FENWICK SOLAR FARM

Preliminary Environmental Information Report

Volume I Chapter 3: Alternatives and Design Evolution

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3. Alternatives and Design Evolution

3.1 Introduction

3.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) describes the consideration of alternatives and design evolution in relation to the Scheme at this preliminary stage.

3.1.2 There is a legislative requirement to present alternatives where these have been considered by the Applicant. Regulation 14(2) of the Infrastructure Planning (Environmental Impact Assessment) (EIA) Regulations 2017 (Ref. 3-1) sets out what an Environmental Statement (ES) must include and refers to Schedule 4 of the EIA Regulations (Ref. 3-1) for additional information to be provided in the ES. Paragraph 2 of Schedule 4 of the EIA Regulations (Ref. 3-1) requires the ES to present *"A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects".*

3.1.3 There is no general requirement in relevant national policy to consider alternatives. Paragraph 4.3.9 of National Policy Statement (NPS) EN-1: Overarching National Policy Statement for Energy (Ref. 3-2) states that *"As in any planning case, the relevance or otherwise to the decision making process of the existence (or alleged existence) of alternatives to the proposed development is, in the first instance, a matter of law. This NPS does not contain any general requirement to consider alternatives or to establish whether the proposed project represents the best option from a policy perspective…".* The same paragraph goes on to explain that *"Although there are specific requirements in relation to compulsory acquisition and habitats sites, the NPS does not change requirements in relation to compulsory acquisition and habitats sites."*

3.1.4 Paragraph 4.3.16 of NPS EN-1 (Ref. 3-2) sets out that the NPSs may set out specific circumstances in which the consideration of alternatives is a policy requirement. These include in relation to biodiversity and geological conservation interests, flood risk and development within nationally designated landscapes. Sections 5.4, 5.8, and 5.10 of NPS EN-1 (Ref. 3-2) explain these policy requirements. Paragraph 4.3.17 of NPS EN-1 (Ref. 3-2) states *"where there is a policy or legal requirement to consider alternatives the applicant should describe the alternatives considered in compliance with these requirements".*

3.1.5 Paragraph 4.3.22 of NPS EN-1 (Ref. 3-2) states that "*Given the level and urgency of need for new energy infrastructure, the Secretary of State should, subject to any relevant legal requirements (e.g. under the Habitats Regulations) which indicate otherwise, be guided by the following principles when deciding what weight should be given to alternatives:*

- *the consideration of alternatives in order to comply with policy requirements should be carried out in a proportionate manner;*
- *only alternatives that can meet the objectives of the proposed development need to be considered".*

3.1.6 At this preliminary stage, it is not anticipated that the Scheme will cause significant harm to biodiversity and geological conservation interests and nationally designated landscapes. **PEIR Volume I Chapter 8: Ecology** and **PEIR Volume I Chapter 10: Landscape and Visual Amenity** demonstrate this, presenting the likely effects of the Scheme on designated ecological sites and designated landscape areas, respectively.

3.1.7 The Site is partially located within Flood Zone 2 and Flood Zone 3 and, therefore, consideration of relevant policy requirements are set out in Section 3.3.23 and also discussed in Section 3.6.1 of this chapter.

3.1.8 Notwithstanding this, Paragraph 4.3.15 of NPS EN-1 (Ref. 3-2) states that "*applicants are obliged to include in their ES, information about the reasonable alternatives they have studied. This should include an indication of the main reasons for the applicant's choice, taking into account the environmental, social and economic effects and including, where relevant, technical and commercial feasibility*."

3.1.9 Paragraph 9.3 of the Planning Inspectorate's Advice Note 7: Environmental Impact Assessment: Process, Preliminary Environmental Information and Environmental Statements (Ref. 3-3) states that a good ES is one that "*explains the reasonable alternatives considered and the reasons for the chosen option taking into account the effects of the Proposed Development on the environment".*

3.1.10 Taking into consideration the policy and legal requirements, as well as the iterative approach to the Scheme design to date, the following alternatives have been considered for the Scheme and are discussed in this chapter:

a. Alternatives sites to the Solar PV Site;

b. Alternative solar design technologies;

c. Alternative layouts within the Solar PV Site; and

d. Alternatives relating to the Grid Connection Corridor.

3.1.11 These alternatives are discussed alongside a summary of the need for the Scheme and the reasons the Applicant has selected the Solar PV Site and the Grid Connection Corridor.

3.1.12 Consideration of 'no development' as an alternative to the Scheme has not been considered further. This is because 'no development' is not considered to be a reasonable alternative to the Scheme as it would not deliver the proposed additional electricity generation capacity or storage proposed. Paragraph 4.3.27 of NPS EN-1 (Ref. 3-2) states *"Alternative proposals which mean the necessary development could not proceed, for example because the alternative proposals are not commercially viable or alternative proposals for sites would not be physically suitable, can be excluded on the grounds that they are not important and relevant to the Secretary of State's decision."*

3.1.13 Other generation schemes, such as wind power, nuclear, coal, or gas fired power stations, have not been assessed due to their unsuitability to the Site (in the case of a large-scale wind project and nuclear energy) or their inability to contribute to the UK's need for low carbon electricity (in the case of coal or gas).

