



THE DROVES
SOLAR FARM

The Droves Solar Farm

Preliminary Environmental Information Report

Volume I, Chapter 13: Climate Change

Prepared by: Bureau Veritas

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13 Climate Change

13.1 Introduction

- 13.1.1 This chapter of the PEIR presents the findings of a preliminary assessment of the likely significant effects in relation to climate change. The information presented within this chapter has been informed by the design information of the Scheme provided in **Volume I, Chapter 5: Scheme Description**.
- 13.1.2 Information considered in this chapter includes relevant climate change policy and guidance, baseline climate conditions, sets out the methodologies and approaches intended to be used to inform the climate change chapter of the Environmental Statement (ES) for the Scheme. This is realised through a description of the climate change baseline conditions (as they are understood at time of writing). This chapter details the findings of work undertaken to date and presents a preliminary assessment of the likely significant effects arising from the Construction, Operational and Decommissioning Phases of the Scheme in relation to climate change. The chapter also considers proposed avoidance, mitigation and compensation measures and any residual effects following the implementation of such measures.
- 13.1.3 Embedded mitigation measures are presented, where necessary, and discussed to minimise the impacts of the Scheme to an acceptable level (i.e. to a residual minor or negligible effect), during the Construction, Operation and Decommissioning Phases.
- 13.1.4 This chapter should be viewed as a preliminary assessment that will be updated and refined as necessary, particularly as the results of further evaluation become available and as the Scheme design evolves. Initial assumptions have been made based on the survey and background information available to date and professional judgement. The PEIR does not replicate or act as a draft ES but rather aims to enable consultees to understand the likely environmental effects of the Scheme and helps to inform consultation responses during the pre-application stage.

Consultation

- 13.1.5 The content and assessment methodology contained within this chapter has been informed by the Scoping Opinion from the Planning Inspectorate (PINS) dated 18 December 2024 (**Volume III, Appendix 2.2**) as well as further updated and informed following consultation with key stakeholders in relation to climate change matters.
- 13.1.6 Consultation feedback received throughout the pre-application phase of the Scheme has been considered in preparing this PEIR chapter. Further detail on consultation undertaken is included at **Volume III, Appendix 13.1**.

Legislation, Planning Policy and Guidance

- 13.1.7 A review of the Legislation, Policy and Guidance that is relevant to the climate change assessment of the Scheme is included at **Volume III, Appendix 13.1**. The review demonstrates that the Scheme has been developed in accordance with the requirements identified in **Volume III, Appendix 13.1**.



13.2 Assessment Methodology

Assessment Scope

13.2.1 The preliminary assessment includes three aspects of Climate Change Assessment:

- Lifecycle Greenhouse Gas (GHG) Impact Assessment: the impact of the Scheme by considering all GHG emissions associated with the Scheme's entire lifecycle;
- In-combination Climate Change Impact (ICCI) Assessment: considering combined effects of the Scheme contributing to climate change, their interactions and cumulative impact on the environment; and
- Climate Change Resilience: the resilience of the Scheme to climate change impacts.

13.2.2 The methodologies described in the following section have been developed in line with the relevant planning policy and appropriate industry standard guidance for assessing GHGs [Ref 13-1] and considering climate change resilience and adaptation [Ref 13-2] in the process of Environmental Impact Assessments (EIAs).

13.2.3 The following aspects will be considered within the climate change assessment process and will align with the requirements of relevant regulations:

Scoped In

Lifecycle Greenhouse Gas Impact Assessment

13.2.4 The preliminary GHG Impact Assessment offers initial information on a quantitative assessment of GHG impacts, based on the preliminary data available at the time of writing. The ES will include a more detailed GHG Impact Assessment as more information on scheme products and proposed scope is confirmed. Any remaining data gaps in the ES will be explicitly noted, and a qualitative method for evaluating GHG impacts will be applied, in accordance with IEMA guidelines.

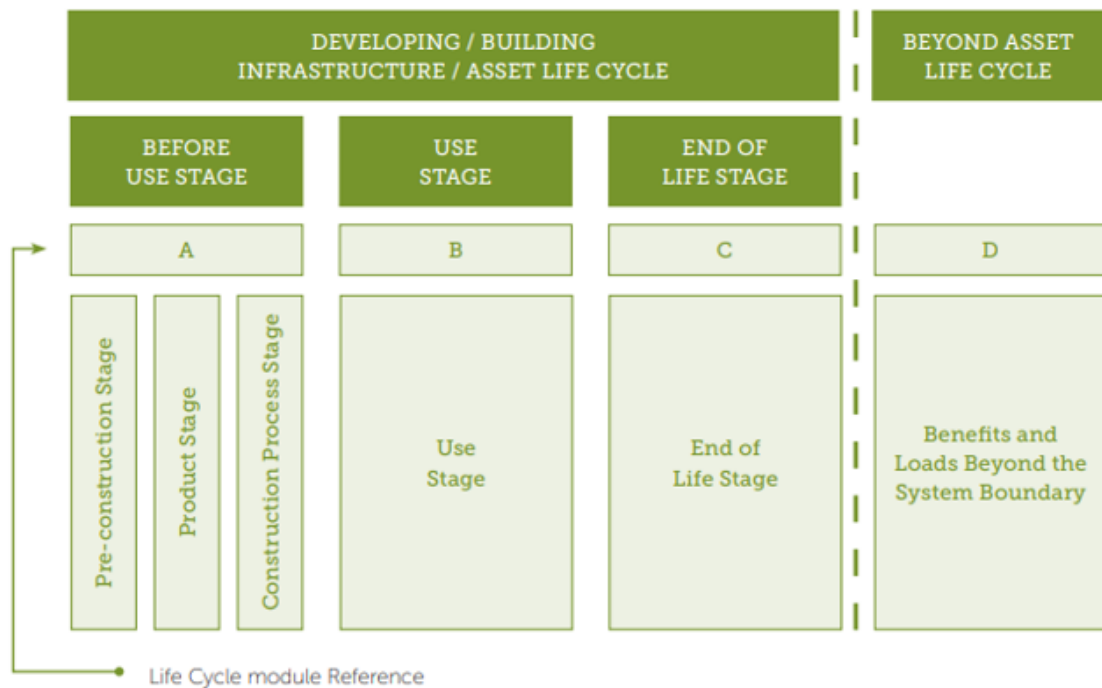
13.2.5 The preliminary assessment establishes the baseline scenario and the GHG emissions over the assessed Scheme through Construction, Operation (including maintenance and replacement) and Decommissioning Phases. This is based on the Scheme lifecycle stages shown in Diagram 13.1. The considered stages include: the before use stage (A), hereafter referred to as the Construction Phase, the use stage (B), referred to as the Operation Phase and maintenance, which is anticipated to be 60 years, and end of life stage (C), referred to as the Decommissioning Phase.

13.2.6 Both direct emissions from activities within the Scheme, as well as indirect emissions from activities outside the Scheme have been considered in the assessment. Direct emissions are those that will occur at or around the Site e.g. tailpipe emissions from vehicles associated with construction. Indirect emissions are those not caused directly from the Site but will be emitted as a result of the scheme e.g. emission generated in the production of solar panels.

13.2.7 For the Scheme operation, GHG emissions arising from activities involved during the Construction and Operational Phase (inclusive of replacement of PV panels and batteries) and Decommissioning Phase will be considered. The assessment will be inclusive of embedded GHG in the construction materials, and emissions from transport of materials, waste and workers will be considered.



Diagram 13.1 Modular approach of life cycle stages and modules [Ref 13-3]



Source: IEMA. EIA Guide.

13.2.8 The study includes activities that might be prevented or changed due to the Scheme, such as existing power production methods. The assessment also considers the emissions avoided as a result of the Scheme, for example, comparison with the UK grid average emissions without the scheme in place.

13.2.9 The seven GHG described in the Kyoto Protocol guidelines [Ref 13-3] are considered within the assessment over the Scheme's lifecycle:

- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous oxide (N₂O)
- Sulphur hexafluoride (SF₆)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs); and
- Nitrogen trifluoride (NF₃).

13.2.10 It should be noted that within this assessment, *GHG emissions* broadly represent all seven Kyoto Protocol GHGs and will be given the unit of 'tCO₂e' representing tonnes of CO₂ equivalent emissions.

