CHAPTER 4: PROPOSED DEVELOPMENT

Document Properties		
Regulation Reference	Regulation 5(2)(a)	
Planning Inspectorate Scheme Reference	EN010123	
Application Document Reference	6.1.4	
Title	Chapter 4: Proposed Development	
Prepared By	Heckington Fen Energy Park Project Team (Pegasus)	
Version History		
Version	**Date**	**Version Status**
Rev 1	February 2023	Application Version
Rev 2	March 2023	Additional Submission- s55 response
Rev 3	August 2023	Change Application

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4 PROPOSED DEVELOPMENT

4.1 INTRODUCTION

4.1.1 This chapter provides a description of the Proposed Development. The physical characteristics of the Proposed Development are described alongside the proposed programme of works. The key activities that would be undertaken during construction, operation (which includes maintenance), and decommissioning are included in this chapter; each of these phases inform the technical assessments included in this Environmental Statement.

4.1.2 The Proposed Development is defined under sections 14(1)(a) and 15(2) of the Planning Act 2008 as a Nationally Significant Infrastructure Project (NSIP), as it consists of construction of an onshore generating station in England exceeding 50 megawatts (MW). Associated development and other ancillary works are also proposed as part of the Proposed Development. The Proposed Development and associated infrastructure are defined in Schedule 1 of the draft Development Consent Order (DCO) (document reference 3.1) and explained within the Explanatory Memorandum of the draft DCO (document reference 3.3).

4.1.3 The DCO application description considered within this Environmental Statement is for a:

> **"Development Consent Order Application for Ground Mounted Solar Panels, Energy Storage Facility, Below Ground Grid Connection to, and extension at, Bicker Fen Substation and all associated infrastructure works."**

4.2 ROCHDALE ENVELOPE

4.2.1 The Proposed Development comprises of an Energy Park with solar PV and Energy Storage System (ESS) and supporting infrastructure. Solar PV and ESS are rapidly evolving and as a result the DCO application and supporting Works Plan (document reference 2.2) will require a degree of flexibility to allow the latest technology to be utilised at the time of construction.

4.2.2 The draft Development Consent Order (DCO) (document reference 3.1) and Works Plans (document reference 2.2) allow for a flexible use of space within the Proposed Development both in terms of the type of activity that can be undertaken in a given area and in temporal terms. The flexibility that is to be sought, and how this will be considered in the technical assessments is set out in Table 4.1 below.

Table 4.1 Flexibility sought within the DCO and Works Plans

Flexibility Sought	Assessment Approach
Certain areas of land will be able to be used as combination of solar PV and/or in some instances an operational compound	Where this is sought the **Works Plans** (document reference 2.2) and the technical assessments within the ES will have all taken a consistent worst-case approach of assuming the maximum spatial parameters for these infrastructure elements, these areas assumed as the worst case for all disciplines.
Land use for temporary construction compounds during construction will be able to be used for solar PV once its construction use is completed	The temporarily used compounds during construction will be assessed as part of the construction phase assessment. Solar panels, gatehouses or spare containers have been assumed to be in place at these locations in the operational assessments (for the use which is worst case by the technical authors).
Cabling will take place across the Proposed Development, including underneath landscaping and other construction and operational areas.	Underground works have been assumed in all areas where this is permitted on the Works Plans (document reference 2.2 / AS-004) and above ground works have been assumed in all areas where they are permitted on the Works Plans (document reference 2.2 / AS-004). The locations where important hedgerows may need to be removed are shown on the Important Hedgerows Plan (document reference 2.9 APP-014). There are no areas where existing landscaping would need to be removed within the Energy Park. The areas where landscaping may need to be removed relate to sections within the Offsite Cable Route Corridor and the land used by National Grid Bicker Fen Substation. The exact location and extent of removal will be known when the final location of the offsite cable and detailed design of the National Grid Bicker Fen Substation extension is known. The Landscape Assessment (document reference 6.1.6 / APP-059) has assessed a worst-case scenario. It has assessed that sections of the landscaping at locations along the Offsite Cable Route Corridor, shown within the Important Hedgerows Plan (document 2.9 / APP-014), will be removed whilst construction takes place and then replaced once the construction/laying of the cable has been completed. This assumption has been