3.1.14 A 'smaller development' as an alternative to the Scheme has also not been considered further as Paragraph 4.3.23 of NPS EN-1 (Ref. 3-2) states the decision maker *"…should be guided in considering alternative proposals by whether there is a realistic prospect of the alternative delivering the same infrastructure capacity (including energy security and climate change benefits) in the same timescale as the proposed development".* A smaller scheme would not deliver the same generation capacity or energy security and climate change benefit as the Scheme and, as such, would not represent a reasonable alternative.

3.2 Need for the Scheme

3.2.1 The Scheme's principal objective is to generate low-carbon electricity for design life of 40 years to help meet the UK's growing need for low carbon electricity. The inclusion of electricity storage assets as 'associated infrastructure' to the principle solar development within the Scheme provides a means of further enhancing the utility of the power generated by the Scheme by providing energy balancing capability and other services to support the decarbonisation and operation of the National Electricity Transmission System.

3.2.2 There is a growing body of UK energy and climate change international commitments, law, policy and guidance which highlights an urgent need for new low carbon energy generation infrastructure, particularly from renewable sources such as solar.

3.2.3 On 20 March 2023, the United Nations (UN) Intergovernmental Panel on Climate Change published its 2023 assessment of global climate change (Ref. 3-4). The advisory report concludes that the world is likely to pass a dangerous temperature threshold within the next 10 years, pushing the planet past the point of catastrophic warming, unless nations drastically transform their economies and immediately transition away from fossil fuels.

3.2.4 In June 2019, the UK became the first major economy to legislate for a 2050 net zero Greenhouse Gases (GHG) emissions target through the Climate Change Act 2008 (2050 Target Amendment) Order 2019 (Ref. 3-5).

3.2.5 In December 2020, the UK Government communicated its Nationally Determined Contributions (NDC) to reduce GHG emissions by at least 68% from 1990 levels by 2030.

3.2.6 In April 2021, the UK Government legislated for the sixth carbon budget, which requires the UK to reduce GHG emissions by 78% by 2035 compared to 1990 levels as per Paragraph 2.2.1 of NPS EN-1 (Ref. 3-2).

3.2.7 The UK Government's objectives for the energy system are to ensure the supply of energy always remains secure, reliable, affordable and consistent with meeting the target to cut GHG emissions to net zero by 2050, including through delivery of UK carbon budgets and NDC.

3.2.8 The UK Government recognizes this will require a step change in the decarbonisation of the UK's energy system. The carbon budget and NDC obligation recognise atmospheric carbon has a cumulative global heating effect and that, therefore, fighting global warming necessitates urgent action (Paragraph 2.3.3 of NPS EN-1 (Ref. 3-2)).

3.2.9 The Climate Change Committee (CCC) (an independent advisory for the UK government) made clear that the UK was not on track to meet its fourth (2023-2027) or fifth (2028-2032) carbon budgets in its Progress Report to Parliament in 2019 (Ref. 3-6).

3.2.10 The CCC's 2022 Progress Report (Ref. 3-7) reiterates that achieving the Fourth Carbon Budget (2023-2027) is not a foregone conclusion and in any case *"meeting the Fourth Carbon Budget is not sufficient to be on track for the later targets".*

3.2.11 The CCC also report significant delivery risks to meeting the NDC which supersedes the fifth carbon budget as the appropriate level of reduction on the way to net zero and the sixth carbon budget (2033-2037), as well as the long-term goal of net zero by 2050.

3.2.12 The CCC's latest Progress Report (Ref. 3-8) states at page 95 that, regarding the Fourth Carbon Budget (2023-2027) *"Our confidence in the UK achieving its Fourth Carbon Budget has slightly increased this year, due to a combination of policy progress and the pandemic and fuel prices affecting demand... …Sufficient plans over this period are predominantly from renewable electricity generation and the transition to electric vehicles..."* However, at page 22 the report states that continued delays in action leading to increased delivery risk have decreased the CCC's confidence in meeting the 2030 NDC and Sixth Carbon Budget. It sets out that these risks are predominantly due to delays in developing a mandate for zero emissions vehicles and a continued lack of strategy for decarbonising the electricity system, alongside increasing delivery risks. It also cites matters including policy gaps in industrial electrification and resource efficiency, and reliance on voluntary uptake of low carbon measures as reasons contributing to decreased confidence in achieving the Sixth Carbon Budget.

3.2.13 The UK Government has committed to decarbonisation of the electricity system by 2035 as a critical step to achieving net zero GHG emissions by 2050, and Government analysis shows a secure, reliable, affordable, net zero consistent system in 2050 is likely to be composed predominantly of wind and solar (Paragraph 3.3.20 of NPS EN-1 (Ref. 3-2)).

3.2.14 Mission Zero 2023 (Ref. 3-9), the UK government's independent review of net zero, published in January 2023, notes the significant steps the UK has taken so far to achieve net zero and deliver future energy security through the greater use of domestically generated renewable and clean sources of power.

3.2.15 Mission Zero strongly warned the pace of national decarbonisation must accelerate not only to protect and secure delivery of national climate commitments, but also to deliver the economic benefits of moving away from a carbon economy.

3.2.16 The UK Government believes solar is a part of the solution and has committed to sustained growth in solar capacity to ensure the UK is on a pathway to net zero emissions. As such, solar is a key part of the government's strategy for low-cost decarbonisation of the energy sector and has an important role in delivering the government's goals for greater energy independence (Paragraph 2.10.9 and 2.10.10 of NPS EN-3 (Ref. 3-10)). The British Energy Security Strategy (Ref. 3-11) states the UK Government expects a five-fold increase in solar deployment by 2035 (up to 70GW).

