One Earth Solar Farm

Volume 6.0 Environmental Statement [EN010159]

Volume 3: Technical Appendices Supporting ES Volume 2

Climate Change Appendix 14.1 to 14.2

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Contents

Glossary

- GHG: A greenhouse gas is a gas which is present in the Earth's atmosphere and released through anthropogenic activities, within the atmosphere they absorb and emit infrared radiation, contributing to global warming.
- CO_2e: Carbon dioxide equivalent is a standard unit used to measure and compare the impact of different greenhouse gases on global warming. It expresses the effect of various gases in terms of the amount of carbon dioxide that would have the same global warming potential (GWP).
- GWP: Global Warming Potential is a measure of how much heat a greenhouse gas traps in the atmosphere over a specific period, compared to carbon dioxide.
- CCGT: Combined Cycle Gas Turbine is a high efficiency power generation technology that uses natural gas to generate electricity in both a gas turbine and a steam turbine.
- CCS: Carbon Capture and Storage is a technology in which carbon dioxide emissions from industrial processes and power generation are captured and then directed to permanent storage in underground reservoirs, preventing them from entering the atmosphere.
- Net Zero: Refers to balancing the amount of greenhouse gases emitted into the atmosphere with the amount removed, resulting in no overall increase in global emission. Achieving net zero is essential for limiting global warming to 1.5°C or 2°C above pre-industrial levels, as outlined in the Paris Agreement.
- RCP: Representative Concentration Pathway refers to a set of climate scenarios that describe possible future greenhouse gas concentration trajectories and their impact on global climate change. Developed for the Intergovernmental Panel on Climate Change (IPCC), RCPs help model how different levels of emissions will affect global temperatures, sea levels, and ecosystems by 2100.
- UKCP18: UK Climate Projections 2018 are the latest set of climate projections for the UK, providing detailed information on how the UK’s climate might change up to the year 2100. It includes data on temperature, rainfall, sea-level rise, and extreme weather events to support climate risk assessments and adaptation planning.
- DCO: Development Consent Order is part of the Planning Act 2008 and is a legal instrument used in the UK to grant approval for certain types of large-scale infrastructure projects, such as power plants, transportation networks, and other developments that may have significant environmental or societal impacts.

List of Abbreviations and Acronyms

Term	Definition
AQC	Air Quality Consultants Ltd
BESS	Battery Energy Storage Systems
CCC	Climate Change Committee
CCGT	Combined Cycle Gas Turbine
CCR	Climate Change Resilience
CCS	Carbon Capture and Storage
CEMP	Construction Environmental Management Plan
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
CoCP	Code of Construction Practice
CTMP	Construction Traffic Management Plan
DCO	Development Consent Order
DEMP	Decommissioning Environmental Management Plan
DESNZ	Department for Energy Security and Net Zero
DfT	Department for Transport
DLUHC	Department for Levelling Up, Housing and Communities
DTMP	Decommissioning Traffic Management Plan

EIA	Environmental Impact Assessment
ES	Environmental Statement
GHG	Greenhouse Gas
GWh	Gigawatt hour
GWP	Global Warming Potential
HMSO	Her/His Majesty's Stationery Office
HV	High voltage
HVAC	Heating, Ventilation and Air Conditioning
IBC	Intermediate Bulk Containers
ICCI	In-Combination Climate Change Impact
IEMA	Institute of Environmental Management and Assessment
kWh	Kilowatt hour
MTonnes CO_2e	Megatonne of carbon dioxide equivalent
MWh	Megawatt hour
NPPF	National Planning Policy Framework
NPS	National Policy Statement
OEMP	Operational Environmental Management Plan
PEIR	Preliminary Environmental Information Report
PV	Photovoltaic

RCP	Representative Concentration Pathway
RICS	Royal Institution of Chartered Surveyors
STP	Staff Travel Plan
Tonnes CO2e	Tonne of carbon dioxide equivalent
UKCP18	UK Climate Projections 2018
UNFCCC	United Nations Framework Convention on Climate Change

Appendix 14.1: Summary of Legislation, Policy and Technical Guidance

A.1.1 Legislation

Climate Change Act 2008[1]

A.1.1.1. The Climate Change Act 2008 sets legally binding targets for reducing GHG emissions, in particular carbon dioxide ('CO_2'). As originally enacted, the Climate Change Act 2008[2] required the SoS to ensure that the net carbon account for the year 2050 is at least 80% lower than the 1990 baseline in the United Kingdom ('UK').

A.1.1.2. The Climate Change Act 2008 also established the Committee for Climate Change ('CCC'), which is responsible for advising the UK government on GHG emissions targets and reporting on progress made towards them.

A.1.1.3. In May 2019, the CCC recommended a new GHG emissions target for the UK: a 100% reduction ('net zero') in GHG by 2050. The Climate Change Act 2008 (2050 Target Amendment) Order 2019, which came into force on 27 June 2019, amended the Climate Change Act 2008 to substitute the 80% target for 100%.

A.1.1.4. This is now the over- arching carbon reduction target for the Government. Carbon budgets set incremental limits on the amount of GHG emissions for the UK over a defined five- year period, with the most recent Sixth Carbon Budget aligned to achieving the net-zero target by 2050.

Climate Change Act 2008 (2050 Target Amendment) Order 2019[2]

A.1.1.5. In June 2019, the Government passed an order to amend the 2050 carbon emissions target in the Climate Change Act 2008 from 80% below 1990 levels to zero net carbon (i.e. 100% below 1990 levels). This new target will essentially end the UK's contribution to climate change by 2050.

Carbon Budget Order 2021[3]

A.1.1.6. The Carbon Budget Order 2021 came into force in June 2021. It sets a legal obligation to meet the targets of the Climate Change Act 2008 and subsequent amendment to cut GHG emissions by 78% by 2035.

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[1] HMSO (2008) Climate Change Act 2008.

[2] HMSO (2019) The Climate Change Act 2008 (2050 Target Amendment) Order 2019.