Flexibility Sought	Assessment Approach
	made to ensure that when the final methodology for laying cabling, in these locations, (HDD, open cut or dam & pump) the loss of landscaping has been assessed. The timing of the landscaping replacement will be seasonally dependent. To ensure that the Landscape Assessment (document reference 6.1.6 / APP-059) has considered the 'worst case scenario' it has assessed that any replacement areas of landscaping along the Offsite Cable Route Corridor would be planted as 'whips' (60-80cm in height).
Cabling which connects the Onsite Substation to the National Grid Bicker Fen Substation will be laid underground in land shown within the Onsite and Offsite Cable Route Corridors.	The extent of the Cable Route Corridor is wider than needed for the laying of this cable. The extent is wider to allow for some flexibility on the final location within this area, and a sufficient working swathe to construct within. Flexibility is needed to allow for ground conditions when the work takes place. The assessments have assumed that the cable could be placed anywhere within the Onsite and Offsite Cable Route Corridor.
Land Use for the Offsite Cable Route Corridor from Heckington Fen to Bicker Fen Substation.	There is one main Offsite Cable Route Corridor which runs from the Energy Park site to the National Grid Bicker Fen Substation. When the Offsite Cable Route Corridor reaches the fields to the immediate north of Bicker Fen Substation, it deviates into two options. Only one will be used. The two options remain as legal discussions are ongoing with landowners of the approved but not yet built Vicarage Drove Solar Farm to the immediate west of Bicker Fen substation for access to lay the necessary underground cable through the development. If legal agreements can be achieved the western route would be progressed. If not, the eastern route would be used which brings the underground cabling around the approved solar farm and takes a more direct route into the Bicker Fen substation over National Grid owned land. The physical area needed for the laying of the grid route is a swathe 25m wide. An area wider than this 25m swathe is included in places in the Order Limits up to

Flexibility Sought	Assessment Approach
	406m[1] to provide flexibility for the final grid route design and allow micro siting of the cable within the corridor to account for constraints such as ground conditions and environmental factors including any potential features of archaeological interest (if relevant based on desk-based assessments and Geophys).
Land Use for the National Grid Bicker Fen Substation Extension design.	The required extension at the Bicker Fen substation will be located in a new southwest bay. The detailed design for the extension by National Grid is yet to commence and so flexibility in land use is required to enable the necessary optionality at this time. There are two design options, the first an Air-Insulated Switchgear System (AIS) and the second is a Gas-Insulated Switchgear (GIS) System. Only one of these two options would be built as a result of the Energy Park. If the detailed design confirms the AIS option is viable, this is the preferred technical option for National Grid. The physical area needed for the AIS option is 14,112m^2 and 5,625m^2 for the GIS option. The additional area of land for the new cable sealing end (CSE), which is needed for either design option, is 9,041m^2. The locations for these areas are shown on Figure 4.27 (Document Reference Pre ExA.ChangeApp.ESFIG4.27.V1). The locations where existing landscaping at Bicker Fen Substation may need to be removed are shown on Figure 3.8 – Extent of plantation clearance at Bicker Fen National Grid Substation (document reference Pre-ExA.ChangeApp.ESFIG3.8.V1) . The areas where landscaping may need to be removed relate to a line of 'gappy' trees immediately south of the existing electrical kit within the Bicker Fen Substation and a section of plantation woodland at the southern extent of the Bicker Fen Substation. The exact extent of removal will be known when the final detailed design of the National Grid Bicker Fen Substation extension is known. However,

[1] This is the widest extent of the Offsite Grid Connection Route Corridor. This area is where the cable route leaves the Energy Park site. The extent remains wide to allow flexibility in the location of joint pits and directional drills around road crossings, drainage ditches and the crossing of existing underground high voltage cables (e.g. Triton Knoll and Viking Link north of the A17). There is also a need to allow flexibility for the appropriate allowances for cable bending radius.

Flexibility Sought	Assessment Approach
	maximum extents for the Heckington Fen bay and all associated equipment are included. The Landscape Assessment (document reference 6.1.6) has assessed a worst-case scenario. It has assessed that the line of 'gappy' trees and plantation woodland (approximately 0.4ha) will be removed. To ensure that the Landscape Assessment (document reference 6.1.6) has considered the 'worst case scenario' it has assessed that there will be no mitigation or enhancement planting within the Order Limits at National Grid Bicker Fen Substation. Additional tree planting of 0.42ha is provided to compensate for the felling of the area of plantation woodland at National Grid Bicker Fen substation and has been included within the north-western section of the Energy Park (Field G8 of Figure 1.4- Field Plan (document reference 6.2.1/APP-077). The location of this additional tree planting can be seen in the Outline Landscape Environmental Management Plan (oLEMP) (Document Reference 7.8) and Figure 6.2: Landscape Strategy Plan (Document Reference: 6.26)

