Rosefield Solar Farm

Environmental Statement

Volume 2
Chapter 8: Climate

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning
(Applications: Prescribed Forms
and Procedure) Regulations 2009

EN010158/APP/6.2
September 2025
Rosefield Energyfarm Limited

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8. Climate

8.1. Introduction

8.1.1. This chapter presents an assessment of likely significant effects arising from the construction, operation (including maintenance) and decommissioning of the Proposed Development upon climate. The full description of the Proposed Development is provided within **ES Volume 1, Chapter 3: Proposed Development Description [EN010158/APP/6.1]**.

8.1.2. This chapter is further supported by the following technical appendices presented in **ES Volume 4 [EN010158/APP/6.4]**:

- **Appendix 8.1: Climate Data Sources and Assumptions**; and
- **Appendix 8.2 Climate Change Resilience Assessment**.

8.1.3. This chapter should also be read in conjunction with the following assessment chapter(s):

- **Chapter 15: Transport and Access [EN010158/APP/6.2]**; and
- **Chapter 17: Cumulative Effects [EN010158/APP/6.2]**.

8.2. Legislative framework, planning policy and guidance

8.2.1. This assessment has been undertaken with regard to the following legislation, planning policy and guidance.

8.2.2. It should be noted that this chapter does not assess the compliance of the Proposed Development against relevant planning policy. Such an assessment is presented in the **Planning Statement [EN010158/APP/5.7]**.

International treaties

- The 2015 Paris Agreement **[Ref. 8-1]**;
- United Nations Framework Convention on Climate Change 1994 **[Ref. 8-2]**; and
- Kyoto Protocol 1997 **[Ref. 8-3]**.

Legislation

- Climate Change Act 2008 (as amended by the Climate Change Act (2050 Target Amendment Order 2019)) **[Ref. 8-4]**;
- Carbon Budget Order 2009 **[Ref. 8-5]**;
- Carbon Budget Order 2011 **[Ref. 8-6]**;

- Carbon Budget Order 2016 **[Ref. 8-7]**;
- Carbon Budget Order 2021 **[Ref. 8-8]**; and
- Energy Act 2023 **[Ref. 8-9]**.

National planning policy

- Overarching National Policy Statement for Energy (NPS EN-1) (2023) Part 3 sets out the importance of Nationally Significant Infrastructure Projects (NSIPs) and explicitly includes solar generation within its scope. Section 5.3 of NPS EN-1 details the requirement for a greenhouse gas (GHG) assessment as part of the ES. Section 4.10 details the requirement for a climate change resilience assessment as part of the ES **[Ref. 8-10]**;
- National Policy Statement for Renewable Energy Infrastructure (NPS EN-3) (2023) – Section 2.10 contains details on solar energy generation **[Ref. 8-11]**;
- National Policy Statement for Electricity Networks Infrastructure (NPS EN-5) (2023) – Section 2.3 references requirements related to climate change adaptation and resilience **[Ref. 8-12]**;
- National Planning Policy Framework (2024) – Section 14 describes how to meet the challenge of climate change, flooding and coastal change **[Ref. 8-13]**;
- British Energy Security Strategy (Department for Business, Energy & Industrial Strategy, and Department for Energy Security & Net Zero, 2022) **[Ref. 8-14]**;
- Energy White Paper: Powering our Net Zero Future (2020) **[Ref. 8-15]**;
- Powering Up Britain (2023) **[Ref. 8-16]**;
- Net Zero Strategy: Build Back Greener (2021) **[Ref. 8-17]**;
- The Ten Point Plan for a Green Industrial Revolution (2020) **[Ref. 8-18]**; and
- The Clean Growth Strategy (2017) **[Ref. 8-19]**.

Local planning policy

- Vale of Aylesbury Local Plan (VALP) 2013 – 2033 (adopted September 2021) - specifically Policy C3 ‘Renewable Energy’. This policy states “*VALP aims to mitigate the impact of climate change by minimising greenhouse gas emissions and adapt to the potential impacts of climate change by managing and reducing risks*”. It mentions the Buckinghamshire Energy Strategy, which supports the delivery of greater local generation; and the VALP introduction of renewable energy developments. **[Ref. 8-20]**; and

- Buckinghamshire Council Climate Change and Air Quality Strategy (adopted 2021). The first aim for this strategy outlines the commitment to achieve net zero by 2050 at the latest. It is aligned with the approach of reducing emissions and adapting to climate change, including the current and growing installation of solar panels to produce renewable energy. **[Ref. 8-21]**.

Guidance

- Assessing Greenhouse Gas Emissions and Evaluating their Significance (Institute of Environmental Management and Assessment (IEMA), 2022) **[Ref. 8-22]**;
- Planning Practice Guidance on Climate Change (Ministry of Housing, Communities and Local Government and Department for Levelling Up, Housing and Communities, 2019) **[Ref. 8-23]**;
- A Corporate Accounting and Reporting Standard (The Greenhouse Gas Protocol, 2004) **[Ref. 8-24]**; and
- Whole Life Carbon Assessment for the Built Environment (Royal Institution of Chartered Surveyors, 2023) **[Ref. 8-25]**.

8.3. Stakeholder engagement

8.3.1. **Table 8.1** provides a summary of the stakeholder engagement activities undertaken separate from the Environmental Impact Assessment (EIA) scoping, Phase One Consultation, Phase Two Consultation and Targeted Consultation process. This table also details the matters raised, how such matters have been addressed, and where they have been addressed within the DCO Application documentation.

8.3.2. **ES Volume 4, Appendix 5.3: EIA Scoping Opinion Response Matrix [EN010158/APP/6.4]** presents the responses received in the EIA Scoping Opinion and the Applicant's response to each matter that has been raised.

8.3.3. **Appendices A4, J1, J2 and K3** of the **Consultation Report Appendices [EN010158/APP/5.2]**, which is submitted in support of the DCO Application, sets out the feedback received during Phase One Consultation, Phase Two Consultation and Targeted Consultation and how regard has been afforded by the Applicant to each matter raised.

Table 8.1: Summary of stakeholder engagement

Consultee	Date of engagement	Summary of matters raised	Outcome of engagement	Where this matter is addressed in the DCO Application documentation
Buckinghamshire Council	11 April 2025 (online meeting)	The assessment should present a comparison against United Kingdom (UK) carbon budgets in order to provide national context for emissions. Mitigation measures were stated to lack specificity in the Preliminary Environmental Information Report (PEIR). A suitable comparison with UK grid carbon intensity should be shown within the chapter.	A comparison of emissions from the Proposed Development against the 7th carbon budget was carried out. Embedded and additional mitigation measures were expanded upon, aiming to ensure that they are specific and actionable. Further context was provided surrounding the differing methodologies between this assessment and that used in the calculating of the UK grid carbon intensity, as well as a presentation of additional comparison methodologies and their outputs.	Comparisons against UK carbon budgets are presented in **Table 8.15** and **Table 8.16**. Embedded mitigation measures are presented in **Section 8.8**, while additional mitigation measures are presented in **Section 8.10**. Further context and explanation concerning UK grid carbon intensities, and the difficulty in comparing with this assessment, is provided in **Section 8.8**, with **Table 8.17** showcasing a comparison of the emissions intensity of the Proposed Development against the UK grid carbon intensity.

8.4. Approach to identifying the scope of the assessment

Study area

8.4.1. The sensitive receptor for GHG emissions is the global atmosphere, which is considered highly sensitive to GHG fluctuations. By proxy, this can also be extended to the UK's commitments under the UK Climate Change Act 2008 (2050 Target Amendment) Order 2019 **[Ref. 8-4]**, which aligned with the goals of the 2015 Paris Agreement **[Ref. 8-1]**, to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C.