13.2.11 For the baseline scenario, the GHG emissions from land use, current methods of generating power considering the progressive shift to Net Zero through the requirement for new combustion power stations >300MW to be Carbon Capture Ready and the development of carbon capture projects to reduce emissions from existing plant, and available baseline



information were considered to the extent possible. For the Scheme, a project lifecycle approach was followed to estimate the GHG emissions associated with different stages of the Scheme, including Construction, Operation and maintenance, and Decommissioning Phases, expressed in tonnes of CO₂ equivalent (tCO₂e). Table 13.1 summarises potential sources of GHG emissions for each stage of the Scheme.

Table 13.1 Possible Sources of GHG Emissions

Lifecycle Stage	Activity	Primary Emission Sources
Construction Phase	<p>The extraction of raw materials and manufacturing of products necessary to make equipment.</p> <p>This stage is anticipated to contribute significantly to GHG emissions, due to the materials that contain high levels of embodied carbon, complex manufacturing processes and equipment design.</p>	<p>GHG emissions embodied within the product.</p> <p>GHGs that are produced during manufacturing.</p>
	<p>Construction materials that are transported and not integrated in embodied GHG emission. Equipment required is likely to require shipment due to overseas origin.</p>	<p>Transportation of materials to the site and the amount of fuel consumed.</p>
	<p>Construction workers that would need transportation to the site.</p>	<p>Transportation of workers to the site and resulting GHG emissions.</p>
	<p>Construction activity on-site.</p>	<p>Energy consumption on-site.</p>
	<p>Waste produced during the construction process that needs to be disposed of.</p>	<p>GHG emissions produced from the transportation and removal of waste materials.</p>
	<p>Water use</p>	<p>Treatment of wastewater and supply of potable water.</p>



Lifecycle Stage	Activity	Primary Emission Sources
Operational Phase and maintenance	Scheme operation	Emissions from routine maintenance are expected to be negligible. However, the periodic replacement of components will be assessed as part of the Scheme operation. An indicative schedule of panel replacements will be used to inform the assessment.
	Scheme maintenance	
	Replacement materials (i.e. batteries and replacement panels)	
	Water use on-site for fire suppression and cleaning panels	
Decommissioning Phase	Decommissioning activity occurring on-site	Energy consumption of on-site vehicles and generators.
	Removal and transportation of any waste materials	GHG emissions generated from the transportation and disposal of waste materials. The use of materials with high associated waste treatment emissions.
	Workers that would need to be transported to the site	Transportation of workers to site and resulting GHG emissions.

13.2.12 The Department for Energy Security and Net Zero (DESNZ) 2024 emissions factors guidance will be used as a calculation-based methodology for estimating the anticipated GHG emissions arising during the construction, operation and maintenance and decommissioning activities of the Scheme [Ref 13-4]. The calculation will be:

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

13.2.13 For example, if a construction worker is expected to make a total 1,200km of trips over the construction period in their petrol car the activity data for this would be 1,200km. The GHG emissions factor for this as sources from the DESNZ 2024 inventory [Ref 13-4] for a medium petrol car is 0.17658kgCO₂e/km. Therefore, the calculation would be:

$$\begin{aligned} &1,200\text{km (Activity)} \times 0.00017658\text{tCO}_2\text{e/km (GHG emissions Factor)} \\ &= 0.212\text{tCO}_2\text{e (GHG Emissions Value)} \end{aligned}$$



Sensitivity of Receptors

13.2.14 For the purposes of this assessment, the receptor for the GHG assessment is the global climate which has been defined as ‘high’ sensitivity as any additional GHG impacts could compromise the UK’s ability to reduce its GHG emissions and therefore meet its future 5-year carbon budgets and Net Zero by 2050 target. This is in line with the latest IEMA guidance [Ref 13-1], which states that all GHG emissions have the potential to be significant.

13.2.15 The extreme importance of limiting global warming to below 2°C this century is broadly asserted by the International Paris Agreement, the United Nations Climate Change Conferences (COP27) and the climate science community.

Magnitude of Impacts

13.2.16 Standard GHG accounting and reporting practices have been followed to assess the effect of the Scheme. The IEMA guidance states that *“it is up to the GHG practitioner’s professional judgement to decide which tool is most appropriate for the project at hand with regard to assessing the magnitude of GHG impacts”*. The GHG accounting method is deemed most appropriate for this part of the assessment.

13.2.17 IEMA guidance [Ref 13-1] states that there are currently no agreed methods to evaluate thresholds of GHG significance, that the application of the standard EIA significance criteria is not considered to be appropriate for climate change mitigation assessments, and that professional judgement is required to contextualise a project’s GHG emission impacts.

13.2.18 The guidance explains that *“the crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050.”*

13.2.19 Table 13.2 presents the different significance levels as per the latest version of IEMA guidance. The guidance 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 13.2 Significance levels as per IEMA guidance [Box 3 Ref 13-1]

Significance Level	Definition	Significant
Major adverse	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.	Yes
Moderate adverse	The project’s GHG impacts are partially mitigated and may partially meet the applicable existing and emerging	Yes



Significance Level	Definition	Significant
	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.	
Minor adverse	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.	No
Negligible	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.	No
Beneficial	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.	Yes

13.2.20 As noted, it is down to the practitioner's professional judgement on how best to contextualise a project's GHG impact. In GHG accounting, it is considered good practice to contextualise emissions against pre-determined carbon budgets.

13.2.21 The UK has a defined national carbon budget and budgets set by industry bodies which have been determined as being compatible with net zero and international climate commitments. For this Scheme, the most appropriate sector carbon budget is for the electricity supply sector. Currently, indicative carbon budgets are available for the electricity supply sector [Ref 13-5]. The electricity supply sectoral carbon budgets (Table 13.3) are in place to track the sector's pathway to being carbon neutral by 2050. Progress against these budgets is reviewed annually, and future budgets are set 12 years in advance.



Table 13.3 UK Carbon Budgets

Carbon Budget	Total budget (MtCO ₂ e)	Sectoral Carbon Budget year	Annual Electricity Supply Sectoral Carbon budget (MtCO ₂ e)
4th (2023 – 2027)	1,950	2023	44.01
		2024	44.44
		2025	41.65
		2026	32.36
		2027	26.70
5th (2028 – 2032)	1,725	2028	23.75
		2029	22.40
		2030	18.55
		2031	15.77
		2032	12.09
6th (2033 – 2037)	965	2033	9.86
		2034	8.00
		2035	6.20
		2036	6.01
		2037	5.67

13.2.22 To assess the impact of GHG emissions from the Scheme, the carbon budgets for the electricity supply sector have been used as a proxy for the climate. To provide further perspective, emissions from the Scheme have also been considered in the context of the UK carbon budgets. The UK carbon budgets are in place to restrict the amount of GHG emissions the UK can legally emit in a five-year period.

13.2.23 A qualitative approach has been taken for assessing the significance of GHG emissions arising as a result of the Scheme for the years beyond 2037. A quantitative approach is not possible beyond 2037 as, although the carbon budgets are set to decrease over time, there



will still be permitted GHG emissions beyond 2050, but with offsetting measures in place to ensure net emissions are zero. The rate at which they will decrease is not known, so it is not possible to predict the quantity of emissions permitted within the carbon budgets beyond 2037. Should future carbon budgets become available following the submission of the PEIR, these would be the relevant carbon budget for future assessments including the ES.

In-combination Climate Change Impact (ICCI) Assessment

- 13.2.24 The scope of the ICCI assessment methodology has been developed in line with the IEMA – ‘Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation’ [Ref 13-6].
- 13.2.25 According to the guidance, an ICCI effect is ‘When a projected future climate impact (e.g. increase in temperatures) interacts with an effect identified by another topic and exacerbates its impact. For example, how an increase in rainfall due to climate change may lead to a higher risk of flooding, this is an ICCI.’
- 13.2.26 An ICCI Assessment identifies how identified receptors in the surrounding environment are affected by the Scheme in combination with future climate change conditions. Climate change impacts relevant to the Scheme will be assessed through the other relevant topics of the ES. For example, how an increase in rainfall may lead to a higher risk of flooding, will be covered in **Volume I, Chapter 12: Water Resources**. These in-combination effects will be summarised within the **Volume I, Chapter 13: Climate Change**.
- 13.2.27 The factors considered in the ICCI Assessment are shown in Table 13.4 below.

Table 13.4 Climate Change Factors for ICCI Assessment

Factor	Anticipated Effect
Temperature change	The anticipated increase in temperature will be summarised within the locality, and any impacts from the Scheme discussed within the Climate Change Chapter with regards to the effect of localised heat island effects.
Precipitation change	This will be considered in the Water Resources Chapter and summarised within the Climate Change Chapter.
Extreme weather conditions (wind)	The anticipated increase in extreme wind/hailstorm and other events within the locality will be summarised and any impacts on the Scheme discussed within the Climate Change Chapter.