[3] HMSO (2021) The Carbon Budget Order 2021.

Energy Act (2023)[4]

A.1.1.7. Enacted in October 2023, the Energy Act makes provision about energy production and security and the regulation of the energy market, including new frameworks to incentivise investment in clean energy technologies, such as low-carbon heat schemes. It also makes provision about energy smart appliances and load control, the energy performance of premises and energy savings opportunity schemes, amongst other measures to ensure clean and affordable energy for the UK.

Net Zero Strategy: Build Back Greener[5]

A.1.1.8. The UK Government's Net Zero Strategy sets out the strategy for achieving the UK's binding commitment to net zero carbon emissions by 2050.

A.1.1.9. The strategy sets out a number of key aims and objectives to decarbonise the UK economy across all sectors. In relation to the power sector the strategy includes commitments to take action so that all of the UK's electricity supply comes from low carbon sources by 2035 and to accelerate the development of renewable energy generation such as wind and solar.

The Clean Growth Strategy[6]

A.1.1.10. The UK government's Clean Growth Strategy (CGS), published in October 2017, sets out the proposals and policies to meet legislated limits on UK emissions in five-year periods to 2028–2032 (the "fifth carbon budget").

Decarbonising Transport: A Better, Greener Britain[7]

A.1.1.11. The DfT published the Decarbonising Transport plan in 2021, setting out how transport emissions reductions will be delivered in order to reach net zero by 2050. This includes phasing out the sale of all non-zero tailpipe emission vehicles by 2040; for HGVs, sales of all new medium sized vehicles are to be zero tailpipe emission from 2035, with the largest vehicles being zero tailpipe emission by 2040.

Energy White Paper: Powering our Net Zero Future[8]

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[4] HMSO (2023) Energy Act 2023.

[5] HM Government (2021) Net Zero Strategy: Build Back Greener.

[6] HM Government (2017) The Clean Growth Strategy.

[7] DfT (2021) Decarbonising Transport: A Better, Greener Britain.

[8] HMSO (2020) The Energy White Paper. Powering our Net Zero Future. Available: https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future

A.1.1.12. The Government's energy white paper sets out the plan for growth and decarbonisation of the UK's energy supply out to 2050, in line with the 2050 net zero target. The white paper provides a framework of policies and incentives to accelerate investment in renewable energy infrastructure and acknowledges that "onshore wind and solar will be key building blocks of the future generation mix"[9].

A.1.2 National Policy

A.1.2.1. There are three National Policy Statements relating to energy generation. These are:

- NPS EN-1[10] which relates to the overarching policy on Energy;
- NPS EN-3[11] which relates to policy on Renewable Energy; and
- NPS-5[12] which relates to policy on Electricity Network Infrastructure.

A.1.2.2. These NPS documents do not provide specific guidance on solar farm or battery storage projects however they do provide general policy on promoting of low carbon energy production and resilience to climate change.

A.1.2.3. In this respect NPS EN-1 paragraphs 3.3.20 to 3.3.31 provide an introduction to the role of wind and solar for electricity generation and subsequent energy storage; paragraphs 4.1.5 to 4.1.7 in relation to the benefits and adverse impacts; Section 5.3 and 4.0 in relation to Environmental Statement assessment methodology and Section 4.9 in relation to climate projections, flood risk and the importance of relevant mitigation.

A.1.2.4. NPS EN-1 recognises the UK's target to cut greenhouse gas emissions to net zero by 2050. Paragraph 3.3.20 confirms that wind and solar are the lowest cost ways of generating electricity and that "*a secure, reliable, affordable, net zero consistent system in 2050 is likely to be composed predominantly of wind and solar*". The NPS identifies a number of renewable energy technologies, including solar PV and in paragraph 3.3.58 states that that there is a need for all these types of infrastructure and that this is urgent. On the issue of urgency, the NPS is clear (see Paragraph 3.3.80) that considering lead times for development of large-scale renewable energy projects, low carbon electricity generation (e.g. solar PV) needs to be brought forward as soon as

[9] See Page 45 of the Energy White Paper.

[10] Department for Energy Security & Net Zero (2023) Overarching National Policy Statement for Energy (EN-1). Available: https://assets.publishing.service.gov.uk/media/64252f3b60a35e00120cb158/NPS_EN-1.pdf

[11] DESNZ (2023) National Policy Statement for Renewable Energy Infrastructure (EN-3). Available: https://assets.publishing.service.gov.uk/media/64252f5f2fa848000cec0f52/NPS_EN-3.pdf

[12] DESNZ (2023) National Policy Statement for Electricity Networks Infrastructure (EN-5). Available: https://assets.publishing.service.gov.uk/media/65a78a5496a5ec000d731abb/nps-electricity-networks-infrastructure-en5.pdf

possible given the crucial role of low carbon electricity as the UK decarbonises its economy.

A.1.2.5. Alongside the development of wind and solar, paragraphs 3.3.25 to 3.3.26 of NPS EN-1 highlight the need for energy storage to maximise the usable output from intermittent low carbon generation (e.g., solar and wind), reduce the total amount of generation capacity needed on the system, provide a range of balancing services, and reduce constraints on the networks to help defer or avoid the need for costly network upgrades as demand increases.

A.1.2.6. Section 5.3 of the NPS EN-1 makes clear that all applications for energy infrastructure should include a whole life GHG assessment as part of the Project's ES.

A.1.2.7. In terms of Climate Resilience, Section 4.9 of NPS EN-1 sets out generic considerations that applicants and the Secretary of State should take into account to help ensure that renewable energy infrastructure is safe and resilient to climate change, and that necessary action can be taken to ensure the operation of the infrastructure over its estimated lifetime. Section 4.9 of NPS EN-1 advises that the resilience of the Project to climate change should be assessed in the ES accompanying an application. For example, the impact of increased risk of drought as a result of higher temperatures should be covered in the water quality and resources section of the ES. The assessment of climate resilience will identify all applicable future climate risks (which will include drought) and assess the resilience of the Project to the climate hazard taking into account embedded mitigation.