8.4.2. The Proposed Development has the potential to affect the climate by the addition and avoidance of GHG emissions in comparison to the baseline and future baseline scenario.

8.4.3. The scope of the GHG assessment includes the addition of GHG emissions directly from construction, operational (including maintenance), and decommissioning activities undertaken within the Order Limits, including fuel consumption. It also includes indirect emissions which would occur outside the Order Limits, but related to the activities of all stages of the Proposed Development, including those from:

- the extraction, manufacture, and transportation of construction products and materials to the Site;
- the transportation of workers to the Site; and
- off-site transportation and disposal of waste.

8.4.4. The assessment also considers the GHG savings from the Proposed Development as a result of displacing fossil-fuel based energy in the national electricity network.

Scope of the assessment

8.4.5. The scope of this assessment has been established throughout the EIA process and design of the Proposed Development. Further information can be found in **ES Volume 1, Chapter 5: Approach to the EIA [EN010158/APP/6.1]**.

8.4.6. This section provides an update to the scope of the assessment from that presented in **ES Volume 4, Appendix 5.1: EIA Scoping Report [EN010158/APP/6.4]** and re-iterates/updates the evidence base for scoping receptors/matters in or out following further iterative assessment.

Receptors/matters scoped into the assessment

8.4.7. **Table 8.2** presents the receptors/matters that are scoped into the assessment reported within this ES, together with appropriate justification.

Table 8.2: Receptors/matters scoped into the assessment

Receptor/matter	Phase	Justification
GHG emissions	Construction, operation (including maintenance), and decommissioning	This matter is scoped into the assessment, as detailed within **ES Volume 4, Appendix 5.1: EIA Scoping Report [EN010158/APP/6.4]** and confirmed within **ES Volume 4, Appendix 5.2: EIA Scoping Opinion [EN010158/APP/6.4]**.

Receptors/matters scoped out of the assessment

8.4.8. **Table 8.3** presents the receptors/matters that are scoped out of the assessment that are therefore not considered as part of this ES, together with appropriate justification.

Table 8.3: Receptors/matters scoped out of the assessment

Receptor/matter	Phase	Justification
Climate resilience	Construction, operation (including maintenance) and decommissioning	This matter is scoped out of the assessment in relation to Solar PV, as detailed within **ES Volume 4, Appendix 5.1: EIA Scoping Report [EN010158/APP/6.4]** and confirmed within **ES Volume 4, Appendix 5.2: EIA Scoping Opinion [EN010158/APP/6.4]**. Nevertheless, the Planning Inspectorate requested that the ES demonstrates how the Proposed Development has been designed to be resilient to climate change. This should include a description of the measures that have been embedded in the design to enable climate resilience during construction, operation (including maintenance) and decommissioning. Climate resilience has been considered in the design development and Solar PV modules have been raised to up to 4.5m in areas of flood risk within Parcel 3 of the Site to account for flood risk and climate resilience, as detailed in **ES Volume 1, Chapter 3: Proposed Development**

Receptor/matter	Phase	Justification
		Description [EN010158/APP/6.1], ES Volume 3, Figure 3.1: Height Parameters [EN010158/APP/6.3] and secured in the **Design Commitments [EN010158/APP/5.9]**. Within **ES Volume 4, Appendix 5.2: EIA Scoping Opinion [EN010158/APP/6.4]**, the Planning Inspectorate further stated that climate resilience in relation to other elements of the Proposed Development (such as the proposed substation, cable corridors, BESS and highways access) should be considered within the ES. An assessment of the impact of climate change on select ancillary components of the Proposed Development, including the proposed Rosefield Substation, BESS, cabling and access was carried out within the PEIR which concluded that there were no likely significant effects. Between the PEIR and the time of writing this assessment, there have been no changes to the climate projections for the UK, the receptors which were assessed, or the guidance or methodology that was used that would have impacted the assessment which was carried out for the PEIR; therefore, the conclusions presented in the PEIR are unchanged. The Climate Change Resilience Assessment, complete with methodology and significance criteria, has been provided in **ES Volume 4, Appendix 8.2: Climate Change Resilience Assessment [EN010158/APP/6.4]** and given that no likely significant environmental effects are identified, further assessment of climate resilience is not included within this chapter.
In-combination impact assessment	Construction, operation (including	This matter is scoped out of the assessment, as detailed within **ES Volume 4, Appendix 5.1: EIA Scoping**

Receptor/matter	Phase	Justification
	maintenance) and decommissioning	**Report [EN010158/APP/6.4]** and confirmed within **ES Volume 4, Appendix 5.2: EIA Scoping Opinion [EN010158/APP/6.4]**. The resilience of receptors identified in other chapters is unlikely to be affected by a combination of future climate change (e.g., temperature change, sea level rise or wind) and the impacts of the Proposed Development. Climate change may lead to an increase in extreme rainfall events. However, no significant impacts on surface water or groundwater levels are expected as a result of precipitation changes, in combination with the Proposed Development, as the flow of precipitation to ground would not be significantly hindered. Therefore, an in-combination impact assessment has been scoped out of the assessment. Refer to **ES Volume 2, Chapter 11: Land and Groundwater [EN010158/APP/6.2]** and **ES Volume 2, Chapter: 16 Water [EN010158/APP/6.2]** for more detail.

8.5. Environmental baseline

Establishing baseline conditions

Data sources to inform the EIA baseline characterisation

8.5.1. The assumptions applied and data obtained in order to undertake the lifecycle GHG assessment are presented in **ES Volume 4, Appendix 8.1: Climate Data Sources and Assumptions [EN010158/APP/6.4]**.

Site visits/surveys

8.5.2. No surveys or site visits specific to climate have been undertaken to inform this assessment.

Existing baseline

8.5.3. The following section presents a summary of the baseline conditions for the receptors/matters scoped into the assessment, as detailed within the **Table 8.2** above.

8.5.4. The land within the Order Limits predominantly consists of agricultural fields and pastureland interspersed with hedgerows, ditches, woodland blocks and farm access tracks. The hedgerows within the Site range from dense tall vegetation with sporadic shrubs and trees present. The fields are bordered by a mix of hedgerows, trees and ditches.

8.5.5. The GHG baseline comprises the existing carbon stock and possible small emissions sources. These small emissions sources may comprise vehicle fuel and fertiliser use, with possible contributions from the land depending on soil and vegetation types.

8.5.6. In line with IEMA's Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) **[Ref. 8-22]**, if a site currently has no physical development or activity, the baseline can be considered to have zero GHG emissions at a site level, to ensure a reasonable worst-case approach to establishing the net GHG effect.

8.5.7. Given that there is no physical development within the Order Limits, and that the potential activity is limited to minor agricultural activities, a baseline of zero GHG emissions at the site level has been considered as a reasonable, precautionary worst-case scenario.

8.5.8. The Climate Change Committee is an independent statutory body established under the Climate Change Act 2008 (2050 Target Amendment) Order 2019 **[Ref. 8-4]**. It advises the UK Government and devolved administrations on reducing GHG emissions, achieving carbon budgets and conducts independent research and analysis into climate change. The Climate Change Committee undertakes an annual assessment of GHG emissions to determine whether the UK is on course to meet its target carbon budget. These budgets are presently set as follows in **Table 8.4**.