Climate Change Resilience (CCR) Assessment

- 13.2.28 While the lifecycle GHG Impact Assessment assesses the significance of the GHG impact of the Scheme, the CCR review does not assess the significance as only a review of the impacts is required in line with the IEMA guidance.
- 13.2.29 The CCR Assessment will provide a description of how the Scheme will be impacted by climate change and how it will be designed to be more resilient to the impacts identified during the review of the UK Climate Projections 2018 (UKCP18) data.



- 13.2.30 For the CCR Assessment, the Scheme during Construction, Operation and Maintenance and Decommissioning Phases is considered the receptor. The CCR Assessment provides a description of how the Scheme will be affected by climate change impacts, taking into consideration the embedded mitigation measures that have been designed into the Scheme so that it will be more resilient to the impacts identified during the review of the UK Climate Projections 2018 (UKCP18) data [Ref 13-7].
- 13.2.31 The EIA regulations require information regarding the vulnerability of the Scheme to climate change. An assessment has been developed based on the IEMA Environmental Impact Assessment Guide to: Climate Change Resilience and Adaption' document [Ref 13-6], which assesses the Scheme's resilience to potential impacts caused by climate change.
- 13.2.32 The risks to the Scheme associated with an increased frequency of extreme weather events, as highlighted by UKCP18 projects will be assessed. The Scheme's resilience against gradual climatic changes over the lifespan of the Scheme, expected to be 60 years, will also be considered.
- 13.2.33 Vulnerable and sensitive receptors were identified, and the sensitivity of the receptors determined using quantifiable data, where available. The susceptibility and vulnerability of the receptor are considered alongside its value and importance.
- 13.2.34 The susceptibility of the receptor is determined using the following scale:
- High susceptibility: receptor has no ability to withstand/not be substantially altered by the projected changes to the existing/prevaling climatic factors (e.g. lose much of its original function and form)
 - Moderate susceptibility: receptor has some limited ability to withstand/not be altered by the projected changes to the existing/prevaling climatic conditions (e.g. retain elements of its original function and form); and
 - Low susceptibility: receptor has the ability to withstand/not be altered much by the projected changes to the existing/prevaling climatic factors (e.g. retain much of its original function and form).
- 13.2.35 The vulnerability of the receptor is determined using the following scale:
- High vulnerability: receptor is directly dependent on existing/prevaling climatic factors and reliant on these specific existing climate conditions continuing in future (e.g. river flows and groundwater level) or only able to tolerate a very limited variation in climate conditions
 - Moderate vulnerability: receptor is dependent on some climatic factors but able to tolerate a range of conditions (e.g. a species which has a wide geographic range across the entire UK but is not found in southern Spain); and
 - Low vulnerability: climatic factors have little influence on the receptors.
- 13.2.36 The likely effects of climate change on the Scheme will be evaluated to identify the magnitude i.e., the degree of change from the relevant baseline conditions. Magnitude is based on a combination of likelihood and consequence.
- 13.2.37 The criteria to assess the likelihood of occurrence and the consequence of the hazard produced by the climate change impact are defined in Table 13.5 and Table 13.6. The



consequence of the climate risk will be determined using professional judgement and supporting evidence.

Table 13.5 Criteria to Assess Likelihood of Climate Change Impact

Level of Likelihood	Definition of Likelihood
Very low	It is highly improbable that the impact will occur during the operational phase or the construction phase of the assets or systems. The event might occur once during the Construction, Operation (including maintenance and replacement) and Decommissioning phases of the Scheme (60 years).
Low	The event occurs during the lifetime of the Scheme (60 years), e.g. once in 60 years.
Medium	The event occurs limited times during the Construction, Operation (including maintenance and replacement) and Decommissioning phases of the Scheme (60 years), e.g. approximately once every 15 years, typically 4 events.
High	The event occurs several times during the Construction, Operation (including maintenance and replacement) and Decommissioning phases of the Scheme (60 years), e.g. approximately once every five years, typically 12 events.
Very High	The event occurs multiple times during the Construction, Operation (including maintenance and replacement) and Decommissioning phases of the Scheme (60 years), e.g. approximately annually, typically 60 events.



Table 13.6 Measure of consequence

Consequence impact	Description
Very large adverse	Single or multiple deaths involving any persons; <ul style="list-style-type: none"> • Disastrous work interruption • Huge financial loss; and • Devastating environmental implications.
Large adverse	Major injuries, including permanent disabling injuries of over 14 days; <ul style="list-style-type: none"> • Major work interruption • Serious financial loss; and • Severe environmental implications.
Moderate adverse	4 - 14 day lost-time injury(s). Medical treatment required; <ul style="list-style-type: none"> • Substantial work interruption • Considerable financial loss; and • Moderate environmental implications.
Minor adverse	Injury requiring first aid treatment; <ul style="list-style-type: none"> • Causing interruption of work for 3 days or less • Slight financial loss or cost; and • Slight environmental consequence.
Negligible adverse	Minor cuts/abrasions requiring minimal treatment; <ul style="list-style-type: none"> • Causing minimal work interruption • No financial loss or costs; and • No environmental consequence.

13.2.38 The receptor significance is evaluated using the sensitivity and magnitude of effect that are combined in the significance matrix shown in Table 13.7.



Table 13.7 Significance matrix

		Measure of Likelihood*				
		Very High	High	Medium	Low	Very Low
Measure of Consequence	Very Large	S	S	S	S	NS
	Large	S	S	S	S	NS
	Moderate	S	S	S	NS	NS
	Minor	S	S	NS	NS	NS
	Negligible	NS	NS	NS	NS	NS

13.2.39 Embedded mitigation measures of the Scheme have been considered as part of the review of potential impacts.

Scoped out

13.2.40 Sea Level rise has been scoped out of the assessment due to the distance of the Scheme from the coast. Further information can be found in **Volume III, Appendix 2.3** Scoping Opinion Response.

Table 13.8 Climate change scoping summary

Aspect	Construction	Operation	Decommissioning
Sea Level Rise	Scoped Out	Scoped Out	Scoped Out

13.3 Study Area

Lifecycle Greenhouse Gas (GHG) Impact Assessment

13.3.1 In accordance with the latest IEMA guidance [13-1] the Study Area for the assessment of GHG emissions has been scoped to be the global climate.

In-Combination Climate Change Impact Assessment

13.3.2 The ICCI Study Area considers receptors that are identified within the Flood Risk assessment that will be impacted by the Scheme in combination with future climatic conditions.

13.3.3 The ICCI Study Area considers receptors that are identified within the Flood Risk Assessment as outlined in **Volume I, Chapter 12: Water Resources** and other relevant topic chapters (for



example, ecology and socioeconomics) that will be impacted by the Scheme in combination with future climatic conditions.

Climate Change Resilience

- 13.3.4 For the CCR Assessment, the scope of study area for this assessment is the extent of the Site during Construction, Operation (including maintenance and replacement) and Decommissioning Phases.

13.4 Baseline Conditions

- 13.4.1 This section describes the baseline environmental characteristics for the Scheme and surrounding areas with specific reference to climate change.

Lifecycle Greenhouse Gas (GHG) Impact Assessment - Existing Baseline

- 13.4.2 The baseline GHG emissions are dependent on the soil and vegetation types present and the fuel used for the operation of any plant and machinery on the Site.
- 13.4.3 For the lifecycle GHG impact assessment, the baseline is a 'business as usual' scenario whereby the Scheme is not implemented. The baseline comprises existing carbon stock and sources of GHG emissions within the Site from the existing activities on-site. As a conservative approach, the baseline activities on site will be assumed to be generating zero emissions of CO₂e.

Lifecycle Greenhouse Gas (GHG) Impact Assessment - Future Baseline

- 13.4.4 The Scheme is expected to provide a substantial source of renewable electricity for the country. Compared to the emissions generated from the current grid as a UK average, the Scheme is anticipated to result in the generation of fewer GHG emissions. This will be assessed by the comparison of emissions of Carbon Dioxide and equivalent gases (CO₂e) from the existing UK average grid emission forecast for 2033 (0.024 kgCO₂e/kWh), which is the estimated first operational year, and the Operational carbon intensity of the Scheme. The first operational year has been used as the future baseline as future forecasts are reliant on developments such as the Scheme being implemented.
- 13.4.5 The development of carbon capture projects to reduce emissions from existing plant and available baseline information were considered to the extent possible.
- 13.4.6 To account for the beneficial effect of the development in reducing GHG emissions compared to a 'without scheme' scenario, this assessment considers forecast g/kwh emissions from the grid as published by DESNZ in the Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - GOV.UK. Using 'Data Table 1-19', Table 1: Electricity emissions factors to 2100, kgCO₂e/kWh [13-8]. The energy generation carbon intensity for the first year of operation has been used as a future baseline value as a conservative approach as explained below.
- 13.4.7 Comparing the carbon intensity of a single electricity generation project, such as the Scheme, against the average carbon intensity of the entire UK electricity grid does not provide a particularly useful comparison for two key reasons.



