Chapter 12: Climate Change

Contents

12. Climate Change 12-1
12.1 Introduction 12-1
12.2 Assessment Methodology 12-1
12.3 Existing Conditions 12-5
12.4 Embedded Design Mitigation 12-6
12.5 Micrositing 12-7
12.6 Scope of the Assessment 12-7
12.7 Assessment of Effects 12-8
12.8 Summary of Likely Significant Effects 12-11

12. Climate Change

12.1 Introduction

12.1.1 This chapter presents the findings of the assessment of effects of the Revised Larbrax Wind Farm (the Proposed Development) on climate change mitigation (including carbon balance) and adaptation.

12.1.2 The impacts of climate change are recognised as one of the world's greatest economic, environmental, and social issues. As a result, climate change is viewed as an essential concern in project assessment and decision-making and is a key thread which runs through National Planning Framework (NPF) 4. A primary source of climate change is an increase in the concentration and volume of Greenhouse Gases (GHGs) in the atmosphere, with the use of fossil fuels to generate electricity playing a large role. The purpose of the Proposed Development is to generate electricity from a renewable source of energy, offsetting the need for electrical generation from the combustion of fossil fuels. As a result, the electricity generated and distributed by the Proposed Development will result in lower carbon dioxide (CO_2) emissions, with associated environmental benefit. The climate change assessment therefore draws largely on this premise. However, no source of electricity generation is completely carbon free. For onshore wind, there will be emissions resulting from the manufacture of components and intermittent back up generation that is required in times of low wind resource, as well as emissions from both construction and decommissioning activities and transport.

12.1.3 The assessment has been undertaken by LUC with inputs from Carbon Forecast Ltd (Carbon Balance Assessment). Further details on expertise are provided in **Technical Appendix 1.1: Statement of Expertise.**

12.1.4 The chapter is supported by the following technical appendices:

- **Technical Appendix 12.1: Carbon Balance Assessment.**

12.2 Assessment Methodology

Legislation and Policy

12.2.1 The climate change assessment has been undertaken in the context of the current key climate change legislation and policy and the targets and aspirations set out within these, including:

- The Climate Change (Scotland) Act 2009[1] as amended by The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019[2];
- Update to the Climate Change Plan 2018-2032: Securing a Green Recovery on a Path to Net Zero 2020[3];
- Onshore Wind Policy Statement 2022[4];
- National Planning Framework 4[5];
- Scotland's Energy Strategy Position Statement 2021[6]; and
- Draft Energy Strategy and Just Transition Plan 2023[7].

12.2.2 Further details of these key legislation and policy documents are set out in the Planning Statement which accompanies the application.

[1] The Climate Change Scotland Act 2009. https://www.legislation.gov.uk/asp/2009/12/contents
[2] The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. https://www.legislation.gov.uk/asp/2019/15/enacted
[3] Scottish Government (2020) Securing a Green Recovery on a Path to Net Zero: Climate Change Plan 2018–2032 – Update. Available [online] at: https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/documents
[4] Scottish Government (2022) Onshore Wind: Policy Statement 2022. Available [online] at: https://www.gov.scot/publications/onshore-wind-policy-statement-2022/
[5] Scottish Government (2023) National Planning Framework 4. Available [online] at: https://www.gov.scot/publications/national-planning-framework-4/
[6] Scottish Government (2021) Scotland's Energy Strategy Position Statement. Available [online] at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2021/03/scotlands-energy-strategy-position
[7] The Scottish Government (2023) Draft Energy Strategy and Just Transition Plan. Available [online] at: https://www.gov.scot/publications/draft-energy-strategy-transition-plan/

Guidance

12.2.3 This assessment is carried out in accordance with the principles contained within the following guidance documents:

- IEMA (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance (2nd Edition)[8];
- IEMA (2020) The Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation[9];
- Scottish Government (2018) Technical Guidance Note on Calculating Carbon Losses and Savings on Scottish Peatlands – Version 2.10.0[10]; and
- Scottish Renewables and Scottish Environment Protection Agency (SEPA) (2012) Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste[11].