3.2.17 There is a pressing need to bring forward grid scale solar and associated energy storage systems developments. Therefore, it is important these assets are brought forward quickly due to the urgency of the need.

3.2.18 Solar generation is already a leading low-cost generation technology in the UK, as set out in the Cost of Energy Report (Ref. 3-11), and is a critical element of the plan to decarbonise the UK electricity sector. The national need for solar generation is urgent and the capacity required is significantly greater than the capacity of the projects currently understood to be in development.

3.2.19 Solar addresses all important aspects of existing and emerging UK Government energy policy. It will make a critical and timely contribution to decarbonisation and the security of energy supply in the UK, whilst helping shield consumer bills from volatile energy prices and international supply markets.

3.3 Site Selection

3.3.1 There are a number of key considerations which typically influence the location and selection of land for solar projects. Some of the factors are identified in Section 2.10 of NPS EN-3 (Ref. 3-10). This section explains the main factors that have influenced how the Applicant has selected the land for the Scheme and considers the factors influencing site selection as set out in the NPS EN-3 (Ref. 3-10).

Irradiance and Site Topography

3.3.2 Irradiation levels from the sun and topography are key factors in identifying suitable locations for solar development. The Applicant has identified the Solar PV Site is within an area of the UK that benefits from good levels of irradiation, is characterised by being generally flat, and is therefore a suitable location for a large scale solar farm in terms of irradiation and topography.

3.3.3 Large scale solar development is ideally located on flat land as this limits the shading of Solar PV Panels. A flat terrain also helps to reduce visual intrusion as panels can be screened thus restricting views of the solar development from surrounding areas. Construction is also easier on flat land.

3.3.4 The Site is located on low lying land within a relatively flat landscape.

Network Connection

3.3.5 Proximity to an available grid connection with appropriate capacity is fundamental to the viability and deliverability of a solar farm and associated Battery Energy Storage System (BESS).

3.3.6 The Applicant undertook a search of available capacity and, following discussions with National Grid, has secured a point of connection at the Existing National Grid Thorpe Marsh Substation. The Solar PV Site is in sufficient proximity to the point of connection at the Existing National Grid Thorpe Marsh Substation. As detailed in Section 3.5, an option for a line drop to substation located within the Solar PV Site is also being explored.

Site Capacity

3.3.7 The amount of land identified for the Scheme has been determined based on the need generate and store electricity to make full use of the grid connection capacity and facilitate environmental mitigation measures that may be required.

Proximity to Residential Dwellings and Other Planning and Environmental Designations

3.3.8 The Applicant has sought to avoid urban areas, as well as landscape, ecology, green belt and heritage designations. The selection of the Solar PV Site has also sought to avoid placing solar PV infrastructure in close proximity to residential dwellings and small settlements to minimise the potential for adverse impacts on visual amenity and from glint and glare.

Agricultural Land Classification and Other Land Use Conflicts

3.3.9 In selecting the Solar PV Site the Applicant has sought to avoid land that is likely to be classified as best and most versatile (BMV) agricultural land – that is land with agricultural land classification (ALC) grades 1, 2 and 3a. Whilst development is not prohibited on BMV agricultural land, the Applicant has sought to minimise the use of BMV land in the Solar PV Site. This is as per the policy set out by NPS EN-1 (Ref. 3-2); and NPS EN-3 (Ref. 3-10) which require impacts on BMV agricultural land to be minimised and justified if used.

3.3.10 The majority of the Solar PV Site is agricultural land, however, this is not classified as BMV based on Natural England Provisional ALC mapping. soil surveys undertaken within the majority of the Solar PV Site between February 2023 and May 2023 has found that 91% of the surveyed area is of moderate quality Subgrade 3b. Areas of the Solar PV Site which are yet to be surveyed have been identified to be Grade 4 land according to the Natural England Provisional ALC mapping.

3.3.11 Section 2.10 of NPS EN-3 (Ref. 3-10) recognises agricultural land will need be used for large scale solar schemes, but that preference should be given to using brownfield land and non-agricultural land. No suitable and available areas of brownfield or non-agricultural land at the appropriate scale have been identified.

Accessibility

3.3.12 Suitable access for heavy goods vehicles (HGVs) and abnormal indivisible loads (AIL) is preferred for straightforward construction of large-scale solar development. Large equipment and construction personnel will need to access the Solar PV Site and, therefore, the Applicant has considered the potential for HGV access in refining the area of search. During the operation and maintenance phase the solar farm will also need to be accessed typically by light goods vehicles (LGVs) for maintenance activities. The Applicant has selected land which has good access to the strategic and local road network, with the M62 located approximately 4 km to the north of the Site and located approximately 6 km to the north of local roads such as Fenwick Lane and Fenwick Common Lane. The M18 is located approximately 8 km to the east of the Site, approximately 8 km east of Lawn Lane and 5 km east of Kirkhouse Green Road. There are a number of A roads in close proximity, including the A19 (Selby Road) located approximately 3 km to the west of the Site and located approximately 2 km west of Fenwick Lane.