Table 8.4: UK carbon budgets

Carbon budget	Carbon budget level (MMtCO_2e)	% reduction below 1990 base year
1st (2008 – 12)	3,018	23
2nd (2013 – 17)	2,782	29
3rd (2018 – 22)	2,544	35
4th (2023 – 27)	1,950	50

Carbon budget	Carbon budget level ($MMtCO_2e$)	% reduction below 1990 base year
5th (2028 – 32)	1,725 (1,765 including international shipping)	57
6th (2033 – 37)	965 (including international aviation and shipping)	78
7th (2038 – 42)	535 (including international aviation and shipping)	87

8.5.9. In its most recent budget report **[Ref. 8-26]** (released in February 2025), the Climate Change Committee recommended that the UK set a 7th Carbon Budget which requires a reduction in emissions of 87% by 2040, relative to 1990 levels. This represents a world-leading commitment which is consistent with the over-arching objectives of the 2015 Paris Agreement **[Ref. 8-1]**. While the 7th Carbon Budget has not yet been formally adopted by the UK Government, or legislated for by Parliament, it has been included here in order to present a comparison for emissions associated with the Proposed Development in the years 2038 to 2042.

Future baseline in the absence of the Proposed Development

8.5.10. No change is expected for the future baseline when compared to the current baseline, with regards to GHG emissions. As the current baseline can be considered to have zero GHG emissions at a Site level, this represents a worst-case scenario in line with IEMA's Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) **[Ref. 8-22].** It is unlikely that under a future 'business-as-usual' scenario there would be any significant changes to the amount of GHG emissions from the Site, either positive or negative.

8.5.11. It is important to note that the UK's national grid is expected to decarbonise as a result of projected renewable energy developments, such as the Proposed Development. This is in accordance with IEMA's Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) **[Ref. 8-22]**. Therefore, any renewable energy development would already form part of the baseline assumption for future grid decarbonisation.

8.6. Approach to the assessment

Approach to design flexibility

8.6.1. The parameters, as outlined in **ES Volume 1, Chapter 3: Proposed Development Description [EN010158/APP/6.1]**, and the parameter plans presented in **ES Volume 3, Figure 3.1: Height Parameters [EN010158/APP/6.3]** and secured in **Appendix 1: Green and Blue**

Infrastructure Parameters and **Appendix 3: Vegetation Removal Parameters** of the **Outline Landscape and Ecological Management Plan [EN010158/APP/7.6], Design Commitments [EN010158/APP/5.11]** and **Works Plans [EN010158/APP/2.3]**, set out the reasonable 'worst-case' parameters for the Proposed Development.

8.6.2. **ES Volume 1, Chapter 5: Approach to the EIA [EN010158/APP/6.1]** sets out those elements of the Proposed Development for which optionality is present within the design. The reasonable 'worst-case' scenario that has been assessed in this climate chapter for each element of the Proposed Development where optionality is present within the design is outlined within **Table 8.5**.

8.6.3. As much of the potential optionality centres around the location of the project elements specified, which has no impact on the assessment of GHG emissions, there is not necessarily a 'worst-case' scenario concerning GHG emissions for many of the project elements listed below within **Table 8.5**.

Table 8.5: Reasonable worst-case scenario assessed for climate

Project element	Reasonable worst-case scenario that has been assessed
Solar PV modules	The flexibility presented for this project element has no impact on the outcome of the assessment, regardless of which location is chosen. There is therefore no specific 'worst-case' associated.
Balance of Solar System (BoSS)	Calculations were carried out to assess the potential GHG impact from all String Inverters being used and all central inverters being used. The string inverter calculations resulted in larger GHG impact and therefore String Inverters have been adopted in these calculations to ensure a conservative approach.
Satellite Collector Compounds	The flexibility presented for this project element has no impact on the outcome of the assessment, regardless of which location is chosen. There is therefore no specific 'worst-case' associated.
Main Collector Compound	The flexibility presented for this project element has no impact on the outcome of the assessment, regardless of which location is chosen. There is therefore no specific 'worst-case' associated.
Battery Energy Storage System (BESS)	The flexibility presented for this project element has no impact on the outcome of the assessment, regardless of which location is chosen. There is therefore no specific 'worst-case' associated.

Project element	Reasonable worst-case scenario that has been assessed
Rosefield Substation	The flexibility presented for this project element has no impact on the outcome of the assessment, regardless of which location is chosen. There is therefore no specific 'worst-case' associated.
Primary Construction Compounds	The flexibility presented for this project element has no impact on the outcome of the assessment, regardless of which location is chosen. There is therefore no specific 'worst-case' associated.
Secondary Construction Compounds	The flexibility presented for this project element has no impact on the outcome of the assessment, regardless of which location is chosen. There is therefore no specific 'worst-case' associated.

Assessment assumptions

8.6.4. A full list of assumptions and data sources is presented in **ES Volume 4, Appendix 8.1: Climate Data Sources and Assumptions [EN010158/APP/6.4]**. Further assumptions relevant to the climate assessment are included below. All assumptions applied constitute a reasonable, precautionary worst-case scenario.

Construction

8.6.5. To estimate construction fuel use, the following assumptions have been used, which are based upon previous project experience and data from similar developments:

- Plant and machinery would use 5,000 litres diesel per week; and
- Generators would use 500 litres diesel per week.

8.6.6. It should be noted that the above (**Paragraph 8.6.5**) is based on the assumption that generators would run for six hours a day over the 30-month construction period. This assumes peak construction over the 30-month construction period and is therefore considered to be a worst-case assumption for the purposes of this assessment.

8.6.7. To estimate construction worker transportation (based on a peak construction workforce of 600), it has been assumed that 600 petrol cars would travel a one-way commuting distance of 50km (distance based on experience of previously consented projects), 6 days per week over the entire construction period.

8.6.8. It has also been assumed that construction workers would consume and otherwise use 60 litres of water per day per worker during construction **[Ref. 8-27]**.

8.6.9. To estimate emissions from material delivery and wastage, relevant Royal Institute of Chartered Surveyors (2023) guidance assumptions have been applied **[Ref. 8-25]**, in conjunction with assumptions provided by the Applicant. The Applicant has also provided the approximate source location and anticipated waste rates for all key components, (e.g., Solar PV modules and BESS). Construction wastage of 5% has been assumed for Solar PV, BESS, switchgear, transformers and inverters; construction wastage of 1% has been assumed for Solar PV frames and foundations.

8.6.10. The source location of the products and materials used to construct the Proposed Development are summarised below:

- Solar PV, Solar PV foundations (steel pile), frames, BESS containers/control containers, Transformers, String Inverters, Inverter Transformer Stations and Switchgear and BESS manufactured and transported from Asia.

8.6.11. It is also understood that either String or Central Inverters or a hybrid of String and Central Inverters would be used as part of the Proposed Development. Given that it is not yet confirmed which type of inverter would be used, GHG calculations have been completed for both types (String only or Central only). The String Inverter calculations have resulted in a larger GHG impact and therefore String Inverters have been adopted in these calculations to ensure a conservative approach, as this would also represent a larger GHG impact than any given hybrid approach.

Operation (including maintenance)

8.6.12. To account for changes in energy generation over the operation (including maintenance) of the Proposed Development, a degradation factor of 0.4% has been applied each year to account for year-on-year reduction in yield. This is based on the assumption that the first year generation would be 324,864 MWh.

8.6.13. To estimate emissions associated with replacement of assets over the 40-year service life of the Proposed Development, the following assumptions have been applied (**Table 8.6**). Assets with a service life of at least 40 years are assumed to not require any replacement.