4.2.3 Given the flexibility applied for and in order to ensure a robust assessment of the likely significant environmental effects of the Proposed Development, the Environmental Impact Assessment (EIA) has been undertaken adopting the principles of the 'Rochdale Envelope', where appropriate, as described in the Planning Inspectorate Advice Note 9[2]. This involves assessing the maximum (and where necessary the minimum) parameters of the Proposed Development where flexibility needs to be retained, as set out above. Where specific elements of flexibility need to be considered by a technical discipline in the context of the Parameters set out in this chapter (Table 4.1), this has been confirmed within the relevant chapters of the Environmental Statement.

4.2.4 This approach sets worst case parameters for the purpose of the assessment but does not constrain the Proposed Development for being built in a manner that would lead to lower environmental impacts. The draft DCO secures the likely worst-case parameters, providing certainty that the impacts of the Proposed Development will be no worse than those assessed as part of the Environmental Statement.

4.3 INDICATIVE TIMESCALES FOR THE PROPOSED DEVELOPMENT

4.3.1 Indicative timescales for the construction and operation of the Proposed Development that have been assumed for the purpose to the assessment are as follows:

- It is currently anticipated that (subject to the necessary consents being granted) construction work will commence, at the earliest in the Spring of 2025 and will run for 30 months. This assumes that the Proposed

[2] Planning Inspectorate (2018) Advice Note Nine: Using the Rochdale Envelope

Development will be built in a single continuous build, which is considered to give rise to the worst-case scenario for the purpose of the assessment. Construction in a single build, rather than multiple builds spaced over longer timescales, would result in higher peak traffic volumes and a greater number of construction activities being undertaken concurrently (generating noise, dust etc). This continuous build would be broken down into a series of phases where it is likely that a few fields would be built at the same time before moving on to the next area of the Energy Park. The National Grid Bicker Fen Substation extension works are expected to be broken down into their own phase(s). The phasing plan included within this ES is indicative only (see Figure 4.3- Indicative Phasing Plan (document 6.2.4 / APP-110)); the final phasing of the construction process would be finalised post consent, as secured by Requirement 3 of the draft Development Consent Order (document reference 3.1 / APP-015).

- It is currently anticipated that the earliest the Proposed Development will commence commercial operation is Autumn 2027.
- The operational life of the Proposed Development is to be 40 years and decommissioning is therefore estimated to take place no earlier than 2067. Decommissioning is expected to take in the region of 6-18 months and will be undertaken in phases. A 6-18 month decommissioning period has been assessed for the purpose of a worst-case assessment in this Environmental Statement.

4.4 NEED FOR THE PROPOSED DEVELOPMENT

4.4.1 The case for the need for the Proposed Development is centred on its significant contribution to the three important national energy policy aims, which are:

- Decarbonisation – achieving Net Zero by 2050 and the importance of urgently deploying zero-carbon generation assets at scale – the Proposed Development will provide a large-scale low carbon energy generating asset which is expected to be operational during 2027.
- Security of supply – geographically and technologically diverse supplies – the Proposed Development will provide the security of supply due to its large scale; direct connection to the National Electricity Transmission System, meaning the power that is generates has a national benefit; ability to complement other renewables and the efficient opportunity to integrate energy storage into the design of the Site to help balance electricity needs over the wider Grid system.
- Affordability – the Proposed Development will provide large scale generation at low cost which removes the market fluctuations from fossil fuel costs, which lead to energy prices rising for the end user.

4.4.2 The Proposed Development will therefore be a critical part of the development of the UK's portfolio of large-scale solar generation required to decarbonise its energy supply and provide secure and affordable energy supplies.

4.4.3 There are layers of International and National Policy and Reports which indicate the need for moving away from the use of fossil fuels for energy generation and a move towards the development and use of renewable energy generation sources. The most recent of these is the Energy Security Strategy, 2022[3] which has indicated that the UK will

[3] British energy security strategy, April 2022, available at: https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy (accessed January 2023)

need to increase its solar generation capacity five-fold by 2035. The details of these policies can be seen in Chapter 5: Planning Policy (document reference 6.1.5 / APP-058) of this Environmental Statement.

4.4.4 A Statement of Need and Planning Statement (document reference 7.3 / APP-234) is submitted with the DCO application. For reference, if the draft NPS EN-3 is adopted before the DCO application is submitted, it would dispense with the requirement for a Statement of Need. However, as the timeframe for the adoption of this draft policy document is still to be defined, the applicant has prepared a Statement of Need on the understanding that this DCO application will be submitted prior to the draft NPS EN-3 being adopted.