- 13.4.8 Firstly, the UK grid's carbon intensity is not static, but rather changes over time as the electricity generation mix evolves. There has been significant decarbonization of the UK grid over the past decade, and this trend is expected to continue in the future. However, this ongoing decarbonization is contingent upon the successful development and integration of new renewable energy projects, like the Scheme. Comparing the Scheme's carbon intensity to projections of future grid carbon intensity fails to recognize that the grid can only continue to decarbonize if additional renewable generation projects, such as the Scheme, are able to come online and contribute to this process.
- 13.4.9 Secondly, it is not the average UK generation capacity that projects like the Scheme seek to displace. Instead, the contribution from renewable electricity projects can only support the grid's decarbonization if they displace existing higher-carbon generating capacity. Currently, the marginal generating capacity on the UK grid is predominantly provided by unabated, gas-fired combined cycle gas turbine (CCGT) power stations.
- 13.4.10 It is the displacement of existing gas-fired power stations that low-carbon installations like the Scheme must achieve in order to support the UK's net-zero emissions ambitions. However, as a conservative approach, the assessment has considered the existing UK average grid emissions forecast for 2033 (0.024 kgCO₂e/kWh), which is the estimated first operational year of the Scheme, as the future baseline.
- 13.4.11 The assessment will establish the baseline which will consider the factors above and will then consider the GHG emissions over the Scheme's Construction, Operation (including maintenance and replacement) and Decommissioning phases.
- 13.4.12 Consideration will be given to the wider impacts of the Scheme including in the context of current and future carbon budget targets developed for the UK, and the Scheme's overall contribution to climate change.
- 13.4.13 In the absence of the Scheme, it is considered there will be no change to the future baseline for climate change. The baseline details including the current forecast national greenhouse gas emissions associated with energy generation are not anticipated to change in the absence of the Scheme.

Climate Change Resilience - Existing Baseline

- 13.4.14 Historical climate data for the 25km grid covering the Site has been obtained from the UK Climate Projections 2018 (UKCP18) data available from the Centre of Environmental Data Analysis (CEDA) Archive from the dataset "HadUK-Grid Gridded Climate Observations on a 25km grid over the UK for 1862-2018" [Ref 13-8].
- 13.4.15
- 13.4.16 Table 13.9 presents a summary of the observed climate in the Study Area.

Table 13.9 Historic Climatic Data

Parameter	Long term average (1991 – 2020)
Duration of sun in a year (hours)	1,543



Parameter	Long term average (1991 – 2020)
Days of snow-lying (days)	7.8
Mean windspeed at 10m above ground (knots)	5.1
Rainfall in a year (mm)	715
Mean vapour pressure (hPa)	10.4
Mean sea level pressure (hPa)	1014
Mean relative humidity (%)	81.4
Days of ground frost (days)	98.2
Mean air temperature (°C)	10.3

Climate Change Resilience Future Baseline

13.4.17 It is anticipated that the future baseline will be different from the current present-day baseline, due to changes in climate. For this assessment, UKCP18 probabilistic projections have been provided for 30-year periods from 2020 - 2099 and obtained for the following climate variables which includes annual and seasonal changes in climatic conditions over the land area of the Scheme.

- Mean annual air temperature
- Mean annual precipitation; and
- Mean annual cloud cover.

13.4.18 A representative 25km² grid square at the geographical centre of the Scheme that encompasses the Scheme's location has been used to analyse the UKCP18 probabilistic projections for changes in average climate. Temperature, precipitation, and cloud anomalies are considered relative to the 1981 to 2010 baseline. These variables are illustrated in Table 13.10.

13.4.19 There are a range of different climate scenarios also known as Representative Concentration Pathways (RCPs) used in UKCP18 that help inform future trends in emissions [13-7]. For this assessment RCP 8.5 has been used, which assumes a 'business as usual' pathway for climate change as recommended by the IEMA guidance.

13.4.20 The impact of climate change on the Scheme including its physical structures, vehicles, workers, staff and visitors will be determined over the course of the Scheme's Construction, Operation (including maintenance and replacement) and Decommissioning phases, which is estimated to be 60 years for the purpose of the EIA. For the assessment, the climatic impacts of GHG emissions at the 10%, 50% and 90% probability levels up to 2099 are included which covers the assessment up to the 2089 expected decommissioning date.



Table 13.10 Anomalies for probabilistic projections (25km) over UK for RCP8.5

Variable	2020-2049	2050-2079	2070-2099
Mean air temperature anomaly at 1.5m (°C)	+1.1 (-0.8 to +3.51)	+2.4 (-0.7 to +7.1)	+3.6 (-0.8 to +10.30)
Mean annual precipitation rate [mm/day]	-0.1 (-55.8 to +43.8)	-2.62 (-73.3 to +68.0)	-2.8 (-86.3 to +95.2)
Mean annual cloud cover (%)	-2.4 (-27.2 to +14.0)	-4.9 (-46.9 to +16.6)	-7.0 (-60.4 to +18.9)

In-Combination Climate Change Impact Assessment

- 13.4.21 Baseline Conditions for the ICCI Assessment will be determined using the climate change projections data. UK Climate Projections 2018 (UKCP18) data is available from the Centre of Environmental Data Analysis (CEDA) Archive.
- 13.4.22 Climate change impacts relevant to the Scheme will be assessed through the other relevant topics of the ES. For example, how an increase in rainfall may lead to a higher risk of flooding, will be covered in the **Volume I, Chapter 12: Water Resources** of the ES and will provide the dataset for our assessment. These in-combination effects will be summarised within the Climate Change Chapter of the ES.

13.5 Embedded Mitigation

Embedded Construction Mitigation Measures

- 13.5.1 The following Construction Phase embedded mitigation measures have been incorporated into the Scheme design, with detailed proposals and locations to be submitted with the DCO Application.

GHG Impact

- 13.5.2 Embedded mitigation measures will be implemented to reduce the GHG impact of the Scheme. Specific embedded mitigation measures include the following and will also be included in the Outline Construction Environment Management Plan (oCEMP):
- Increasing recyclability by segregating construction waste to be re-used and recycled where reasonably practicable
 - Designing, constructing and implementing the Scheme 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; and



- Reusing suitable infrastructure and resources already available within the Development Area where practicable to minimise the use of natural resources and unnecessary materials (e.g. reusing excavated soil for fill requirements).

13.5.3 General Practices:

- Adopting the Considerate Constructors Scheme (CCS) to assist in reducing pollution, including GHGs, from the Scheme by employing good industry practice measures; and
- Conducting regular planned maintenance of the construction plant and machinery to optimise efficiency.

13.5.4 Reducing vehicle emissions:

- Encouraging the use of lower carbon modes of transport by identifying and communicating local bus connections and pedestrian and cycle access routes to/from the Scheme to all construction staff, and providing appropriate facilities for the safe storage of cycles
- Switching vehicles and plant off when not in use and ensuring construction vehicles conform to current EU emissions standards; and
- Implementing a shuttlebus to transport employees to the sites.

Climate Change Resilience

13.5.5 Climate change resilience measures are embedded within the Scheme, particularly in relation to flood risk. These measures are outlined below. The specific flood risk impacts and associated mitigation measures are discussed in more detail in **Volume I, Chapter 12: Water Resources** and include:

- Any tracks to be implemented will comprise a graded Type 2 or 3 washed / clean aggregate. Where new access points are required the bellmouth will typically be asphalt and would be limited in extent. This limits the potential for increased surface water runoff rates and sedimentation effects during rainfall events
- The Scheme has been sequentially designed to locate all electrically sensitive infrastructure (e.g., the substation compounds, inverters and transformers) outside of Flood Zones 2 and 3 to mitigate against the risk of flooding
- Existing access tracks would be retained to limit the requirement to develop new access which can disturb soils and lead to compaction, where practicable. Where new access tracks are required, they would be designed to avoid crossing drainage ditches, where practicable
- An oCEMP accompanying the DCO Application, will describe water management measures to control surface water runoff and drain hardstanding and other structures during the Construction Phase of the Scheme. This will form part of a Pollution Prevention Plan (PPP) to be implemented for the Scheme
- Access to the Scheme during construction would be taken from new permeable or existing farm tracks accessed from the local highway network. This limits the potential for increased surface water runoff rates and sedimentation effects during construction/decommissioning; and



- A Water Management Plan (which will form part of a detailed CEMP) will include details of pre-construction, construction, and post-construction water quality monitoring. This will be based on a combination of visual observations and reviews of the Environment Agency's automatic water quality monitoring network.