A.1.2.8. NPS EN-3 covers renewable energy infrastructure comprising solar PV above 50MW in England. The NPS EN-3 Section 3.10 recognises solar farms as one of the most established renewable electricity technologies in the UK and the cheapest form of electricity generation worldwide. It provides support for large scale solar development, by stating that: *"The government has committed to sustained growth in solar capacity to ensure that we are on a pathway that allows us to meet net zero emissions. As such solar is a key part of the government's strategy for low cost decarbonisation of the energy sector"* (Paragraph 3.10.1).

A.1.2.9. The NPS EN-5 relates to any above ground electricity line where nominal voltage is expected to be 132kV or above with a length greater than 2km which is not a replacement line and not exempted. However, Paragraph 1.6.1 of NPS EN-5 states that other kinds of electricity infrastructure (including underground cables at any voltage and associated infrastructure such as substations and converter stations) will be covered by this NPS if it constitutes associated development for which consent is sought along with a nationally significant infrastructure projects such as a generating station.

National Planning Policy Framework (NPPF) (2024)[13]

A.1.2.10. The National Planning Policy Framework also provides guidance on climate change, specifically Section 14: Meeting the challenge of climate change, flooding and coastal change. Paragraphs 163 and 164 provide guidance in relation to adaptation, mitigation and climate change resilience; Paragraph 161 supports the increased use and supply of renewable and low carbon energy, and Paragraph 168 provides guidance to local planning authorities in determining planning applications for renewable and low carbon development, and states that "local planning authorities should: a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; b) approve the application if its impacts are (or can be made) acceptable".

A.1.3 Local Policies

Newark and Sherwood Amended Core Strategy (2019)[14]

A.1.3.1. The Amended Core Strategy sets out the District Council's spatial policy framework for delivering the development and change needed to realise the District Council's vision for the District up to 2033.

A.1.3.2. Specific policies detailed in the Core Strategy which are relevant to the Proposed Development are detailed below.

A.1.3.3. Core Policy 9 on Sustainable Design states that:

"The District Council will expect new development proposals to demonstrate a high standard of sustainable design that both protects and enhances the natural environment and contributes to and sustains the rich local distinctiveness of the District. Therefore all new development should:...

…Provide for development that proves to be resilient in the long-term. Taking into account the potential impacts of climate change and the varying needs of the community"

A.1.3.4. Core Policy 10 on Climate Change states that:

[13] Ministry of Housing, Communities & Local Government (2024) National Planning Policy Framework. Available: https://assets.publishing.service.gov.uk/media/675abd214cbda57cacd3476e/NPPF-December-2024.pdf

[14] Newark and Sherwood District Council (2019) Amended Core Strategy. Available: https://www.newark-sherwooddc.gov.uk/media/newark-and-sherwood/images-and-files/planning-policy/pdfs/core-strategy/ACS2019.pdf

"The District Council is committed to tackling the causes and impacts of climate change and to delivering a reduction in the Districts carbon footprint. The District Council will work with partners and developers to:…

- *Promote energy generation from renewable and low-carbon sources, including community-led schemes, through supporting new development where it is able to demonstrate that its adverse impacts have been satisfactorily addressed. Policy DM4 'Renewable and Low Carbon Energy Generation' provides the framework against which the appropriateness of proposals will be assessed;*

- *Mitigate the impacts of climate change through ensuring that new development proposals minimise their potential adverse environmental impacts during their construction and eventual operation. New proposals for development should therefore:*

    - *Ensure that the impacts on natural resources are minimised and the use of renewable resources encouraged; and*

    - *Be efficient in the consumption of energy, water and other resources."*

Central Lincolnshire Local Plan (2023)[15]

A.1.3.5. The Local Plan for the central Lincolnshire area sets out the approach to planning policy and overarching development allocations to drive growth in the area over a 20-year period. The Local Plan is contextualised into a wider vision, series of objectives and core policies toward delivery.

A.1.3.6. Specific policies within the Local Plan that are relevant to the Propsoed Development are detailed below.

A.1.3.7. Policy S14 Renewable Energy:

"The Central Lincolnshire Joint Strategic Planning Committee is committed to supporting the transition to a net zero carbon future and will seek to maximise appropriately located renewable energy generated in Central Lincolnshire (such energy likely being wind and solar based).

Proposals for renewable energy schemes, including ancillary development, will be supported where the direct, indirect, individual and cumulative impacts on the following considerations are, or will be made, acceptable. To determine whether it is acceptable, the following tests will have to be met:

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[15] Central Lincolnshire Joint Strategic Planning Committee (2023) Local Plan. Available: https://www.n-kesteven.gov.uk/sites/default/files/2023-04/Local%20Plan%20for%20adoption%20Approved%20by%20Committee.pdf

i. *The impacts are acceptable having considered the scale, siting and design, and the consequent impacts on landscape character; visual amenity; biodiversity; geodiversity; flood risk; townscape; heritage assets, their settings and the historic landscape; and highway safety and rail safety; and*

ii. *The impacts are acceptable on aviation and defence navigation system/communications; and*

iii. *The impacts are acceptable on the amenity of sensitive neighbouring uses (including local residents) by virtue of matters such as noise, dust, odour, shadow flicker, air quality and traffic;*

Testing compliance with part (i) above will be via applicable policies elsewhere in a development plan document for the area (i.e. this Local Plan; a Neighbourhood Plan, if one exists; any applicable policies in a Minerals or Waste Local Plan); and any further guidance set out in a Supplementary Planning Document.

In order to test compliance with part (ii) above will require, for relevant proposals, the submission by the applicant of robust evidence of the potential impact on any aviation and defence navigation system/communication, and within such evidence must be documented areas of agreement or disagreement reached with appropriate bodies and organisations responsible for such infrastructure.

In order to test compliance with part (iii) above will require, for relevant proposals, the submission by the applicant of a robust assessment of the potential impact on such users, and the mitigation measures proposed to minimise any identified harm.