Public Rights of Way

3.3.13 Section 2.10 of NPS EN-3 (Ref. 3-10) identifies public rights of way (PRoW) as a factor for consideration by applicants in selecting sites and designing large-scale solar farms. In selecting the land for the Scheme, the Applicant has sought to avoid land which is crossed by PRoW, where practicable. Where land with PRoW has been proposed, consideration has been given to the potential size of the developable area for solar PV infrastructure which will remain following the application of appropriate buffers. The land selected provides a Solar PV Site which largely avoids PRoW, whilst those which are located within the Solar PV Site would be retained and available for use throughout the operation and maintenance phase of the Scheme, with buffers applied to preserve amenity.

Land Availability

3.3.14 Minimising the number of landowners affected by the Scheme and enhancing opportunities for necessary land rights to be acquired voluntarily have been key requirements of the Applicant's approach to the selection of the Solar PV Site. Following non-statutory consultation, the land within the Solar PV Site was extended to the south, following feedback from landowners and a positive assessment of the suitability of the land for the Scheme. The Applicant has identified and secured the majority of land for the Solar PV Site and will continue to progress voluntary discussions for the remainder.

Flood Risk

3.3.15 Approximately 44% of the Solar PV Site is located within Flood Zone 2, with approximately 24% of the Solar PV Site being located in Flood Zone 3. The remaining parts of the Solar PV Site are located in Flood Zone 1 (32%).

3.3.16 Although solar farm development is considered 'essential infrastructure' in terms of flood risk vulnerability in Annex 3 of the National Planning Policy

Framework (NPPF) (Ref. 3-13) and can be resilient to flooding, the policy context set out by Section 5.8 of NPS EN-1 (Ref. 3-2) requires a sequential approach (the Flood Risk Sequential Test) to be taken as part of the site selection process, preferring land in Flood Zone 1 over land in Flood Zone 2 and then Flood Zone 3.

3.3.17 In selecting the Solar PV Site, the Applicant has given preference to using land in Flood Zone 1 and then to land in Flood Zone 2. However, due to the large extent of Flood Zones 2 and 3 in the area of search surrounding the point of connection at the Existing National Grid Thorpe Marsh Substation, and other constraints as detailed herein, no other areas of suitable and available land within Flood Zone 1 have been identified. The Applicant has thus aimed to maximise the integration of land within Flood Zone 1 into the Scheme.

3.3.18 Areas of Flood Zone 3 (high risk) are located immediately adjacent to the River Went and along Fleet Drain to the far north and east of the Solar PV Site, respectively. Areas of Flood Zone 2 (medium risk) are located predominantly in the wider northern and eastern areas of the Solar PV Site. The areas of Flood Zone 2 and Flood Zone 3 are presented in **PEIR Volume II Figure 9-4: Environment Agency Flood Map for Planning (Rivers and Seas)**. The proposed layout of the Solar PV Site will take account of the flood risk profile of the land and ensure that it is resilient to flooding and does not increase the risk of flooding within the Site or elsewhere.

3.3.19 Further details of how the Applicant selected the Solar PV Site in accordance with the requirements of the Flood Risk Sequential Test will be submitted with the DCO Application. Compliance with this policy requirement will be set out in the Planning Statement and the Flood Risk Assessment (FRA) to be submitted with the DCO Application.

Heritage Assets

3.3.20 In selecting the land for the Scheme, the Applicant has sought to avoid direct impacts and to minimise setting impacts to heritage assets. A 20 m buffer strip free of Solar PV Panels, located to the east of the scheduled moated site of Fenwick Hall (1012459) and within the Solar PV Site, has been agreed with Historic England and then further enhanced within the scheme design by the extension of the buffer to include the entire field.

Ancient Woodland

3.3.21 In selecting the site the Applicant sought to avoid the need to impact ancient woodland.

3.3.22 Bunfold Shaw is an Ancient Woodland and Local Wildlife Sites (LWS) located approximately 15 m from the Solar PV Site within the central area. In selecting the land for the Scheme, the Applicant has sought to include appropriate protection zones around the boundary of Bunfold Shaw (semi-natural ancient woodland habitat) where it is close to the Site Boundary, to protect it.

Summary

3.3.23 In summary, the main reasons for selecting the Solar PV Site are that the land chosen:

a. Has topography which meets the requirements of the Scheme to efficiently generate significant amounts of electricity and store it;

b. Is at a suitable distance from the point of connection at the Existing National Grid Thorpe Marsh Substation (and the potential line drop connecting to existing overhead lines) to be able to export the electricity generated efficiently;

c. Is not located within designated green belt;

d. Is not located within internationally and nationally designated biodiversity sites and is not located within or close to areas of national or locally designated landscape value;

e. Is not located in close proximity to a large number of residential properties;

f. Uses low grade, non-BMV agricultural land;

g. Has good transport access for construction being in close proximity to the M62, M18 and A19 (Selby Road);

h. Minimises impacts on PRoW;

i. Has limited land use conflicts with existing non-agricultural businesses;

j. Is available to the Applicant during the construction and operation and maintenance phases of the Scheme;

k. Maximises use of areas in Flood Zone 1;

l. Avoids direct physical impact on designated heritage assets; and

m. Minimises impacts on ancient woodland.