Consultation

12.2.4 No consultation has been undertaken to inform this assessment.

Study Area

12.2.5 The assessment considers the effects of the Proposed Development on the global climate, with specific reference to the climate changes expected in the UK. These have been defined using the UK's climate change projections (UKCP18), which allow climate changes to be projected at the regional level; in this case, the west of Scotland. The effects of a changing climate on the Proposed Development have largely been assessed in relation to the Site and its immediate surroundings.

12.2.6 The study area for calculating stored soil carbon in **Technical Appendix 12.1** has been the Site under existing conditions. For the carbon payback assessment, since greenhouse gas emissions and savings are both ultimately a global 'pool', this assessment is not restricted solely to those emissions or savings that occur within the boundary of the Proposed Development. Land-based emissions from peat and habitat losses are based on the Site footprint, but other activities, for example, emissions resulting from the extraction and production of steel for turbines, are still attributable to the Proposed Development even though they are likely to occur in other parts of the world.

Desk Based Research and Data Sources

12.2.7 In addition to the aforementioned Carbon Balance Assessment (**Technical Appendix 12.1**), the following data sources have informed the assessment:

- UK Climate Projections (UKCP18)[12];
- Department for Business, Energy and Industrial Strategy (BEIS): National Statistics publication Energy Trends. Table 6.1. Renewable Electricity Capacity and Generation[13];
- Scottish Government Carbon Calculator Tool[14]; and

[8] IEMA (2022). Assessing Greenhouse Gas Emissions and Evaluating their Significance (2nd Edition). Available [online] at: IEMA Guide: Assessing Greenhouse Gas Emissions and Evaluating their Significance 2nd Edition
[9] IEMA (2020). The Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation. Available [online] at: https://www.iema.net/media/mabhqino/iema-eia-climate-change-resilience-june-2020.pdf
[10] Scottish Government (2018). Calculating Potential Carbon Losses and Savings from Wind Farms on Scottish Peatlands – Version 2.10.0. Available [online] at: https://www.gov.scot/publications/carbon-calculator-technical-guidance/
[11] Scottish Renewables and SEPA (2012). Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste. Available [online] at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2014/07/assessment-of-peat-volumes-reuse-of-excavated-peat-and-minimisation-of-waste-guidance/documents/guidance-on-the-assessment-of-peat-volumes-reuse-of-excavated-peat-and-the-minimisation-of-waste/guidance-on-the-assessment-of-peat-volumes-reuse-of-excavated-peat-and-the-minimisation-of-waste/govscot%3Adocument/Guidance%2Bon%2Bthe%2Bassessment%2Bof%2Bpeat%2Bvolumes%252C%2Breuse%2Bof%2Bexcavated%2Bpeat%252C%2Band%2Bthe%2Bminimisation%2Bof%2Bwaste.pdf
[12] Met Office Climate Change Projections over land UKCP18: http://ukclimateprojections.metoffice.gov.uk
[13] Department for Business, Energy & Industrial Strategy (2021). National Statistics publication Energy Trends. Table 6.1. Renewable electricity capacity and generation. Published 30 September 2021
[14] Smith et al. (2011). Carbon Implications of Windfarms Located on Peatlands – Update of the Scottish Government Carbon Calculator Tool. Version 2 (as updated). Available [online] at: https://www.researchgate.net/publication/256473182_Carbon_Implications_Of_Windfarms_Located_On_Peatlands_-_Update_Of_The_Scottish_Government_Carbon_Calculator_Tool

- RenewableUK Wind Energy Statistics[15].

Field Survey

12.2.8 The assessment has been desk based, drawing largely from published guidance and data. Peat depth probing was undertaken to inform the layout of the Proposed Development, and this data was also used to inform the carbon balance assessment (see **Technical Appendix 9.2: Peat Survey Report**).

Assessing Significance

Climate Change Mitigation

12.2.9 All emissions contribute to climate change. However, specifically in the EIA context, the IEMA guidance[9] provides relative significance descriptions to assist with assessments. A number of distinct levels of significance have been defined, which are not solely based on whether a project emits GHG emissions alone, but how the project makes a relative contribution towards achieving a science-based 1.5°C aligned transition towards net zero.

