Dean Moor

Solar Farm

Carbon Emissions Lifecycle Assessment

on behalf of **FVS Dean Moor Limited**

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DEAN MOOR SOLAR FARM

CARBON EMISSIONS LIFE CYCLE ASSESSMENT

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PREPARED ON BEHALF OF FVS DEAN MOOR LIMITED

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1 Introduction

1.1.1 This supplemental Carbon Emissions Lifecycle Assessment ('CELA') has been produced for FVS Dean Moor Limited (the 'Applicant') as a standalone Technical Note ('TN') to support the application for a Development Consent Order (the 'DCO application') for Dean Moor Solar Farm ('the Proposed Development') located between the villages of Gilgarran and Branthwaite in West Cumbria (the 'Site'), which is situated within the administrative area of Cumberland Council ('the Council').

1.2 Background

1.2.1 Environmental Statement (ES) Chapter 9 – Climate Change [**6.1**] [**APP-040**] assesses the likely significant effects of the Proposed Development with respect to climate change. While not forming part of the ES this TN should be read alongside Chapter 9, which sets out the relevant legislation and planning policy context at section 9.2, the assessment methodology at section 9.3, and the baseline conditions at section 9.4.

1.2.2 This TN presents an indicative, quantitative assessment of the Proposed Development's likely carbon emissions during the construction, operation, and decommissioning lifecycle stages. The CELA details further information on the potential whole-life emissions (including Scope 3 emissions) associated with the Proposed Development.

1.2.3 The TN has been produced to supplement information previously provided in the following Examination responses:

- The Applicant Response to the Examining Authority's (ExA) First Written Questions (AREQ1) [**REP2-010**] (Q2.01, Q2.04, and Q2.0.5) (see section 3);
- Applicant Response to the Issue Specific Hearing Agenda Items (ARISH) [**REP3-015**] (see section 7);
- The Applicant Response to the ExA's Second Written Questions (AREQ2) (Q2.2.1) [**REP4-004**] (see section 3). And is prepared in response to the ExQ2 request for '*a more holistic, lifecycle approach to calculating greenhouse gas emissions during each phase of the proposed development*.'.

1.2.4 The figures in this CELA differ from those used in ES Chapter 9 as they reflect carbon emissions derived from assumptions on materials, transport (including shipping) and waste associated with the Proposed Development, as well as using more recent carbon factors which are typically updated on a yearly basis. This in turn provides a more granular indicative assessment of carbon emission figures.

1.2.5 The position set out in ES Chapter 9 (and previous responses) regarding the limited information available relating to the specification, procurement, and transport of generating station materials and equipment still applies. The CELA approach has therefore taken account of these limitations.

1.2.6 In completing this assessment, it is acknowledged that carbon figures vary from those in the ES, as the CELA represents an indicative expansion on the data relied on by the ES, with this assessment's methodology (see section 2) making use of indicative and confirmed project data provided in similar calculations completed by other solar DCO project applicants.

1.3 Overview and Structure

1.3.1 This CELA is divided into the following chapters:

- Methodology; and
- Assessment of Potential Effects.

1.3.2 The assessment outcomes are supported by Appendices A, B, C, D and E, which set out the raw data relied upon to determine the indicative carbon figures across each lifecycle stage of the Proposed Development. The energy generation calculations and resulting carbon savings are provided in Appendix D.

2 Methodology

2.1 Assessment Approach

2.1.1 The method has applied the Institute of Sustainability and Environmental Professionals (ISEP) guidance (ISEP Guidance)[1], the British Standards Institute (BSI) PAS 2080 guidance (PAS Guidance)[2] and the Royal Institution of Chartered Surveyors (RICS) guidance (RICS Guidance)[3].

2.1.2 The metric for assessing carbon emissions is units of CO_2 equivalent (CO_2e). This allows the use of Global Warming Potential (GWP) for the emissions of the seven key greenhouse gasses (GHGs) to be expressed in terms of their equivalent GWP as a mass of CO_2e.

2.1.3 The indicative carbon emissions have been calculated by multiplying assumptions about the activities and components associated with the Proposed Development ('Activity Data') by relevant carbon factors accessed from industry-accepted sources, such as Department for Energy Security and Net Zero ('DESNZ') GHG Conversion Factors 2025[4]. All carbon factors used within this assessment are outlined in **Appendices A - D**. The calculation used is as follows:

Activity Data x GHG emissions factor = GHG emissions value

2.1.4 Activity Data has been based on reasoned estimates and assumptions within worst-case parameters. The scope of Activity Data and assumptions behind project information vary considerably across solar DCO project application documents. As outlined in the AREQ1 [**REP2-010**], the variability regarding the parameters used in these calculations often means their usefulness is unclear.

[1] Institute of Sustainability and Environmental Professionals, ISEP (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance.

[2] British Standards Institute, BSI (2023) PAS 2080:2023 Carbon management in Infrastructure. BSI Standards Limited.

[3] RICS (2024) Whole life carbon assessment for the built environment. Accessed: 31/10/2025

[4] DESNZ (2025) Greenhouse gas reporting: Conversion factors 2025: full set (for advanced users)

2.1.5 In the absence of a validated approach to quantifying lifecycle emissions associated with a solar PV generating station at the application stage, and a lack of detailed project information - which is only available post-consent following detailed design and procurement - this CELA has developed an approach based on a comparison with the assumptions which have been relied on in earlier assessments for other solar DCO projects.

2.1.6 In total, 15 climate change assessments for DCO solar farms have been reviewed, including made DCOs and a selection of other projects in respect of which the Examination stage has recently closed to provide insight into recent approaches, as indicated by an asterisk in the list below. Full referencing for all reviewed solar DCO climate change documents is provided at Appendix E, Table E.1.

2.1.7 The projects reviewed to inform the CELA, including all of those listed in the AREQ2, [**REP4-004**] (see Q.2.2.1) are:

- EN010152 – Fenwick Solar Farm ('Fenwick')*
- EN010149 – Springwell Solar Farm ('Springwell')*
- EN010143 – East Yorkshire Solar Farm ('East Yorkshire')
- EN010142 – Tillbridge Solar Project ('Tillbridge')
- EN010140 – Helios Renewable Energy Project ('Helios')*
- EN010139 – Byers Gill Solar (,Byers Gill')
- EN010135 – Stonestreet Green Solar ('Stonestreet Green')
- EN010133 – Cottam Solar Project ('Cottam')
- EN010132 – West Burton Solar Project ('West Burton')
- EN010127 – Mallard Pass Solar Project ('Mallard Pass')
- EN010123 – Heckington Fen Solar Park (Heckington Fen')
- EN010122 – Oaklands Farm Solar Park ('Oaklands')
- EN010118 – Longfield Solar Farm ('Longfield')
- EN010101 – Little Crow Solar Park ('Little Crow')
- EN010085 – Cleve Hill Solar Park ('Cleve Hill')

2.1.8 Following this review, it is noted that not all solar DCO applicants have undertaken a carbon emissions lifecycle assessment, and where assessments are provided, not all projects provide information on the carbon calculations undertaken and/or information relied on to inform reported outcomes. Where this information is not available, the climate change chapters (or associated appendices and technical notes) cannot be used reliably for comparison in this CELA.

2.1.9 Of the 15 projects reviewed, the following solar DCO projects were the only climate chapters to provide an assessment of lifecycle carbon emissions and which detail source data, assumptions and limitations (although this is not the case for all data, as set out below). The projects that have been used to inform this carbon assessment are:

- **EN010118** – Longfield (consented June 2023);
- **EN010133** – Cottam (consented September 2024);
- **EN010132** – West Burton (consented January 2025);
- **EN010139** – Byers Gill (consented July 2025); and
- **EN010149** – Springwell (recommendation stage).

Limitations to Comparison Study

2.1.10 The above five projects used to inform the carbon assessment each include a Battery Energy Storage System (BESS) facility. Of the 15 reviewed projects only two projects do not include BESS. This includes East Yorkshire (consented May 2025), which provides lifecycle assessment data, although a complete list of assumptions and carbon factors used that would allow for a comparison is not provided. It also departs from the Proposed Development in relevant respects such as the use of a ‘tracker’ PV system and a Work No 1 acres/MWac usage ratio outside the typical range established in NPS EN-3 at 2.10.17.

2.1.11 A more similar project, without BESS, is Mallard Pass (consented September 2024). However, it includes no embodied carbon emissions assessment in the climate change chapter and the applicant satisfied further inquiry into this topic via a D3 response which was provided in lieu of an assessment and was based on generalised figures derived from Longfield and generic sources.

2.1.12 As the Proposed Development does not include BESS, this assessment and comparison has not considered information related to BESS incorporated into the lifecycle assessments for the projects listed above, although it is recognised that the inclusion of BESS could affect areas that have been considered (e.g. quantities of materials such as cables). As this would only potentially increase volumes compared with what the Proposed Development might require, this would represent a worst-case overage for assessment purposes.

2.1.13 In completing this comparison, it is acknowledged that carbon figures will vary due to the differing use of indicative and confirmed project data across the calculations completed by other applicants. The review has highlighted the lack of reliable, detailed project information available at the ES stage, and clear lack of consistency in methodology and the types of things included or excluded from climate change chapter assessments, even for those applicants able to provide full data/detail behind the carbon outcomes asserted for each phase.

2.1.14 Further detail on how this CELA has drawn on the data provided by other solar DCO projects is provided in relevant sections where specific data is utilised. Professional judgement has been used to determine the most applicable assumptions when factoring the nature of the data provided, how it is sourced, the date of data sources as this may relate to reliability for current purposes, and comparisons between the Proposed Development and other projects on factors that influence outcomes such as the export capacity of the generating station and the ratio of the acres/MWac analysis undertaken for each Site so that data from other sources can be made proportionate to the Proposed Development in comparison.

2.1.15 Assumptions adopted for this assessment are summarised alongside the carbon calculations in **Appendices A, B and C.**

2.2 Construction Assumptions

Solar PV Arrays

2.2.1 The core components of solar PV arrays are listed in the Design Parameters Document (DPD) [**APP-028**]. Work No. 1 Solar PV arrays comprise solar PV panels fixed to mounting structures, with data relevant to a carbon assessment associated with both elements.

2.2.2 The exact solar panel type, size and technology to be utilised is not fixed at the DCO application stage, and neither is the design of the mounting equipment. The role of the mounting equipment as part of the structural framework for (non-tracker) arrays is fixed. A parameter-based approach has been adopted to provide optionality to pursue a variety of configurations which might come forward post-consent within parameters established by the DPD. This approach aligns with latest regulations and advice on good practice, as outlined in ES Chapter 2 EIA [APP-033].