3.4 Alternatives Sites to the Solar PV Site

3.4.1 The reasons that the Applicant selected the Solar PV Site are described in Section 3.3.

3.4.2 As detailed therein, the Applicant was required to consider alternative sites due to the relevant flood risk policy requirements set out at 3.3.18. In Accordance with those requirements, the Applicant has sought to identify suitable and available alternative land within Flood Zone 1, but no reasonably available Floor Zone 1 sites within the Applicant's area of search were identified (other than the areas of Flood Zone 1 that have been incorporated into the Solar PV Site following completion of the non-statutory consultation stage).

3.4.3 Further details of how alternative locations to the Solar PV Site have been considered in response to the flood risk policy requirement will be submitted with the Development Consent Order (DCO) Application. Compliance with these policy requirements will also be set out in the Planning Statement and Flood Risk Assessment to be submitted with the DCO Application.

3.5 Alternative Solar Design Technologies

3.5.1 As described in **PEIR Volume I Chapter 2: The Scheme**, the parameters of the DCO will maintain some degree of design flexibility to allow the latest technology to be utilised at the time of Scheme construction. Notwithstanding this, several design options in relation to the solar technology have been considered and where practicable at this preliminary stage, preferred options have been defined taking into account potential environmental effects, the Scheme requirements, and need for optimal functionality. Table 3-1 summarises these technological design alternatives and options being taken forward for further consideration and assessment.

Table 3-1: Solar Design Technological Alternatives

Design Technology Element	Considerations
Solar PV technology and arrangement	Three types of solar photovoltaic panels and their electricity production were considered at the EIA scoping stage (**PEIR Volume III Appendix 1-1: EIA Scoping Report**): a. Option 1 (fixed south facing solar panels) – an arrangement which remains static and has been commonly used on solar PV developments in the UK to date. The panel tilt is typically between 15 to 35 degrees from horizontal with a height of up to 3.5 m above ground and spacing of 2 m to 12 m between the Solar PV Panel arrays. b. Option 2 (fixed east-west facing solar panels) – an arrangement typically installed in a fixed triangular arrangement with one panel facing east and the other facing west which remain static. The panel tilt is typically between 15 to 35 degrees from horizontal with a height of up to 3.5 m above ground and spacing of 2 m to 4 m between the Solar PV Panel arrays. When compared with other arrangements, this would have lower biodiversity net gain (BNG) options because it removes space between the Solar PV Panel arrays which also reduces the ability to graze sheep in fields and the amount of light reaching the ground. The fixed east-west fixed option would also generate more construction traffic due to the larger volume of panels needing to be installed. c. Option 3 (single axis east-west tracker solar panels) – an arrangement which follows the position of the sun throughout the day via a horizontal north-south axis. The panel tilt ranges from +/- 60 degrees from horizontal with a height of up to 3.5 m above ground during early morning and late evening and

Design Technology Element	Considerations
	spacing of 4 m to 8 m between the Solar PV Panel arrays. The Solar PV Panels would be horizontal at midday and are also stored in a horizontal position over night. This means they are lower in height for most of the day compared to the fixed south facing arrangement and, therefore, could reduce the level of landscape and visual impact. This option requires a larger land area for each solar PV table, compared to fixed south facing, in order to limit any inter-row shadowing and obtain the maximum possible efficiency from the panels. The Applicant has determined that Option 1, fixed south facing solar panels, is appropriate for the scheme. This is because the fixed south facing option is more space-efficient than Options 2 and 3, thereby enabling the scheme to make the best use of the grid connection.
BESS arrangement	Two options for arranging the BESS have been considered: a. Option 1 (centralised arrangement) – arrangement would keep all BESS located, in containers, in a single field. This allows it to be co-located with other larger scale infrastructure such as the On-Site Substation, and enables this infrastructure to be sited in an area at low risk of flooding. b. Option 2 (decentralised arrangement) – arrangement with BESS located across and amongst the area of Solar PV Panel arrays. Likely require some BESS to be located in Flood Zone 2 and spreads the location of larger scale infrastructure across the site. Option 1 (centralised BESS) has been selected as the technically and environmentally preferred option.
Grid connection method	Four methods of providing the grid connection were considered at the EIA scoping stage (**PEIR Volume III Appendix 1-1: EIA Scoping Report**): a. Option 1 (400 kilovolt (kV) line drop to 400 kV/33 kV substation along the Grid Connection Corridor, close to the Solar PV Site); b. Option 2 (400 kV line drop to 400 kV/33 kV substation within the Solar PV Site); c. Option 3 (up to two underground 132 kV circuits connecting a 132 kV/33 kV substation along the Grid Connection Corridor or within the Solar PV

Design Technology Element	Considerations

Site to a 400 kV/132 kV substation along the Grid Connection Corridor, located close to and connecting via a 400 kV underground cable to the Existing National Grid Thorpe Marsh Substation); and

d. Option 4 (400 kV underground cables connecting a 400 kV/33 kV substation within the Solar PV Site to the Existing National Grid Thorpe Marsh Substation).

All options include the construction of above ground 132 kV/33 kV and/or 400 kV/33 kV substation(s) which involve some local ground disturbance and potential permanent adverse landscape and visual and other impacts. Option 1 and 2 involve an overhead line drop which would require an additional compound at or near the location of the line drop, however it would not require a new below ground cable between the Solar PV Site and the Existing National Grid Thorpe Marsh Substation. Options 3 and 4 would not require an additional compound, but would result in c. 6 km of below ground cables being laid within the Grid Connection Corridor.