13.5.6 Additional climate change resilience measurements will be embedded within the Scheme:

- Using equipment's cooling systems where necessary/adapting working practices and equipment used based on current weather conditions
- Measures to protect workers and resources from extreme weather conditions
- Monitoring weather forecasts and the news for Environment Agency flood warnings, relevant weather warnings, and water levels of the local waterway; and
- BESS systems would include heating, ventilation and cooling (HVAC) systems and these would be contained within the individual equipment containers.

Operational Phase

13.5.7 Replacement activities as well as regular planned maintenance of the Scheme will occur during operation. Where applicable, the construction mitigation measures as outlined above will also be put in place during operation to optimise efficiency and will be outlined in the Operational Environmental Management Plan.

13.5.8 Specifically, the following embedded mitigation measures will be in place for the Operational Phase:

- With regards to flood risk, the individual Sites which make up the Scheme have been assessed on the best available data for each Site. Based on the assessed flood risk the following embedded design has been implemented
- Critical infrastructure within the Scheme (the conversion units, substations, and energy storage compounds) will be sequentially located where possible to an area with a "Low probability of flooding" and therefore in land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)
- Non-flood sensitive infrastructure forming the wider Scheme (PV arrays and cabling) will be sequentially located outside the 1 in 100 plus climate change annual probability extent (1% +CC) or where this is not practicable restricted to areas which experience less than 1 m depth of flooding during the same event
- Flexibility for either Single Axis Trackers or Fixed South Facing PV Arrays has been built into the EIA. The PV panels will have metal frames that hold PV panels in rows (PV Tables), either secured via metal post driven into the ground at a depth of 1.5-3.5m or weighed down using concrete feet (detailed in the **Volume I, Chapter 5: Scheme Description**)
- For both Single Axis Trackers or Fixed South Facing PV Arrays, all sensitive and electrical equipment on the PV panel will be elevated by the legs (including the PV panel face itself)
- Single Axis Trackers panel units will be mounted on raised frames and will therefore, be raised above surrounding ground levels and fitted with a tracking system. During times of flooding, PV panels may be stowed by the tracking system algorithm onto a horizontal



plane, to the minimum post height of 2.5 m above ground level. This ensures that all sensitive and electrical equipment on the PV panel is raised to a minimum of 2.5 m above ground level in the horizontal position

- Using equipment's cooling systems where necessary/adapting working practices and equipment used based on current weather conditions
- Protecting workers and resources from extreme weather conditions through appropriate PPE and working practices as secured through the OEMP
- Monitoring weather forecasts and the news for Environment Agency flood warnings, relevant weather warnings, and water levels of the local waterways. This will be included within the OEMP; and
- Battery Energy Storage System (BESS) systems would include Heating, Ventilation and Cooling (HVAC) systems and these would be contained within the individual equipment containers.

Decommissioning Phase

13.5.9 Similar measures to the Construction Phase will be developed prior to the Decommissioning Phase for the use of lower-carbon and more climate change resilient methods and will be outlined in the Decommissioning Environmental Management Plan (DEMP).

13.5.10 Decommissioning is expected to occur in 2093. The requirements for decommissioning are subject to change as the environment beyond 2093 is likely to be considerably different to today. The future technological, regulatory, and environmental landscape beyond 2089 is difficult to predict with certainty, so maintaining flexibility in the decommissioning approach is prudent.

13.6 Assessment of Likely Significant Effects

13.6.1 Considering the embedded mitigation measures as detailed in Section 13.5, the potential for the Scheme to generate effects was assessed using the methodology as detailed in Section 13.2 of this chapter. In the sections below, associated impacts and effects during the Construction, Operational and Decommissioning Phases of the Scheme are discussed.

GHG Impact Assessment

13.6.2 The impacts and effects (both beneficial and adverse) associated with the construction, operation and maintenance, and decommissioning of the Scheme are outlined in the sections below. The PEIR assessments have been based on a preliminary GHG assessment which used available design information, comparisons with similar proposed developments and industry benchmarks. It should be noted that the information used to inform the assessments is preliminary and is subject to change within the DCO Application. The assessment below provides the best estimates available at the time of writing.

13.6.3 Whilst it is important to understand the GHG impacts at each individual lifecycle stage, it is also important to understand the net lifecycle GHG impact of the Scheme due to the long-term cumulative nature of GHG emissions over the assessed lifespan of the Scheme.



13.6.4 The net impact of the Scheme is also identified and assessed, considering the renewable energy generation and the benefit of this in the context of the wider energy generation sector and the National Grid average GHG intensity DESNZ forecast for 2033 (0.024 kgCO₂e/kWh) as described in the future baseline section (paragraphs 13.4.5 to 13.4.13). This overall assessment, which accounts for all GHG emissions over the assessed lifespan of the Scheme, compares the Scheme’s GHG intensity to the National Grid average GHG intensity to quantify the net GHG impact of the Scheme compared with other predicted energy generation sources.

Construction Phase (2031-2033)

13.6.5 For the purposes of the GHG impact assessment, the Construction Phase is anticipated to last for two years beginning Q3 2031 and ending Q3 2033. Emissions will result from activities during site preparation / enabling works, construction, commissioning activities, the production of materials e.g. extraction of raw materials and manufacturing products necessary to make equipment, and the transportation of the equipment as detailed in Table 13.1.

13.6.6 Details of the Construction Phase is set out in **Volume 1, Chapter 5: Scheme Description**.

13.6.7 During the Construction Phase, the greatest impact of GHGs is the result of embodied carbon in the materials used for construction. As mentioned previously, the PV panels are expected to be sourced from China or a country of similar distance and therefore, the manufacture and supply of PV panels and associated products will likely be the largest source of GHG emissions.

13.6.8 The GHG emissions associated with the construction activities and embodied carbon in products to be installed on site are detailed in Table 13.11.

Table 13.11 Construction GHG emissions

Emission Source	Emissions (tCO ₂ e)	% Construction Emissions
Products (PV arrays including mounting)	119,281	32.2
Products (Transformers)	9,428	2.5
Products (Cables)	2,388	0.6
Products (Inverters)	1,570	0.4
Products (BESS)	210,370	56.7
Transportation of Materials by Sea	25,332	6.8
Worker Transportation & Delivery Vehicles	1,617	0.4



Emission Source	Emissions (tCO ₂ e)	% Construction Emissions
Waste (accounting for sewage waste and excavation which is unable to be reused)	223	0.1
Water used for cleaning and potable water	3	<0.1
Energy Usage for Construction Period	293	0.1
Packaging	82	<0.1
Pylons	236	0.1
Total	370,822	100.0

13.6.9 It is assumed that with the conversion of arable land to grassland required for the installation of PV panels; there will be an increase in sequestered carbon, due to the conversion of large cropland areas into grassland, which has greater carbon sequestration potential [Ref 13-9]. However, for the purpose of this assessment, it is assumed that these grasslands will be reverted back to cropland after the Scheme is decommissioned, releasing any stored carbon back into the atmosphere. Following a conservative approach, the positive GHG impact from the land use change is considered temporary, only through the lifespan of the Scheme, and has been excluded from the lifecycle GHG impact assessment. This conservative approach may underestimate the Scheme's beneficial effects, as it would be open for landowners to retain any trees and hedgerows planted as part of the Scheme post-decommissioning, allowing continued carbon storage in soil and vegetation.

Significance of Effect (Construction)

13.6.10 Total GHG emissions from the Construction Phase are estimated to equate to around 370,822 tCO₂e.

13.6.11 GHG emissions from construction activities will be limited to the duration of the Construction Phase (2 years). When annualised, the total annual construction emissions equate to around 185,106 tCO₂e. It should be noted that the majority of emissions arise from embodied carbon associated with the manufacture of products.