Table 8.6: Service life of the Proposed Development components

Item	Service life (years)
Solar PV	40
Solar PV frames	40
Solar PV foundations	40
BESS	17.5

Item	Service life (years)
BESS containers/control containers	40
Switchgear	30
String Inverters	10
Inverter Transformer Stations	40
Main & PV Transformers	40
Substation buildings and security cabin	40

8.6.14. The emissions associated with the construction of the substation buildings have been modelled using One Click Life-Cycle Assessment (LCA) software (a life cycle assessment tool for calculating building and infrastructure whole life carbon emissions), and a 40-year service life has been applied. However, replacement of individual parts/elements of the buildings would likely be required and is therefore accounted for within the model. Therefore, there are some replacement emissions associated with these assets despite a 40-year service life being applied.

8.6.15. It should also be noted that 1.5 replacement cycles have been assumed for BESS – at the end of the first replacement cycle, there are only 5 years remaining before the end of the 40-year service life of the entire Proposed Development. Therefore, half a replacement cycle has been assumed given that it is unlikely that all BESS would be replaced 5 years before the Proposed Development is decommissioned.

8.6.16. The following worst-case assumptions have been applied to estimate emissions associated with operational workers:

- 24 daily on-site workers, one-way commuting distance of 25km and travelling via petrol car.

8.6.17. Emissions associated with water consumption and water treatment for Solar PV module cleaning have also been estimated. Based on publicly available information **[Ref. 8-28]**, it has been assumed that 76 litres of water would be required per MWh of anticipated annual generation. The initial year's expected generation (324,864 MWh) has been applied and used for all subsequent years, because the number of panels would remain consistent during operational life.

8.6.18. For operational water use associated with workers, it has been assumed that each worker would use 60 litres of water per day, per the assumption applied for construction workers.

8.6.19. Emissions associated with maintenance activities during operation have been estimated as 1% of A1-5 emissions per Royal Institution of Chartered Surveyors 2023 guidance **[Ref. 8-25]**.

8.6.20. Emissions associated with repair are assumed to equal 25% of emissions associated with maintenance, or 10% of A1-5 emissions (see **Paragraph 8.9.1** for further detail) for electrical equipment, per Royal Institution of Chartered Surveyors 2023 guidance **[Ref. 8-25]**.

8.6.21. Finally, emissions associated with operational generator diesel consumption have been estimated. There are two emergency back-up generators, with consumption rates of approximately 149.8 litres/hour at 750 kVa **[Ref. 8-29]** and 62.5 litres/hour at 250 kVa **[Ref. 8-30]**. The worst-case assumption is that they would run for 1 hour per month for testing and maintenance, as well as 72 consecutive hours in the event of a grid outage, occurring every 5 years as an estimate. These data were provided by the Applicant.

Decommissioning

8.6.22. It has been assumed that the majority of materials would be recycled at end of life, with a very small proportion sent to landfill. This has largely been based on publicly available data from disposal scenarios available in Environmental Product Declarations (a document that outlines the environmental performance, including the whole life carbon impact, of a product or material). More detail on decommissioning can be found within the **Outline Decommissioning Environmental Management Plan (Outline DEMP) [EN010158/APP/7.4]**. All emission factors and Environmental Product Declarations used are presented in **ES Volume 4, Appendix 8.1: Climate Data Sources and Assumptions [EN010158/APP/6.4]**.

8.6.23. For decommissioning fuel use (fuel required by plant to deconstruct the Proposed Development), it has been estimated that the fuel required would be 50% of the fuel used during the construction phase, per Royal Institution of Chartered Surveyors (2023) guidance **[Ref. 8-25]**.

8.6.24. An off-site disposal distance of 100km has been applied to estimate emissions from transportation of waste materials from the Site to waste processing facilities at end of life. This is a conservative distance based on access to specialist construction recycling facilities.

8.6.25. IEMA's Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) **[Ref. 8-22]** states "*activities that do not significantly change the result of the assessment can be excluded where expected emissions are less than 1% of total emissions, and where all such exclusions total a maximum of 5% of total emissions; all exclusions should be clearly stated*". The expected emissions of the change in land use following decommissioning are expected to be less than 1% of total emissions and therefore are not considered further.

Assessment methodology and criteria

8.6.26. In accordance with the GHG Protocol **[Ref. 8-24]**, this assessment quantifies applicable Kyoto Protocol **[Ref. 8-3]** GHGs as measured in tonnes of carbon dioxide equivalence (tCO_2e) (global warming potential), where equivalence means having the same warming effect as CO_2 over 100 years. The six original Kyoto Protocol gas groups are CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF_6) and perfluorocarbons (PFCs). Nitrogen trifluoride (NF_3), a chemical released in certain high-tech industries, was added in 2013. The global warming potential of each is presented in **Table 8.7**.

Table 8.7: Kyoto Protocol GHGs and their global warming potential based upon Intergovernmental Panel on Climate Change’s Fifth Assessment Report **[Ref. 8-3]**

Greenhouse gas/group	Chemical formula	Global warming potential (CO_2e)
Carbon dioxide	CO_2	1
Methane	CH_4	28
Nitrous oxide	N_2O	265
Hydrofluorocarbons	HFCs	Depends on specific gas
Sulphur hexafluoride	SF_6	23,900
Perfluorocarbons	PFCs	Depends on specific gas
Nitrogen Trifluoride	NF_3	16,100

8.6.27. Data associated with the activities contributing to the construction phase of the Proposed Development have been provided by the Applicant. Where it has not been possible to provide this data, as this assessment represents a forecast of emissions and some information may not yet be known, secondary data (such as estimates, extrapolations, benchmarks, and proxy data such as distance travelled) have been used. Emissions have then been quantified by applying the most relevant and up-to-date emission factors. All supporting data used is available in **ES Volume 4, Appendix 8.1: Climate Data Sources and Assumptions [EN010158/APP/6.4]**.

8.6.28. An emission factor is a representative value that relates the quantity of a pollutant released into the atmosphere with an activity associated with the release of that pollutant. Emission factors are typically available from government publications, independent agencies, and scientific research journals. However, the quality and accuracy of such factors can vary significantly. Factors can differ depending on the research body and/or underlying methodologies applied. It is therefore good practice to apply emission factors only from reputable sources.

8.6.29. The approach to this GHG assessment follows the GHG Protocol's **[Ref. 8-24]** core principles:

- **Relevance**: selecting an appropriate inventory boundary that reflects the GHG activities of the Proposed Development and serves the decision-making needs of users;
- **Completeness**: accounting for all emission sources within the chosen inventory boundary, with any specific exclusions disclosed and justified;
- **Consistency**: aiming to collect meaningful and consistent data over time whilst transparently documenting any significant changes to data quality and/or format;
- **Transparency**: addressing all relevant issues in a coherent and clear manner; and
- **Accuracy**: minimising uncertainty and avoiding systematic over-or under-quantification of emissions, and ensuring any necessary estimates or assumptions required are conservative and guided by industry standards.

8.6.30. In line with the GHG Protocol **[Ref. 8-24]** and IEMA's Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) **[Ref. 8-22]**, a materiality threshold of 1% may be set whereby emissions that are expected to contribute to less than 1% of the overall emissions inventory may be excluded from the assessment.

8.6.31. Emissions from materials have been quantified by utilising One Click LCA, scientific research papers, Environmental Product Declarations, Inventory of Carbon and Energy (University of Bath, 2019) **[Ref. 8-31]** and Department for Energy Security and Net Zero's (2023) **[Ref. 8-32]** conversion factors to use the most accurate densities and emission factors possible.

8.6.32. Conversions between mass, volume and area have been calculated where appropriate to allow the application of specific emissions factors. Details of emission factors used have been included in **ES Volume 4, Appendix 8.1: Climate Data Sources and Assumptions [EN010158/APP/6.4]**. In addition, some material types, build ups, weights and dimensions have been based on publicly available information, where required.