4.5 KEY COMPONENTS OF THE PROPOSED DEVELOPMENT

4.5.1 The key components of the Proposed Development are:

- Solar PV panels;
- PV module mounting structures;
- Inverters;
- Transformers;
- Switchgear;
- Cabling (including extra high, high, and low voltage power, earthing, communication, and control) – below ground for the grid connection to Bicker Fen, and in trenches and/or behind the panels on the Energy Park;
- Energy Storage Systems (ESS) (technology not determined at this time);
- Water storage tanks within the ESS, which is present as mitigation for potential fire risk within the ESS;
- Onsite substation comprising substation and control buildings;
- Fencing, Gatehouses and Security Measures (including CCTV cameras);
- Internal access tracks;
- Community orchard;
- Permissive path;
- Construction of new access point from the Energy Park onto highway (previously consented as part of the previous wind park application);
- Landscaping including creation of new habitat areas;
- Construction of temporary construction areas and worker facilities;
- Digging of cable trench/moling and laying underground cables for connection to the National Grid Bicker Fen substation
- Installing above ground grid cable access points along the Cable Route Corridor;
- Improving existing access points off highways for construction access for Grid Route; and
- Extension of Bicker Fen National Grid Substation to include the clearance of a section of plantation woodland and installation of all above and below ground equipment (technology not determined at this time) and associated works.

4.5.2 Once operational the Energy Park site will remain operational for 40 years. After this time the Energy Park site will be decommissioned. The assessment for the decommissioning phases assumes that all the structures on the Energy Park site will be removed. The above ground structures (link boxes) along the Offsite Cable Route Corridor will be removed, but all cable laid will remain buried. National Grid have indicated that the above ground equipment (for both AIS and GIS technical design) that is installed at Bicker Fen for this Energy Park will, once operational, have split ownership, where some of the equipment is owned by them and other parts owned by the Applicant. At decommissioning, the equipment owned by the Applicant will be removed, but the equipment owned by National Grid will remain. It should be noted at this point that if the GIS solution is progressed, over the lifetime of the Heckington Fen project other (currently unknown) grid connections may be housed within the GIS housing building. Therefore, at decommissioning of the Heckington Fen Energy Park the GIS housing building would remain as the barn would have passed into the ownership of National Grid. The indicative extent of this new GIS housing building can be seen in Figure 4.28 (document reference: Pre-ExA.ChangeApp.ESFIG4.28.V1) The permissive path within the Energy Park will also cease to be open, and the route will return to that of the current definitive route of PROW HECK/15/1.

4.5.3 The elevation plans within this ES are indicative and designed to fit within the maximum extents for the proposed scheme. Final equipment selection will depend on the timescales and availability of the components and dimensions/number/locations. The power ranges of equipment may change but will be comparable to parameters given and assessed within this ES.

Solar PV Infrastructure

4.5.4 Illustrative figures for the solar PV technology are provided in Figures 4.4 – 4.26 (document reference 6.2.4 / APP-111 – APP-133). The layout of the solar PV infrastructure has been determined through consultation with the landowner, drainage board and known utility asset owners. On site there is a high-pressure gas pipeline which runs in a north-south direction across the centre of the Energy Park site. A series of drains, some maintained by the Black Sluice Internal Drainage Board (IDB) and some by the Landowner are located in the Energy Park site.

4.5.5 A setback distance of 5m from power lines, and the c.24m easement for the pipeline has been incorporated into the design. The fencing is proposed to cross the gas pipe along with one new access track. The fencing will allow access to the pipeline at all times for the operators. An alternative fencing solution has been considered as a worst case which would increase fencing requirements by 3.3km. A 9m setback from IDB ditches has been incorporated to enable ongoing maintenance throughout the operational lifetime of the Energy Park.

Solar PV Modules

4.5.6 Individual modules/panels are typically 2-2.5 metres long and 1-1.5 metres wide and typically consist of a series of cells which make up each panel. The module frame is typically built from anodised aluminium. Several panels can be installed in either the landscape or portrait orientation on the racking, see Figure 4.4 – Solar Panel Elevations (document reference 6.1.4 / APP-111). and would remain stationary during operation.

4.5.7 Each module could have a DC generating capacity around 600 watts (W), or more depending on advances in technology.

4.5.8 The number of modules required at the Development will be highly dependent upon the iterative layout design process however the initial Indicative Site Layout is shown in Figure 2.1 (document reference 6.2.2 / APP-078).