Solar PV Panels

2.2.3 Based on the parameters for the Proposed Development, including the area of Work No. 1 as identified in the Work Plans [**APP-007**], the quantity of panels which could be used is approximately 350,000 panels. This is intended to be a worst-case assumption and final quantities may be less, with the 350,000 estimation taken forward for CELA purposes.

2.2.4 The specification for solar panels has been based on a 2024 datasheet for JA Solar panels[5] currently in use by the Applicant on in-construction projects. While procurement for 2026/27 construction may utilise a different model, this would likely be a 2025 or early 2026 model and therefore would not be materially different as it could be for a much more advanced scheme (e.g. > 2029 start). Based on the datasheet, the following assumptions have been made:

- Total weight of an individual panel is 33.1 kg;
- There would be a total of 132 solar cells per panel;
- The surface area for one panel is 2.7m^2; and
- The thickness of the glass on each panel is 3.2 mm.

2.2.5 It is noted that West Burton and Cottam have used different PV panel specification documents that differ slightly from the above. In addition, information on solar panels in the Byers Gill assessment is stated to be

[5] JA Solar (2024) JAM66D45 LB n-type Double Glass Bifacial Modules

confidential and so assumptions behind the number of panels, specifications and carbon calculations are unknown. Variability is to be expected as it will be influenced by each applicant's requirements and expectations for a future procurement phase based on experience with previous projects, and changes over time in PV technology.

2.2.6 For Longfield, Environmental Product Declaration (EPD) for a PV panel was used but not sourced. Reference in the climate change chapter was made to panels having an embodied carbon factor of 0.00912 $kgCO_2e/kWh$. As this was not sourced and cannot be compared against the JA Solar specification, and as this is the oldest of the projects and less likely to be as-relevant for PV technology comparison, the assumptions from Longfield have not been used in this CELA.

2.2.7 Springwell references an emission factor of 217 $kgCO_2e/m^2$ of solar PV module panels based on an average of EPDs sourced from One Click LCA (a life cycle assessment tool for calculating building and infrastructure whole life carbon emissions). The assessment in this TN does not utilise the One Click software and therefore it has not been possible to verify the carbon factor provided to determine how applicable it would be to the Proposed Development.

2.2.8 West Burton and Cottam both applied the following assumptions alongside their PV panel specification document:

- Each solar cell contains approximately 11g of silicon based on a study undertaken by the Global Silicon Council (Brandt et al., 2019)[6];
- A value of 2.5kg of glass per mm thickness per m2 based on a document commissioned by the Global Silicon Council (Brandt et al., 2019);
- The remaining weight of the panel is assumed to be from the metal frame which is assumed to be steel.

Solar PV Mounting Frameworks

2.2.9 Solar PV mounting structures are steel or steel-alloy metal frames which are typically pile-driven into the ground and the solar panels are affixed to

[6] Brandt, B., Kletzer, E., Pilz, H., et al. (2019) Executive Summary: Silicon-Chemistry Carbon Balance. An assessment of greenhouse gas emissions and reductions.

the frame they provide. While mounting framework design can vary to accommodate alternative design requirements for ground sensitivities, for a fixed array solar farm the framework composition is broadly the same between manufacturers and the design is not evolving as it does for PV generation technology. Assessment of embodied carbon depends on the quantities assumed for an amount of steel associated with the framework.

2.2.10 Byers Gill, Longfield, and Springwell provide emissions for mounting equipment but do not provide insight into how the quantity of steel has been determined. West Burton and Cottam both applied the following assumptions alongside their PV panel specification document:

- Each MW of electricity generated requires approximately 30 tonnes of mounting equipment, based on information provided by Solarport, a supplier of solar panel mounting equipment;
- All mounting equipment will be steel.

Conclusions

2.2.11 Due to the similarity of information available for the Proposed Development, and the transparency of data sources, the assumptions by West Burton and Cottam have been applied to estimate the material composition of the solar PV arrays (panels and mounting frameworks) for the Proposed Development. However, for the Proposed Development it is anticipated that steel-aluminium alloy will be a component of the PV panels rather than steel alone. The percentage of steel vs aluminium cannot be known at this stage, and as aluminium is more carbon intensive per kg, this assessment has assumed aluminium only to be conservative.

Transformer and Inverters

2.2.12 Inverters and transformers are PCS units that form part of Work No. 1. These convert and transform the DC energy generated by the panels to AC electricity capable of being exported to the grid. As per ES Chapter 3 – Site and Proposed Development [**APP-034**] and the DPD, these can be configured in various ways including 'central inverters' which combine inverters and transformers and can come in full or half-size versions, or 'standalone transformers' (the size of a 1/2 size central inverter) alongside small ‘string inverters’. For this assessment, and as reflected within the ES, the largest central inverters have been assumed because they have the largest footprint and include two inverters in each containerised unit

2.2.13 Although the number (DC capacity) of solar panels will not align with the export connection to the grid due to a requirement for overplanting (see EN-3, Footnote 92), the PCS technology will set the export capacity of the generating station and the exact number and design-type to be used will be specified as part of the detailed design and engineering optimisation..

2.2.14 The Proposed Development is assumed to include approximately 22 units including a transformer and two inverters per unit based on the Applicant’s experience with current solar farm projects being prepared for 2025/26 construction. For the purposes of this assessment, the carbon factors are based on Sunny Central 4600 inverters[7] (which details emissions for each lifecycle stage).

2.2.15 As the Applicant is able to rely on a detailed manufacturer analysis for the PCS Unit technology, it has not been necessary to rely on assumptions drawn from other projects. The variations in approaches in all solar DCO lifecycle emissions assessments, and in the language applies to this type of equipment (which can be conflated by inclusion of BESS) means it is more appropriate that no comparison is made, and the Applicant base this aspect of the CELA on its recent experience and known preference for the SMA technology for which lifecycle carbon emissions data is available.

Substations and Work No. 2

2.2.16 Customer side transformers and switchgear are part of Work No. 2 Grid Connection Infrastructure for the Proposed Development, as well as a new 132kv substation including both the Customer and Distribution Network Operator (DNO) infrastructure.

2.2.17 Of the 15 reviewed projects, only the Little Crow and Oaklands projects include similar on-site DNO substation works to Applicant’s Work No. 2

[7] SMA (2025) Sunny Central 4600 UP Life cycle assessment

Grid Connection Infrastructure. Of these, Little Crow (consented April 2022) includes no lifecycle analysis, with climate change only dealt with in a policy chapter that does not go as far as ES Chapter 9, and a carbon assessment appendix that assessed traffic-related emissions only.

2.2.18 The more recent Oaklands project (consented June 2025) climate change chapter includes asserted assumptions of GHG emissions during each phase, but with limited information, particularly on the substation where referencing suggests all data comes from a 2010 academic paper providing a 'preliminary assessment' of lifecycle emissions in the UK-wide transmission network[8]. The proportion of materials utilised within Oaklands appears to miscalculate percentages that lead to a makeup of greater than 100%, and given the time elapsed since the publication of the academic paper, this not considered to be a reliable source of information.

2.2.19 The Applicant notes that Stonestreet Green does include a reference to a new 132kv substation in the project's ES Chapter 3 – Project Description. However, this is a supplemental ('intermediary') substation for the primary grid connection which is at an existing Transmission Network Operator (TNO) substation. As the transmission and distribution networks are distinctive and have different owners/operators, the Applicant does not have certainty as to how this could affect differences compared to the on-Site DNO substation of Work No. 2.

2.2.20 Moreover, while Stonestreet Green does give a figure, there is no data provided other than an assertion of the total embodied carbon from all substations; this is one figure provided for part of its work no 2 and all of work nos. 3 and 4. This includes customer switchgear (substation) equipment, a new intermediate 132kv substation, and an upgrade/extension to the primary TNO Sellindge substation, without breaking down data or specifying that to which it relates.

[8] Harrison, GP, Maclean, EJ, Karamanlis, S & Ochoa, LF. (2010). Life cycle assessment of the transmission network in Great Britain, *Energy Policy,* vol. 38, no. 7, pp.3622-3631

2.2.21 The Stonestreet Green assessment also confirms that these substations (which reflect more substation development than is required for the Proposed Development), would only represent 1.7% of construction phase embodied carbon emissions for a project with a 99.9 MWac capacity. This is 2/3 of the Proposed Development's size, meaning substation development should be a greater proportion of Stonestreet Green's embodied carbon than it would be for the Proposed Development as a 150 MWac generating station with only one type of substation facility.

2.2.22 If the Applicant were to adopt the embodied carbon figure provided by Stonestreet Green, as well as the uncertainties surrounding this figure, an additional 2,032 tCO_2e of embodied emissions would be allocated to the construction phase of the Proposed Development. The proportion of the embodied emissions resulting from purchased materials would therefore increase by 0.41%. This does not point to a conclusion that further analysis would be beneficial.

2.2.23 The Applicant's review of other projects also noted limited inclusion of figures provided for on-site 'customer' substation equipment, primarily relating only to assumptions for components such as concrete pads that may be utilised as foundations for ancillary buildings, with some but not all projects also providing data for switchgear and auxiliary transformers. This includes more detailed chapters such as West Burton, which does not review the embodied carbon associated with substation equipment and focuses only on main components like solar arrays and power conversion system (PCS) units, vehicle movements, and waste.

2.2.24 Given the lack of consistency relating to how embodied emissions associated with substations are reported, and given the lack of available data in the solar DCO projects where a climate change chapter is provided for a site with an on-site substation, this CELA has not been able to rely on approaches taken by other projects, and has therefore focused on the Proposed Development's core generating station equipment and associated infrastructure represented primarily by Work No.1 and Work No.3.

Cables

2.2.25 Unlike other project examples listed in Section 2.1, there is no off-site cable route corridor for the Proposed Development. Likewise, the Proposed Development is well-contained as a single Site and does not require substantial lengths of cable to connect disconnected parcels as is the case with Byers Gill, Cottam, West Burton, and Springwell.

2.2.26 Other than off-site cables, cable lengths are very specific to the layout and technology proposed and, as a result, vary substantially across each project. Comparing lengths of cables from other projects would not be a reliable or useful exercise to determine reasonable assumptions for the Proposed Development. There is also no available, project-specific information for cable lengths and types at this stage of the design for the Proposed Development, and therefore it has not been possible to assess any resulting carbon emissions.

2.2.27 It is noted that Byers Gill and Longfield demonstrate cables as being less than 1% of construction emissions, and for West Burton and Cottam cables are less than 1% of total lifecycle emissions. Springwell states that cables make up 5% of total embodied carbon, or 2.6% of total lifecycle emissions. These projects all have cable route corridors and are a collection of smaller “sites” dispersed over a large area.