Significance of effect

8.6.33. Impact assessments normally assess to what degree a development will affect the baseline environment of the study area. In the case of GHG emissions, any emissions will have a long-term, irreversible negative effect on the global atmosphere, which is considered to be highly receptive to any emissions of GHGs. A specific source of GHG emissions cannot be linked to impacts at a specific location, but would have impacts globally.

8.6.34. This GHG assessment therefore evaluates the significance of emissions based upon guidance from IEMA's Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) **[Ref. 8-22]**, which provides a framework for determining significance against the goals of the 2015 Paris Agreement (i.e., against a science-based 1.5°C trajectory) (see **Table 8.8**). The criteria defining the separate levels and definitions of significance have been taken directly from the guidance, and have not been altered or reworded.

8.6.35. The IEMA guidance acknowledges that some projects may replace existing development or baseline activity with a higher GHG profile and thus the significance of a project's emissions should be based on its net impact over its lifetime which may be positive, negative or negligible. It states that significance should not be determined purely on the magnitude of GHG emissions, but whether a project contributes to reducing GHG emissions consistent with a trajectory towards net zero by 2050.

8.6.36. If GHG emissions cannot be avoided, a goal of the EIA process should be to identify mitigation options to reduce a project's residual emissions at all stages. If GHG emissions remain significant but cannot be further reduced, approaches to compensate a project's remaining emissions should be considered.

Table 8.8: Framework for assessment of significant GHG effects

Significance	Level	Criteria
Significant	Major adverse	Project adopts a business-as-usual approach, not compatible with the national Net Zero trajectory, or aligned with the goals of the 2015 Paris Agreement **[Ref. 8-1]** (i.e., a science-based 1.5°C trajectory). GHG impacts are not mitigated or reduced in line with local or national policy for projects of this type.
	Moderate adverse	Project's GHG impacts are partially mitigated, and may partially meet up-to-date policy; however, emissions are still not compatible with the national Net Zero trajectory, or aligned with the goals of the 2015 Paris Agreement **[Ref. 8-1]**.

Significance	Level	Criteria
Not significant	Minor adverse	Project may have residual emissions, but the project is compatible with the goals of the 2015 Paris Agreement **[Ref. 8-1]**, complying with up-to-date policy and good practice.
	Negligible	Project has minimal residual emissions and goes substantially beyond the goals of the 2015 Paris Agreement **[Ref. 8-1]**, complying with up-to-date policy and best practice.
Significant	Beneficial	Project causes GHG emissions to be avoided or removed from the atmosphere, substantially exceeding the goals of the 2015 Paris Agreement **[Ref. 8-1]** with a positive climate impact.

8.7. Mitigation embedded into the design

8.7.1. This assessment has been based on the principle that measures have been 'embedded' into the design of the Proposed Development to avoid or reduce potential significant effects as far as practicable, for example by the considered placement of infrastructure. The embedded mitigation relevant to this assessment is detailed in **Table 8.9** below.

Table 8.9: Embedded mitigation relevant to climate

Embedded mitigation measures relevant to climate	Function	Securing mechanism
Lean design to minimise use of concrete, steel, aggregates, etc.	Minimising the use of construction materials reduces product stage emissions associated with the construction of the Proposed Development.	**Outline Construction Environmental Management Plan (Outline CEMP) [EN010158/APP/7.2]**
Any vegetation cleared for the Proposed Development would be compensated by a planting scheme that equals or exceeds the	Ensuring that the potential for carbon sequestration within the Site is maintained or exceeded as much as practical.	**Outline Landscape and Ecological Management Plan (Outline LEMP) [EN010158/APP/7.6]**

Embedded mitigation measures relevant to climate	Function	Securing mechanism
current levels of vegetation		
Rosefield Substation, BESS, ITS, Independent Outdoor Equipment (transformer, switchgear and central inverters), Collector Compounds and Construction Compounds will be located outside of Flood Zone 2 and 3 areas. **The height of the lower part of the solar PV panels will be no greater than 1.8m AGL (post-earthworks) within Flood Zones**	Electrical infrastructure will be less likely to flood.	**Design Commitments [EN010158/APP/5.9]**
The condition and integrity of assets would be regularly assessed, and maintenance undertaken as early as required, giving consideration to materials with enhanced tolerance to fluctuating temperatures and exposure to rainfall.	Assets would be less likely to fail due to changes in climate.	**Outline CEMP [EN010158/APP/7.2]** **Outline Operational Environmental Management Plan (Outline OEMP) [EN010158/APP/7.3]**

8.8. Assessment of likely effects (without additional mitigation)

8.8.1. Lifecyle GHG emissions associated with the Proposed Development have been reported using the modular structure as outlined in Royal Institution of Chartered Surveyors (2023) guidance **[Ref. 8-25].** The reporting modules are defined as follows:

- **A1-3 product stage** – this category includes the embodied emissions of materials used to construct the Proposed Development. It includes the emissions associated with raw material extraction, transport to the manufacturing site and manufacturing emissions;
- **A4 transport** – this comprises the emissions associated with the transport of materials from the manufacturing site to the construction site;
- **A5 construction and installation** – this source includes four sub-categories which include emissions from pre-construction demolition (if applicable), construction activities (such as equipment fuel use), material wastage and construction worker transport;
- **B1 in-use emissions** – emissions associated with refrigerant gas leaks (if applicable) and emission release from products or reabsorption into products (such as sequestration from timber);
- **B2-5 maintenance, repair, replacement and refurbishment** – this includes emissions associated with routine maintenance (B2), repair (B3), replacement of materials (B4) and any planned refurbishment (B5);
- **B6 operational energy** – energy used during the operation of the asset;
- **B7 operational water** – water used during the operation of the asset;
- **B8 user activities not covered in B1-7** – emissions may include transport of persons to and from the asset during operation, for example; and
- **C1-4 end of life** – this category includes deconstruction and demolition emissions (C1), transport of waste materials from the Site to disposal sites (C2), waste processing for recycling (C3) and disposal emissions from landfill (C4).

8.8.2. Results within the tables of this chapter are accurate to the number of significant figures presented. Any inconsistencies in totals versus individual values are due to rounding and should not be viewed as erroneous.

Construction

8.8.3. The GHG assessment of construction emissions has calculated the life cycle emissions for the building materials and systems, accounting for their embodied and construction emissions. The construction period occurs during 2029 – 2031, and is therefore relevant to the 5th carbon budget, as detailed in **Table 8.15**.

8.8.4. **Table 8.10** provides an indication of the key emissions sources that are anticipated during the construction phase of the Proposed Development.

8.8.5. The total construction GHG emissions are estimated as 642,309tCO_2e, with 91% comprising those from the product stages (modules A1-3), and 9% from construction and installation processes (modules A4-5), which includes emissions from construction fuel and water use, wastage and worker transportation.

Table 8.10: Construction phase GHG emissions

Description	Emissions (tCO_2e)	Proportion of emissions (%)
Product Stage (A1-3)	583,462	91%
Construction and installation (A4 - A5)	58,847	9%
Total	**642,309**	**100%**

8.8.6. The largest emission sources from the A1-3 product stage are from Solar PV modules (54%) and the BESS (31%), comprising 495,239 tCO_2e of the total embodied emissions. A breakdown of the embodied emissions sources for the different components is provided below in **Table 8.11**.