12.2.10 The UK has set a legally binding GHG emission reduction target for 2050 (2045 in Scotland) with interim five-yearly carbon budgets which define a trajectory towards net zero. The IEMA guidance states (in Section 6):

"The 2050 target (and interim budgets set to date) are…compatible with the required magnitude and rate of GHG emissions reductions required in the UK to meet the goals of the Paris Agreement, thereby limiting severe adverse effects…. To meet the 2050 target and interim budgets, action is required to reduce GHG emissions from all sectors, including projects in the built and natural environment. EIA for any proposed project must therefore give proportionate consideration to whether and how that project will contribute or jeopardise the achievement of these targets." (page 23).

12.2.11 Furthermore, the guidance also states the following:

"The crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050." (page 24).

Criteria for Assessing Significance

12.2.12 For the purposes of this assessment, this guidance has been interpreted as outlined in **Table 12.1** and has been used to determine significance of effects.

Table 12.1 : Significance Citeria

Significance of Effects	Description
Adverse (major or moderate)	The Proposed Development is not compatible with the UK's budgeted science-based net zero trajectory. Further evaluation will be required to determine whether this is of Major or Moderate significance.
Adverse (minor or negligible)	The Proposed Development will be a net generator of GHG emissions but is compatible with the UK's budgeted science-based net zero trajectory. Further evaluation will be required to determine whether this is of Minor or Negligible significance.
Beneficial (major, moderate or minor significance)	The net GHG emissions associated with the Proposed Development will be negative. Further evaluation in the context of the UK's budgeted science-based net zero trajectory will be required to determine whether this is of Major, Moderate or Minor significance.

[15] RenewableUK Wind Energy Statistics. Available [online] at: https://www.renewableuk.com/news-and-resources/facts-and-figures/

Climate Change Adaptation

12.2.13 The purpose of the in-combination climate adaptation assessment is to determine whether the significance of effects of the Proposed Development on a given receptor (under the existing climate baseline) are likely to be changed/or made worse by future climatic conditions and whether the Proposed Development is likely to affect a receptor's ability to adapt to these changes. Significance of effects are determined through the following steps:

Criteria for Assessing Magnitude of Change

12.2.14 Receptors identified and assessed in the topic chapters of the EIA Report under the current climate baseline are evaluated to determine whether the susceptibility and vulnerability as well as their value/importance will change with the future climatic conditions defined. A high value receptor that has very little resilience to changes in climatic conditions should be considered more likely to be significantly affected than a high value receptor that is very resilient to changes in climatic conditions.

Citeria for Assessing Magnitude of Change

12.2.15 The magnitude of the effects on the receptors under the existing climate baseline is evaluated to determine whether the probability and/or consequence of the effect changes with the future climatic conditions.

Citeria for Assessing Significance

12.2.16 Building on the evaluation of sensitivity and magnitude of the effect, an assessment is undertaken to identify whether the additional effects of future climate impacts alter the sensitivity and/or magnitude of the effect so that the level of significance of the effects within other topics identified against baseline conditions changes. The assessment uses the significance criteria used by other topics assessed in the EIA Report i.e., if a Minor (adverse) effect on direct habitat loss is not likely to change under a future climatic scenario, then the in-combination effect (effect of the Proposed Development with future climate change) remains as Minor (adverse).

Assessment Assumptions

12.2.17 In considering future climate change scenarios, IEMA guidance[9] recommends the use of the UK Climate Projections UKCP18 website[12]. 'Probabilistic' projections are provided for a range of variables including temperature, precipitation and sea level rise. Wind speed and storm frequency/intensity are considered separately as global modelling information is currently more limited.

12.2.18 The current projections, UKCP18[16], updated in August 2022, are now the most recent climate change projections available. This was released to replace the dataset from November 2018. According to the climate projections website, UKCP18 provides a valid assessment of the UK's future climate over land, however when considering decisions that are sensitive to projected future changes in summer rainfall, additional data should be considered.

12.2.19 The UKCP18 projections for temperature and precipitation are presented for the UK as a whole and also on a regional basis. The UK projections consider three variables:

- Timeframe: the projections are presented for four overlapping time periods (2020s, 2040s, 2060s and 2080s);
- Probability: The projections are provided as probability distributions rather than single values, with figures provided for 5, 10, 50, 90 and 95% probability; and
- Representative Concentration Pathways (RCP): Four pathways have been adopted; RCP2.6, RCP4.5, RCP6.0 and RCP8.5. These pathways describe different greenhouse gas (GHG) and air pollutant emissions as well as their atmospheric concentrations and land use with each one resulting in a different range of global mean temperature increases over the 21st Century. RCP2.6 represents a scenario which aims to keep global warming likely below 2°C compared to pre-industrial temperatures. RCP4.5 and RCP6.0 represent intermediate scenarios while RCP8.5 is the highest impact emission scenario. All scenarios are considered to be equally plausible.