For all matters in (i)-(iii), the applicable local planning authority may commission its own independent assessment of the proposals, to ensure it is satisfied what the degree of harm may be and whether reasonable mitigation opportunities are being taken.

Where significant adverse effects are concluded by the local planning authority following consideration of the above assessment(s), such effects will be weighed against the wider environmental, economic, social and community benefits provided by the proposal.

In this regard, and as part of the planning balance, significant additional weight in favour of the proposal will arise for any proposal which is community-led for the benefit of that community. In areas that have been designated for their national importance, as identified in the National Planning Policy Framework, renewable energy infrastructure will only be permitted where it can be demonstrated that it would be appropriate in scale, located in areas that do not contribute positively to the objectives of the designation, is sympathetically designed and includes any necessary mitigation measures."

A.1.3.8. Policy S16 Wider Energy Infrastructure:

"The Joint Committee is committed to supporting the transition to net zero carbon future and, in doing so, recognises and supports, in principle, the need for significant investment in new and upgraded energy infrastructure.

Where planning permission is needed from a Central Lincolnshire authority, support will be given to proposals which are necessary for, or form part of, the transition to a net zero carbon sub-region, which could include: energy storage facilities (such as battery storage or thermal storage); and upgraded or new electricity facilities (such as transmission facilities, sub-stations or other electricity infrastructure).

However, any such proposals should take all reasonable opportunities to mitigate any harm arising from such proposals, and take care to select not only appropriate locations for such facilities, but also design solutions (see Policy S53) which minimises harm arising."

A.1.3.9. Policy S17 Carbon Sinks:

"Existing carbon sinks, such as peat soils, must be protected, and where opportunities exist they should be enhanced in order to continue to act as a carbon sink.

Where development is proposed on land containing peat soils or other identified carbon sinks, including woodland, trees and scrub; open habitats and farmland; blanket bogs, raised bogs and fens; and rivers, lakes and wetland habitats, the applicant must submit a proportionate evaluation of the impact of the proposal on either the peat soil's carbon content or any other form of identified carbon sink as relevant and in all cases an appropriate management plan must be submitted."*

There will be a presumption in favour of preservation of peat and other carbon sinks in-situ. Proposals that will result in unavoidable harm to, or loss of, peat soils or other identified carbon sinks will only be permitted if it is demonstrated that:

a) the site is allocated for development; or

b) there is not a less harmful viable option to development of that site.

In any such case, the harm caused must be shown to have been reduced to the minimum possible and appropriate, satisfactory provision will be made for the evaluation, recording and interpretation of the peat soils or other form of carbon sink before commencement of development. For peat soils that are to be removed, the soils must be temporarily stored and then used in a way that will limit carbon loss to the atmosphere. Proposals to enhance peat soils and protect its qualities will be supported. Proposals to help strengthen existing, or create new, carbon sinks will be supported."

Bassetlaw District Council (2011) Local Development Framework, Publication Core Strategy and Development Management Policies[16]

A.1.3.10. The Core Strategy for the Bassetlaw District sets out the overarching vision for the area up until 2026, including the policy approach to deliver this.

A.1.3.11. Policy DM10 *"Renewable and Low Carbon Energy"* is related to the Proposed Development and states:

"The Council will be supportive of proposals that seek to utilize renewable and low-carbon energy to minimize CO_2 emissions. Proposals for renewable and low-carbon energy infrastructure will need to demonstrate that they:

- Are compatible with policies to safeguard the built and natural environment, including heritage assets and their setting;

- Will not lead to the loss of or damage to high-grade agricultural land;

- Are compatible with tourism and recreational facilities;

- Will not result in unacceptable impacts in terms of visual appearance, landscape character, noise, shadow-flicker, watercourse engineering and hydrological impacts, pollution, traffic generation, or loss of features of recognized importance for biodiversity;

- Will not result in an unacceptable cumulative impact in relation to the factors above.

Large-scale renewable and low-carbon energy proposals must provide full details of arrangements for decommissioning and reinstatement of the site if/when it ceases to operate.

B. District Heating and Co-location

Proposals for new development in District Heating Opportunity Areas (as identified on the Energy Opportunities Diagram) will, where the scale of the proposal permits, be expected to demonstrate consideration of District Heating as a means of achieving carbon compliance. District Heating opportunities include those supplied by heat from waste management sites, power stations, coal mine methane facilities or new standalone infrastructure. Applicants will be expected to engage with the Council at pre-application stage to assess the feasibility of achieving this objective. Where District Heating Networks are established, all subsequent new development close enough to connect to such a network will be expected to do so where there are no barriers to this connection. Proposals for heat-producing development will be expected to

[16] Bassetlaw District Council (2011) Bassetlaw District Local Development Framework. Available: https://www.bassetlaw.gov.uk/media/1657/bsinfrastructurestudy.pdf

demonstrate consideration of the feasibility of utilizing its waste heat for heat-consuming development. Support will be given to proposals that will ensure the co-location of compatible heat-producing and heat-consuming development.

C. Major Development

Major development proposals will be expected to deliver specific low-carbon and renewable energy infrastructure in line with assessments of feasibility and overall viability.

D. Community Energy Schemes

Support will be given to community-led energy schemes in line with the Council's Renewable and Low Carbon Energy Study (or subsequent replacement), on exception sites, if necessary, where strong local support is demonstrated."

Bassetlaw Local Plan (2023) 2020-2038: Main Modifications Version, August 2023[17]

A.1.3.12. This Local Plan sets out Bassetlaw District's planning and policy framework, development strategy and site allocations to inform effective delivery of the overall vision up until 2038.

A.1.3.13. Specific policies detailed in the Local Plan that are relevant to the Propsoed Development are detailed below.