The Scheme is retaining both options (i.e. for either a line drop or a below ground connection to the Existing National Grid Thorpe Marsh Substation) pending the outcome of discussions with stakeholders.

However, Options 1 and 3 have been ruled out by the Applicant as these would require the construction of a new substation outside and remote from the Solar PV Site, thereby introducing the potential for environmental impacts, including landscape impacts to locations outside of the Solar PV Site.

Options 2 and 4 continue to be taken forward at this stage.

Design Technology Element	Considerations
Arrangement of transformers, switchgear and inverters	Three options for the arrangement of the transformers, switchgear and inverters are being considered by the Applicant: a. Option 1 (all elements housed together) – proposed to house the transformers, switchgear and central inverter together in single container (Field Station Unit) within each Field Station. Field Stations will be distributed throughout the Solar PV Site. The Applicant is committed to locating Field Stations a minimum of 250 m from residential properties. b. Option 2 (transformers and switchgear housed together and separate string inverters) – transformers and switchgear housed together in a single container (Field Station Unit) within each Field Station. Field Stations will be distributed throughout the Solar PV Site. The Applicant is committed to locating Field Stations a minimum of 250 m from residential properties. Inverters will be provided separately as string-type arrangement within the Solar PV Panel arrays (on the rear of the frame mounts behind the panels or at the end of each frame). c. Option 3 (all elements housed separately) – transformers and switchgear will each form a separate item within each of the Field Stations. Field Stations will be distributed throughout the Solar PV Site. The Applicant is committed to locating Field Stations a minimum of 250 m from residential properties. Inverters will be provided separately as string-type arrangement within the Solar PV Panel arrays (on the rear of the frame mounts behind the panels or at the end of each frame). The Applicant is retaining the flexibility of implementing any of these three options and this flexibility has been assessed in the technical topic chapters reported herein. Therefore, the parameters of all three options have been presented in **PEIR Volume I Chapter 2: The Scheme** and assessed to ensure the worst case is considered within this PEIR, as set out in **PEIR Volume I Chapter 5: Environmental Impact Assessment Methodology**.

3.6 Alternative Layouts within the Solar PV Site

3.6.1 The layout of the Scheme has evolved iteratively and will continue to evolve through the integrated EIA and design process taking into consideration potential environmental effects, the Scheme's primary objective to deliver significant amounts of low carbon energy, and feedback from stakeholders and from the consultation process.

3.6.2 The purpose of this section is to describe the alternative layouts considered for the Solar PV Site to date. The Design and Access Statement (DAS) to be submitted with the DCO Application will explain in detail the design evolution of the Scheme.

3.6.3 Since the initial identification of the Solar PV Site, there have been several stages of design evolution to date - these are explained further in Table 3-2.

Table 3-2: Main Design Layout Iterations for the Solar PV Site

Stage	Proposed Layout	Consultation which Influenced the Layout	Design Evolution
EIA Scoping and Non-Statutory Consultation Layout (June and July 2023)	The Solar PV Site boundary represented the anticipated maximum extent of land being considered at the EIA scoping and non-statutory consultation stages. The layout comprised an approximately 323 hectare (ha) area located off Lawn Lane to the south of the River Went in Fenwick, Doncaster. No detailed layout was explored at this stage.	Discussions with landowners, and National Grid Consultation with Statutory Environmental Bodies as part of the EIA Scoping process including Natural England, Environment Agency and Historic England. Consultation with other key stakeholders as part of the EIA Scoping Process including City of Doncaster Council, National Highways, Yorkshire and Humber Drainage Boards, Yorkshire Water, South Yorkshire Police and South Yorkshire Archaeology Service. The land assembled was chosen prior to extensive consultation and, therefore, was not influenced by other stakeholders.	The EIA Scoping Layout was produced with limited data from desk based and preliminary environmental surveys. It was an initial boundary of land assembled by the Applicant for the Solar PV Site taking into account known planning and environmental constraints and other factors as discussed in Section 3.3. The land assembled was informed by meetings with landowners and National Grid regarding the point of connection. The main factors at this early stage which influenced the extent of land identified included flexibility in the type of Solar PV Panels as discussed in Table 3-1 which have varying land take requirements.
PEIR Layout	The Solar PV Site comprises an	Discussions with landowners and other key stakeholders	The layout of the Solar PV Site was developed as part of a strategic masterplanning process, influenced by the

Stage	Proposed Layout	Consultation which Influenced the Layout	Design Evolution
	approximately 421 ha area located off Lawn Lane to the south of the River Went in Fenwick, Doncaster. The layout of the Scheme at this preliminary stage is shown on **PEIR Volume II Figure 2-3: Indicative Site Layout Plan**.	including Natural England, Environment Agency, Historic England, National Grid; Network Rail, City of Doncaster Council, North Yorkshire Council and South Yorkshire Fire Service. Non-statutory consultation feedback.	outcome of baseline ecology, landscape and visual, heritage, flood risk, access surveys, and consultation feedback. Additional land to the south west and south east of the EIA Scoping Layout have been incorporated into the Solar PV Site after non-statutory consultation following discussions with landowners in the vicinity of the Solar PV Site. This feedback identified this land as available, suitable and adjacent to the Solar PV Site (with such land predominantly being located in Flood Zone 1). This additional land provides flexibility for designing the Solar PV Panel arrangement (as discussed in Table 3-1 above) and for providing potential mitigation areas that may be needed, but are not yet known due to ongoing surveys. Design principles at this preliminary stage which have influenced the proposed layout include: Climate a. Efficiently generate a large amount of renewable energy for supply to the National Electricity Transmission System, maximising use of the available grid connection capacity, and contribute towards the UK meeting its net zero targets. b. Minimise embodied carbon by selecting low-carbon materials where practicable, utilising efficient designs and implementing sustainable practices throughout construction, operation and maintenance and decommissioning.