12.2.20 **Table 12.2** below explains the assumptions made in applying the UKCP18 projections to the assessment of the Proposed Development. The IEMA guidance states, "*Recommended best practice is to use the higher emissions scenario (RCP 8.5 in the latest UKCP18 projections) at the 50th percentile, for the 2080s timelines, unless a*

[16] UKCP Key Results 2022 Spreadsheet. Available [online] at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-key-results.xlsx

substantiated case can be made for not doing this (e.g., anticipated lifespan of the project is shorter than 2080s)" (page 44).

Table 12.2 : Climate Change Assessment Assumptions

Variable	Assumptions	Rationale
Timeframe	2060 – 2079	This is considered a realistic timeframe given the design life of the Proposed Development (35 years).
Probability	50th percentile used to establish what is projected as the central estimate with consideration given to lowest (5th) and highest (95th) percentiles to determine the lowest and highest projections that could happen within the timeframe.	By providing a range of results rather than single best estimate values, a clearer picture can be provided regarding the level of confidence in different outcomes.
RCP	RCP 8.5	RCP8.5 is selected as recommended in the IEMA guidance and allows for a worst-case scenario future climate to be defined resulting in a conservative assessment.

12.2.21 All key assumptions made with input data for the carbon calculator are set out in **Technical Appendix 12.1**.

Assessment Limitations

12.2.22 The key limitations to the assessment of effects in this chapter are as follows:

- Estimated carbon losses in the calculator are conservative, and it is assumed that all the carbon in excavated peat is lost even though all excavated peat will be re-used as set out in **Technical Appendix 9.5: Outline Peat Management Plan (OPMP)**.
- The carbon gains included in the calculator do not include future carbon sequestration from improved carbon fixing vegetation such as native woodland enhancement proposals set out in **Technical Appendix 7.5: Outline Biodiversity Enhancement Management Plan (OBEMP)**.
- The carbon calculator does not account for carbon emissions and direct CO_2 and NO_x emissions from Heavy Goods Vehicles (HGV) (including cumulatively) transporting components, materials and their production (including stone, concrete, and batteries) and staff to Site during construction, but rather only emissions associated with turbine life and emissions associated with their production, and so a qualitative approach has been used in regards to transport emissions in the assessment. This effect can therefore only be assessed qualitatively in the absence of a whole life cycle carbon assessment.
- The carbon calculator does not account for emissions associated with the working of machinery onsite such as excavators, generators, and forestry felling vehicles.

12.2.23 It is beyond the scope of this assessment to quantitively assess the cumulative offsetting effects of other schemes, and so any other beneficial effects identified are qualitative and based on professional judgement. Whilst some information gaps have been identified, it is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant environmental effects on climate change.

12.3 Existing Conditions

12.3.1 **Table 12.3** below outlines the projected changes in temperature, precipitation and wind speed and storms by 2060-2079, assuming a 50th percentile probability.

Table 12.3 : Projected Climate Change

Climate Variable	Projected Change
Temperature	Temperatures across West Scotland are projected to increase, with projected increases in summer temperatures greatest. The central estimate of increase in winter mean temperature is 2.1ºC; it is very unlikely to be less than 0.2ºC and also unlikely to be greater than 4.2ºC. The central estimate of increase in summer mean temperature is 2.8ºC; it is unlikely to drop below 0.7ºC and more than 5.1ºC.
Precipitation	Winter rainfall across West Scotland is projected to increase, and summer rainfall is most likely to decrease. The central estimate of change in winter mean precipitation is 19%; it is very unlikely to be less than -7% and is very unlikely to be more than 53%. The central estimate of change in summer mean precipitation is -15%; it is very unlikely to be less than -38% and is very unlikely to be more than 9%.
Wind Speed and Storms	Changes in wind speeds are not currently available at the regional level and there remains considerable uncertainty in the projections with respect to wind speed. However, there are small changes in projected wind speed, for example, across the UK, near surface wind speeds are expected to increase in the second half of the 21st century with winter months experiencing more significant impacts of winds. This is accompanied by an increase in frequency of winter storms over the UK. However, the increase in wind speeds is projected to be modest.