2.2.28 To provide additional validation the Applicant sought to consider outcomes for projects more comparable to the Proposed Development. This includes the contained 135MW Oaklands scheme with an on-Site substation, which does not provide any information on cables in its climate change chapter assessment, and neither does Mallard Pass as a similarly sized scheme with no BESS. The recent Tillbridge scheme (500MW) which includes BESS and off-site grid reports <1% for cables, the Fenwick scheme (237MW) reports 1%, and Stonestreet Green (99MW) reports 7.4% of embodied carbon emissions, or 4.5% of total lifecycle emissions. These projects represent the most recent determined solar SCO and one which has recently completed its Examination.

2.2.29 Of the five solar DCO projects primarily relied on for this CELA, four projects demonstrate that less than 1% of lifecycle emissions are associated with cabling. Of the additional schemes, six projects also report cabling as less than 1% of lifecycle emissions, even when they include longer cable corridors and BESS which also requires cabling. Two other schemes do not assess cables and two report more than 1% of lifecycle emissions. The latter are considered to be outliers due to project-specific variations that may require greater lengths in cables then is required for the Proposed Development.

2.2.30 Based on the above, it is reasonable to assume that embodied emissions relating to the cable route of the Proposed Development will also be less than 1% and therefore of negligible effect. As a result, carbon emissions from cable routes have been scoped out. The scoping out of activities that are anticipated to be less than 1% of total lifecycle emissions is in accordance with ISEP (2022)[1] and PAS 2080 (2023)[2] guidance and methodology.

Other Materials

2.2.31 The following information has been provided by the Applicant, based on the Site area and project parameters, drawing on the Applicant's experience as a Principal Contractor (PC) for the construction on 16 no. 50MWac UK solar PV projects since 2022. Data has been averaged from the bills of materials (BoM) for past schemes and applied proportionately to the Proposed Development as a 150MWac project, while relying on Site specifics (e.g. land area, expectation of access tracks relying primarily on the existing track network, etc.) to refine where possible. This information is indicative and, as such, a range of for the anticipated material quantities was provided. The assessment has taken the upper end of the range for each:

- 10,000 – 12,000 metres of perimeter fencing (deer fencing), assumed to be comprised primarily of steel mesh between wooden posts. The CELA has assumed all material is steel to be conservative;
- 10,000 – 15,000 m3 (25,500,000 kg) of aggregate for access tracks;

- 200 – 250 m3 (250,000 kg) of concrete for foundations.

2.2.32 Assumptions made by other solar DCO projects do not need to be applied due to the above indicative project information provided by the Applicant, although it is noted that these materials are not assessed by all the other projects.

2.2.33 The assessment assumes that all materials (including those referred to in other sections, such as steel), are sourced as primary or virgin materials when in reality a proportion of materials will be sourced from recycled sources. This represents a conservative approach, given that the proportion of recycled materials is currently unknown.

Transport and Access

2.2.34 Road transport trip numbers remain the same as stated in ES Chapter 9 - Climate Change [**APP-040**] and have been included in this assessment. This carbon assessment has also taken account of emissions associated with the shipping of materials.

2.2.35 The supply chains for construction of the Proposed Development are not yet known and will depend on market conditions such as detailed technical specification, pricing, availability of materials and programme. It is reasonable to assume the solar PV panels would be sourced from China, as China accounts for approximately 80% of global solar PV panel production and would also represent the worst case for distance and therefore carbon emissions. Other materials are anticipated to be sourced from Europe and the UK. It is reasonable to assume therefore that there will be emissions associated with transport by sea and HGV delivery from port to the Site.

2.2.36 HGV and sea freight distances assumed for transportation of materials and workers are as follows:

- 19,333 km sea freight distance from China to England (based on sea freight distance between Shanghai and Port of Barrow as the closest port to the Site);
- 82 km distance from Port of Barrow to the Site;

- 80 km distance for all other materials delivered to Site, based on RICS Guidance;
- 100 km distance for transport of waste;
- 50 km distance for workers commuting to Site, based on distance to Carlisle and RICS Guidance (which assumes a worst case that does not account for the requirements of a Construction Worker Travel Plan (CWTP) as per the Outline Construction Traffic Management Plan (OCTMP) [**REP2-025**].

2.2.37 The above approach for estimating distances of transport trips is consistent with the five other solar DCO projects reviewed, but tailored to account for site-specific information (such as accounting for the closest port and towns).

Water Use

2.2.38 The specific information on water use is not currently available for the Proposed Development.

2.2.39 The assumptions on water use used by other solar DCO projects vary and have each been noted as having been provided by the relevant applicant. These are as follows:

- Springwell assumes 45 litres/per worker/per day;
- Byers Gill and Longfield assume 90 litres/per worker/per day;
- West Burton assumes 2,293 litres per annum;
- Cottam assumes 2,631 litres per annum.

2.2.40 A figures of 90 litres / per worker / per day has been taken forward within this assessment due to it being utilised by two other projects, and because it is more conservative than the Springwell assumption. It has not been possible to utilise information within West Burton and Cottam projects due to there being no further information on how water use has been calculated.

2.2.41 The use of the larger 90l/day figure is considered conservative given the dispersed nature of these other projects compared to the Proposed Development, as water would be used for temporary construction compounds, with more of these required when there are multiple large distinct site areas, and where more works will be required (and/or a longer construction period would be required) to implement these projects which range from 480-800 MWac (except Byers Gill which is 280 MWac with a 1.6 overplanting ratio). Therefore, although specific data cannot be provided for the Proposed Development, the use of a figure that is known to be conservative supports the robustness of this assessment.

2.2.42 The anticipated number of workers on Site per day is expected to be up to 150, and the average is expected to be 50-80 per day. To enable a conservative assessment and to align with the approach taken within the ES, the peak staff requirement of 150 per day has been taken forward. The number of working days has been based off 6 working days per week, across a construction period of 18 months. These assumptions are consistent with information set out in the ES.

Waste

2.2.43 No specific quantities of waste generation are currently available for the Proposed Development.

2.2.44 Byers Gill assumes that 5% of the total volume of concrete and aggregate would go to waste, with 50% being recycled and 50% sent to landfill, and 2.5% of total volume of steel with 75% recycled and 25% landfill. Longfield does not explicitly state the assumptions that have been applied for waste, but from the Activity Data provided in the appendix to the climate chapter it appears the same ratios as Byers Gill has been utilised. Srpingwell has also applied 5% of materials to go to waste for solar PV, transformers and inverters, and 1% of solar PV frames and foundations however it was specified what assumption was applied in relation to treatment of waste.

2.2.45 Cottam and West Burton assess waste from sewage and excavated materials only based on estimated volumes of each.

2.2.46 While Byers Gill and Longfield do not source the ratio of waste that has been applied to their assessment, it is similar waste rates provided in RICS Guidance and therefore the same ratios are appropriate for use in this CELA.

Fuel and Energy Use

2.2.47 No specific information on fuel use is currently available for the Proposed Development.

2.2.48 Cottam and West Burton assess electricity use for office cabin and welfare facilities based on estimates provided by the Applicant but does not assess fuel use from equipment or plant.

2.2.49 Longfield and Byers Gill have assumed fuel use for generators at 16.5 litres/hour, and plant and machinery use at 5,000 litres per week.

2.2.50 It is unclear how Springwell has assessed fuel and energy use during construction.

2.2.51 The same assumptions used by Longfield and Byers Gill have been applied to the project-specific construction period for the Proposed Development, due to the ease of use of the information and conservative approach of assuming that a fuel generator would be used to supply electricity to the Site.

2.2.52 The Applicant also considers this represents a conservative estimate given that for the 16 projects for which it has been PC since 2022, it has relied on hybrid generators with solar panels. And a commitment to seek to minimise fuel use and use hybrid technology is secured as part of the Proposed Development's ES Appendix 5.1 - Outline Construction Environmental Management Plan (OCEMP) [**REP4-021**] (see section 8.3)

Land Use Change

2.2.53 The assessment of land use change is challenging to do accurately as there are several variables such as soil moisture, habitat conditions and on-site management that can lead to substantial variation across sites and changes over time.

2.2.54 Byers Gill provides an assessment of land use change, accounting for loss of existing arable land, grassland, and scrub using carbon factors published by Natural England. While carbon figures and factors are presented within Byers Gill, there is limited text to set out how the carbon figures have been used within the assessment. From a review of the data, it appears that the Byers Gill assessment compares carbon stored with existing land use/habitats to that of proposed areas post-development to determine the difference in stored carbon in soils and vegetation on site. The assessment presented shows an overall increase in emissions released during the operation stage and does not quantify any land use change during construction or decommissioning.

2.2.55 Similarly, Longfield assesses land use change by comparing the vegetation to be converted from existing land use to temporary and permanent land use of the operation stage using factors published by the European Commission. This, however, shows an overall reduction in carbon emissions equivalent to nearly a third of operational emissions due to increased carbon sequestration. An assessment of land use change during decommissioning is also presented, showing release of stored carbon due to temporary grassland converted back to arable land.

2.2.56 The substantial difference in positive and negative (sequestered) emissions from land use change presented in Byers Gill and Longfield, despite both projects having similar mix of existing arable and proposed land uses, demonstrates the variability and uncertainty of assessments for land use change emissions.

2.2.57 Springwell, Cottam and West Burton have not assessed land use change or disturbance and no justification for scoping out is provided.

2.2.58 Expanding the review to the additional 10 projects; 9 projects do not quantify land use change emissions, of which 4 provide justifications and are as follows:

- **Tillbridge, Fenwick and East Yorkshire** describe an anticipated beneficial impact due to the conversion of arable land to grassland during operation which is anticipated to increased carbon storage in soil and vegetation, but that this would reverse following decommissioning when the site is returned to arable land. This approach was considered to underestimate the potential beneficial effects as there were proposed tree and hedgerow planting that would be permanent and continue to provide carbon sequestration after decommissioning.

- **Stonestreet Green** refers to emissions from land use change as inconsequential as the Project will retain most of the existing (pastoral) grassland on site and secures measures to retain and enhance habitats and biodiversity which would help to improve carbon sequestration.
- **Heckington Fen** quantifies land use change during construction from tree loss only, and for operation by making assumptions on transport to import food and crops from elsewhere, which could otherwise have been grown on the site. This is a substantially different approach from the other 14 projects and was undertaken in response to a specific request from the county and local authority during scoping.

