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Chapter 14: Greenhouse Gas Assessment

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INDEX

14 GREENHOUSE GAS ASSESSMENT

14.1 Introduction

14.1.1.1 This chapter of the Environmental Impact Assessment Report (EIAR) presents the findings of the potential impacts from the release of greenhouse gas (GHG) emissions from the construction, operation and decommissioning of the Proposed Development. This chapter describes the scope, methods and the findings of the assessment.

14.1.1.2 This GHG assessment is included in this EIAR as a response to the requirement under The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 ('the EIA Regulations') that climate change be considered in an EIA assessment.

14.1.1.3 The Proposed Development aims to support regional and national net zero ambitions by providing renewable electricity to the UK grid. **Chapter 1: Introduction** and **Chapter 5: Policy and Legislative Context** describes the overall impact of the Proposed Development and its contribution to the UK's net zero ambitions.

14.2 Policy and Legislation

14.2.1.1 The policy and legislation relevant to this chapter supports developments that rapidly increase electricity generation from renewable sources. The policy and legislation requires developments to reduce and minimise as far as is possible the impact they have on the climate. The relevant policy and legislation are detailed below:

14.2.1.2 Climate change legislation:

- The Climate Change Act 2008[1] is the UK Government's legislation for addressing climate change. In relation to climate change mitigation, it commits the UK to GHG emissions reductions and reporting. The Climate Change Act 2008 (2050 Target Amendment) Order 2019[2] sets the UK's net zero target by 2050.

- The Climate Change Act (Emissions Reduction Targets) (Scotland) Act 2019 amends the Climate Change (Scotland) Act 2009[3] and sets a legally binding target for Scotland to reach net zero by 2045. The Climate Change (Emissions Reduction Targets) (Scotland) Act 2024 introduces a carbon budget-based approach for setting emissions reduction targets in Scotland.

14.2.1.3 National planning legislation:

- Paragraph 5 of Schedule 4 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations[4] ('the EIA Regulations') sets out the requirement to consider

[1] UK Government, Climate Change Act 2008, Climate Change Act 2008
[2] The Climate Change Act 2008 (2050 Target Amendment) Order 2019, The Climate Change Act 2008 (2050 Target Amendment) Order 2019
[3] Climate Change Act (Emissions Reduction Targets) (Scotland) Act 2019 Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 and Climate Change (Scotland) Act 2009 Climate Change (Scotland) Act 2009
[4] Schedule 4 of The Electricity Works (Environmental Impact Assessment) Regulations 2017, The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017

climate change within EIA assessment and decision-making processes: "*A description of the likely significant effects of the development on the environment resulting from… the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions)*"; and

- The National Planning Framework 4 (2023)[5] guides spatial planning development in Scotland by setting out national planning policies, designating national developments and highlighting spatial priorities. The Proposed Development falls into Annex 3 of NPF4 as it will support Scotland to meet its net zero emissions targets by supporting the rapid increase in electricity generation from renewable sources. NPF4 requires that the Proposed Development be considered against national planning policies. The Policy statements relevant to the Proposed Development involve Policy 1 'tackling the climate and nature crises' by providing renewable electricity generation; and Policy 2 'climate mitigation and adaptation' which requires the Proposed Development to minimise GHG emissions.

14.2.1.4 Local planning policy

- Scottish Borders Local Development Plan 2024[6] promotes net zero GHG emissions by 2045 by supporting renewable energy developments as well as infrastructure that promotes sustainability and the protection, enhancement and conservation of nature and biodiversity, historic environment and archaeological heritage and other environmental impacts.

14.3 Consultation

14.3.1.1 The stakeholders that were consulted for the Proposed Development involved statutory consultees, local landowners and local communities. The feedback received from these stakeholders did not relate to climate change and the GHG assessment covered by this chapter.

14.4 Basis of the Assessment

14.4.1.1 **Chapter 3: Development Description** presents a summary of the current design of the Proposed Development which has been used to inform the GHG assessment. In summary, the Proposed Development involves the construction, operation and decommissioning of a solar powered energy generating station (up to approximately 165 MW capacity) including a co-located Battery Energy Storage System (BESS) (up to 80 MW capacity) and associated electricity generation infrastructure involving substation and access tracks.

14.4.1.2 The primary objective of the Proposed Development is to generate renewable electricity from solar energy and provide storage capacity to the grid by using battery storage systems. It is located in open countryside which is predominantly made up of pastoral upland and plateau farmland in the Scottish Borders in the Southeast of Scotland (see **Chapter 2: Site Design and Evolution** for further information on the location and setting).