Stage	Proposed Layout	Consultation which Influenced the Layout	Design Evolution
			c. Ensure the Scheme is designed to be resilient to future climate change. People d. Demonstrate considerate neighbourly conduct during the construction, operational and maintenance and decommissioning phases of the Scheme. e. Embrace open and transparent interactions with nearby communities, stakeholders, and residents, leveraging their local insights to mitigate and enhance the Scheme. f. Maintain existing levels of public right of way connectivity through and across the site and enhance routes within the Order limits, where practicable. Place a. Seek to establish spaces that can serve for energy generation, biodiversity improvement, water and flood control, and green infrastructure. b. Seek to safeguard the water environment and be resilient from flooding both now and in the future. c. Site the Scheme sensitively in the landscape, respecting the distinctive and unique character of settlements adjacent to the site and the surrounding countryside and exploring reasonable opportunities to mitigate visual impacts. d. Develop the Scheme sensitively with regard to cultural heritage assets and their settings. Value

Stage	Proposed Layout	Consultation which Influenced the Layout	Design Evolution
			e. Acknowledge the ever-changing and progressing state of technology and strive to use current and advanced options to optimise efficiency. f. Seek opportunities for local communities and businesses to benefit economically through promoting employment opportunities locally and opportunities for local business to tender to supply services in delivery of the Scheme.

3.7 Selecting the Grid Connection Corridor

3.7.1 The Scheme will connect to the national electricity transmission system either via cables routed within the Grid Connection Corridor, or via line drop connecting to existing overhead lines within the Solar PV Site. At this stage it is anticipated that it is most likely that the connection will take the form of cables routed within the Grid Connection Corridor, however, the Applicant is continuing to explore the line drop solution. The sections below provide details regarding how the route of the Grid Connection Corridor has been selected and evolved.

3.7.2 The Grid Connection Corridor is shown in **PEIR Volume II Figure 1-2: Site Boundary Plan** and **PEIR Volume II Figure 2-3: Elements of the Site**.

3.7.3 The Grid Connection Corridor links the On-Site Substation to the Existing National Grid Thorpe Marsh Substation, located north west of Kirk Sandall and west of Barnby Dun. The Grid Connection Corridor is contained within the Solar PV Site, where practicable, before it travels south to the Existing National Grid Thorpe Marsh Substation. The land use within the Grid Connection Corridor is predominantly agricultural. **PEIR Volume I Chapter 2: The Scheme** describes how the cabling is expected to be laid.

3.7.4 Table 3-3 summarises the main factors that have determined the selection of the Grid Connection Corridor from the southern extent of the Solar PV Site to the Existing National Grid Thorpe Marsh Substation.

Table 3-3: Grid Connection Corridor Considerations

Criteria	Considerations	How these Considerations have Influenced the Proposed Grid Connection Corridor at this Preliminary Stage
Operational and engineering requirements	• Point of connection at the Existing National Grid Thorpe Marsh Substation. • Optimising routing so the cable can be laid in roadside verges in a straight line or in shallow curves so that the cable can be pulled through the ducting efficiently. • Requires space to undertake the works to lay the cable.	A corridor has been identified which is as direct a route as practicable to the point of connection, avoiding any losses in transmission. The Grid Connection Corridor optimises routing to ensure the cable can be laid in a straight line or shallow curve so that the cable can be pulled through the ducting efficiently. The route crosses agricultural land and therefore there is sufficient space for jointing bays and pits. There is sufficient working area for cable trenching. There is a sufficient working area for crossing obstacles.
Planning and environmental constraints[1]	• Proximity to residential properties in local settlements. • Proximity to other land uses such as businesses and other existing and proposed infrastructure. • Proximity to international and nationally designated biodiversity sites. • Proximity to nationally or locally designated landscapes. • Proximity to public rights of way. • Proximity of designated heritage assets.	The Grid Connection Corridor avoids passing through settlements including Thorpe in Balme and the hamlets of Hawkhouse Green and Trumfleet. The corridor is not located within, or in close proximity, to nationally or locally designated landscapes or ecological designations. Direct impacts on designated assets have also been avoided with listed buildings and scheduled monuments outside the proposed corridor. There may still be impacts on the setting of such assets but these would be temporary.