4.5.9 The modules are fixed onto a mounting structure in groups known as tables. This mounting structure would be fixed in one position and at one angle, typically, between 10 and 20 degrees, The number / type / rating of the modules which will make up the project is not yet known. Various factors will help to inform the number and arrangement of modules, and it is likely some flexibility will be required to accommodate future technology developments.

Module Mounting Structures

4.5.10 The modules will be mounted on a rack or table supported by galvanised steel poles driven into the ground, depending on ground conditions and 'pull-out' tests prior to construction, these could be approximately 3m deep. Three mounting structure options are defined within the DCO. These (a) piles rammed into a hole; (b) a pillar attaching to a steel ground screw; or (c) a pillar set in concrete in a pre-made hole in the ground (micro piled). Option (a) is expected to be the most likely foundation solution. As shown on Figure 4.4 Solar Panel Elevations (document reference 6.2.4 / APP-111) any of these foundation solutions could offer a foundation depth of between 1-3m. Between each table of panels there could be a separation distance of 3-5m to maximise generation and allow sufficient access for maintenance, see Figure 4.4 – Solar Panel Elevations (document reference 6.2.4 / APP-111).

4.5.11 The assessments within the ES have assumed that panel modules are mounted on structures with a ground clearance of 1.5m and an upper height of a maximum of 3.5m in the northeast section of the Energy Park site. The remaining area of the Energy Park site for solar panels has a maximum height of 3m with the lower edge being 1m.

4.5.12 Figure 4.1c- Proposed Solar PV Development Area (document reference 6.2.4 / APP-104) details the solar infrastructure arrangement.

Inverter and Transformer Station

4.5.13 Inverters and transformers are required to convert low voltage DC electricity generated by the PV modules into high voltage alternating current (AC) which allows the electricity to be exported to the National Grid.

4.5.14 As a worst-case scenario multiple central inverters, with a maximum number of 127 have been assessed. The unit itself tends to be containerised with associated control, switchgear equipment and transformer within a 13m x 4m x 4m (maximum dimensions) container and will be distributed throughout the Energy Park site. Depending on the final site configuration each unit would be typically rated around 3 to 9MW. An alternative arrangement would use smaller string inverters mounted to the module supports; this could mean a reduced footprint of the units as it would then only contain the transformers and switchgear. See Figure 4.5 – Inverter and Transformer Station Elevations (document reference 6.2.4 / APP-112). e.g. it is possible the Energy Park site could use around 60 x 7MW inverter and transformer stations or around 100 x 4MW inverter and transformer stations.

4.5.15 Transformers are required to control the voltage of the electricity generated across the Energy Park site and efficiently transmit the power from the inverters to the Onsite Substation located in the centre of the Energy Park. To connect to the National Grid, main step-up transformers will raise the voltage to 400kV. A number of small transformers will also be required for providing auxiliary supplies to buildings and control equipment.

4.5.16 For the main step-up power transformers, the approximate dimensions will be 15m x 10m x 12m. Auxiliary transformers will be approximately 4m x 4m x 4m.

4.5.17 Figure 4.1d- Proposed Energy Storage System and New Infrastructure (document reference 6.2.4 / APP-105) details the solar infrastructure location.

Energy Storage System (ESS)

4.5.18 An energy storage facility will be an associated part of the electrical infrastructure of this Proposed Development. It is proposed that there will be an energy storage area located in the central section of the Energy Park site, located on land to the north of the existing farm buildings. The ESS will be housed in a series of individual containers. It is estimated at this time that the storage capacity of this Energy Park site would be approximately up to 200-400MW. A maximum of 5.3ha is set aside for this element of the Energy Park Development, within the wider Energy Storage and main Onsite Substation and control buildings. The combined area is 11.9ha. The maximum height of structures within the Energy Storage Area is 6m.

4.5.19 The ESS will likely be a containerised design utilising standard dimension 40ft shipping containers. Each of these containers has dimensions of up to 13m x 4m x 6m, see Figure 4.6 – Energy Storage Elevations (document reference 6.2.4 APP-113). It is estimated that the ESS will consist of up to 400 containers.