A.1.3.14. Policy ST50: Reducing Carbon Emissions, Climate Change Mitigation and Adaptation:

"All proposals, including the change of use of existing buildings and spaces, should be designed to improve resilience to the anticipated effects of climate change taking into account the design principles in the Bassetlaw Design Quality SPD and the Bassetlaw Design Code. Proposals should incorporate, where appropriate, the following measures that address issues of climate change mitigation and adaptation through:

a) ensuring no unacceptable adverse impact on local air quality;

b) designing layouts so that the orientation of buildings and spaces maximise opportunities for solar gain;

[17] Bassetlaw District Council (2024) Bassetlaw Local Plan. Available: https://www.bassetlaw.gov.uk/media/gn1kjm1b/adopted-bassetlaw-local-plan-2020-2038.pdf

h) providing space for habitats and species to move through the landscape and for the operation of natural processes to occur;

i) where possible, minimising the use of natural resources over the development's lifetime, such as minerals and consumable products, by reuse or recycling of materials in construction, and by making the best use of existing buildings and infrastructure;
adapting surface materials and drainage design to reduce the risk of flooding to land, property and people as a result of more extreme rainfall in accordance with Policy ST50;
using integrated water management systems to manage runoff and provide a non-potable water supply; providing green/blue infrastructure, and where possible, retaining existing trees and woodlands to reduce the 'urban heating effect' during warmer summers; and using urban greening methods within the design of new buildings.

A.1.3.15. Policy ST51 "Renewable Energy Generation" states that:

"Development that generates, shares, transmits and/or stores zero carbon and/or low carbon renewable energy including community energy schemes will be supported subject to the satisfactory resolution of all relevant site specific and cumulative impacts upon:

a) Location, setting and position in the wider landscape, resulting from its siting and scale;

b) Natural and heritage assets and their settings;

c) Air and water quality;

d) Hydrology and hydrogeology;

e) The best and most versatile agricultural land;

f) Existing highway capacity and highway safety;

g) Noise, light, glare, smell, dust, emissions or flicker;

h) Aviation and radar; and

i) Recreation and local amenity.

Proposals must take into account operational and approved developments, as well as any proposed intensification to operational or approved proposals. Proposals involving one or more wind turbines will be supported where:

a) the site is located within an area defined as being suitable for wind energy in a made neighbourhood plan or development plan document; and

b) following consultation, it can be satisfactorily demonstrated that all potential adverse planning impacts identified by affected local communities have been fully addressed, including cumulative impacts identified in Part 1 above.

All renewable energy development will be expected to provide details of the expected power generation based upon expected yield or local self-consumption to enable effective monitoring of the district's contribution to the national zero carbon targets.

A decommissioning programme applied by a Condition to any planning permission granted will be required to demonstrate that the site can be returned to an acceptable state, three years after cessation of operations."

Appendix 14.2: GHG Footprint Methodology

A.1.4 Introduction

A.1.4.1. This appendix sets out the methodology for the calculating the baseline Greenhouse Gas (GHG) footprint, and GHG footprint for the Proposed Development. It covers the following GHG emissions sources:

- Existing site: agricultural emissions from arable land use;
- Construction phase: embodied GHG emissions in materials used in the construction of the Proposed Development, construction transport and construction site emissions;
- Operational phase: operational transport emissions and repair, maintenance and replacement;
- Decommissioning phase: decommissioning site emissions and decommissioning transport and waste material emissions; and
- Energy intensity.

A.1.4.2. The GHG footprint has been calculated for the lifetime of the Proposed Development, which includes a 24-month construction period (assumed to occur in 2027) and then a 60-year operational period from 2030 onwards.

A.1.4.3. Details of the methodology to calculate the GHG emissions from each of the emission sources included in the GHG footprint is provided in the following sections.

A.1.5 Baseline Emissions

A.1.5.1. The existing Site's baseline GHG emissions, are established by taking account the total emissions from current land use such as agricultural activities.

A.1.5.2. A summary of the data used for the calculation of the current GHG emissions from the Site resulting from agricultural activities is shown in **Table A14.2.1**. The GHG factor for agricultural land use has been taken from Natrual England[18].

[18] Natural England (2021) Carbon Storage and Sequestration by Habitat 2021 (NERR094)

Table A14.2.1: Exiting Site Data

Land use	Total site area	GHG Emissions Factor ($kgCO_2/ha$)	GHG Emissions (tonnes CO_2e)[a]
Agricultural land	1,550	0.29	449

[a] Value rounded to nearest whole number.

A.1.6 Construction Phase

Embodied GHG Emissions in Materials used in the Construction of the Proposed Development

A.1.6.1. Embodied carbon emissions from the construction phase of the Proposed Development have been estimated based on extensive data and information provided by the Applicant, including:

- plans and area schedules for the Proposed Development;
- quantities (mass and/or volume) of key construction materials such as concrete for hard surfaces, and steel for PV modules and mounting structures;
- dimensions of key structures on site including substations and battery containers;
- numbers, sizes, weights, dimensions for key components of the solar and BESS systems including PV panels, inverters, transformers, switchgear, battery cells, DC-DC converters and HVAC systems;
- lengths, type and specifications of cabling to be used throughout the Proposed Development; and
- the dimensions, type and materials used for perimeter fencing.

A.1.6.2. These input data have been processed and combined with embodied carbon emissions factors from a number of sources to model the embodied carbon emissions.

A.1.6.3. A summary of the sources and assumptions used in the calculation of embodied carbon emissions is presented in **Table A14.2.2**.

Table A14.2.2: Sources and Assumptions of Emissions Factors for Embodied Carbon

Component	GHG Emissions Factors Source and Assumptions
Site Preparation	
Hard Surfacing	GHG emission factors for aggregates and sand obtained from Bath University Inventory of Carbon and Energy (ICE) 3.0 database[20].
Solar Array	
PV Modules	GHG emissions factor of 0.0081 $kgCO_2e/kWh$ calculated using an Environmental Performance Declaration (EPD) for Jolywood JW-HD156N-158.75 monocrystalline solar panels (manufactured in China)[19].
Mounting Structures PV Frames	GHG emission factor for electro galvanised steel obtained from ICE 3.0 database[20].
Cabling (Low Voltage Distribution Cables and Grid Connection Cables)	Material composition of cables assumed from the Lifecycle Carbon Impact Assessment of the Respond Project Report[21]. GHG emission factors for aluminium, copper, and plastics (XLPE and MDPE) obtained from ICE 3.0[20] and ICE 2.0 databases[22].
HV Infrastructure	
Inverters	EPD CO_2e intensity calculated using and Environmental Environmental Performance Declaration (EPD) for Sungrow central power inverter[23].
Transformers	Typical material composition of transformers obtained from lifecycle analysis of power transformers[24] and emissions factors for steel, copper and insulating paper taken from ICE 2.0[22] and 3.0[20].