13.6.12 As noted above, the significance of effect will be assessed for the lifespan of the Scheme.



Operational Phase

13.6.13 During the Operational Phase, GHG emissions will likely arise from routine operation and maintenance of the Scheme as well as embodied carbon in replacement products to be installed on site as parts installed during initial construction reach the end of their lifecycles. The GHG emissions associated with the operational activities are detailed in Table 13.13.

13.6.14 Scheduled replacement activities will be required as part of the Scheme, replacement of PV panels and batteries will likely be required as part of maintenance activities, the estimated lifetime and replacement rates for PV panels and batteries is set out in Table 13.12.

Table 13.12 Estimated Replacement Rate of Components

Component	Comment	Design life / Replacement Frequency	Recyclable
PV Panels	The approximate operational life of PV Panels is 40 years. It is assumed that repowering would be undertaken once during the operation of the Scheme.	40 years	Yes
Ground mounted PV Modules	Replacement is not anticipated during Scheme operation.	Entire Operational Phase	Yes
DC Cables (low voltage on-site cabling between PV Panels and Conversion Units)	It is not anticipated that the DC cables will need to be replaced during operation, although an allowance has been made for up to 20% of the DC cabling to be replaced during the Scheme operation due to damage or defects.	Entire Operational Phase	Yes
BESS and Inverters	Assumed design life of up to 10 years.	10-15 years	Yes
AC Cable (medium voltage on-site cabling)	Replacement is not anticipated during Scheme operation.	Entire Operational Phase	Yes
Transformers	Assumed design life of 20 years, although replacement will only be carried out if required for performance or health and safety reasons.	20 + years	Yes



Component	Comment	Design life / Replacement Frequency	Recyclable
Switchgear	Assumed design life of 20 years, although replacement will only be carried out if required for performance or health and safety reasons.	20 + years	Yes
HV Cabling (Grid Connection Cable)	Replacement is not anticipated during Scheme operation.	Entire Operational Phase	Yes
On-Site Substation (National Grid Substation and Customer Substation)	Replacement of substations is not anticipated during Operational Phase.	Entire Operational Phase	Yes

13.6.15 GHG emissions have also been generated as a result of additional operational activities such as the transportation of operational workers to and from the Site and some minor emissions from mains water consumption, wastewater treatment and the transport and treatment of waste from staff facilities.

13.6.16 It should be noted that assumptions around replacement emissions are all based on the current year baseline. In reality, it is expected that GHG emissions associated with transport and generation of products will be significantly lower, so the below assessment is indicative of a worse case approach.

Table 13.13 Operational GHG emissions

Emission Source	Emissions (tCO ₂ e)	% Operation Emissions
Maintenance trips	2,202	0.17
Replacement BESS	1,051,849	82.99
Replacement PV modules	119,281	9.41
Water Usage	53	0.00
Operational Waste	15	0.00



Emission Source	Emissions (tCO ₂ e)	% Operation Emissions
Energy Usage for Operational Phase	31,157	2.46
Replacement Transformers	18,855	1.49
Replacement Inverters	3,139	0.25
Replacement Transport of Materials by Sea	39,042	3.08
Replacement Transport of Materials by Land	1,885	0.15
Total	1,267,477	100.0

Significance of Effect (Operational)

- 13.6.17 Renewable energy generation from the Scheme during the first year of operation is estimated to be around 1,467,220MWh/year. To account for natural wear and tear of products on site, a 2% degradation factor for the first year has been applied, followed by a 0.45% degradation factor for each subsequent year. With full expected replacement after 40 years, this results in an estimated energy generation figure of 1,319,792 MWh in the final year of operation. The total energy generated by the Scheme would be around 82,033,353 MWh over the 60-year Scheme lifespan. It is possible this is a slightly conservative estimate as future climate projections indicate a reduction in annual cloud cover over time (Table 13.10) which may have a beneficial impact on the energy generation potential of the Scheme and has not been taken into account in the calculations.
- 13.6.18 Accounting for the estimated Construction Phase and Operation Phase emissions, the Scheme's total carbon intensity value is 19.97 gCO₂e/kWh.
- 13.6.19 In 2023, the UK grid carbon intensity was 207 gCO₂e/kWh. The available UK grid carbon intensity figure only takes into account operational emissions from the generation of electricity, primarily from the fossil fuels used to power gas-fired and occasionally coal-fired power stations¹.
- 13.6.20 For context only, currently, the most carbon-efficient fossil-fuelled technology available is gas-fired Combined Cycle Gas Turbine (CCGT) generating facility, which has a representative figure for the carbon intensity of a CCGT is 350 gCO₂e/kWh.

Ref 13-1. ¹ PAS 2080:2023 Carbon Management in Infrastructure, British Standards Institution, 2023.



- 13.6.21 It should be noted that NPS EN-1 2024 requires all combustion power stations with a capacity at or over 300MW to be constructed Carbon Capture Ready (CCR). However, for the purpose of this assessment, the Scheme is compared to the Department for Energy Security & Net Zero UK grid average projection for 2030.
- 13.6.22 A range of other low-carbon electricity generation technologies are available, such as on- and offshore wind, biomass and nuclear power. Each of these technologies will have a different carbon intensity in terms of total emissions per kWh of electricity generated. A literature review indicates a range of carbon intensity figures for each power source, making it challenging to directly compare the carbon impact of a specific installation, such as the Scheme, with data for a broad generation technology.
- 13.6.23 The significance of the operational effect will be studied for the whole lifespan of the Scheme.
- 13.6.24 While sulphur hexafluoride (SF₆) is a potential source of GHG emissions over the lifetime of the Scheme (i.e. derived from certain electric items such as gas-insulated switchgear and gas-insulated transformers during production, operation through leakage, and dismantling), it has not been possible to quantify fugitive emissions from the leakage of SF₆ due to insufficient research data being available on this topic. SF₆ is one of the seven GHGs identified by the Kyoto Protocol [Ref 13-3] due to its high Global Warming Potential (GWP) of 23,900. GWP allow comparisons of the global warming impacts of different gases. Specifically, it is a measure of how much energy the emission of 1 ton of a gas will absorb over a given period of time, relative to the emission of 1 ton of carbon dioxide (CO₂). The larger the GWP, the more that a given gas warms the Earth compared to CO₂ over that time period. It is not anticipated that SF₆ emissions will significantly affect the overall outcome of this assessment, however, the ES will articulate the presence of SF₆ following refinement of the Scheme and discuss this in greater detail subject to confirmation of Scheme components are known prior to submission of the ES.
- 13.6.25 It is anticipated that greenhouse gas emissions from energy usage will reduce over the lifespan of the Scheme as a result of the decarbonization of the grid. However, that assumption is reliant on Schemes such as this one being developed. As a conservative assumption, the baseline value for 2029 from DESNZ [Ref 13-4] has been applied and the same emissions per kWh have been applied over the estimated 60 year project lifespan.
- 13.6.26 Over the Scheme's lifespan, the Scheme will result in a net saving of 2,004,431tCO₂e in comparison with a scenario whereby the Scheme does not come into effect and emissions from the grid in the first year of operation were used.

Decommissioning Phase

- 13.6.27 As the decommissioning activities associated with the Scheme will occur far into the future, more than 60 years from the date of writing this report; there is uncertainty over the total estimate of GHG emissions that will be produced and the available technology. Also, the Decommissioning Phase GHG emissions will be lower than Construction, for example because the products do not need to be produced and there will be technological advancements unknown to date.
- 13.6.28 Therefore, based on the expected lower emissions profile of the Decommissioning Phase compared to Construction, the magnitude of effect is therefore considered low. GHG emissions from the decommissioning of the Scheme are considered to have a Minor Adverse significant effect on the climate. A negligible significant effect is not possible where any GHG



emissions are released to the atmosphere. The overall effect from Construction is considered not significant in EIA terms.

13.6.29 While it is anticipated the GHG emissions will be less for decommissioning compared to Construction, there will still likely be emissions arising at this stage. As such, it is anticipated that the effect of decommissioning on Climate Change will be minor adverse. This is based on the project's GHG impacts being fully consistent with applicable existing and emerging policy requirements and good practice design standards at the time of decommissioning. This is not considered significant in EIA terms.

13.6.30 Prior to decommissioning, a DEMP will be prepared inclusive of mitigation measures.

Overall GHG Significance Effect

13.6.31 UK's fourth, fifth and sixth carbon budgets have been used to contextualise emissions from the Scheme in line with IEMA guidance on Assessing Greenhouse Gas Emissions and Evaluating their Significance [Ref 13-1]. The 7th carbon budget has not been formally approved but it has been published by the Climate Change Committee. The published 7th carbon budget will be considered further in the ES.