[1] Drawn from national and local policy requirements

Criteria	Considerations	How these Considerations have Influenced the Proposed Grid Connection Corridor at this Preliminary Stage
	• Flood risk. • Sensitivity of watercourse crossings and the Environment Agency and Internal Drainage Board's requirements for watercourse crossings. • Avoiding where practicable best and most versatile agricultural land.	Flood risk has been identified and the Grid Connection Corridor is located largely within Flood Zone 3 with smaller areas of Flood Zone 2 along its central section and approximately 700 m within Flood Zone 1 toward its northern extent. The location of the Grid Connection Corridor in Flood Zones 2 and 3 will not impact on the operation of the below ground cables. The corridor also avoids other land use conflicts and is predominantly agricultural. Natural England's provisional ALC mapping suggests that the Grid Connection Corridor and Existing National Grid Thorpe Marsh Substation are located predominantly within Grade 4 land with some areas of Grade 3 land in the central section of the Grid Connection Corridor between the villages of Moss and Thorpe in Balne. Therefore, the agricultural land within the Grid Connection Corridor and Existing National Grid Thorpe Marsh Substation is not anticipated to comprise a large amount of BMV land. Approximately 1.47 km of the length of the Grid Connection Corridor is located within a mineral safeguarding area (MSA) for sand and gravel, and a further approximately 1.1 km is located within the associated MSA buffer.
Other land use and land ownership constraints	• Minimising number of affected landowners. • Following field edges in order to minimise possible disturbance for the landowner when farming or using land for other purposes.	The corridor is crossed by eight watercourses which, from north to south, include Ell Wood and Fenwick Grange Drain, Moss Road and London Hill Drain, Moss Little Common Drain, Hawkhouse Green Dike, Mill

Criteria	Considerations	How these Considerations have Influenced the Proposed Grid Connection Corridor at this Preliminary Stage
	• Following the road network where practicable and reducing interaction with the rail network, utilities and other infrastructure such as the existing National Grid infrastructure and its proposed infrastructure.	Dike, Wrancarr Drain, Engine Dike, and Thorpe Marsh Engine Drain. Horizontal Directional Drilling (HDD) will be needed to meet the requirements of the Environment Agency and Internal Drainage Board (IDB). The routing of cables within the Grid Connection Corridor will be to the edges of fields and the road network where this is practicable, to minimise the number of landowners affected.

3.7.5 Based on consideration of these factors, the Applicant initially identified a Grid Connection Corridor Search Area of approximately 2,010 ha and up to approximately 3 km wide, broadly between the railway line to the west and the River Don and the Village of Braithwaite to the east (see **PEIR Volume II Figure 3-1: EIA Scoping and Non-Statutory Consultation Boundary**). This was presented at the EIA scoping and non-statutory consultation stages (**PEIR Volume III Appendix 1-1: EIA Scoping Report**). The Grid Connection Corridor has since been refined to an approximately 100 m wide corridor based on desk-based environmental information, engineering and construction requirements, and land constraints.

3.7.6 The Grid Connection Corridor now being proposed has been designed to take a direct route whilst following existing linear features such as roads and avoiding sensitive receptors as far as practicable, such as habitat designations, residential and commercial properties, heritage assets and a large number of land interests. It will be further refined prior to the DCO Application submission based upon ongoing studies and surveys, as well as feedback from consultees. The routing of the cables inside this wider corridor will follow field edges as far as practicable to minimise disturbance to agricultural land, or cables will be run in the roadside.

3.7.7 The Grid Connection Corridor is largely located within areas of medium risk of fluvial flooding (Flood Zone 2) and high fluvial flooding (Flood Zone 3) (see **PEIR Volume II Figure 9-4: Environment Agency Flood Map for Planning (Rivers and Seas)**). As discussed in Section 3.3, the Existing National Grid Thorpe Marsh Substation has the capacity and availability to accept the electricity generated by the Scheme. The identification of the Grid Connection Corridor considered the flood risk context and confirmed that a corridor outside Flood Zones 2 and 3 connecting the Solar PV Site to the Existing National Grid Thorpe Marsh Substation would not be possible as the Existing National Grid Thorpe Marsh Substation and surrounding land in all directions for several km is located in Flood Zone 3. Therefore there are no reasonable alternatives within areas of Flood Zone 1 or that avoid Flood Zone 3. The location of the Grid Connection Corridor in Flood Zones 2 and 3 will not impact on the operation of the below ground cables.

3.7.8 Approximately 1.47 km of the length of the Grid Connection Corridor is located within a mineral safeguarding area (MSA) for sand and gravel, and a further approximately 1.1 km is located within the associated MSA buffer. The factors in Table 3-3, including in particular the need for a direct route that follows existing linear features, minimises the number of land owners affected, and avoids sensitive receptors, interaction with utilities and environmental designations as far as practicable, are the reasons that the Grid Connection Corridor is routed as proposed. A Mineral Safeguarding Report has been prepared to consider the impact of the proposed cables on the MSA (**PEIR Volume III Appendix 12-2: Minerals Safeguarding Report**). This notes that the cables will be installed via a shallow and narrow trench (approximately 0.7 m wide and 1.2 m to 1.4 m deep) and that this would not prevent potentially economic mineral resource being extracted in the future, in the unlikely scenario that proposals for extraction were to come forward.

3.8 Summary

3.8.1 The Scheme's primary objective is to deliver a significant amount of low carbon energy to help meet the UK's growing need for low carbon electricity and its legal and policy obligations with regard to climate change and net zero.

3.8.2 Following statutory consultation, the feedback received will be reviewed and will further inform the design for the Scheme. The design of the Scheme will continue to evolve through the integrated EIA and design process, taking into consideration the consultation feedback and environmental effects identified. Options considered by the Applicant through this process will be reported in more detail in the ES and other supporting documentation that will be submitted with the DCO Application.

3.9 References

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