2.2.59 It is considered that the reasoning for scoping out land use change set out in Tillbridge, Fenwick, East Yorkshire and Stonestreet is also applicable to the Proposed Development. The existing land uses within the Site mainly comprise grazing land, with smaller areas of woodland, highways land and verges and scrubland vegetation. No tree loss is required and habitats are protected during construction via the OCEMP. Most of the soil within the Site will not be disturbed due to there being limited intrusive earthworks associated with solar array piling which makes up the majority of development. And, where the ground is disturbed the protection of peat deposits and soil resource conservation is secured by the ES Appendix 5.3 - Outline Soil Management Plan (OSMP) [REP4-023].

2.3 Operation Assumptions

Replacement of Panels

2.3.1 All projects have assumed that the embodied carbon at replacement will be the same as during the construction phase and have applied replacement rates to determine this. The following approaches are noted in the assessments provided:

- West Burton and Cottam assume 0.04% of panels will require replacement each year based on supplier input. Over their 40 year operation period that equates to a replacement rate of 1.6%.
- Byers Gill and Longfield assume 10% replacement rate of panels over the course of the operation period.

- Springwell assumes no replacement of solar PV panels or foundations over the operation.

2.3.2 This CELA has utilised the 10% replacement rate of panels to be conservative and assumes no other replacement of materials is required. In addition, the specification for PCS units provided by the Applicant sets out a service life of 20 years. While this stems from standard manufacturer warranty conditions and does not necessarily mean replacements will be required, it has been assumed that all PCS units will be replaced once during the operation of the Proposed Development.

Road Transport

2.3.3 The distances used within construction have been used to calculate operational transport for replacement materials and workers. Worker transport trips numbers are sourced from section 5.2 of ES Appendix 2.5 - Transport Statement (TS) [**REP4-027**].

Water Use

2.3.4 The assumptions on water use used by other projects vary and have each been noted as having been provided by the Applicant. These are as follows:

- Springwell assumes 76 litres of water per MWh of anticipated annual generation;
- Longfield assumes 90 litres/per worker/per day for 8 workers total;
- West Burton assumes 5.3 million litres over the lifespan of the project;
- Cottam assumes 7.8 million litres over the lifespan of the project;
- Byers Gill deem emissions from water consumption to be negligible as no permanent buildings are expected on-site during the operational phase. Therefore, emissions from water use were not quantified.

2.3.5 It is appropriate to exclude litres/per worker/per day from this assessment, as on-Site welfare facilities for maintenance during operation are not expected to have a mains water supply and Byers Gill have taken the same approach. However, this CELA has taken a conservative approach by also accounting for cleaning of solar panels, noting that while dry cleaning options are available, wet (water based) cleaning is also utilised. A value of 76 litres/per MWh has been taken forward within this assessment, as has been used by Springwell, noting this is highly conservative as Springwell has a site area of 1,280ha and will have to provide cleaning for an 800MW generating station.

2.3.6 West Burton and Cottam have provided only a total volume of water, and there is no further information on how water use has been calculated, so this information cannot be used for the purposes of this comparative assessment. The Applicant also notes that assumptions on water volumes not specifically related to panel cleaning could be in association with requirements for a water source to be available as part of a BESS safety strategy, which would not be required for the Proposed Development.

Energy Use

2.3.7 Energy use data published by other projects cannot be applied to this assessment due to the uncertainty associated with the assumptions on which the figures have been based.

2.3.8 This assessment has applied a value of 1,639 kWh per inverter/per year for energy use during the operational phase of the Proposed Development. This figure has been sourced from the SMA Sunny Central 4600 UP Lifecycle Assessment[9] and has been applied to the anticipated 22 PCS units for the Proposed Development. The 1,638 kWh/year figure relates to an assumption of approximately 4.5 kW of import a day for start-up before the equipment can rely on self-production.

Waste

2.3.9 West Burton, Cottam, and Longfield assess sewage waste (wastewater) only. This is not applicable to the Proposed Development as no sewage outlets are expected for the Site, including the welfare facilities. These projects include existing off-site substation facilities which are large TNO facilities which do typically include welfare and are connected to mains water supplies.

[9] SMA (2025) Sunny Central 4600 UP Lifecycle Assessment.

2.3.10 Springwell and Byers Gill have not considered operational waste in their assessments.

2.3.11 Carbon emissions from waste generated during operation have not been calculated due to limited project information for these areas. Based on the nature of the Proposed Development, the 5 main projects for comparison, and other similar solar DCO projects. While waste is regularly considered in relation to construction and decommissioning, operational waste does not appear to be factored in to carbon lifecycle assessments, including for the most recent solar DCOs, Stonestreet Green and Tillbridge. For solar DCO projects which do include waste as part of a whole-life assessment, it is less than 1% of total GHG emissions. This assumption is made for the Proposed Development, and the outcome is not significant. This approach is in line with ISEP guidance[1] and PAS 2080 methodology (BSI, 2023)[2].

2.4 Decommissioning Assumptions

2.4.1 All projects note the high-level uncertainty of activities and practices to be undertaken during the decommissioning phase due to this occurring 40 years after each project is first operational. West Burton and Cottam do not quantify decommissioning emissions for this reason.

2.4.2 While Springwell has included an assumed figure/outcome for GHG emissions associated with decommissioning, this is brief and with no materials or Activity Data provided for what is behind this outcome.

2.4.3 Byers Gill and Longfield assume the same volume of materials purchased during construction will be disposed of during the decommissioning phase. It is assumed all materials will be recycled with nothing going to landfill. A combination of 50 km (for concrete and aggregate) and 200 km (all other products) have been applied by both projects as distances travelled for the transport of waste. Longfield also assumes that all other emissions from worker commuting, plant use, and water use would be 50% of the value from the construction phase.

2.4.4 The assumptions made by Longfield have been applied within this CELA due to the comparatively detailed amount of information and the conservative nature of the approach taken.

2.5 Net Carbon Emissions, Carbon Intensity and Contextualisation Assumptions

2.5.1 ISEP Guidance recommends that a project's carbon footprint is contextualised to assist in the determination of likely significant effects. All five solar DCO projects primarily referred to as background to this CELA utilise the UK Carbon Budgets to contextualise lifetime emissions, which is consistent with the approach undertaken in ES Chapter 9 – Climate Change for the Proposed Development. This assessment therefore contextualises against the UK Carbon Budgets, informed by the Proposed Development's anticipated start and end dates for each stage.

Degradation Factors

2.5.2 Degradation relates to the decreasing performance (output) of solar panels over time which occurs due to factors such as corrosion, delamination, oxidation, etc, due to the panels' exposure to the air and weather. This may be partly compensated for by overplanting as per EN-3 paragraph 2.10.55. Regardless of overplanting it remains the case that the generation capacity (DC) will reduce over time, with the effect of this on output (AC) potentially partly mitigated by overplanting.

- **Byers Gill**: 1% degradation factor each year, and after 20 years of operation the efficiency is restored due to gradual replacement of panels and the degradation factors outlined are reset.
- **Cottam and West Burton:** 1% degradation in the first year, followed by a 0.4% degradation factor for each subsequent year. (equating to 0.42 % per annum over the 40-year period)
- **Longfield:** 2% degradation in the first year followed by a 0.45% degradation factor for each subsequent year. (equating to 0.49 % per annum)
- **Springwell:** 0.4% degradation factor each year.

2.5.3 For the Proposed Development, the solar panel specification document provided by the Applicant confirms that there would be 1% degradation in the first year, followed by a 0.4% degradation factor for each subsequent year, which equates to 0.42% a year over the 40-year operational life, or 16.8% less DC production capability at year 40 compared to year 1. This assumption has therefore been taken forward in this assessment.

Carbon Intensity of each Project

2.5.4 Carbon intensity of a solar project is estimated using the total kWh generated by a project alongside lifetime emissions. To provide an appropriate contextualisation of carbon intensity, this is then compared to the carbon intensity of other sources of energy generation. Assumptions are required to enable this comparison, for which the following have been identified within the five other projects.

- **West Burton:** the carbon intensity figure includes construction and operational emissions but excludes decommissioning as these were not assessed. West Burton uses a carbon factor for UK electricity from 2022 (the most up to date figure at the time of the assessment, sourced from DESNZ). This was assumed to remain the same throughout the 40-year operational period and so the assessment did not take account of the forecasted decarbonisation of the grid.

- **Cottam**: the carbon intensity figure includes construction and operational emissions but excludes decommissioning as these were not assessed. Cottam sets out the carbon intensity of a variety of energy generation types but takes forward the carbon factor for UK electricity from 2022 using the same approach as West Burton.

- **Springwell:** the carbon intensity figure is inclusive of all lifecycle emissions. The carbon intensity of Combined Cycle Gas Turbine (CCGT) is 354 gCO2e/kWh. This was assumed to remain the same throughout the, the 40 -year operational period.

- **Byers Gill and Longfield:** carbon intensity figure excludes construction and decommissioning emissions, only accounting for operational emissions. Carbon intensity of Combined Cycle Gas Turbine (CCGT) as 354 gCO2e/kWh. This was assumed to remain the same throughout the 40 -year operational period.

2.5.5 Each assumption taken forward by the above projects is supported by justifications for its use, which is why these have been utilised as they contrast with all other solar DCO projects which either do not include a lifecycle assessment or do not include data behind outcomes and assumptions. However, it should be noted that the differences across these five projects lead to a large range in calculated carbon emission savings. Professional judgement has therefore been used to determine the approach taken forward in this CELA.

2.5.6 This assessment accounts for all lifecycle emissions when determining the Proposed Development's carbon intensity figure. This is to enable a conservative approach to be taken, given that the average carbon intensity of the UK grid, published by DESNZ, only accounts for operational emissions.

2.5.7 The average carbon intensity of the UK grid has been considered to determine potential carbon savings of the Proposed Development. Again, this is to enable a conservative approach as the purpose of the Proposed Development is to contribute to displacing the grid's reliance on energy from fossil fuel sources, and the UK grid's carbon intensity is based on a grid that includes energy from renewable and non-renewable sources.

2.5.8 This CELA provides two comparisons against the UK grid's carbon intensity average, one against the 2025 carbon factor for the UK grid[10] which was current at the time of the preparation of this TN, and the second against a forecasted average for future years that shows decarbonisation year on year[11]. The former assumes that the UK grid's average carbon intensity remains consistent in the future baseline without the Proposed Development.

2.5.9 This enables an assessment based on known data. However, on its own it is likely to show an overestimation of carbon emissions savings given the advances made toward the push to decarbonise the grid and reduce the amount of the grid's energy supply mix depending on fossil fuel sources.