Table 8.11: Embodied GHG emissions from the manufacture of materials and components

Description	Emissions (tCO_2e)	Proportion of emissions (%)
Battery Energy Storage System (BESS)	178,500	31%
BESS containers	3,129	1%
Solar PV modules	316,739	54%
String Inverters	2,673	<1%
PV framework	10,305	2%
PV foundations	54,726	9%
Rosefield Substation	324	<1%
Main Transformers	2,817	<1%
PV Transformers	13,733	2%
Inverter Transformer Stations	475	<1%
Switchgear	41	<1%
Total	**583,462**	**100%**

Operation (including maintenance)

8.8.7. Total estimated operational GHG emissions equal 462,996 tCO_2e, the majority of which (89%) come from the replacement of the BESS over the lifetime of the Proposed Development, as detailed in **Table 8.12**. The operation (including maintenance) phase occurs during 2031 – 2071, and is therefore relevant to the 5th, 6th, and 7th carbon budgets, as detailed in **Table 8.15** (further Carbon Budgets have not been defined).

Table 8.12: Operational GHG emissions

Lifecycle stage	Description	Emissions (tCO_2e)	Proportion of emissions (%)
Operational Maintenance (B2)	Maintenance	6,423	1%
Operational Repair and Replacement (B3-4)	BESS	410,792	89%
	BESS containers	9	<1%
	Solar PV modules	31,674	7%
	String Inverters	8,422	2%
	PV framework	27	<1%
	PV foundations	162	<1%
	Rosefield Substation	4	<1%
	Transformers	1,655	<1%
	Inverter Transformer Stations	1	<1%
	Switchgear	48	<1%
Operational Energy Use (B6)	Backup generator	563	<1%
Operational Water Use (B7)	PV cleaning	333	<1%
Operational Water Use (B7)	Worker water	0.4	<1%
Operational User Activities Not Covered in B1-B7 (B8)	Worker transport	2,882	1%
	Total	**462,996**	**100%**

Decommissioning

8.8.8. GHG emissions from the decommissioning phase of the Proposed Development are estimated to total 86,258 tCO_2e. This estimate aligns with standard practice for life cycle assessments as detailed in **Table 8.13**. This phase includes emissions from decommissioning fuel use, transport of materials to disposal sites and emissions associated with recycling and landfill. These emissions are subject to a high level of uncertainty, as it is difficult to predict the decommissioning conditions 40 years into the future. However, it should be noted that calculations are guided by the Royal Institute of Chartered Surveyors 2023 guidance **[Ref. 8-25]** to ensure a robust approach.

Table 8.13: Anticipated key GHG emissions sources during the end-of-life stage

Description	Emissions (tCO_2e)	Proportion of emissions (%)
End of life (C1-4)	86,258	100%
Total	**86,258**	100%

Summary of GHG emissions

8.8.9. The predicted lifecycle GHG emissions of the Proposed Development (which includes all emissions from the construction, operation (including maintenance) and decommissioning phases) are 1,191,562 tCO_2e. Product Stage emissions are the largest emissions source (49%), followed by operational emissions (39%), as displayed in **Table 8.14**.

Table 8.14: Lifecycle GHG emissions from the Proposed Development

Description	Emissions (tCO_2e)	Proportion of emissions (%)
Product Stage (A1-3)	583,462	49%
Construction Process Stage (A4-A5)	58,847	5%
Operation (B1-8)	462,996	39%
End of life (C1-4)	86,258	7%
Total (not including GHG savings from operation)	**1,191,562**	**100%**

8.8.10. GHG emissions from the Proposed Development have been compared against the appropriate and available UK Carbon Budget cycle within the design life of the Proposed Development in **Table 8.15** (to date the UK has agreed up to the 7th Carbon Budget which runs from 2038 to 2042) **[Ref. 8-26]**. Those emissions falling within the 5th Carbon Budget (2028 to 2032) are largest as they include all of the emissions from the construction stage (2029 to 2031). These estimations have adopted a conservative approach and are deemed to represent a reasonable worst-case scenario.

Table 8.15: UK carbon budgets

Carbon budget	Carbon Budget level (ktCO_2e)	Estimated Proposed Development emissions during the Carbon Budget period (ktCO_2e)	Project emissions as a percentage of UK Carbon Budget
5th (2028 – 2032)	1,725,000	645	0.037%
6th (2033 – 2037)	965,000	8	0.001%
7th (2038 – 2042)	535,000	10	0.002%

8.8.11. The GHG emissions associated with the Proposed Development until 2042 range between 0.001% and 0.037% of the UK carbon budget.

8.8.12. The sectoral carbon budgets (electricity supply) **[Ref. 8-26]**, which provide year-on-year carbon budgets for select national sectors in line with the national carbon budgets, have also been used to contextualise the magnitude of GHG emissions associated with the Proposed Development in **Table 8.16**, depending on the years in which the emissions are expected to occur. Construction emissions would occur in 2029,2030 and 2031. The Proposed Development would be operational from no earlier than 2031, and therefore annualised operational emissions up to 2050 would fall during the operation of the Proposed Development, which is expected to include multiple sets of equipment replacements in 2041 and 2048 (which are estimated to result in an anomalous spike in GHG emissions). The GHG emissions in **Table 8.16** assume that the carbon intensity of components remains constant throughout the Proposed Development's design life; however, this is not expected to happen in reality and therefore the figures are anticipated to be an overestimate.

Table 8.16: Sectoral carbon budgets

Year	Lifecycle stage	Carbon budget tCO_2e	Proposed Development tCO_2e	% Carbon budget
2029	Construction	17,139,427	256,924	1.5%
2030	Construction	9,779,644	256,924	2.6%
2031	Construction/ Operation	8,642,360	129,235	1.5%
2032	Operation	7,505,075	1,546	0.0%
2033	Operation	6,857,107	1,546	0.0%
2034	Operation	6,209,139	1,546	0.0%
2035	Operation	5,561,171	1,546	0.0%
2036	Operation	5,368,784	1,546	0.0%

Year	Lifecycle stage	Carbon budget tCO_2e	Proposed Development tCO_2e	% Carbon budget
2037	Operation	5,176,398	1,546	0.0%
2038	Operation	4,984,011	1,546	0.0%
2039	Operation	4,791,625	1,546	0.0%
2040	Operation	4,599,238	1,546	0.0%
2041	Operation	4,038,111	4,265	0.1%
2042	Operation	3,476,984	1,546	0.0%
2043	Operation	2,915,857	1,546	0.1%
2044	Operation	2,354,730	1,546	0.1%
2045	Operation	1,793,603	1,546	0.1%
2046	Operation	1,635,285	1,546	0.1%
2047	Operation	1,476,967	1,546	0.1%
2048	Operation	1,318,649	263,508	20.0%
2049	Operation	1,160,331	1,546	0.1%
2050	Operation	1,002,013	1,546	0.2%
Total			**937,143**	

GHG savings

8.8.13. GHG savings as part of the operation of the Proposed Development and the displacement of fossil-fuel derived electricity within the national electricity network are expected to be considerable and have been quantified below.

8.8.14. For the purposes of this assessment, the Proposed Development is anticipated to have an installed capacity of 334.1 MW, and generation of 324,864 MWh in the first year of operation. Taking into account an annual degradation factor of 0.4%, the total energy generation from the proposed 40-year operational life is approximately 12,030,492 MWh.

8.8.15. Dividing the lifetime emissions of the Proposed Development (1,191,562 tCO_2e) by the lifetime energy generation (12,030,492 MWh) gives a total lifecycle carbon intensity value of 99.0 gCO_2e/kWh (grams of CO_2 equivalent per kilowatt hour).

8.8.16. The Proposed Development would provide electricity to the national grid that may otherwise be generated by processes with higher carbon intensities, and the benefit of the Proposed Development, with regards to climate, is to replace the electricity generation from fossil fuels. Therefore, to assess the GHG savings of the Proposed Development, operational emissions from a Combined Cycle Gas Turbine have been used as a comparison, as it is currently the most carbon-efficient fossil-fuelled technology available.