12.3.2 With respect to climate change adaptation, all specialist topic area authors were provided with a summary of the climate change projections above and were asked to consider the relevance of this for their baseline descriptions in order to determine those receptors which are susceptible to a changing climate.

12.3.3 For the following topics, it is not considered that baseline conditions, and therefore the susceptibility and vulnerability of receptors as well as their value/importance will change with the future climatic conditions defined, such that in-combination climate change adaptation effects are unlikely, and these topics are not considered further in the assessment.

- **Chapter 10: Noise and Vibration**: The consequences of the projected climate change scenario are unlikely to substantially affect baseline noise conditions for the purpose of the assessment in this EIA Report, given that periods of rainfall are excluded and the variation with wind speed was taken into account, in line with requirements of ETSU-R-97 and current good practice.
- **Chapter 11: Access, Traffic and Transport**: It is considered that climate change projections will not have a discernible impact on the baseline conditions for road traffic within the timescales of the Proposed Development. It is assumed that, at a regional level, appropriate measures will be put in place to ensure flood risk is managed and does not have long term effects on transport infrastructure.

12.3.4 The following assessments provided more detailed consideration on baseline conditions that will be influenced by projected climate change:

- **Chapter 5: Landscape and Visual Impact Assessment**;
- **Chapter 6: Cultural Heritage**;
- **Chapter 7: Ecology**;
- **Chapter 8: Ornithology**; and
- **Chapter 9: Hydrology, Hydrogeology, Geology and Peat**.

12.4 Embedded Design Mitigation

12.4.1 The purpose of the Proposed Development is to generate electricity from a renewable source of energy, avoiding the need for power generation from the combustion of fossil fuels. Consequently, the electricity that will be produced by the Proposed Development will result in a saving in emissions of CO_2 with associated environmental benefits. The overall design has at all stages tried to maximise the renewable energy production from the Site, with consideration of all of the environmental constraints. A range of embedded mitigation measures have already been applied as part of the iterative design process (see below and **Chapter 3: Site Selection and Design Strategy**).

12.4.2 Modifications and design considerations that have been made during the iterative EIA process include:

- Impacts upon priority peatland habitat (including blanket bog) through physical damage, excavation and transportation have been minimised as far as possible;
- Areas of deeper peat within the Site have been avoided as far as possible. 86% of peat probes were less than 0.5 m deep indicating that the majority of infrastructure is not located on peat.
- The use of one temporary borrow pit from which it is anticipated that all stone aggregate will be sourced for construction including stone for tracks, hardstandings and construction compound, will reduce the theoretical volume of construction traffic calculated in **Chapter 11** and associated emissions;
- Concrete batching will be undertaken onsite thereby reducing traffic and associated emissions;
- Onsite coniferous woodland has been avoided;
- A minimum area of 13.01 hectares (ha) is proposed for peatland restoration within the Site (see **Technical Appendix 7.5**). This will help to reduce the release of carbon into the atmosphere from degrading bog habitat.
- All new and replacement watercourse crossings will be bottomless arched culverts designed to withstand 1 in 200 year plus climate change flows; and
- Modern turbines are designed and constructed to withstand the forces likely to be exerted on them, often in remote environments which are regularly subject to high wind speeds. Adherence to relevant design and safety standards ensures that there is extremely limited risk of structural failure of turbines or foundations from wind or high temperatures.

12.5 Micrositing

12.5.1 It is proposed that the turbines and other infrastructure will be subject to a 100 m micro-siting allowance which will be applied should adverse ground conditions be encountered during pre-construction ground investigations, or where more optimal ground conditions are available. The magnitude and resulting significance of effects identified in this chapter will not be affected by this.