[5] The National Planning Framework 4 (2023), National Planning Framework 4 - gov.scot
[6] Scottish Borders Local Development Plan 2024, Adopted Local Development Plan 2 | Local development plan | Scottish Borders Council

14.4.1.3 The Proposed Development will generate renewable electricity and this is assumed to have zero GHG emissions associated with the generation of the electricity. However, the construction, operation and decommissioning of the Proposed Development will release GHG emissions and these are described below:

- Construction (proposed to be undertaken over an 18-month period): This includes the extraction, manufacture and transport of materials to the Proposed Development; as well as the emissions associated with the construction processes on site (including fuel consumed by equipment and vehicles used to construct the Proposed Development; and fuel used in hybrid generators for electricity supply during construction);

- Operation (proposed to commence following construction in year two for 40-year duration): The GHG emissions associated with the operation of the Proposed Development will involve fuel consumption related to the maintenance equipment and vehicles used; and the supply of electricity to the installed equipment; and

- Decommissioning: This will involve the GHG emissions associated with the fuel consumption of plant, machinery and vehicles during the decommissioning phase and disposal and/ or recycling of materials and equipment.

14.4.1.4 The GHG assessment scope is limited to the data available at the design stage and assumptions and limitations are described in **Section 14.5.7**.

14.5 Assessment Methodology and Significance

14.5.1.1 The GHG assessment methodology has been developed in line with relevant planning policy, industry guidance for completing GHG assessments and Institute of Environmental Management and Assessment (IEMA) guidance. The GHG methodology aims to understand the net impact of the Proposed Development on the climate.

14.5.2 Methodology

14.5.2.1 The GHG assessment was prepared in accordance with the UK Government's environment reporting guidelines (BES, March 2019)[7]; and the Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (revised edition) developed by the World Resources Institute and the World Business Council for Sustainable Development (2004)[8].

14.5.2.2 The GHG assessment also used the most up-to-date conversion factors as detailed by non-financial reporting guidance and specifically the UK Government Department for Energy Security and Net Zero (DESNZ) and Department for Environment, Food and Rural Affairs (DEFRA) conversion factors for company reporting[9].

[7] UK Government, Environmental Reporting Guidelines (2019), Environmental Reporting Guidelines
[8] GHG Protocol, A Corporate Accounting and Reporting Standard (revised edition) (2004), ghg-protocol-revised.pdf
[9] UK Government conversion factors for company reporting (2024), Government conversion factors for company reporting of greenhouse gas emissions - GOV.UK

14.5.2.3 The methodology used in the GHG assessment was guided by the Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating the Significance (IEMA, 2022)[10].

14.5.3 Assessment Approach

14.5.3.1 To report on the GHG emissions that arise from the activities associated with the Proposed Development, the GHG assessment identified the sources of GHG emissions and categorised these in accordance with best practice GHG reporting guidelines as follows:

- Scope 1 GHG emissions (direct): GHG emissions that arise from sources that are owned or controlled by the Proposed Development such as consumption of diesel to generate electricity, for use in vehicles, plant or machinery and fugitive emissions (for example sulphur hexafluoride (SF6) which can be used in high-voltage equipment);

- Scope 2 GHG emissions (indirect): GHG emissions from the generation of purchased electricity. This can involve electricity consumed in transformers, substations, switch rooms, control buildings and operation or maintenance buildings; and

- Scope 3 GHG emissions (indirect): GHG emissions that occur as a consequence of the activities of the Proposed Development but occur from sources not owned or controlled by the Proposed Development. For instance, fuel and energy associated with the extraction, refining and transport of raw materials; disposal of wastes; recycling of materials at the end of their life.

14.5.3.2 The availability of activity data determined the sources of, and categories of GHG emissions reported in this GHG assessment. As a result, the GHG assessment presents an estimation of the GHG emissions associated with the Proposed Development and is limited to the data available at the design stage and the assumptions and limitations as described in **Section 14.5.7.**

14.5.4 Baseline

14.5.4.1 The baseline of the GHG assessment is the GHG emissions associated with the mix of electricity generators on the UK grid. This represents the baseline case of equivalent emissions for the Proposed Development if it was not to go ahead.

14.5.4.2 To understand the impact of GHG emissions associated with the Proposed Development on the climate, the GHG assessment calculates:

- The GHG emissions avoided by generating renewable electricity to the UK grid (and the equivalent baseline case); and

- The GHG emissions that arise from the activities associated with the construction, operation and decommissioning of the Proposed Development.