8.8.17. In the July 2024 Decision Letter for Gate Burton Energy Park **[Ref. 8-34]** the Secretary of State commented that it considered a Combined Cycle Gas Turbine an inappropriate baseline for these comparisons as "*2011 NPS EN-1 requires all combustion power stations with a capacity over 300MW to be constructed Carbon Capture Ready*". This still holds true in NPS EN-1 (2023) **[Ref. 8-10]**. The future energy baseline is uncertain, and whilst there are requirements for all combustion power stations with a capacity over 300 MW to be constructed to be 'Carbon Capture Ready', this does not guarantee the application of carbon capture technology, nor the timeframes to which it may be applied. The need for carbon abatement is immediate and technologies that can do so in the short-term, such as the Proposed Development, play a vital role in the pathway to Net Zero. As such, and in the absence of any more appropriate identified methodology, this assessment maintains that a comparison to Combined Cycle Gas Turbine emissions is a robust and appropriate method to understand the level of GHG savings from the Proposed Development.

8.8.18. The carbon intensity of a Combined Cycle Gas Turbine is 354 gCO_2e/kWh **[Ref. 8-36]**, and so the Proposed Development would emit 254.95 g fewer CO_2e per kWh than if the same electricity were generated by a gas fired Combined Cycle Gas Turbine, representing savings of 72%. This is not a direct comparison, as the 99.05 gCO_2e/kWh calculated here is a lifecycle carbon intensity value and the carbon intensity of the Combined Cycle Gas Turbine is assumed to represent operational emissions (not including maintenance, replacement and repair of components). This results in a conservative assessment of emissions savings for the Proposed Development.

8.8.19. Over the proposed 40-year lifetime, the operation of the Proposed Development results in GHG savings of over 3 million tonnes CO_2e when compared to Combined Cycle Gas Turbine-generated electricity. It should be noted that, like the UK grid carbon intensities published by the UK Government, this comparison does not account for the embodied carbon in the Combined Cycle Gas Turbine and is therefore a conservative estimate.

Additional comparisons

UK electricity grid factors

8.8.20. Whilst the comparison to Combined Cycle Gas Turbine is deemed the most appropriate for the determination of the GHG emissions savings for the Proposed Development, recognition is given to observations made by the Secretary of State in the decision letter for Gate Burton Energy Park (detailed in **Paragraph 8.8.17** above). As such, additional comparisons have been undertaken here to support the findings that the Proposed Development has a significantly positive impact on the climate.

8.8.21. The UK Government publishes annual emissions factors for electricity supplied to the grid, to allow for annual company reporting **[Ref. 8-37]**. For 2024 (the most recently published data) the average grid electricity emission factor is 207.05 gCO_2e/kWh. However, this factor reflects *"only generator emissions in the operational phase and does not include emissions related to the fuel supply chain or maintenance activities"* **[Ref. 8-38]**. The UK electricity well-to-tank emissions factor, comprising those emissions associated with the extraction, refining and transportation of primary fuels before their use in the generation of electricity, is 45.9 gCO_2e/kWh. Therefore, the overall average grid emission factor, inclusive of well-to-tank, is 252.95 gCO_2e/kWh. This is an emissions factor representative of purely operational emissions, and does not include any emissions associated with the construction or decommissioning of the energy sources, and neither does this value include those emissions from the operational maintenance, repair and replacement of the energy sources.

8.8.22. When deriving this emissions factor, the UK Government includes those emissions from fossil fuel-, nuclear- and renewable-sourced energy, as well as those from imported electricity. Since renewable energy sources have no direct operational emissions, the emissions factor for their contribution to the grid is taken as 0 g/kWh.

8.8.23. It is therefore inappropriate to compare these UK Government grid emissions factors with the operational emissions of solar developments (which comprise emissions from activities not considered under the government methodology, such as maintenance and repair activities). If the same methodology used in calculating national grid emissions factors was adopted to assess the savings of the Proposed Development, the operational emissions from the Proposed Development would be 0 gCO_2e/kWh, which would not allow for a meaningful comparison of GHG savings.

8.8.24. However, using the current UK emissions factor as a comparison, the operational carbon intensity of the Proposed Development compared with the average value for the UK grid in 2024 can be seen in **Table 8.17**. The carbon intensity of the Proposed Development has been calculated as 99.05 gCO_2e/kWh across the whole lifecycle (i.e., construction, operation, decommissioning). However, the UK average grid factor is calculated purely on operational emissions (emissions associated with fossil-fuel based energy). The carbon intensity of the Proposed Development based purely on operational emissions (repair, replacement and maintenance) therefore is 38.49 gCO_2e/kWh.

Table 8.17: Comparison of operational emissions from the Proposed Development to the average UK grid factor in 2024

	GHG intensity (gCO2e/kWh)				
Source	Fossil fuel emissions	Well to Tank emissions	Repair, maintenance and replacement emissions	Total	Source
Proposed Development	0	0	38.49	38.49	
UK Grid Electricity (2024)	207.05	45.9	Not included	252.95	DESNZ and Defra: UK Government GHG Conversion Factors for Company Reporting **[Ref. 8-37]**
Proposed Development as % of UK grid				**15.2%**	

8.8.25. **Table 8.17** shows that the emissions from the Proposed Development comprise 15.2% of the GHG emissions from the national grid in 2024 per kWh; this is approximately 6.5 times more efficient than the current UK grid. Using this methodology the Proposed Development therefore significantly contributes to the UK grid's transition to new zero.

Alternative forms of energy

8.8.26. IEMA guidance **[Ref. 8-22]** states that a comparable baseline must be established to serve as a reference point for assessing the impact of a new project. This baseline may include "GHG emissions arising from an alternative project design for a project of this type." If it is assumed that the future energy baseline necessitates increased integration of renewable technologies into the National Grid, then it may be appropriate to evaluate the impact of a solar development in comparison with other renewable energy technologies.

8.8.27. The carbon intensities of differing technologies are shown in **Table 8.18** and demonstrate that the operational emissions of the Proposed Development are comparable with other low carbon energy generation.

Table 8.18: Estimated emissions of selected electricity generation technologies

	Energy generation technology	GHG Intensity (gCO2e/kWh)	Source
Operational	Rosefield Solar Farm	38.49	**ES Volume 2, Chapter 8: Climate [EN010158/APP/6.2]**
	Combined Cycle Gas Turbine	354	UK Parliament (2015) **[Ref. 8-36]**
Lifetime	Rosefield Solar Farm	99.05	**ES Volume 2, Chapter 8: Climate [EN010158/APP/6.2]**
	Combined Cycle Gas Turbine	490 (410 – 650)	IPCC AR5 **[Ref. 8-39]**
	Solar – rooftop	41 (26 – 60)	
	Solar – utility	48 (18 – 180)	
	Nuclear	12 (3.7 – 110)	
	Hydropower	24 (1.0 – 2200)	
	Onshore wind	11 (7 – 56)	
	Offshore wind	12 (8 – 35)	
	Wind	8 – 20	Wiser et al (2011) **[Ref. 8-40]**
	Wind	12 (1.7 – 81)	National Renewable Energy Laboratory (NREL) **[Ref. 8-41]**

8.9. Additional mitigation

Construction

8.9.1. A large majority of GHG emissions associated with the Proposed Development comprise those embodied emissions from infrastructure (approximately 83% of overall emissions when also taking into account embodied emissions from component replacement), primarily the BESS and Solar PV modules. The most effective mitigation would therefore be in the responsible sourcing of materials and infrastructure, which is secured in the **Outline CEMP [EN010158/APP/7.2]**.