12.6 Scope of the Assessment

Effects Assessed in Full

12.6.1 The following potential effects were identified following a review of baseline data, project design and embedded mitigation for consideration in this assessment:

- Direct carbon dioxide (CO_2) and nitrogen oxide (NO_x) emissions during construction such (including cumulatively);
- Other carbon emissions in the materials and systems which form temporary and permanent structures, arising as a result of the extraction and manufacture of materials, fabrication, transportation to Site, waste and the future demolition and potential re-use;
- The contribution that the Proposed Development will make to offsetting CO_2 emissions arising from construction and decommissioning once operational (including peat restoration) as well as cumulatively (climate mitigation); and
- The ability of receptors, such as species and habitats, to adapt to climate change (climate adaptation) during operation of the Proposed Development, and whether the effects of the Proposed Development on those receptors assessed under the current climate baseline will change with a future climate, i.e. in-combination effects.

Effects Scoped Out

12.6.2 On the basis of the desk-based assessment, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, the following topic areas have been ‘scoped out’ of detailed assessment:

- Direct CO_2 and NO_x emissions from vehicles during operation (and cumulatively) as movements associated with turbine maintenance are considered to be minimal;
- The ability of receptors to adapt to climate change during construction of the Proposed Development as these effects are assessed long term, i.e., over the 35-year operational period;
- The ability of receptors to adapt to climate change during operation of the Proposed Development in-combination with other nearby wind farms as this is largely a project specific consideration, namely the resilience of the project in question to climate change and the extent to which projected climate change could alter the predicted effect judgements;
- Indirect emissions arising from the demand for energy produced using fossil fuels (e.g., electricity for heating, cooling and lighting); and
- Project resilience (or vulnerability) to climate change. The latest Institute of Environmental Management and Assessment (IEMA) guidance[9] states that, "*The resilience of something is a measure of its ability to respond to changes it experiences. If a receptor or a project has good climate change resilience, it is able to respond to the changes in climate in a way that ensures it retains much of its original function and form. A receptor or project that has poor climate change resilience will lose much of its original function or form as the climate changes*" (page 49). The Proposed Development is designed to cope with changes in temperature and rainfall. Turbines will shut down if winds are too strong or if overheating occurs, and appropriate infrastructure design including maintaining up to a 50 m buffer around watercourses where possible and the incorporation of standard good practice measures for site drainage (including SuDS principles and designing all watercourse crossings and infrastructure to withstand a 1:200 year flood event) will be achieved.

12.7 Assessment of Effects

12.7.1 The assessment of effects is based on the Proposed Development description as outlined in **Chapter 4**. Unless otherwise stated, potential effects identified in this chapter are considered to be adverse.

Construction Effects

Predicted Construction Effects

Carbon Emissions Including Directs CO_2 and NO_x Emissions from HGV Vehicles and Construction Equipment

12.7.2 Carbon emissions associated with the production, transportation, and erection of turbines and concrete production, are included in the carbon balance calculation discussed further below (see **Technical Appendix 12.1**). As detailed in **Table 12.5** of **Technical Appendix 12.1**, the estimated carbon emissions during construction as a result of losses due to turbine and battery storage lifecycle and construction materials, as well as CO_2 loss from excavated peat, is estimated to be approximately 13,600 tonnes of CO_2 (tCO_2e).

12.7.3 As stated in **Chapter 11**, the highest levels of vehicle movements associated with the Proposed Development will occur during its construction. A total of 9,268 two-way construction vehicle journeys are estimated across the 12-month construction programme. Whilst CO_2 and NO_x emissions have not been calculated for these vehicle movements, it is considered that the opportunity to use the onsite borrow pit for the majority of stone requirements will likely significantly reduce HGV traffic movements and the associated emissions. In addition, concrete batching will be undertaken onsite which will reduce concrete delivery requirements. Whilst there will be fuel emissions arising from other construction equipment such as diesel generators and plant, these will be operated in the most efficient way possible to reduce noise effects in accordance with BS 5228, thereby limiting the associated emissions.

12.7.4 Overall, the Proposed Development will be a net generator of GHG emissions during construction. Based on qualitative consideration of the likely scale of emissions, and in accordance with the assessment methodology (whereby the expected estimated generation of GHG emissions during construction are compatible with the UK's budgeted net zero trajectory), a **Minor (negative**) effect is predicted which will be **Not Significant** under the EIA Regulations.