[19] Environmental Performance Declaration (2020) Jolywood N-type Bifacial Double Glass PV Modules, valid to Nov 2025: https://pvsky.pl/wp-content/uploads/2021/12/Jolywood-JW-HD144N-445-470W-Raport-EPD.pdf

[20] University of Bath (2019) Inventory of Carbon and Energy (ICE) Version 3.0.

[21] FuturoFirma (2018) Lifecycle Carbon Impact Assessment of the Respond Project: https://www.enwl.co.uk/globalassets/innovation/respond/respond-key-documents/carbon-impact-assessment-final-report.pdf

[22] University of Bath (2013) Inventory of Carbon and Energy (ICE) Version 2.0.

[23] Environmental Performance Declaration (2024) EPD Sungrow central power inverter: https://en.sungrowpower.com/Downloads

[24] Hong Guo, Yuting Gao, Junhao Li (2022) The greenhouse gas emissions of power transformers based on life cycle analysis. Energy Reports Volume 8, Supplement 15, Pages 413-419.

Switchgear	GHG intensity of switchgear converters assumed from the Lifecycle Carbon Impact Assessment of the Respond Project Report[21].
BESS	
Battery Cells	GHG emissions factor of 172 kgCO_2e/kWh calculated using an Environmental Performance Declaration (EPD) for Huawei battery cells[25].
Battery Containers	GHG emissions calculated based on size of structures using GHG emissions factors obtained from RICS guidance for specialist buildings/structures[26].
HVAC Systems	GHG emissions factor for HVAC systems obtained from embodied carbon in HVAC system lifecycle analysis and applied to total area of all battery containers[27].
DC-DC Converters	GHG intensity of switchgear converters assumed from the Lifecycle Carbon Impact Assessment of the Respond Project Report.
Substations & Compound Room	
Substations Control Rooms	GHG emissions calculated based on size of structures using GHG emissions factors obtained from RICS guidance for specialist buildings/structures[26].
Compound Rooms	GHG emission factors for aggregates and sand obtained from ICE 3.0 database[20].
Security fencing	
Fencing	GHG emission factors for general concrete, timber and steel obtained from ICE 3.0 database[20].

A.1.6.4. The resultant embodied carbon emissions are provided in **Table A14.2.3**.

[25] Environmental Performance Declaration (2022) Huawei Digital Power Technolgies battery modules valid to Sep 2027: https://www.epditaly.it/wp-content/uploads/2016/12/EPD_Huawei_2022-Battery-Modules.pdf

[26] RICS (2012) Methodology for the calculation of embodied carbon in materials. 1st edition.

[27] Rodriguez Droguett, B (2019) Embodied Carbon of Heating, Ventilation, Air Conditioning and Refrigerants (HVAC+R) Systems. University of Washington.

Table A14.2.3: Embodied Carbon Emissions (tonnes CO_2e)

Component	Embodied Carbon (tonnes CO_2e)[a]	% of Total
PV Modules	212,583	40.0%
Mounting Structures	39,499	7.4%
Cabling (Low Voltage Distribution Cables and Grid Connection Cables)	42,057	7.9%
Power Conversion Stations (PCS) (Inverters, Transformers and Switchgear)	32,232	6.1%
Battery Energy Storage Systems (BESS)	162,941	30.6%
Onsite Substations and Ancillary Buildings	39,758	7.5%
Hard surfacing	1,962	0.4%
Fencing	860	0.2%
Total	**531,892**	**100.0%**

[a] All values rounded to nearest whole number.

Construction Transport

A.1.6.5. The transport movements generated by the Proposed Development during the construction phase have been provided by the project transport consultant. The transport movements included vehicle movements associated with the delivery of goods and materials, and movement of construction site workers by private car, van and minibus.

A.1.6.6. GHG factors for contruction transport have been obtained from the DfT's WebTAG data book[28], published in 2024. The appropriate GHG factors have been used for the years 2027 to 2029 and take into account decarbonisation of road transport.

A.1.6.7. For contruction transport, LDVs and cars assume an average travel distance of 50 km and for HGV movements an average travel distance of 120 km has

[28] DfT (2024) TAG data book May 2024 v1.23. Available: https://www.gov.uk/government/publications/tag-data-book.

been used. In the absence of trip distance data, distances have been based on RICS guidance[29].

A.1.6.8. For construction site staff, an average travel distance of 50 km has been used which is also based on RICS guidance[29].

A.1.6.9. It is expected that many of the products and materials used within the Proposed Development will be manufactured abroad and shipped to the UK for installation. GHG emissions associated with the international shipping of these goods has therefore been accounted for in the GHG footprint. It is likely that the PV modules, cables, inverters, transformers and the BESS will be manufactured in China. The GHG factors for a container ship has been taken from DESNZ GHG conversion factors[30].

A.1.6.10. A summary of the data used for the calculation of construction transport GHG emissions is shown in **Table A14.2.4**, **Table A14.2.5** and **Table A14.2.6**.

Table A14.2.4: Construction Vehicles Data and Emissions

Vehicle Type	Year	Number of Two-Way Movements	Distance Travelled (km)	GHG Emissions Factor ($kgCO_2e/km$)	GHG Emissions (tonnes CO_2e)[a]
Car/LDV	2027	38,808	1,940,400	0.134	260
	2028	54,384	2,719,200	0.127	345
	2029	6,248	312,400	0.119	37
HGV	2027	34,132	4,095,791	0.495	2,027
	2028	34,327	4,119,258	0.490	2,018
	2029	4,347	521,660	0.485	253

[a] All values rounded to nearest whole number.