[10] Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating the Significance (IEMA, 2022), 2022_iema_greenhouse_gas_guidance_eia.pdf

14.5.4.3 By comparing the baseline GHG emissions against the GHG emissions of the Proposed Development the overall net impact of the Proposed Development on the climate can be assessed.

14.5.5 Significance Criteria

14.5.5.1 Any GHG emissions released to the atmosphere is classified as an impact to climate change due to the importance of limiting GHG emissions to the atmosphere as set out by the Paris Agreement[11] and the UK Government's net zero ambitions.

14.5.5.2 To understand the significance of the Proposed Development on the climate the net GHG emissions impact of the Proposed Development will be evaluated against the IEMA significance criteria detailed in **Table 14.1**, below.

TABLE 14.1 EXAMPLE OF SIGNIFICANCE CRITERIA RELEVANT TO GHG EMISSIONS ASSESSMENTS

SIGNIFICANCE	SIGNIFICANCE CRITERIA
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.
Moderate adverse:	The project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.
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.
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.
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.

[11] The Paris Agreement, parisagreement_publication.pdf

14.5.6 Basis of Calculations

14.5.6.1 To conduct the GHG assessment, activity data such as the quantity of materials used, fuel consumed, waste generated, or distances travelled is gathered from primary sources (for example data provided by the developer or manufacturer). Where data is not available, alternative approaches were used that involved generic or publicly available information that best represented the Proposed Development and its activities (as described in **Section 14.5.7 Assumptions and Limitations**).

14.5.6.2 The activity data is then multiplied by the most appropriate conversion factor using the UK Government's conversion factors for company reporting or alternative conversion factors as detailed in **Technical Appendix 14.1**. Representative materials and goods have been used for emission factor mapping as supplier-specific emissions data is not available at this stage of the project development.

14.5.6.3 The following methodology is applied and the result of the assessment is reported in tonnes of carbon dioxide equivalent (tCO_2e):

- Activity data x GHG emissions factor = GHG emissions (tCO_2e).

14.5.6.4 To calculate the GHG emissions avoided (the equivalent baseline case), the GHG assessment uses the UK Government's published 2024 UK grid average electricity emissions factor (generation based)[12]. This factor assumes that the equivalent generation from the Proposed Development is provided by a mix of fossil fuel and renewable generators associated with the UK grid over its 40-year operational lifetime. This calculation also assumes that the Proposed Development is operating at its maximum capacity and that it is displacing the existing average generation rather than adding capacity overall.

14.5.7 Assumptions and Limitations

14.5.7.1 The GHG assessment focused on design and engineering activity data that was available at the design stage and was based on a proposed 18-month construction phase, 40-year operational phase and decommissioning at the end of the 40-year operational period.

14.5.7.2 The activity data that was used to inform the assessment involved:

- Construction activity data covering:
  - Stationary combustion for onsite generators;
  - Mobile combustion fuel use for heavy goods vehicles (HGVs); and
  - Materials and resources for civil and electrical works and information on generation capacity.
- Operational activity data involving:

[12] UK Government conversion factors for company reporting (2024), Government conversion factors for company reporting of greenhouse gas emissions - GOV.UK

– Stationary combustion for onsite generators; and

– Electricity consumption for buildings and infrastructure onsite.

14.5.7.3 For the decommissioning phase a decommissioning plan was not available therefore it was assumed that all infrastructure and system services would be decommissioned. The material and resources for civil and electrical works was used to calculate the GHG emissions associated with this phase of the Proposed Development. The National Renewable Energy Laboratory (NREL) life cycle assessment[13] for solar photovoltaics was used to estimate the GHG emissions for the decommissioning of the civil and electrical materials used in the Proposed Development.

14.6 GHG Assessment

14.6.1.1 The GHG assessment understands the impact of GHG emissions associated with the Proposed Development by calculating:

- The estimated GHG emissions associated with the construction, operation and decommissioning of the Proposed Development; and
- The estimated GHG emissions avoided by generating renewable electricity from the Proposed Development.

14.6.2 GHG Emissions Associated with the Proposed Development

14.6.2.1 The total GHG emissions (tCO_2e) from the construction, operation and decommissioning of the Proposed Development are estimated to be around 545,000 tCO_2e. Around 75% of the GHG emissions arise during the construction phase and the decommissioning phase contributes a further 20%. **Table 14.2** provides a breakdown of the GHG emissions at each stage of the Proposed Development's life cycle.