2.5.10 The second comparison accounts for the decarbonisation of the grid in the future baseline based on UK policy which supports new low carbon technology, such as the Proposed Development, to come forward in line

[10] Department of Energy Security and Net Zero, DESNZ (2025) GHG conversion factors [online] Available at: ghg-conversion-factors-2025-full-set.xlsx. Accessed: 17/11/2025

[11] Department of Energy Security and Net Zero, DESNZ (2023). Valuation of Energy Use and Greenhouse Gas Emissions. [online] Available at: Valuation of energy use and greenhouse gas: background documentation. Accessed: 17/11/2025

with the UK’s 2050 net zero statutory obligation There are, however, uncertainties with this forecast and it should be used as an indicative projection. It is likely that the carbon emissions displaced from the grid as a result of the Proposed Development will fall within the range that the comparison against these two sources will provide.

2.5.11 Contextualisation compared to natural gas and coal emissions has been provided for continuation with the approach in ES Chapter 9, but this figure should be viewed for illustrative purposes only. This is due to policy requiring CCGT over 300MW to be constructed Carbon Capture Ready.

2.5.12 As a result, it can be reasonably assumed that CCGT emissions in a future baseline without the development will be mitigated and less than its current carbon intensity factor. Using natural gas and coal carbon intensity factors as a comparison could therefore lead to overestimating emissions saved by a solar project.

3 Assessment of Potential Effects

3.1 Construction

3.1.1 The construction phase includes embodied carbon emissions from raw material supply, transport within the supply chain and manufacturing of purchased materials required to construct the Proposed Development. It is anticipated that Scope 3 embodied carbon will represent the greatest source of construction-phase emissions.

3.1.2 The embodied carbon associated with the Proposed Development will be heavily influenced by the type and amount of material required to construct the Proposed Development. Extraction and production processes can be carbon intensive, particularly for materials such as aluminium and steel. It is also noted that embodied carbon is heavily influenced by available materials and supply chains in the local and wider area.

3.1.3 The below list outlines the assumed primary materials which typically go into the construction of the components of the Proposed Development:

- Solar panels: silicon, steel/aluminium, and glass;
- Transformers and inverters: oil, steel, aluminium, copper, brick, plasterboard and plastics;
- Fencing: wire/steel; and
- Access Roads (internal): aggregate and gravel.

3.1.4 As per ES Chapter 5 – Construction Methodology and Phasing [**APP-036**], the construction phase is expected to be 18 months. An analysis of the construction HGV and worker traffic was assessed in ES Chapter 9 – Climate Change based on the data provided in the ES Appendix 2.5 – TS [**REP4-027**] and the mitigation secured via the ES Appendix 5.2 OCTMP [**REP2-025**] . The construction phase is also expected to result in carbon emissions as a result of activities and the use of materials on Site such as combustion of fuel for the construction plant and equipment, water use, vegetation and topsoil disturbance, and waste disposal.

3.1.5 The temporary construction office, welfare facilities, and temporary lighting on the Site may require fuelled generators which would result in direct GHG emissions generated from the burning of fossil fuels on Site.

3.1.6 All phases of construction waste management, such as reuse, recycling and recovery before disposal to landfill, will result in indirect GHG emissions.

3.1.7 Table 3.1 summarises the embodied emissions anticipated during the construction phase from both manufacture of the materials and components and the emissions resulting from the construction phase.

Table 3.1: Indicative Construction Emissions

Emissions Source	Carbon Emissions (tCO_{2e})	Proportion of total carbon emissions (%)
A1-A3 Embodied Carbon from Purchased Materials	50,424	88
A4 Transportation of products and materials (Shipping & HGV Movements)	5,220	9
A4 Worker Transport	467	0.8
A5 Fuel Use (on-Site)	1,072	1.9
A5 Waste (Processing)	1.7	0.003
A5 Water Use	1.1	0.002
TOTAL	57,186	100

3.1.8 The OCEMP [**REP4-021**] expands on the assessment of ES Chapter 5, and sets out the types of activities that will occur, and the mitigation provided to minimise environmental effects, including GHG emissions. The emissions set out in Table 3.1 do not account for mitigation within the OCEMP as these figures are based on worst-case assumptions.

3.1.9 As outlined in ES Chapter 9 and in the AREQ1 [**REP2-010**], the final CEMP and CTMP, secured by DCO Requirements 4 and 5, to be substantially in accordance with the OCEMP and OCTMP, will reduce emissions where possible. A review of construction phase mitigation outlined in climate change chapters for other solar DCO projects confirms that the Proposed Development's measures are aligned with the mitigation incorporated by other projects (e.g. commitments to follow the waste hierarchy, to incorporate a CWTP, restrictions on vehicle idling, local sourcing of materials where possible, prevention of peat deposit disturbance, protecting hedgerows and woodland, etc). which are referenced across climate change chapters as contributing to GHG minimisation as per the objectives of carbon assessment in EN-1, 5.3.5[12].

3.1.10 Considering the secured mitigation alongside the residual emissions in Table 3.1, it is considered that the Proposed Development complies with up-to-date policy and 'good practice' reduction measures for projects of this type. Therefore, a Minor Adverse effect is expected for construction, which is **Not Significant**. This conclusion is the same as set out in ES Chapter 9 – Climate Change.

3.1.11 As the purpose of the Proposed Development is to provide a source of renewable energy, the construction-stage effects must be considered together with the net emissions of the Proposed Development and contextualisation of emissions against the without-project baseline. This is set out in section 3.4 below.

3.2 Operation

3.2.1 As set out in ES Chapter 9, the Proposed Development will contribute to the decarbonisation of the energy sector through the generation of renewable energy exported to the grid. Solar PV generating stations aid in reducing the grid's average overall emissions per kWh by increasing the proportion of the energy mix from renewable sources, thereby reducing the demand for energy in the mix from traditional fossil fuel power stations. For this reason, the NPS EN-3[13] promotes solar as 'Critical National Priority' infrastructure because it can cheaply and reliably contribute to the Government's net zero trajectory.

3.2.2 The operational phase of the Proposed Development is 40 years from the date of final commissioning. As per ES Chapter 3, the Proposed

[12] DESNZ. (2023). *Overarching National Policy Statement for Energy (EN-1).* DESNZ. London, UK.
[13] DESNZ. (2023) *National Policy Statement for Renewable Energy Infrastructure (EN-3).* DESNZ. London, UK

Development could become operational as early as late 2027 and is expected to be operational and contributing to decarbonisation before the 2030 interim targets for renewable energy generation, and in advance of the 2050 net zero obligation[14].

3.2.3 Just as the DCO secures mitigation for the construction phase, control documents are also secured for the construction phase which relate to GHG emissions mitigation, with final versions to be substantially in accordance with the following: a LEMP in accordance with the Outline Landscape Environmental Management Plan (OLEMP) [**APP-145**] (Requirement 7), an OMP in accordance with the Outline Operational Management Plan (OOMP) [**REP4-019**] (Requirement 11), and a Drainage Strategy (SD) in accordance with the Flood Risk Assessment (FRA) and Outline Drainage Strategy (ODS) [**REP4-025**] (Requirement 8).

3.2.4 These control documents will ensure the Site is sensitively managed and that best practice from the construction phase is brought forward where required. They secure commitments like the inclusion of electric vehicle (EV) charging points for operations and maintenance (O&M) vehicles to support the transition to EV, a nature-based-solutions oriented drainage strategy, and the implementation and management of new and enhanced planting which can support greater levels of carbon sequestration within the Site alongside the delivery of a significant biodiversity net gain (BNG).

3.2.5 The Proposed Development is anticipated to have residual emissions as a result of maintenance activities, including servicing of plant and equipment and vegetation management, which are anticipated to require equipment that relies on fossil fuels. While this is decreasingly not the case, and electric options are increasingly available, for the purpose of this CELA it is assumed that the current more prevalent traditional tools/equipment would be utilised.

3.2.6 As per the TS, and as assessed in ES Chapter 9, vehicle movements during operations will be negligible There will also be some required

[14] DESNZ (2024) *Clean Power 2030 Action Plan.* DESNZ. London, UK.

imported grid energy (for powering up) and water use (panel cleaning) for the operation of the Proposed Development.

3.2.7 Table 3.2 sets out the anticipated carbon emissions during the operation stage for maintenance, including replacement of solar panels, transport of materials and staff.

Table 3.2: Indicative Operation Emissions

Emissions Source	Carbon Emissions (tCO_{2e})	Proportion of total carbon emissions (%)
B2-B5 Embodied carbon from the replacement of PV modules	5,571	81
B2-B5 Transportation of materials (shipping and HGV)	522	8
B2-B5 Maintenance and Repair – Workers Commuting	73	1
B6 Operational Energy	597	9
B7 Operational Water Use	78	1
TOTAL (40)	**6,841**	**100**

3.2.8 Once operational, the Proposed Development will achieve emissions reductions compared to the do-nothing (as-is) baseline through the generation of renewable energy, as set out in CELA section 3.4 and Appendix D.

3.2.9 The calculations undertaken in this assessment demonstrate that the Proposed Development has the potential to indirectly avoid GHG emissions when considered against the future baseline of the carbon intensity of the grid. During the operational phase, the Proposed Development is therefore considered to have a Major Beneficial and therefore **Significant** effect at the local level, and a Minor Beneficial (**Not Significant**) effect at the national level. Whilst it will continue to help avoid and reduce GHG emissions and support the transition to net zero through the generation of low carbon energy, there may be the potential for the scale of the contribution to reduce over the longer term, but only if renewable energy projects are consented and continue to be delivered, especially as demand for electrification increases and an early era of renewable energy schemes come to the end of their operational lives from

2035- 2041 for the projects delivered with Renewable Obligation Certificate (ROC) support[15].

3.2.10 The conclusions of the CELA in relation to operational phase effects remain the same as those established by ES Chapter 9 – Climate Change.

3.3 Decommissioning

3.3.1 The Proposed Development is anticipated to be decommissioned over an 18-month period after the end of the 40-year operational lifetime, which would be initiated in 2067 based on a 2027 operational phase start. This is beyond the timeframe for the UK to meet the statutory net zero obligation per the Climate Change Act 2008. The technologies that will be used to decommission the Proposed Development, and the reuse or recycling of equipment and materials associated it, are unknown at this stage.

3.3.2 The decommissioning phase has the potential to result in carbon emissions due to decommissioning traffic, combustion of fuel for plant and equipment, and waste disposal.

3.3.3 It is assumed that the Proposed Development will be compliant with future regulations and best practice standards for construction works and solar farm decommissioning which will become more established following the decommissioning of earlier solar schemes from about 2035 onwards.