Table A14.2.5: Construction Staff Transport Data and Emissions

Vehicle Type	Year	Number of Two-Way Movements	Distance Travelled (km)	GHG Emissions Factor ($kgCO_2e/km$)	GHG Emissions (tonnes CO_2e)[a]

[29] RICS (2023) Whole life carbon assessment for the built environment, 2nd edition.

[30] DESNZ (2024) Greenhouse gas reporting: conversion factors 2024.

Car	2027	996	49,800	0.134	7
	2028	1,110	55,500	0.127	7
	2029	60	3,000	0.119	0
Van	2027	1,328	66,400	0.196	13
	2028	1,480	74,000	0.193	14
	2029	80	4,000	0.189	1
Minibus	2027	4,316	215,800	0.121	26
	2028	4,810	240,500	0.117	28
	2029	260	13,000	0.114	1

[a] All values rounded to nearest whole number.

Table A14.2.6: Construction Shipping Data and Emissions

Vehicle Type	Item	Mass (T)	Total (T)[b]	GHG Emissions Factor (kg CO_2 per tonne.km)	GHG Emissions (tonnes CO_2e)[a,b]
Container Ship	PV panels	54,626	114,962	0.016	29,818
	Cables	6,919			
	Inverters	10,266			
	Transformers	809			
	BESS	31,891			

[a] Values rounded to nearest whole number.

[b] Includes 10% uplift for packaging and uncertainty.

[c] Based on distance from UK to China via Suez Canal.

A.1.6.11. The estimate construction phase transport emissions are **38,298 tonnes CO_2e**.

Construction Site Emissions

A.1.6.12. Emissions from diesel consumed by construction site plant and machinery has been estimated based on data from the Applicant in relation to the types of machinery to be used for the construction works. A detailed plan of plant

requirements for each of the phases of the work has been obtained from the Applicant.

A.1.6.13. Fuel consumption for each machine/plant has been obtained from data in the European Environment Agency/EMEP emissions inventory guidebook[31]. The data provides fuel consumption per hour.

A.1.6.14. Emissions factors for diesel fuel consumption have been obtained from DESNZ GHG conversion factors[30].

A.1.6.15. Construction site emissions are estimated using the following assumptions:

- Numbers of each machine/plant have been estimated based on discussions with the Applicant;
- Site operating hours and the duration of each work phases have been estimated based on discussions with the Applicant;
- Each machine/plant operates for 50% of available site hours on average; and
- Average engine loading during operation is 50% of full load/power.

A.1.6.16. The estimate construction phase emissions from site plant and machinery are **12,279 tonnes CO_2e**.

A.1.7 Operatioal Phase (including Maintenance)

Operational Transport

A.1.7.1. The applicant has advised that it is likely that the operational transport movements will be limited to 5 round trip journeys per day with an average travel distance of 20 km per round trip.

A.1.7.2. The operational transport data and assumptions used in the assessment is shown in **Table A14.2.7**.

Table A14.2.7: Operational Transport Data, Assumptions and Emissions

Parameter	Value	Unit	Notes
Number of Trips	5	Per day	From the Applicant.
Type of Vehicle	Car	n/a	From the Applicant.

[31] EEA/EMEP (2019) Air pollutant emissions inventory guidebook 2019, Part 1.A.4 Non road mobile machinery.

Average Travel Distance	20	km	10 km each way.
GHG Factor (2030)	0.111	kgCO_2e/km	DESNZ GHG conversion factors[30].
Annual GHG Lifetime GHG (60 Years)	3.2 105	tonnes CO_2e	Taking account of the decarbonisation of road transport in line with DfT's WebTAG data book[28].

Repair, Maintenance and Replacement

A.1.7.3. Repair, maintenance and replacement of the Proposed Development over its 60-year operational lifetime is predominated by the embodied carbon associated with parts and products used for repairs, maintenance and replacements.

A.1.7.4. In order to be conservative, the assessment has used the same embodied carbon emissions factors and intensities as used in the calculation of embodied carbon emissions described above. This is conservative as it ignores the potential future decarbonisation of the mining, processing and manufacturing sectors.

A.1.7.5. The data and assumptions used in the calculation of emissions from repair, maintenance and replacement at provided in **Table A14.2.8**. The replacement frequency/schedule for major components of the Proposed Development has been based on discussion with the Applicant and taking an average of the indicative design life of scheme components which are presented in **Table 5.6** within **Volume 6, Chapter 5: Descrption of the Proposed Development [EN010159/APP/6.5]**.

Table A14.2.8: Operational Repair, Maintenance and Replacement Assumptions, Data and Emissions

Component	Number of Replacements during Lifetime	Lifetime Carbon (tonnes CO_2e)[a]
Site Preparation		
Hard Surfacing	0.1	196
Solar Array		
PV Modules	1.1	233,841
PV Framework	1	18,895
Mounting Structures	2	20,604

Cabling (Low Voltage Distribution Cables and Grid Connection Cables)	1	42,057
HV Infrastructure		
Inverters	3	88,216
Transformers	2	5,174
Switchgear	1	240
BESS		
Battery Cells	6	899,886
HVAC Systems	3	6,743
DC-DC Converters	3	6,880
Substations & Compound Room		
Substations	1	37,714
Security fencing		
Fencing	1	860
	Total	**1,381,910**

[a] All values rounded to nearest whole number.

A.1.8 Decommissioning

Decommissioning Site Emissions

A.1.8.1. It is likely that by the time of decommissioning, that most or all of the plant and machinery used to decommission the site will be zero tailpipe emission (i.e. electric or similar). However, there is currently uncertainty about the trajectory to zero emissions for heavy non-road mobile machinery and as such a worst-case assumption has been applied that emissions from site plant and machinery during decommissioning are 50% of the emissions during construction. This arbitrary percentage reduction has been applied in the absence of available information and is considered appropriate. It is intended to reflect the likely improvement in technology and techniques that will be available in the future (at the time the Proposed Development is decommissioned) that will have lower associated emissions than those currently available.