Operational Effects

Predicted Operational Effects

Carbon Losses and Savings

12.7.5 The carbon losses (generated emissions) associated with the Proposed Development once operational, as a result of losses due to carbon fixing potential etc are estimated at approximately 600 tCO_2e. However, the gains (avoided emissions) are estimated to be approximately 2,300 tCO_2e, associated with the positive change in emissions due to the proposed peatland restoration measures (see **Technical Appendix 7.5**), and will largely occur during the operational phase. The net carbon emissions associated with the Proposed Development across construction and operation are therefore estimated at approximately 12,200 tCO_2e.

12.7.6 **Technical Appendix 12.1** estimates that once operational, approximately 16,200 tCO_2e will be displaced each year, assuming a conservative grid-mix of electricity generation. As a comparison, the figure would be approximately 33,200 tCO_2e for a fossil fuel mix of generation and approximately 74,100 tCO_2e for coal fired electricity generation, therefore; a conservative approach has been taken. Over the 35 year lifetime of the Proposed Development, this therefore equates to the displacement of approximately 568,000 tCO_2e, assuming a grid-mix of electricity generation. Taking account of the net emissions generated across the construction and operational periods and the emissions displaced through clean energy generation, the Proposed Development is likely to achieve a 'payback' period of 0.7 years (approximately 8.5 months). Thereafter, the Proposed Development will be considered as a 'net avoider' of emissions.

12.7.7 Overall, the Proposed Development will have a **Moderate** (**Beneficial**) effect on carbon losses and savings which is Significant under the EIA Regulations.

Adaptation

12.7.8 Taking account of those receptors identified above, under 'baseline conditions', as potentially susceptible to a changing climate, this section gives further consideration as to whether or not the introduction of the Proposed Development is likely to affect judgements of effects and/or the ability of the receptors within or close to the Site to adapt to climate change.

- **Chapter 5: Landscape and Visual Impact Assessment** – UKCP18 projections highlight that in 2060s, summer and winter temperatures will be higher than the current baseline (higher for summer), with winter rainfall increasing and summer rainfall decreasing. The Landscape Institute's Position Statement on Climate Change[17] acknowledges that changes in average temperatures, precipitation and extreme weather events will have an effect on the landscape. However, whilst a change in rainfall and rising temperatures are anticipated, it is not considered that this will appreciably change the baseline landscape conditions. Mitigation associated with reducing climate change is likely to be a more noticeable change in the landscape. Therefore, the predicted landscape and visual effects noted in **Chapter 5** are unlikely to change in-combination with projected climate change.
- **Chapter 6: Cultural Heritage** – Based on the UKCP18 and RCP8.5, it is assessed that any changes in temperature, precipitation and wind speed will have a low to negligible impact on the current condition of the identified cultural heritage assets within the Site. Therefore, the predicted effects noted in **Chapter 6** are unlikely to change in-combination with projected climate change.
- **Chapter 7: Ecology** – Based on the UKCP18 projections, fluctuations of habitat condition and species' behaviour and distribution may occur at a local level, over time. However, the overall baseline conditions in the local area are likely to remain relatively consistent over time, and so the data allows for a robust assessment of the effects of the Proposed Development, during its lifespan, on ecology. Moreover, climate mitigation measures are proposed within the Outline Biodiversity Enhancement Management Plan (OBEMP) (**Technical Appendix 7.5**) including at least 13.01 ha of peatland restoration and native broadleaf planting. It is therefore considered that the Proposed Development will have benefits on the ability of ecological receptors to adapt to future climate change. Therefore, the predicted effects noted in **Chapter 7** are unlikely to change in-combination with projected climate change.

[17] Landscape Institute (2021). Landscape for 2030: How Landscape Practice Can Respond to the Climate Crisis. Available [online] at: https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2021/04/12510-LANDSCAPE-2030_v6.pdf