13.6.32 The UK's fifth carbon budget has been used to contextualise the magnitude of GHG emissions from the Scheme in Table 13.14, depending on the years in which the emissions are expected to occur. Construction emissions will fall under the 5th (2028 -2030) UK carbon budget. In line with IEMA guidance on Assessing Greenhouse Gas Emissions and Evaluating their Significance, the sectoral carbon budgets for electricity supply have also been used to contextualise emissions from the Scheme. The Operational Phase of the Scheme accounts for less than 1% of the 2028, 2029 and 2030 Electricity Supply Carbon budget . The Scheme will be operational no earlier than 2030, and therefore operational emissions up to 2037 (the end of the 6th carbon budget) will fall under the 5th and 6th UK carbon budgets, beyond which point no carbon budgets have yet been published. The Operational Phase accounts for less than 1% of Electricity Supply Carbon budgets from 2030 to 2037 combined. Emissions during the Operational Phase will primarily be associated with embodied carbon in replacement products.

Table 13.14 Contextualization of the Construction Phase GHG emissions with the UK Carbon Budgets

Relevant Electricity Supply Sectoral UK Carbon Budgets	Annual Electricity Supply Sectoral Carbon budget (MtCO _{2e})	Annual Emissions for the Scheme During Carbon Budget Period (MtCO _{2e})	Emissions from the Scheme as a Proportion of Carbon Budget
2028	26.7	0.08	0.31%
2029	23.75	0.08	0.35%
2030	22.4	0.02	0.09%

13.6.33 Once in operation, the Scheme will achieve emissions reductions compared to the without-project baseline, i.e. in a scenario in which the Scheme does not go ahead and the power it



generates is provided by the current grid supply, inclusive of higher carbon generation sources such as CCGT. For context only, the current emissions from a CCGT are 350 gCO₂e/kWh. The current UK grid average carbon intensity is 180 gCO₂e/kWh. The predicted carbon intensity by 2030 is 45gCO₂e/kWh [Ref 13-7]. For the purpose of this assessment, the Scheme is compared with the predicted carbon intensity for the grid in 2030 as detailed in paragraphs 13.4.5 to 13.4.13 and is not compared directly to emissions from CCGT energy generation.

- 13.6.34 Therefore, the GHG emissions during construction, operation, and decommissioning of the Scheme can be considered to be ‘offset’ by the net positive impact of the Scheme on GHG emissions and the UK’s ability to meet its carbon targets.
- 13.6.35 As the GHG emissions from the Scheme in operation will offset emissions in a comparative scenario where energy generation may be from other sources inclusive of non-renewables, it is considered that the overall GHG impact of the Scheme is **beneficial** and **significant**, as it will play a part in achieving the rate of transition required by nationally set policy commitments and supporting the trajectory towards net zero. The without-project baseline alternative would result in higher GHG emissions.
- 13.6.36 The significance conclusion will be reviewed as part of the ES based on the more detailed overall findings inherent within that assessment.

Climate Change Resilience Assessment

- 13.6.37 Potential climate risks to the Construction, Operational and Decommissioning Phases, the embedded mitigation that will contribute to climate change resilience, and the likelihood, consequence and significance are detailed in Table 13.15, Table 13.16, and Table 13.17, respectively.



Table 13.15 Potential Climate Change Impacts and Embedded Mitigation Measures during Construction Phase

Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to the Scheme	Embedded mitigation	Likelihood	Consequence	Significant or Not Significant
High temperatures	Increase in annual temperature	Workers, staff and visitors on site	Risk of overheating to workers	Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions. To be included in CEMP.	Low	Minor adverse	Not Significant
		Plant and vehicles, physical structures, materials,	Overheating of electrical equipment. Damage to materials.	BESS Equipment has HVAC cooling systems where necessary. The increase in annual temperature remains within tolerance ranges for the materials being used.	Low	Minor adverse	Not Significant



Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to the Scheme	Embedded mitigation	Likelihood	Consequence	Significant or Not Significant
High temperatures	Increase in summer temperature	All receptors	Overheating of electrical equipment. Damage to materials. Risk of overheating to workers.	Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions. To be included in CEMP.	Low	Minor adverse	Not Significant
High temperatures	Increase in heat waves	Workers, staff and visitors on site	Increased heat stress/ heat exhaustion for workers.	The Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather. To be included in CEMP.	Very Low	Minor adverse	Not Significant
		Plant and vehicles,	Overheating of electrical	The Contractor will monitor weather	Very Low	Minor adverse	Not Significant



Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to the Scheme	Embedded mitigation	Likelihood	Consequence	Significant or Not Significant
		physical structures, materials,	equipment. Damage to materials	forecasts and plan works accordingly, protecting workers and resources from any extreme weather. To be included in CEMP. BESS has HVAC cooling systems where necessary.			
High precipitation	Increase to winter rainfall	Plant and vehicles, physical structures, materials, and access routes to sites and access routes to sites.	Viability of and access to sites (such as heavy rain resulting in surface water flooding of local roads, sources of power supply or inundation of sites).	The contractors will monitor weather forecasts and receive Environment Agency's (EA) flood alerts and plan works accordingly, protecting workers and resources from any extreme weather conditions such as storms, flooding. To be included in CEMP.	Very Low	Minor adverse	Not Significant



Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to the Scheme	Embedded mitigation	Likelihood	Consequence	Significant or Not Significant
Low precipitation	Decrease to summer rainfall	All receptors	Increased construction dust.	Dust mitigation measures will be included within the CEMP.	Low	Minor adverse	Not significant
Increase in storm intensity	Stronger winds, heatwaves, heavy precipitation	Plant and vehicles, physical structures, materials, and access routes to sites	Damage to structures / materials / equipment and resulting in delays to programme and associated costs and/or unacceptable safety risks. May include high winds increasing dust (and other debris) and storm surge.	The Contractor will monitor weather forecasts and receive Environment Agency flood warnings and alerts and plan works accordingly, protecting workers and resources from any extreme weather conditions. To be included in CEMP.	Low	Moderate adverse	Not Significant



Table 13.16 - Potential Climate Change Impacts and Embedded Mitigation Measures during Operation and Maintenance Phase.

Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to Proposed Development	Existing or embedded mitigation measure		Likelihood	Consequence	Significance
High temperatures	Increase in summer temperature	All receptors (infrastructure, buildings, workers and staff)	Increase in air conditioning requirements. Overheating of electrical equipment. Risk of overheating to workers.	BESS systems would include HVAC systems, and these would be contained within the individual equipment containers. Workers and staff to forecasts and plan works accordingly. To be included in OEMP.		Low	Moderate adverse	Not Significant
High temperatures	Increase in heat waves	All receptors (infrastructure, buildings, workers and staff)	Increase in air conditioning requirements.	BESS systems would include HVAC systems and these would be contained		Low	Moderate adverse	Not Significant



Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to Proposed Development	Existing or embedded mitigation measure		Likelihood	Consequence	Significance
			Overheating of electrical equipment. Risk of overheating to workers.	within the individual equipment containers. Workers and staff to forecasts and plan works accordingly. To be included in OEMP.				
High precipitation	Increase to winter rainfall	All receptors (infrastructure, buildings, workers and staff)	Surface water flooding and standing waters. Deterioration of structures or foundations due to increase in soil moisture levels.	All sensitive and electrical equipment on the PV panel will be elevated by legs or mounted on raised frames.		Very Low	Moderate adverse	Not Significant



Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to Proposed Development	Existing or embedded mitigation measure		Likelihood	Consequence	Significance
			Damage to building surfaces/ exposed utilities from increased drying/wetting and increase frost penetration					
Low precipitation	Decrease to summer rainfall	All receptors (infrastructure, buildings, workers and staff)	Water shortages. Deterioration of structures or foundations due to decrease in soil moisture levels.	Water expected to be stored on site for fire suppression		Very Low	Minor adverse	Not Significant
Increase in storm intensity	Stronger winds, heatwaves,	Plant and vehicles, physical	Surface water flooding and	The OCEMP accompanying the DCO		Very Low	Minor adverse	Not Significant



Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to Proposed Development	Existing or embedded mitigation measure		Likelihood	Consequence	Significance
	heavy precipitation	structures, materials, and access routes to sites	<p>standing waters.</p> <p>Deterioration of structures or foundations due to increase in soil moisture levels.</p> <p>Damage to building surfaces/ exposed utilities from increased drying/wetting and increase frost penetration or tree falls.</p> <p>Strong winds damaging structures directly or via</p>	Application, will describe water management measures to control surface water run-off and drain hardstanding and other structures.				



Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to Proposed Development	Existing or embedded mitigation measure	Likelihood	Consequence	Significance
			falling trees and debris.				

Table 13.17 - Potential Climate Change Impacts and Embedded Mitigation Measures during Decommissioning Phase.

Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to Proposed Development	Existing or embedded mitigation measure	Likelihood	Consequence	Significance
High temperatures	Increase in annual temperature	All receptors	Overheating of electrical equipment. Damage to materials.	Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather	Low	Minor adverse	Not Significant



Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to Proposed Development	Existing or embedded mitigation measure	Likelihood	Consequence	Significance
			Risk of overheating to workers.	conditions. To be included in DEMP.			
High temperatures	Increase in summer temperature	All receptors	Overheating of electrical equipment. Damage to materials. Risk of overheating to workers.	Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions. To be included in DEMP.	Low	Minor adverse	Not Significant
High temperatures	Increase in heat waves	Workers, staff and	Increased heat stress/ heat	The Contractor will monitor	Very Low	Minor adverse	Not Significant



Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to Proposed Development	Existing or embedded mitigation measure	Likelihood	Consequence	Significance
		visitors on site	exhaustion for workers.	weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather. To be included in DEMP.			
		Plant and vehicles, physical structures, materials,	Overheating of electrical equipment. Damage to materials	The Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme	Very Low	Minor adverse	Not Significant



Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to Proposed Development	Existing or embedded mitigation measure	Likelihood	Consequence	Significance
				weather. To be included in DEMP.			
High precipitation	Increase to winter rainfall	Plant and vehicles, physical structures, materials, and access routes to sites and access routes to sites.	Viability of and access to sites (such as heavy rain resulting in surface water flooding of local roads, sources of power supply or inundation of sites).	The contractors will monitor weather forecasts and receive Environment Agency's (EA) flood alerts and plan works accordingly, protecting workers and resources from any extreme weather conditions such as storms,	Very Low	Minor adverse	Not Significant



Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to Proposed Development	Existing or embedded mitigation measure	Likelihood	Consequence	Significance
				flooding. To be included in DEMP.			
Increase in storm intensity	Stronger winds, heatwaves, heavy precipitation	Plant and vehicles, physical structures, materials, and access routes to sites	Damage to structures / materials / equipment and resulting in delays to programme and associated costs and/or unacceptable safety risks. May include high winds increasing dust (and other debris) and storm surge.	The Contractor will monitor weather forecasts and receive Environment Agency flood warnings and alerts and plan works accordingly, protecting workers and resources from any extreme weather conditions. To be	Low	Moderate adverse	Not Significant



Climate hazard	Potential Climate Change Impact	Receptor	Potential Climate Change Risk to Proposed Development	Existing or embedded mitigation measure	Likelihood	Consequence	Significance
				included in DEMP.			



Significance of Effect

- 13.6.38 Future climate change projections have been reviewed, and the sensitivity of assets have been examined, before commenting on the adequacy of the climate change resilience measures built into the Scheme.
- 13.6.39 The Climate Change Risk Assessment has considered the measures which are integrated into the design. These are considered an adequate response to the projected climate change impacts to which the Scheme would be exposed.
- 13.6.40 As a result of the proposed resilience measures **no significant** climate change risks during the Construction, Operational Phase or Decommissioning Phase have been identified.

In Combination Risk Assessment

- 13.6.41 The greatest risk of in combination effects are the increased flooding events from extreme weather arising from a changing climate.
- 13.6.42 Given the nature of the Scheme, the increase of permanent impermeable area on the Site will be negligible, however equipment such as the proposed substations and battery / energy storage areas will generate increased surface water runoff when compared to the current undeveloped nature of the Site. There can be no off-site detriment in terms of surface water runoff rates and volumes and therefore it is proposed to maintain the predevelopment surface water regime post development. Mitigation by design will be embedded in the Scheme.
- 13.6.43 **Volume I, Chapter 12: Water Resources** provides insight into the likely effects of climate change on flood risk around the site. The chapter concludes that 1 % AEP Annual Exceedance Probability (AEP) + 20 % climate change, the 0.5 % AEP and the 0.1 % AEP flood outlines do not encroach into the site area. As such the risk to flooding has been deemed as not significant. this will be subject to any further refinements of other technical chapters in the ES.
- 13.6.44 Besides the risk of increased flooding, Climate Change also has the potential to affect species and habitats. This has been considered in the Ecology and Biodiversity assessment and the potential risks of a changing climate detailed therein. Measures to mitigate against Climate Change for habitats and species include new planting being elected to be locally appropriate and resilient to foreseeable changes in climate and disease. Management is detailed in the OLEMP. The scheme itself will reduce national GHG emissions and help to mitigate the effects of climate change and as such is not anticipated to have a significant in combination effect on species and habitats.
- 13.6.45 As the scheme will generate jobs and affect people's movements and activities there will be in combination effects with Socio-Economics. These have been identified through the assessment of emissions and are included within the overall GHG assessment, e.g. for vehicle emissions from worker transport.
- 13.6.46 Following implementation of the proposed mitigation the residual effect is considered to be negligible and **not significant**.



13.7 Additional Mitigation

- 13.7.1 No additional mitigation measures for the Scheme are considered to be required for any given stage as no significant adverse effects are predicted. However, this will be investigated further within the ES.

13.8 Residual Effects

- 13.8.1 This section summarises the residual significant effects of the Scheme following the implementation of embedded mitigation as outlined in Section 13.5.
- 13.8.2 During the different stages of the Scheme (construction, operation including maintenance, and decommissioning), inevitable GHG emissions will be generated with associated transport, energy, and fuel-use. Despite this, the Scheme will provide a means of energy generation which negates GHG emissions from more polluting sources and aids in reducing UK grid average energy generation emissions, it is therefore considered that the overall GHG impact of the Scheme is beneficial and significant, as it will play a part in achieving the rate of transition required by nationally set policy commitments and supporting the trajectory towards net zero.
- 13.8.3 The findings of the GHG assessment show that the Scheme itself will provide beneficial impacts and a net reduction in GHG emissions compared to a scenario without the scheme where energy must be generated by the baseline grid means and without the capacity for any energy storage.
- 13.8.4 The climate change risk assessment has considered the measures which are integrated into the design. These are considered an adequate response to the projected climate change impacts to which the Scheme would be exposed.
- 13.8.5 The design has accounted for Climate Resilience through accommodating embedded design mitigation within flood risk zones, though there remains uncertainty to the extent of which severe weather events will affect the UK.
- 13.8.6 As a result of the embedded mitigation measures no significant climate change risks during the Construction, Operation or Decommissioning Phase have been identified.
- 13.8.7 Whilst at this stage of the project, residual effects due to climate risks have not been fully assessed, it is anticipated that through the use of further mitigation measures such as BESS systems including HVAC systems and being contained within the individual equipment container and by not placing sensitive electrical equipment in flood risk areas, there will be a no significant residual adverse effects.
- 13.8.8 There are no significant ICCI effects identified.

13.9 Cumulative Effects

- 13.9.1 The ES will consider potential cumulative effects of the Scheme and other relevant projects within the vicinity of the Scheme on a single receptor/resource.
- 13.9.2 A list of cumulative projects can be found in **Volume III, Appendix 2.4** of the PEIR, the list will be reviewed and refined in preparation of the DCO Application submission through further consultation and will be presented and assessed in the ES.



- 13.9.3 The receptor for the GHG Assessment is the global climate. All projects worldwide have the potential to contribute to cumulative impacts on the global climate through their GHG emissions.
- 13.9.4 The receptor for the Climate Resilience Review is the solar scheme itself and its surrounding area. Given this, the potential for cumulative effects of climate change on the project is considered within the overall climate change risk assessment. The assessment has not identified any significant cumulative effects as a combined effect of multiple developments in the region. This is due to the implementation of appropriate mitigation measures to address GHG emissions and climate change resilience for the proposed solar farm scheme. The residual cumulative impacts on the global climate and the project's resilience to climate change are therefore considered to be not significant.



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- Ref 13-3. Kyoto Protocol. 1998.
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- Ref 13-5. Sixth Carbon Budget – Dataset (Version 2 – December 2021). Committee on Climate Change, 2021.
- Ref 13-6. Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation, IEMA, 2020.
- Ref 13-7. UK Climate Projections 2018 (UKCP18), UK Met Office, 2018.
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- Ref 13-10. Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal, 30th November 2023



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