3.3.4 Requirements for this, along with minimum commitments based on known-knowns (e.g. the commitment to ensure recycling of equipment) are set out in the Framework Decommissioning Management Plan ('FDMP') [**APP-111**] with which the future DMP suite will be required to comply, and which secures management plans equivalent to those required for the construction phase based on future standards

3.3.5 It would not be appropriate to detail specific decommissioning requirements at this stage beyond those of the FDMP as the decommissioning environment in 40 years is uncertain. However, policy is

[15] Ofgem. (2025). Renewables Obligation (RO) Annual Report: Scheme Year 22 (April 2023 to March 2024)

likely to be considerably different to today and is decommissioning is expected to occur in a context where the transition to EVs has been realised, and a net zero grid has been achieved.

3.3.6 Table 3.3 sets out the anticipated decommissioning emissions. Despite the expectations of the EV transition and net zero context, for the purpose of the CELA it is assumed that fuel use and worker commuting emissions would correspond to construction emissions.

Table 3.3: Indicative Decommissioning Emissions

Emissions Source	Carbon Emissions (tCO_{2e})	Proportion of total carbon emissions (%)
D1-D5 Waste Transport	215	20.7
D1-D5 Worker Transport	189	18.2
D1-D5 Waste Recycling	98	9.4
D1-D5 Plant and Water Use	537	51.7
TOTAL	**1,038**	**100**

3.3.7 Based on the assumption that fossil fuels will not be used in a net zero economy by 2067 and can therefore be expected to be lower than the emissions set out in **Table 3.3**, and that activities will align with policy requirements and good practice standards at the time of decommissioning, it is considered that there would be a Negligible (**Not Significant**) effect.

3.3.8 The decommissioning emissions should be considered alongside the net emissions of the Proposed Development, as outlined in section 3.4, where emissions are contextualised.

3.4 Net Carbon Emissions & Carbon Intensity

3.4.1 Table 3.4 below presents a summary of the net emissions associated with the Proposed Development, including the construction period, the 40-year operational period, and the decommissioning period.

Table 3.4 Indicative Whole-Life Carbon Emissions

Project Stage	Carbon Emissions (tCO_{2e})	Proportion of total carbon emissions (%)
Construction	57,186	88
Operation (40 years)	6,841	10
Decommissioning	1,038	2
TOTAL	**65,064**	100

3.4.2 The emissions associated with the Proposed Development have been contextualised against the UK Carbon Budgets and the indicative Carbon Budget for the Power Sector in **Table 3.5** and **Table 3.6** respectively. This is prior to consideration of the carbon emissions avoidance that can be attributed to the Proposed Development because of zero carbon renewable energy generation.

Table 3.5: Contextualisation of the Proposed Developments Emissions Against UK Carbon Budgets

Carbon Budget Period	Carbon Budget (tCO2e)	Project contribution (tCO2e)	Project contribution (%)
4th (2023-2027)	1,950,000,000	57,357	0.0029
5th (2028-2032)	1,725,000,000	855	0.00005
6th (2033-2037)	965,000,000	855	0.00009
7th (2038-2042)	535,000,000	855	0.00016

Table 3.6: Contextualisation of the Proposed Developments Emissions against indicative Power Sector carbon budgets

Carbon Budget Delivery Plan Power Sector	Carbon Budget (tCO2e)	Project contribution (tCO2e)	Project contribution (%)
4th (2023-2027)	143,000,000	57,357	0.0401
5th (2028-2032)	63,000,000	855	0.0013
6th (2033-2037)	42,000,000	855	0.0020

3.4.3 Based on the Proposed Development's export capacity of 150 MW, and the net carbon emissions in Table 3.4, the Proposed Development is anticipated to have a net carbon intensity factor of 0.0133 kgCO2e/kWh. The carbon factor for the UK grid utilised in the assessment 0.177

$kgCO_2e/kWh$[16], which is forecast to decrease to 0.067 kgCO2e/kWh by 2027[17] (the earliest likely operation of the Proposed Development).

3.4.4 It should however be noted that the UK grid's carbon intensity data only considers operational emissions from the generation of electricity, whereas the net carbon emissions from the Proposed Development also include construction and decommissioning. The comparison of the Proposed Development's net carbon intensity figure against the average associated with the current and forecasted grid mix is therefore conservative.

3.4.5 **Table D.1** and **D.2** in **Appendix D** set out the comparison of the Proposed Development's carbon emissions against the average carbon intensity of the national grid for the 40-year operational period. As set out in Section 2, given the uncertainty of the likely carbon intensity of the grid energy mix by the end of the operational period (2067), both the current national grid average and the projected national grid average has been used. The two figures present a potential range of carbon emission savings associated with the Proposed Development, based on the generation capacity contribution without accounting for any sources of potential benefits associated with the new/improved landscaping and maintenance in accordance with a LEMP, which deliver benefits to climate change as well as biodiversity.

3.4.6 In total, the Proposed Development could affect a savings between 31,991 and 80,943 tCO_2e over the 40-year operational period. The lower figure assumes that emissions avoided by the Proposed Development will reduce year-on-year as the grid decarbonises over the operational period lifetime.

3.4.7 The carbon intensity of the grid from 2027 to 2067 is forecast to reduce from 0.067 $kgCO_2e/kWh$ to 0.002 $kgCO_2e/kWh$. The Proposed

[16] DESNZ (2025) GHG Conversion factors. Available here: ghg-conversion-factors-2025-full-set.xlsx

[17] DESNZ (2023) Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal: data table 1-19. [Online] Available here: https://assets.publishing.service.gov.uk/media/6567994fcc1ec5000d8eef17/data-tables-1-19.xlsx Accessed: 31/10/2025

Development would have a lower carbon intensity value per kwh than that of the projected grid forecast for the first 15 years of operation (based on a 2027 start). However, this assumes that the Proposed Development's carbon emissions do not also reduce alongside the decarbonisation of the grid, and other sectors such as transport.

3.4.8 The Proposed Development's carbon intensity is substantially lower than that of the average 2025 carbon factor of natural gas and coal 0.26946 $kgCO_2e/kWh$. When compared against this figure, the Proposed Development could save approximately 1,253,296 tCO_2e across a 40-year operational period. As noted in section 2.5, this figure does not account for mitigation of gas and coal emissions which is secured through policy and therefore could be an overestimation of carbon savings.

3.4.9 Based on the above, the Proposed Development would avoid emissions when compared with the do-nothing (as-is) baseline of the current and forecasted average carbon intensity of the national grid. As a result, the Proposed Development is expected to have a net **Beneficial** and **Significant** effect across its lifetime.

3.5 Summary

3.5.1 This Technical Note has been produced to expand on the Applicant's responses provided in the AREQ1, ARISH-A, and AREQ2 regarding a quantitative assessment of whole-life carbon emissions.

3.5.2 The Proposed Development's carbon savings when compared to the average carbon intensity of the UK grid is anticipated to be between 31,961 and 800,942 tCO_2e. This is inclusive of the new emissions considered for each lifecycle stage of the Proposed Development. From this, it can be assumed that the Proposed Development will offset emissions arising from the construction, operation and decommissioning stages.

3.5.3 It is also noted that this compares to a previous estimate of 1,340,902.8 tCO2e of carbon savings over the 40-year operational lifespan of the

Proposed Development, as described within the ES Climate Change chapter, which did not encompass the lifecycle aspects of this CELA.

3.5.4 While the CELA has enabled further insight into lifecycle emissions of the Proposed Development, it does not alter the original conclusions made in ES Chapter 9 – Climate Change regarding the significance of effects. Both assessments are based on indicative scenarios and limited data, and both assessments identify carbon savings associated with the Proposed Development.

3.5.5 While the indicative carbon emission savings within this CELA are lower than that estimated in ES Chapter 9, the Proposed Development is still anticipated to avoid emissions. As set out in ISEP Guidance, a reduction in emissions compared to a 'without project' baseline is beneficial, and all beneficial climate effects should be considered significant.

Appendix A Construction Calculation Tables

Table A.1: Embodied Carbon associated with PV Panel materials.

(A1-A3) Product Stage - PV Panels							
Material Type	**Amount of material per PV module (kg)**	**Amount of material for project (kg)**	**Carbon factor ($kgCO_2e/kg$)**	**Carbon Emissions (kg CO_2e)**	**Carbon Emissions (t/CO_2e)**	**Assumptions**	**References**
Silicon	1.45	508,200	6	3,049,200	3,049	350,000 solar panels 132 cells per panel 11g silicon per cell	Brandt, B., Kletzer, E., Pilz, H., Hadzhiyska, D. and Seizov, P. (2019) Silicon-Chemistry Carbon Balance An assessment of Greenhouse Gas Emissions and Reductions EXECUTIVE SUMMARY Covering the Production, Use and End-of-Life of Silicones, Siloxanes and Silane Products in Europe, North America and Japan. Carbon Factor: Inventory of Carbon and Energy (ICE) Version 3
Glass	21.6	7,560,000	1.40	10,604,916	10,605	2.5 kg per mm thickness per m2 2.7 m2 each panel 3.2 mm thickness	For amount of glass: Brandt, B., Kletzer, E., Pilz, H., Hadzhiyska, D. and Seizov, P. (2019) Silicon-Chemistry Carbon Balance An assessment of Greenhouse Gas Emissions and Reductions EXECUTIVE SUMMARY Covering the Production, Use and End-of-Life of Silicones, Siloxanes and Silane Products in Europe, North America and Japan. Carbon factor: DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting.
Aluminium	10.05	3,516,800	6.67	23,457,056	23,457	Quantity of steel assumed remaining proportion of PV weight (33.1kg minus weight of silicon and glass).	Carbon Factor: Inventory of Carbon and Energy (ICE) Version 3
				TOTAL	37,111		
Steel (Mounting)	30,000	4,500,000	3	12,420,000	12,420	30kg per MW	Information provided by Solarport, a mounting equipment supplier. Carbon Factor: Inventory of Carbon and Energy (ICE) Version 3
				TOTAL	49,531		

Table A.2: Embodied Carbon associated with Transformers / Inverters.

(A1-A3) Product Stage - Inverters						
Item	**Number**	**Carbon Factor ($kgCO_2e$/unit)**	**Carbon Emissions (kg CO_2e)**	**Carbon Emissions (t/CO_2e)**	**Assumptions**	**References**
PCS Units (central inverter-transformers)	22 units	14,037	617,628	618	22 full size central inverter units (2 inverters each) = 44 inverters	SMA Sunny 4600 inverter lifecycle carbon assessment.
			TOTAL	618		

Table A.3: Embodied Carbon associated with Concrete and Aggregate.

