

Decommissioning

14.4.32 The risks assessed in the CCRA at the Decommissioning Phase of the Project are mainly made up of risks to the workforce.

14.4.33 These risks are driven by climatic variables like temperatures, rainfall, and extreme weather events.

14.4.34 As a result of the embedded climate change Mitigation measures, it has been concluded that all climate change risks during the Construction Phase have been identified to be low and not significant.

In-combination Effects of Climate Change and the Project on Environmental Receptors

14.4.35 The assessment of potential ICCIs during construction, operation (including maintenance), and decommissioning will be undertaken alongside the further development of the Project design as it progresses and will be examined by other disciplines with their assessment results to be obtained from ongoing surveys and monitoring. The results of the assessment will be presented in the ES.

14.5 Additional Mitigation

14.5.1 No additional Mitigation beyond the embedded Mitigation is proposed at this stage.

14.6 Residual Effects

14.6.1 In absence of any additional Mitigation, the residual effects are the same as the potential effects set out in Section 14.4.

14.7 Effect Interactions

14.7.1 The ICCI assessment presented in this chapter constitutes the consideration of effect interactions between climate change and other technical disciplines.

14.8 References

Ref 14-1 World Business Council for Sustainable Development and World Resources Institute (2001). The GHG Protocol: A Corporate Accounting and Reporting Standard.

Ref 14-2 The Inventory of Carbon and Energy (ICE database) (2019).

Ref 14-3 Environdec (2010) Environmental Product Declarations (EPD) Library.

Ref 14-4 Department for Energy Security and Net Zero (DESNZ) (2024) Conversion Factors Database (2024).

Ref 14-5 IEMA (2022) Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance.

Ref 14-6 Department for Energy and Climate Change (2015) Fossil Fuelled Power Stations: Carbon Emissions and Nitrogen Oxides

Ref 14-7 Her Majesty's Stationery Office (HMSO) (2009) The Carbon Budgets Order 2009.

Ref 14-8 HMSO (2011) Carbon Budget Order 2011.

Ref 14-9 HMSO (2016) Carbon Budget Order 2016.

Ref 14-10 Climate Change Committee (2020). The Sixth Carbon Budget: Electricity Generation.

Ref 14-11 Royal Institution of Chartered Surveyors (RICS) (2023) Whole life carbon assessment for the built environment.

Ref 14-12 Elementa Consulting and Willmott Dixon (2022) Whole life carbon of photovoltaic installations.

- Ref 14-13 DESNZ (2023) Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal.
- Ref 14-14 UK Parliament (2015). Fossil fuelled power stations: carbon emissions and nitrogen oxides – answer to written question 17799 tabled by Dr Alan Whitehead MP.
- Ref 14-15 IEMA (2020) Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation.
- Ref 14-16 UK Met Office (2019). UK Climate Averages (Valley, Isle of Anglesey).
- Ref 14-17 UK Met Office (2018) UK Climate Projections (UKCP).
- Ref 14-18 Global Facility for Disaster Reduction and Recovery (GFDRR) (2020) ThinkHazard.
- Ref 14-19 His Majesty's Government (HM Government) (2023). Carbon Budget Delivery Plan.
- Ref 14-20 JUDGMENT R (on the application of Finch on behalf of the Weald Action Group) (Appellant) v Surrey County Council and others (Respondents). (n.d.).
- Ref 14-21 Environmental Product Declaration. (n.d.).
- Ref 14-22 MAXEON 3 Mono-Crystalline Photovoltaic Module SunPower. (2021).