A.1.8.2. The estimated emissions from decommissioning phase site plant and machinery are **6,139 tonnes CO_2e.**

Decommissioning Staff Transport

A.1.8.3. Emissions from staff transport during decommissioning of the Proposed Development are assumed to be equal to those during the construction phase but taking account of transport decarbonisation in line with the DfT's WebTAG data book[28]. This represents a worst-case scenario as the decomissioning phase will likely require less staff than the construction phase.

A.1.8.4. The estimated emissions from decommissioning site transport are **24 tonnes CO_2e.**

Waste Transport and Disposal

A.1.8.5. The transport movements generated by the Proposed Development during the decomissioning phase are assumed to be the same as during the construction phase which has been agreed with the Applicant. The transport movements included vehicle movements associated with the delivery of goods and materials, and movement of construction site workers by private car, van and minibus.

A.1.8.6. GHG factors for decomissioning transport have been obtained from the DfT's WebTAG data book[32], published in 2024. The GHG factors for 2050 have been used for the years 2090 to 2092. In the absence of GHG factors post 2050, this approach is approriate and worst-case.

A.1.8.7. For decomissioning transport including car vehicles an average travel distance of 50 km has been used and for HGV movements an average travel distance of 120 km has been used. In the absence of trip distance data, distances have been based on RICS guidance[33].

A.1.8.8. A summary of the data used for the calculation of decomissioning transport GHG emissions is shown in **Table A14.2.9**, **Table A14.2.10** and **Table A14.2.11**.

Table A14.2.9: Decomissioning Vehicles Data and Emissions

Vehicle Type	Year	Number of Two-Way Movements	Distance Travelled (km)	GHG Emissions Factor ($kgCO_2e/km$)	GHG Emissions (tonnes CO_2e)[a]
Car/Lights	2090	38,808	1,940,400	0.055	106
	2091	54,384	2,719,200	0.055	149

[32] DfT (2024) TAG data book May 2024 v1.23. Available: https://www.gov.uk/government/publications/tag-data-book.

[33] RICS (2023) Whole life carbon assessment for the built environment, 2nd edition.

	2092	6,248	312,400	0.055	17
HGV	2090	34,132	4,095,791	0.407	1,666
	2091	34,327	4,119,258	0.407	1,676
	2092	4,347	521,660	0.407	212

[a] All values rounded to nearest whole number.

Table A14.2.10: Decomissioning Staff Transport Data and Emissions

Vehicle Type	Year	Number of Two-Way Movements	Distance Travelled (km)	GHG Emissions Factor ($kgCO_2e/km$)	GHG Emissions (tonnes CO2e)[a]
Car	2090	996	49,800	0.055	3
	2091	1,110	55,500	0.055	3
	2092	60	3,000	0.055	0
Van	2090	1,328	66,400	0.089	6
	2091	1,480	74,000	0.089	7
	2092	80	4,000	0.089	0
Minibus	2090	4,316	215,800	0.012	2
	2091	4,810	240,500	0.012	3
	2092	260	13,000	0.012	0

[a] All values rounded to nearest whole number.

A.1.8.9. The decommissioning phase will involve the deconstruction of components of the solar array and removal from site for reuse, recycling or disposal.

A.1.8.10. An estimate of GHG emissions from waste transport and disposal has been made using GHG factors for company reporting published by DESNZ[30].

A.1.8.11. The GHG factors are applied to a mass of the components removed from site. Masses of componentry are estimated from the data used to calculate the embodied carbon emissions and it has been assumed that 100% of PV modules are recycled, with 70% recycling of all other components and 30% going to landfill. This is intended as a worst-case and it is expected that the

decommissioning phase will aim to minimise or eliminate diversion of any waste to landfill.

A.1.8.12. The emissions from waste transport and disposal in the decommissioning phase are presented in **Table A14.2.9**.

Table A14.2.11: Waste Disposal Data and Emissions

Component	Mass (T)	GHG Emissions Factor (recycling)	GHG Emissions Factor (landfill)	GHG Emissions (tonnes CO_2e)[a]
PV panels	54,626	6.41	8.88	350
Cables	6,919	6.41	8.88	49
Inverters	10,266	6.41	8.88	73
Transformers	809	6.41	8.88	6
BESS	31,891	6.41	8.88	228
Concrete	7,296	6.41	8.88	52
PV Frames	54,626	6.41	8.88	391
Mounting Structures	6,800	6.41	8.88	49
Other (fencing)	433	6.41	8.88	3

[a] All values rounded to nearest whole number.

A.1.8.13. The estimated emissions from decommissioning Waste Transport and Disposal are **1,519 tonnes CO_2e**

A.1.9 Energy Intensity/Offset

A.1.9.1. The calculation of the lifecycle energy intensity of the Proposed Development is calculated using the total lifecycle carbon emissions and the total expected lifetime electricity export. To calculate the lifetime electricity exported, the annual (opening year) value has been extrapolated over 60 years, assuming a PV panel degradation rate of 0.45% per annum and one full replacement of PV panels with the 60 year lifetime.

A.1.9.2. A summary of the energy intensity calculation is provided in **Table A14.2.12**.

Table A14.2.12: Energy Intensity Calculation

Parameter	Value	Unit
Total Annual Electricity Export	1,080,000,000	MWh
Annual Degradation Rate	0.45[a]	%
Total Lifetime (60-year) Electricity Export	60,566,940,000	kWh
Total Lifetime GHG Emissions	1,972,166	tonnes CO_2e
Lifecycle Carbon Intensity	32.6	gCO_2e/kWh

[a] Degradation rate assumed up to Year 30, at which point the total annual electricity export is reset to 1,080,000,000 MWh to represent complete replacement of all PV panels. The 0.45% degradation rate is then applied each year from Year 31 to Year 60.

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