(A1-A3) Product Stage - Concrete and Aggregate							
Material Type	**Unit**	**Material (tonnes)**	**Carbon Factor ($kgCO_2e$/unit)**	**Carbon Emissions (kg CO_2e)**	**Carbon Emissions (t/CO_2e)**	**Assumptions**	**References**
Concrete	250 m^3	600	118.79306	71276	70	Indicative project information has been provided by the Applicant.	Carbon factor: DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting.
Aggregate	15000 m^3	25,500	7.79306	198,723	195		Carbon factor: DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting.
Fencing (Steel Mesh)	12,000 m	46	0.00382	-	10		Assumption: 3.8 kg steel mesh / metre. Carbon factor: Inventory of Carbon and Energy (ICE) Version 3
				TOTAL	275		

Table A.4: Embodied HGV Transport Emissions

(A4 Transport) – Number of HGV trips							
Vehicle Type	**Number of Trips**	**Distance (km)**	**Carbon factor ($kgCO_2e$/km)**	**Carbon Emissions ($kgCO_2e$)**	**Carbon Emissions (tCO_2e)**	**Assumptions**	**References**
HGV (Articulated > 33t)	18720	82	0.63282	971404	971	No. of trips based on 40 movements, 432 days of construction. 82 km distance from Port of Barrow (closest port) to the Site.	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting.
LGV	6912	80	0.25395	140424	140	No. of trips based on 16 movements, 432 days of construction. 82 km distance from Port of Barrow (closest port) to the Site.	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting.
				TOTAL	**1,112**		

Table A.5: Embodied Worker Transport Emissions

(A4 Transport) - Construction Workers							
Vehicle Type	**Number of trips**	**Distance (km)**	**Carbon factor (kgCO2e/km)**	**Carbon Emissions (kgCO2e)**	**Carbon Emissions (tCO2e)**	**Assumptions**	**References**
Minibus	64800	50	0.02776	89942.4	90	432 days of construction.. Peak staff no. = 150, by minibus = 75 (50%), 7 per bus = 24 trips total (two-way) 50 km distance for workers commuting to Site, based on distance to Carlisle and RICS Guidance	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting.
Car	43200	50	0.17474	377438	377	432 days of construction.. Petrol car, medium car, Peak staff no. = 150, by car = 75 (50%) = 100 trips (two-way). 50 km distance for workers commuting to Site, based on distance to Carlisle and RICS Guidance.	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting.
				TOTAL	**467**		

Table A.6: Embodied Shipping Transport Emissions

(A4 Transport) - Shipping								
Material Type to be Transported	**Weight (kg)**	**Weight (tonnes)**	**Distance (km)**	**Carbon factor (kgCO2e/tonne/km)**	**Carbon emissions (kgCO2e)**	**Carbon emissions (tCO2e)**	**Assumptions**	**References**
Solar PV and Steel Mounting	16085000	16085	19333	0.01321	4107931	4108	Shanghai to Port of Barrow Average, general cargo.	Carbon factor: DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting.

Table A.7: Embodied Construction Water Emissions

(A5 – Plant) Construction Water					
Million litres	**Carbon Fator (kgCO2e/million litres)**	**Carbon Emissions (kgCO2e)**	**Carbon Emissions (tCO2e)**	**Assumptions**	**References**
5,832,000	191.30156	1,116	1.12	Byers Gill and Longfield assumption of 90 litres/per worker/per day used as a more conservative option. 432 days of construction, 150 workers	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting.

Table A.8: Embodied Construction Waste Emissions

(A5 – Plant) Construction Waste							
Waste Type	**tonnes**	**Recycling Carbon Factor (kgCO2e/tonne)**	**Landfill Carbon Factor (kgCO2e/tonne)**	**Recycled Carbon Emissions (tCO2e)**	**Landfill Carbon Emissions (tCO2e)**	**Assumptions**	**References**
Steel and Aluminium	202	1.00835	1.26435	0.15	0.06	2.5% of total volume, of that, 75% recycled and 25% in landfill.	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting
Concrete & Aggregate	1305	1.00835	1.26338	0.66	0.82	5% of total volume, of that, 50% recycled and 50% sent to landfill.	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting
			TOTAL	**1.70**			

Table A.9: Embodied Construction Fuel Emissions

(A5 Plant) - Construction Fuel						
Source	**litres**	**Carbon Factor kgCO2e/litres**	**kg/CO2e**	**tCO2e**	**Assumptions**	**References**
Generator	42,768	2.66155	11,3829	114	Byers Gill and Longfield assumption of fuel use for generators at 16.5 litres/hour 432 days of construction, 6 hours each working day	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting
Plant and Machinery	360,000	2.66155	958,158	958	Byers Gill and Longfield assumption of fuel use for plant and machinery use at 5,000 litres/week. 432 days of construction = 72 weeks	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting
			TOTAL	**1,072**		

Appendix B Operation Calculation Tables

Table B.1: Operational Emissions from Maintenance Worker Trips

(B2-B5 Operational) - Maintenance Worker Trips							
Vehicle Type	**Number of trips**	**Distance (km)**	**Carbon factor (kgCO2e/km)**	**Carbon Emissions (kgCO2e)**	**Carbon Emissions (tCO2e)**	**Assumptions**	**References**
Car Trips	8,320	50	0.17474	72,692	73	Petrol car, medium car. 50 km distance for workers commuting to Site, based on distance to Carlisle and RICS Guidance.	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting.

Table B.2: Operational Emissions from Component Replacement

(B2-B5 Operational) - Component Replacement					
Item	**Design life replacement rate**	**Original embodied emissions (tCO2e)**	**Carbon Emissions (tCO2e)**	**Assumptions**	**References**
PV Panels	10.0%	49,531	4,953	Solar PV modules – will be replaced depending on efficiency. It is expected to replace 10% of these over the lifetime of the Proposed Development.	Byers Gill Climate Change ES Chapter: applicant information.
Inverter	100.0%	618	618	Replace once (after 20 years).	SMA Sunny 4600 inverter lifecycle carbon assessment.

Table B.3: Operational Emissions from Transport of Replacement Material Trips

(B2-B5 Operational) - Transport of Replacement Material			
Item	**Original embodied emissions (tCO2e)**	**Replacement embodied emissions (tCO2e)**	**Assumptions**
HGV	1,112	111	Assumes 10% of constructions trips for materials and delivery
Shipping	4,108	411	
	TOTAL	**522**	

Table B.4: Emissions from Operational Energy Use

kWh/year	Operation period kWh (40 years)	Carbon Factor (kgCO2e/kwh)	Carbon Emissions over 40 years (tCO2e)	Assumption	References
72,116	2,884,640	0.20705	597	1,639 kWh per transformer per year is obtained from the utility grid over a service life of 20 years.	Carbon Factor: DESNZ Zero (2025) UK Government GHG Conversion Factors for Company Reporting.
					Assumption: SMA Sunny 4600 inverter lifecycle carbon assessment.

Table B.5: Emissions from Operational Water Use

(B7) Operational Water Use							
Litres / MWh	**MWh/year**	**million litres/year**	**Carbon Fator (kgCO2e/million litres)**	**Annual Carbon Emissions (tCO2e)**	**Total 40-Year Carbon Emissions (tCO2e)**	**Assumptions**	**References**
76	134120	10,193,120	191.30156	2	78	Springwell assumption of 76 litres/MWh water used for cleaning of solar panel used as a more conservative option.	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting

Appendix C Calculations (Decommissioning)

Table C.1: Embodied Emissions from Waste during Decommissioning

(D1-D5 Decommissioning) - Materials (Recycling)					
PV Panels					
Material Type	**Weight (tonne)**	**Carbon factor (kgCO2e/tonne)**	**Carbon Emission (tCO2e)**	**Assumptions**	**References**
Steel and Aluminium (Metal)	8,063	1.00835	8	Same volume of materials purchased during construction will be disposed of during the decommissioning phase. It is assumed all materials will be recycled with nothing going to landfill.	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting.
Glass	7,560	4.68568	35		
Silicon (Plastic)	508	4.68568	2		
Concrete	600	1.00835	1		
Aggregate	25,500	1.00835	25		
		TOTAL	71		

Table C.2: Embodied Emissions from the Transport of Waste during Decommissioning

(D1-D5 Decommissioning) - Transport of Waste									
Material Type	**Weight Tonnes**	**Number of trips**	**Distance (km)**	**Carbon Factor Laden ($kgCO_2e/km$)**	**Carbon Factor Unladen ($kgCO_2e/km$)**	**Carbon Emission ($kgCO_2e$)**	**Carbon Emission (tCO_2e)**	**Assumptions**	**References**
Steel and Aluminium	8,063	244	200	0.93552	0.62775	76,390	76	Articulated HGV (>3.5 - 33t). 50 km distance for concrete and aggregate assumes a local recycling facility 200 km for all other products assumes regional recycling facility two way trips (one way 100% laden, one way 0% laden)	DESNZ (2025) UK Government GHG Conversion Factors for Company Reporting
Glass	7,560	229	200	0.93552	0.62775	71,626	72		
Silicon (Plastic)	508	15	200	0.93552	0.62775	4,815	5		
Concrete	600	18	50	0.93552	0.62775	1,421	1		
Aggregate	25,500	773	50	0.93552	0.62775	60,399	60		
						TOTAL	215		

Table C.3: Embodied Emissions Water, Worker Commuting and Plant Use during Decommissioning

Activity	**Carbon Emission (tCO_2e)**	**Assumption**
Water Use	0.558	All other decommissioning emissions from worker commuting, plant use and water use would be 50% of the value from the construction phase.
Worker Commuting	189	
Plant Use	536	

Table C.4: Embodied Emissions from the disposal and transport of Inverters during Decommissioning.

Component	**No. of inverters**	**Carbon Factor ($kgCO_2e$/unit)**	**Carbon Emission (tCO_2e)**	**Reference**
Inverters	44	616	27	SMA Sunny 4600 inverter lifecycle carbon assessment decommissioning carbon factor (includes disposal and transport).

Appendix D Energy Generation Calculations

Table D.1: Estimated annual energy generation and operational GHG effects (current grid average).