TABLE 14.2 SUMMARY OF THE ESTIMATED GHG EMISSIONS ASSOCIATED WITH CONSTRUCTION, OPERATION AND DECOMMISSIONING OF THE PROPOSED DEVELOPMENT

GHG EMISSIONS FROM CONSTRUCTION, OPERATION AND DECOMMISSIONING ACTIVITIES	TOTAL ESTIMATED GHG EMISSIONS (tCO_2e)	PERCENTAGE CONTRIBUTION OF GHG EMISSIONS (%)
Construction emissions (including embedded emissions)	409,000	75
Operation emissions	24,000	5
Decommissioning emissions	109,000	20
Total estimated GHG emissions	542,000	_

[13] Life Cycle Greenhouse Gas Emissions from Solar Photovoltaics (Fact Sheet), NREL (National Renewable Energy Laboratory)

14.6.2.2 From the assessment the key sources of GHG emissions are the embedded emissions associated with the extraction, manufacture and transport of materials (including concrete, aluminium framed solar panels, cables, inverters and transformers); and the decommissioning at the end of the Proposed Development's life (40 years). A breakdown of the GHG emissions by scope and activity is provided in **Table 14.3** and further details are provided in **Technical Appendix 14.1.**

TABLE 14.3 SUMMARY OF THE SOURCE OF ESTIMATED GHG EMISSIONS ASSOCIATED WITH CONSTRUCTION, OPERATION AND DECOMMISSIONING OF THE PROPOSED DEVELOPMENT

SCOPE	GHG EMISSIONS SOURCE (FROM CONSTRUCTION, OPERATION AND DECOMMISSIONING ACTIVITIES)	TOTAL ESTIMATED GHG EMISSIONS (tCO_2e)
Scope 1	Stationary and mobile combustion used in construction and operations	2,000
Scope 2	Electricity used in operations	24,000
Scope 3	Embedded, transportation and decommissioning emissions	516,000
Total estimated GHG emissions (construction, operation and decommissioning)		**542,000**

14.6.2.3 To put the GHG emissions from the construction, operation and decommissioning of the Proposed Development into context, the lifetime GHG intensity (total lifetime GHG emissions divided by output) of the Proposed Development was calculated and estimated at 45 gCO_2e/kWh. This is well below the lifetime GHG intensity of 490 gCO_2e/kWh for a gas-fired CCGT.

14.6.2.4 To understand the significance of the GHG emissions associated with the Proposed Development the GHG emissions are compared to the UK Carbon Budgets. The UK Carbon Budgets restrict the amount of GHG emissions the UK can legally emit during a set period of time.

14.6.2.5 The GHG emissions associated with the construction, operation and decommissioning have been shown against the relevant Carbon Budget time period in **Table 14.4.** Based on the GHG assessment it is not anticipated that the total GHG emissions from the Proposed Development's construction, operation and decommissioning will impact the overall ability for the UK Government to meet its climate targets and Carbon Budgets. It should be noted that the UK Carbon Budgets have not been set beyond 2037, therefore GHG emissions beyond 2037 have been included in the 6th Carbon Budget.

TABLE 14.4 SUMMARY OF THE ESTIMATED GHG EMISSIONS ASSOCIATED WITH CONSTRUCTION, OPERATION AND DECOMMISSIONING OF THE PROPOSED DEVELOPMENT AGAINST THE RELEVANT UK CARBON BUDGET PERIOD

UK Carbon Budget period	UK Carbon Budget total ($mtCO_2e$)	Proposed Development's contribution to the relevant Carbon Budget (tCO_2e)	% emissions against the Carbon Budget
4th Carbon Budget (2023-2027)	1,950	409,000	0.02
5th Carbon Budget (2028-2032)	1,725	3,000	<0.01
6th Carbon Budget (2033-2037)	965	130,000	0.01

Note: Carbon Budgets have not been set beyond 2037, therefore all emissions beyond 2037 have been included in the 6th Carbon Budget.

14.6.2.6 From the results of the GHG emissions assessment it can be concluded that the likely impact of the Proposed Development on the climate is consistent with the IEMA definition '**Negligible**' and '**Not Significant**' whereby "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".

14.6.3 GHG Emissions Displaced by the Proposed Development

14.6.3.1 It is assumed that the Proposed Development supports the generation of renewable electricity that avoids the combustion of GHG emissions from other forms of more GHG intensive grid-connected electricity in the UK (such as gas-fired CCGT power stations).

14.6.3.2 To calculate the GHG emissions avoided the equivalent UK grid GHG emissions factor was multiplied by the estimated lifetime output from the Proposed Development. The total GHG emissions avoided by the Proposed Development during its 40-year operation was calculated at an estimated 2,400,000 tCO_2e. If the Proposed Development displaced the equivalent fossil fuel (natural gas) powered generation, then the equivalent GHG emissions can be estimated at 4,800,000 tCO_2e.