8.9.2. Members of the procurement team will explore opportunities to reduce emissions associated with the supply chain and, where practicable, will look to propose environmentally friendly options to minimise emissions and benefit the local environment. Use of products with lower embodied/pre-use phase emissions, such as lower carbon concrete mixes, would significantly improve the carbon balance of the Proposed

Development. This would likewise be secured in the **Outline CEMP [EN010158/APP/7.2]**.

8.9.3. In addition to the above, the **Outline CEMP [EN010158/APP/7.2]**, also includes measures to decrease GHG emissions from the construction process phase, which has been submitted in support of the DCO Application. These measures include:

- Implementing measures to decrease fuel use by maximising energy efficiencies in vehicles and plant, for example to ensure all vehicles switch off engines when stationary and ensure vehicles are well maintained and conform to current emissions standards;
- Promoting the use of sustainable fuels in vehicles, and where possible making use of electric vehicles to reduce fuel consumption;
- Using locally sourced and/or produced materials. The use of recycled aggregates, where appropriate, for foundations, subbases, hard-standings and pavement materials; and
- Actions to meet the waste hierarchy in accordance with the principles of the Government's Resources and waste strategy for England 2018 **[Ref. 8-35]**. Promoting the recycling of materials by segregating construction waste to be re-used and recycled where practical.

8.9.4. Additionally, an **Outline Travel Plan**, appended to the **Outline Construction Traffic Management Plan (Outline CTMP) [EN010158/APP/7.5]**, will ensure that there is a coordination with construction staff on measures to minimise the GHG emissions associated with commuting during construction. Such measures include promoting lower carbon modes of travel such as car sharing options and use of public transport.

Operation (including maintenance)

8.9.5. As the overall impact on climate during this phase is positive, no further additional mitigation measures are required.

8.9.6. However, the maintenance and replacement of components of the Proposed Development shall be carried out in accordance with the additional mitigation measures set out above for the construction phase. These are detailed in and secured by the **Outline OEMP [EN010158/APP/7.3]**.

Decommissioning

8.9.7. Due to the potential advancements in technology and best practice between the present and the time that decommissioning would take place, no additional mitigation can be proposed at this time. It is anticipated that additional mitigation measures specific to the decommissioning phase would broadly emulate those set out for the construction phase. These measures would be agreed with the relevant planning authority at the time of decommissioning.

8.10. Assessment of residual effects (with additional mitigation)

Lifecycle emissions

8.10.1. Renewable energy developments such as the Proposed Development have a major role to play in the transition to a low carbon economy, and the decarbonisation of the UK national electricity network. Without projects such as the Proposed Development, the GHG intensity of the UK's electricity generation would not decrease as projected and would severely compromise the UK's ability to meet its carbon reduction targets.

8.10.2. GHG emissions are inherently cumulative, and so, aligned with IEMA's Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) **[Ref. 8-22]**, the significance of the impact of the Proposed Development on the global atmosphere is determined from its lifecycle impact (i.e. lifecycle GHG emissions and savings).Over its 40-year operational life, the Proposed Development will generate approximately 12,030,492 MWh of energy. Emissions from the construction, operation (including maintenance), and decommissioning phases of the Proposed Development total 1,191,562 tCO_2e (**Table 8.14**). When taking into account whole lifecycle emissions, the net GHG savings, compared against equivalent gas-fired electricity generation, are over 3 million tCO_2e. This provides a beneficial contribution to the goals of the Buckinghamshire Council Climate Change and Air Quality Strategy, which includes a commitment to achieving net zero by 2050 at the latest. **[Ref. 8-21]**.

8.10.3. When assessed against whole lifecycle emissions, the Proposed Development has a carbon payback period of approximately 11 years. When assessed against operational emissions only, the Proposed Development has a carbon payback period of approximately 4 years.

8.10.4. The Proposed Development is therefore considered likely to have a **significant beneficial** effect on the climate.

8.11. Opportunities for enhancement

8.11.1. The nature of the Proposed Development offers an enhancement to the original environment in terms of GHG emissions.

8.12. Monitoring requirements

8.12.1. There are no monitoring requirements in relation to the climate impact of the Proposed Development as no significant adverse effects are identified.

8.13. Difficulties and uncertainties

8.13.1. The following difficulties and uncertainties have been encountered in undertaking the climate assessment:

- The accuracy of a GHG assessment depends on the quality of the data provided. Primary data should be used where available; however, the fact that this assessment represents a forecast from a future scenario means that all data is 'secondary' (extrapolated, estimated or benchmarked). Assessments such as this, based largely on secondary data, should be viewed as an estimate of GHG emissions impact, and actual emissions may vary. To mitigate against this, a conservative approach has been adopted, whereby the most reasonable worst-case scenario has been assumed.
- The impact of additional mitigation measures on GHG emissions is considered impractical to quantify due to the measures themselves currently only being outlined, and the challenges in assessing their impact in a quantitative way.
- The quantity of solar panels assumed in this assessment presents a worst case scenario with regards to the emissions resulting from the construction, operation, and decommissioning of the Proposed Development. However, this is also corresponds to a best case scenario with regards to emissions savings. It should be noted that even with a reduction in the quantity of solar panels, the outcome of the assessment with regards to significance would not change.
- The replacement of individual components of the Proposed Development have been accounted for based on the anticipated service life of each component. Despite this, it is acknowledged that there is a potential for unexpected failures that may necessitate further replacement, which is considered to be unquantifiable.
- The beneficial impact of carbon sequestration has not been accounted for within this assessment, due to the inherent difficulty of accurately quantifying such measures. This results in a more conservative, worst-case scenario.
- While the emissions associated with the decommissioning phase of the Proposed Development have been quantified in this assessment, it is difficult to accurately determine the appropriate mitigation measures that would be implemented during decommissioning due to the potential advancements in technology and best practice between the present and the time in which decommissioning will take place. It is likely that

advancements in technology will reduce the estimated emissions associated with the decommissioning phase; therefore, the decommissioning calculations performed present a worst-case scenario.

8.14. Summary

8.14.1. A summary of this assessment is presented in **Table 8.19**. Relevant embedded mitigation is identified, together with the likely effects that could arise. Any proposed additional mitigation measures are stated and the residual effects then assessed. Finally, any monitoring requirements are stated where applicable.

Table 8.19: Summary of the climate assessment

Receptor/matter	Phase	Embedded mitigation	Likely effect (without additional mitigation)	Additional mitigation	Residual effect (with additional mitigation)	Monitoring requirement
GHG emissions	Construction, operation (including maintenance), and decommissioning	Lean design to minimise use of concrete, steel, aggregates, etc. Any vegetation cleared for the Proposed Development would be compensated by a planting scheme that equals or exceeds the current levels of vegetation.	The predicted lifecycle emissions associated with the Proposed Development, not accounting for any GHG savings, is 1,191,562 tCO2e. Taking into account GHG savings results in a net total of 3 million tCO_2e saved over lifespan of the Proposed Development when compared to Combined Cycle Gas Turbine-generated electricity.	Measures set out in: **Outline CEMP [EN010158/APP/7.2]** **Outline OEMP [EN010158/APP/7.3]** **Outline DEMP [EN010158/APP/7.4]** **Outline CTMP [EN010158/APP/7.5]**	The predicted lifecycle emissions associated with the Proposed Development, not accounting for any GHG savings, is 1,191,562 tCO2e. Taking into account GHG savings results in a net total of 3 million tCO_2e saved over the lifespan of the Proposed Development when compared to Combined Cycle Gas Turbine-generated electricity. This is a **significant beneficial** effect.	N/A

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