Year Operation	Year	MWh	National Grid average carbon intensity factor 2024 (KgCO2e/Kwh)	Current Average National Grid Emissions (tCO2e)	Current grid average avoided emissions (tCO2e)
1	2027	132,779	0.177	23,502	21,736
2	2028	132,242	0.177	23,407	21,648
3	2029	131,706	0.177	23,312	21,560
4	2030	131,169	0.177	23,217	21,473
5	2031	130,633	0.177	23,122	21,385
6	2032	130,096	0.177	23,027	21,297
7	2033	129,560	0.177	22,932	21,209
8	2034	129,023	0.177	22,837	21,121
9	2035	128,487	0.177	22,742	21,034
10	2036	127,950	0.177	22,647	20,946
11	2037	127,414	0.177	22,552	20,858
12	2038	126,877	0.177	22,457	20,770
13	2039	126,341	0.177	22,362	20,682
14	2040	125,804	0.177	22,267	20,594
15	2041	125,268	0.177	22,172	20,507
16	2042	124,731	0.177	22,077	20,419
17	2043	124,195	0.177	21,983	20,331
18	2044	123,658	0.177	21,888	20,243
19	2045	123,122	0.177	21,793	20,155
20	2046	122,585	0.177	21,698	20,067
21	2047	122,049	0.177	21,603	19,980
22	2048	121,513	0.177	21,508	19,892
23	2049	120,976	0.177	21,413	19,804
24	2050	120,440	0.177	21,318	19,716
25	2051	119,903	0.177	21,223	19,628
26	2052	119,367	0.177	21,128	19,541
27	2053	118,830	0.177	21,033	19,453
28	2054	118,294	0.177	20,938	19,365
29	2055	117,757	0.177	20,843	19,277
30	2056	117,221	0.177	20,748	19,189
31	2057	116,684	0.177	20,653	19,101
32	2058	116,148	0.177	20,558	19,014
33	2059	115,611	0.177	20,463	18,926
34	2060	115,075	0.177	20,368	18,838
35	2061	114,538	0.177	20,273	18,750
36	2062	114,002	0.177	20,178	18,662
37	2063	113,465	0.177	20,083	18,574
38	2064	112,929	0.177	19,988	18,487
39	2065	112,392	0.177	19,893	18,399
40	2066	111,856	0.177	19,798	18,311
	TOTAL	**4,892,690**		**611,586**	**800,942**

Table D.2: Estimated annual energy generation and operational GHG effects (projected grid average).

Year Operation	Year	MwH	National Grid average carbon intensity factor projections (KgCO2e/Kwh)*	Projected Average National Grid Emissions (tCO2e)	Projected grid average avoided emissions (tCO2e)
1	2027	132,779	0.067	8,896	7,130
2	2028	132,242	0.058	7,670	5,911
3	2029	131,706	0.049	6,454	4,702
4	2030	131,169	0.045	5,903	4,158
5	2031	130,633	0.038	4,964	3,227

Year Operation	Year	MwH	National Grid average carbon intensity factor projections (KgCO2e/Kwh)*	Projected Average National Grid Emissions (tCO2e)	Projected grid average avoided emissions (tCO2e)
6	2032	130,096	0.03	3,903	2,173
7	2033	129,560	0.024	3,109	1,387
8	2034	129,023	0.019	2,451	736
9	2035	128,487	0.018	2,313	604
10	2036	127,950	0.018	2,303	602
11	2037	127,414	0.017	2,166	472
12	2038	126,877	0.016	2,030	343
13	2039	126,341	0.015	1,895	215
14	2040	125,804	0.015	1,887	214
15	2041	125,268	0.014	1,754	88
16	2042	124,731	0.013	1,622	N/A
17	2043	124,195	0.008	994	N/A
18	2044	123,658	0.008	989	N/A
19	2045	123,122	0.007	862	N/A
20	2046	122,585	0.007	858	N/A
21	2047	122,049	0.005	610	N/A
22	2048	121,513	0.005	608	N/A
23	2049	120,976	0.003	363	N/A
24	2050	120,440	0.002	241	N/A
25	2051	119,903	0.002	240	N/A
26	2052	119,367	0.002	239	N/A
27	2053	118,830	0.002	238	N/A
28	2054	118,294	0.002	237	N/A
29	2055	117,757	0.002	236	N/A
30	2056	117,221	0.002	234	N/A
31	2057	116,684	0.002	233	N/A
32	2058	116,148	0.002	232	N/A
33	2059	115,611	0.002	231	N/A
34	2060	115,075	0.002	230	N/A
35	2061	114,538	0.002	229	N/A
36	2062	114,002	0.002	228	N/A
37	2063	113,465	0.002	227	N/A
38	2064	112,929	0.002	226	N/A
39	2065	112,392	0.002	225	N/A
40	2066	111,856	0.002	224	N/A
	TOTAL	**4,892,690**		**68,552**	**31,992**

Appendix E Reviewed Documents References

Table E.1 – Solar DCO Climate Change Documentation References

EN Ref	Project	References
EN010152	Fenwick Solar Farm *	Fenwick Solar Project Ltd. (2024). *Environmental Statement Volume 1, Chapter 6: Climate Change, Document Reference: EN010152/APP/6.1, Revision 1, Clean*. (18 December 2024) [APP-224]
EN010149	Springwell Solar Farm*	Springwell Energyfarm Ltd. (2025). *Environmental Statement Volume 1, Chapter 8: Climate, Document Reference: EN010149/APP/6.1.2, Revision 2, Clean.* (14 August 2025) [REP3-008]
EN010143	East Yorkshire Solar Farm	East Yorkshire Solar Farm Ltd. (2023), *Environmental Statement Volume 6, Chapter 7: Climate Change, Document Reference: EN010143/APP/6.1, Revision 0.* (19 December 2023) [APP-058]
EN010142	Tillbridge Solar Project	Tillbridge Solar Ltd. (2024). *Environmental Statement Volume 1, Chapter 6: Climate Change, Document Reference: EN010142/APP/6.1, Revision 0.* (08 May 2024) [APP-038]
EN010140	Helios Renewable Energy Project*	Enso Green Holdings D Ltd. (2024). *Environmental Statement Chapter 12: Climate Change, Document Reference: EN010140/APP/6.1.12, Revision 0.* (30 June 2024) [APP-032]
EN010139	Byers Gill Solar	RWE Renewables UK Solar and Storage Ltd. (2024). *Byers Gill Solar, EN010139, 6.2.5 Environmental Statement Volume 6, Chapter 5: Climate Change, Revision C01.* (08 March 2024). [APP-028] RWE Renewables UK Solar and Storage Ltd. (2024). *Byers Gill Solar, EN010139, 6.4.5.1 Environmental Statement* *Appendix 5.1 Greenhouse Gas Assessment* [APP-123] RWE Renewables UK Solar and Storage Ltd. (2024). *Byers Gill Solar EN010139, 8.9 Energy Generation and Design Evolution Document. Revision 1. (*02 September 2024). [REP2-010]
EN010135	Stonestreet Green Solar	EPL 001 Ltd. (2024). *Stonestreet Green Solar, Environmental Statement, Volume 2: Main Text, Chapter 15: Climate Change, EN010135, Doc Ref. 5.2, Version 1.* (09 July 2024) [APP-039] EPL 001 Ltd. (2024). *Stonestreet Green Solar Environmental Statement, Volume 4: Appendices, Chapter 15: Climate Change Appendix 15.2: GHG Footprint Methodology, EN010135, Doc Ref. 5.4, Version 1.* (09 July 2024) [APP-121] EPL 001 Ltd. (2024). *Stonestreet Green Solar, Climate Change Technical Note, EN010135, Doc Ref. 8.19, Version 1.* (17 April 2024) [REP5-027] EPL 001 Ltd. (2025) *Stonestreet Green Solar Environmental Statement Volume 2: Main Text, Chapter 3: Project Description, EN010135, Doc Ref. 5.2(B), Version 3.* (20 May 2025) [REP5-009]
EN010133	Cottam Solar Project	Cottam Solar Project Ltd. (2023). *Environmental Statement, Chapter 7: Climate Change, Revision A, EN010133, Reference: EX1/C6.2.7_A. (*15 October 2023) [APP-042]
EN010132	West Burton Solar Project	West Burton Solar Project Ltd. (2023). *Environmental Statement, Chapter 7: Climate Change, Revision A, EN010132, Reference: EX1/WB6.2.7_A. (*29 November 2023) [APP-045]
EN010127	Mallard Pass Solar Project	Mallard Pass Solar Farm Ltd. (2024). *Environmental Statement Volume 1, Chapter 13: Climate Change, Document Ref: EN010127/APP/6.1, Revision P0.* (09 December 2022) [APP-043] Mallard Pass Solar Farm Ltd. (2024). *Environmental Statement Volume 2, Appendix 13.2: Climate Change - Assessment Methodology, Document Ref: EN010127/APP/6.2, Revision P0.* (09 December 2022) [APP-097] Mallard Pass Solar Farm Ltd. (2024). *Deadline 3 Submission 9.21 Responses to Interested Parties' Deadline 2 Submissions - Climate Change, Document Ref: EN010127/APP/9.21.* (03 July 2023) [REP3-029]
EN010123	Heckington Fen Solar Park	Ecotricity (Heck Fen Solar) Ltd. (2023). *Environmental Statement - Chapter 13 - Climate Change, EN010123, Document Reference: 6.1.13, Revision 2.* (13 March 2023) [6.1.13]
EN010122	Oaklands Farm Solar Park	Oaklands Solar Farm Ltd. (2024). *Environmental Statement Chapter 13: Climate Change, Document Reference: EN010122/D3/6.1, Revision 2, Clean*. (23 August 2024)[REP3-021]
EN010118	Longfield Solar Farm	Longfield Solar Energy Farm Ltd. (2022). *Environmental Statement Volume 1, Chapter 6: Climate Change, Document Reference: EN010118/APP/6.1, Revision 1.* (28 March 2022) [APP-038] Longfield Solar Energy Farm Ltd. (2022). *Environmental Statement Volume 2, Appendix 6A: Climate Change – Technical Appendix, Document Reference: EN010118/APP/6.2, Revision* 1. (28 March 2022) [APP-056]
EN010101	Little Crow Solar Park	INRG Solar (Little Crow) Ltd. (2020). *Environmental Statement Chapter 5: Legislation, Climate Change, Energy Planning Policy and Guidance, EN010101, Document Ref: 6.5 LC ES CH5, Revision 1*. (23.December 2020) [APP-062] INRG Solar (Little Crow) Ltd. (2021). *Environmental Statement Technical Appendicies, Appendix 4.5 – Air Quality and Carbon Assessment, EN010101, Document Ref: 7.12C LC TA4.5, Revision C, Clean*. (08.June 2020) [REP6-010]
EN010085	Cleve Hill Solar Park	Cleve Hill Solar Park Ltd. (2018). Environmental Statement Volume 1, Chapter 15 - Climate Change, EN010085, Document Reference: 6.1.15, Revision A. (23 November 2018). [APP-045] Cleve Hill Solar Park Ltd. (2018). *Deadline 2 Climate Change Chapter Clarification Note, Document Reference: 10.6.3, Revision A*. (23 November 2018) [REP2-043]