14.6.3.3 It is therefore anticipated that by generating renewable energy, the Proposed Development will avoid GHG emissions, relative to the baseline, over its 40-year operating lifetime of an estimated 2.4 million tCO_2e.

14.7 Mitigation of Embedded Emissions

14.7.1.1 To reduce GHG emissions from the construction, operation and decommissioning of the Proposed Development the following mitigations have been integrated into the Proposed Development's design and will be implemented through the Construction Environment Management Plan (CEMP):

- Engineering design considerations have reduced the GHG emissions associated with the materials used in the Proposed Development's design and during construction (for example there is no SF6 containing equipment used in the design);

- Use of lower GHG emitting generators, vehicles and lighting during construction and the operation phase of the Proposed Development, including hybrid generators which will only use diesel during winter months, solar powered lighting and electric vehicles; and

- Wastes will be recycled and disposed of locally and excavated materials and soils will be reused to minimise the use of natural resources.

14.8 Assessment of Likely Impacts and Effects

14.8.1.1 To understand the net impact of the Proposed Development the GHG emissions associated with the 40-year operation of the Proposed Development were evaluated against the baseline case whereby if the Proposed Development was not to go ahead the UK grid would generate electricity over the 40-year timeframe of the Proposed Development.

14.8.1.2 This assessment calculated that the equivalent mix of generators on the UK grid would generate around 2,500,000 tCO_2e. Despite producing 542,000 tCO_2e during the construction, operation and decommissioning, the Proposed Development would have a net climate benefit by offsetting around 1,958,000 tCO_2e during its operational lifetime (see **Table 14.5**).

14.8.1.3 From the results of the GHG emissions assessment it can be concluded that the likely impact of the Proposed Development on the climate is consistent with the IEMA definition '**Beneficial**' and '**Significant**' whereby "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 the net zero requirements with a positive impact".

TABLE 14.5 SUMMARY OF THE NET IMPACT OF THE ESTIMATED GHG EMISSIONS FOR THE PROPOSED DEVELOPMENT

SOURCE	TOTAL ESTIMATED GHG EMISSIONS (tCO_2e)
Total estimated GHG emissions from the construction, operation and decommissioning of the Proposed Development	542,000
Total estimated GHG emissions associated with the equivalent annual UK grid generation for the Proposed Development (using the UK grid emissions factor)	(2,500,000)
Net impact on the climate from the Proposed Development*	(1,958,000)
The net impact of the Proposed Development will result in the reduction or displacement of around 1,958,000 tCO_2e during the operational lifetime of the project.	

14.9 Conclusions and Summary

14.9.1.1 In response to the scoping report produced as part of the EIA Regulations, key stakeholders requested that a GHG assessment be completed and included in the EIAR for the Proposed Development. This Chapter summarised the methods and approach of the GHG assessment and presents the findings of the assessment.

14.9.1.2 The Proposed Development will provide renewable energy which when operational will support the decarbonisation of the UK electricity generation and the UK Government's net zero ambitions.

14.9.1.3 The Proposed Development will emit GHGs during its construction, operation and decommissioning. To understand the impact of the GHG emissions associated with the Proposed Development a GHG assessment was completed. This GHG assessment was based on the data available at the design stage of the Proposed Development and using the methods, assumptions and limitations as detailed in this Chapter.

14.9.1.4 The GHG emissions from the Proposed Development's construction, operation and decommissioning (scopes 1, 2 and 3) were estimated at around 542,000 tCO_2e for the project lifetime. When compared with the relevant UK Carbon Budgets the assessment concluded that it these emissions would not impact the UK climate targets and Carbon Budgets It was concluded that the likely impact of the Proposed Development's construction, operation and decommissioning on the climate is consistent with the IEMA definition '**Negligible'** and 'N**ot Significant'.**

14.9.1.5 Mitigations to reduce GHG emissions associated with the Proposed Development have been designed in and have been highlighted in this Chapter for inclusion during the Proposed Development's construction, operation and decommissioning phases through the implementation of the CEMP.

14.9.1.6 The GHG assessment also identified that over the Proposed Development's 40-year lifetime it would avoid around 2,500,000 tCO_2e by displacing or reducing GHG emissions from the equivalent UK grid generation. The GHG assessment concluded that the Proposed Development would provide a net climate benefit, by offsetting around 1,958,000 tCO_2e, consistent with the IEMA definition '**Beneficial'** and '**Significant'**.