- **Chapter 8: Ornithology** – As a result of the UKCP18 projections, fluctuations in species abundance and distribution are likely to occur at a local level, over time which are representative of wider scale changes to populations, and so the assessment of impacts is applicable (i.e. the impact magnitude will remain the same % - e.g. smaller numbers onsite will be part of a smaller population). Measures included in the OBEMP are likely to have benefits for local bird assemblage through increasing and enhancing habitat suitability. Therefore, the predicted effects noted in **Chapter 8** are unlikely to change in-combination with projected climate change.
- **Chapter 9: Hydrology, Hydrogeology, Geology and Peat** - Hydrological implications of the UKCP18 predictions and the SEPA guidance are that river flows will increase as weather events grow more extreme. Baseline hydrological conditions for flood events are likely to become flashier and more intense. This is accounted for when applying SEPA climate change uplifts to hydrological estimates and drainage / watercourse crossing design and adhering to SEPA guidance on watercourse buffers. Increased temperatures and disruption to seasonal rainfall are likely to lead to increased peatland degradation as localised water table decreases are exacerbated. Micrositing of proposed turbine locations to avoid areas of deep peat has been incorporated to help mitigate peatland degradation. In addition, proposed new and upgraded watercourse crossings will be designed to accommodate 1 in 200 year climate change flows which will serve to minimise flood events onsite. Moreover, the Flood Risk Assessment (FRA) (**Technical Appendix 9.4: Proposed Access Flood Risk Assessment**) concludes that there will be no increased risk of flooding to the B738 at the Green Burn river crossing on the basis of the proposed bottomless arched culvert design. Peatland restoration proposals will involve damming active drains (even if vegetated) in order that the water level is raised sufficiently to create conditions suitable for a range of blanket bog species which will avoid the further degradation of onsite peatland habitats. Therefore, the predicted effects noted in **Chapter 9** are unlikely to change in-combination with projected climate change.

Committed Additional Mitigation

12.7.9 No additional mitigation measures are proposed in relation to climate change, although a Construction Traffic Management Plan (CTMP) and Staff Travel Plan (an outline of which is provided in **Technical Appendix 11.1**: **Transport Assessment**) will be implemented as part of the Construction Environmental Management Plan (CEMP) which will ensure that traffic movements are undertaken efficiently during construction, and unnecessary journeys avoided. It is also anticipated that the CTMP will include a vehicle idling policy to ensure that vehicle engines are turned off when not in use. A Site Waste Management Plan will also be implemented as part of the CEMP to reduce materials wastage onsite.

Residual Effects

Residual Construction Effects

12.7.10 All residual construction effects are considered to be **Minor (Not Significant)**.

Residual Operational Effects

12.7.11 All residual operational effects remain as discussed above. Overall, the Proposed Development will have a **Moderate (Beneficial)** effect on carbon losses and savings which is **Significant** under the EIA Regulations.

Cumulative Effects

Predicted Cumulative Construction Effects

Carbon Emissions Including Direct CO_2 and NOx Emissions from HGV Vehicles and Construction Equipment

12.7.12 Climate change is essentially a cumulative impact of emissions from various sources, including new developments. All wind farms will produce direct and embodied greenhouse gas emissions during construction. It is assumed, however, that any other applications that are consented and built will include reasonable measures to avoid, reduce and/or avoid the generation of greenhouse gas emissions, particularly from construction traffic. Overall, a **Minor** (**negative**) cumulative construction effect is therefore predicted which will be **Not Significant**.

Predicted Cumulative Operational Effects

Carbon Losses and Savings

12.7.13 The Proposed Development, in combination with other onshore wind developments, will have a beneficial effect on offsetting emissions released from the burning of fossil fuels and will play an integral part in helping Scotland meet its climate change and energy targets. A **Major** (**Beneficial**) effect is therefore identified, given the importance of this collective role of onshore wind generation to addressing the global climate emergency.

Proposed Mitigation

12.7.14 No mitigation measures are proposed in relation to cumulative climate change effects during construction and operation of the Proposed Development, therefore residual effects remain as noted above.

12.8 Summary of Likely Significant Effects

12.8.1 Once the Proposed Development is operational, it will begin to offset the carbon lost during manufacture and construction, as well as the emissions lost to construction traffic and backup generation requirements. It will, overall, have **Significant** benificial effects on its own (**moderate**) and cumulatively (**major**) with respect to the avoidance of emissions as detailed in **Table 12.4** below.

Table 12.4 : Summary of Likely Significant Effects

Description of Effect	Significance of Potential Effect		Mitigation Measures	Significance of Residual Effect	
	Significance	Beneficial /Adverse		Significance	Beneficial/Adverse
Operation					
Carbon Losses and Savings (climate change mitigation)	Moderate	Beneficial	None	Moderate	Beneficial
Cumulative					
Carbon Losses and Savings (climate change mitigation)	Major	Beneficial	None	Major	Beneficial