4.5.20 The ESS is likely to include batteries, inverters and system controllers but its final design has not yet been determined. Inverters/power converters are required to convert the DC to AC and to house the switchgear. For the purpose of this assessment, it has been assumed that up to 100 inverters will be included. The dimensions of these inverters would be up to 6m x 3m x 6m, see Figure 4.7 – Energy Storage Inverter Elevations (document reference 6.2.4 / APP-114). Transformers will also be required to step up from the inverter voltage. For the purpose of this assessment, it has been assumed that up to 100 transformers will be included. The dimensions of these transformers would be 5m x 3m x 4m, see Figure 4.8 – Energy Storage Transformer Elevations (document reference 6.2.4 / APP-115). Finally, there will be a Central Control Room Figure 4.21 (document reference: 6.2.4 / APP-128). This would be required for energy storage monitoring and control, telecoms, protection, O&M storage, welfare facilities etc. The welfare facilities would include a containerised septic tank. It is the current wish that rainwater harvesting could be used for the welfare facilities. The dimensions for this central control room would be 20m x 10m x 4m.

4.5.21 Through discussions with Lincolnshire Fire and Rescue Service and risk management consultants, a series of water storage tanks and lagoons have been allowed for within the ESS area. These tanks and lagoons are to store water that could be used to hose on to the EES containers, to keep them cool, if needed in the event of a fire. This water would then be gathered in a bunded system within the ESS area to be pumped and tanked off site for safe disposal. The need and reasoning for these water storage tanks and lagoons is considered in more detail in Chapter 18: Miscellaneous Issues (document reference 6.1.18 / APP-071) and the Outline Energy Storage Safety Management Plan (document reference 7.11 / APP-242).

4.5.22 The indicative design would include up to 10 tanks each with dimensions of 10m diameter x 4m, see Figure 4.10 – Water Tank Elevations (document reference 6.2.4 / APP-117). At this indicative design stage, the mix would be up to 8 for clean water and 2 for storage of contaminated water. These tanks may be partially sunk below ground. If a lagoon is needed within the design, it would be gravity fed and would cover an area of 120m x 30m. The depth of this lagoon would be 2m, contained by either an earth bund or kerb with a height of 1m, see Figure 4.11 – Lagoon Elevations (document reference 6.2.4 / APP-118).

4.5.23 Any system installed will be compliant with the appropriate standards and strenuously tested during the factory and pre-commissioning testing regime before being given the final sign off to energise.

4.5.24 There are 2 main battery storage options used within the industry. These are Li-ion with a few different chemistry options (NMC/LFP) (Nickel-Manganese-Cobalt / Lithium-Iron Phosphate) and Flow battery technologies.

- Li-ion is an established technology that has been used in mobile phone/laptops electric vehicles for many decades. The battery cells are housed in purpose-made containers, which include an extremely efficient an intelligent management system as well as state of the art cooling and fire suppression systems.

- The systems can detect the off-gases predating the thermal runaway event and shut down the malfunctioning cell/rack safely. The sensors used to do this are sensitive down to 1pmm (parts per million)
- LithiumIron Phosphate as a chemistry has a higher thermal runaway temperature threshold and hence, improved battery safety and tends to be more commonly used in stationary storage applications.
- Flow batteries use electrolyte as an aqueous form which is inherently safe and non-flammable. Flow batteries are housed in similar purpose-made containers with slightly different management and support systems but ultimately functioning the same as the Li-ion batteries.

4.5.25 Figure 4.1d- Proposed Energy Storage and New Infrastructure (document reference 6.2.4 / APP-105) details the energy storage location within the Energy Park site. With Figure 4.1g Indicative Energy Storage Arrangement (document reference 6.2.4 / APP-108) showing a zoomed in plan of the energy storage area within the Energy Park site. This plan shows the proposed locations for the energy storage containers, 400kV substation, lagoon, water tanks ESS control room and internal access tracks that run around this area.

Onsite Cabling within the Energy Park

4.5.26 The onsite cabling will connect the solar inverter and transformer stations and the ESS to the onsite 400kV substation. There will also be cabling connecting buildings and equipment. All of this high voltage cabling will be laid below ground. Cables will then leave the substation (400kV) and run to National Grid Bicker Fen Substation via the Onsite and then Offsite Cable Route Corridor. It is estimated that there will be approximately 50km of onsite high voltage (33 or 66kV) cabling laid underground onsite through this Proposed Development.

Onsite and Offsite Cable Route Corridor

4.5.27 The ES assessment will consider only the installation and operation of below ground cable for the Proposed Development. The removal of cables in the decommissioning process is not being proposed as they are being laid below 1m underground.

4.5.28 The majority of this cable will be laid into trenches and then the soil will be re-laid. The process will follow a soil management plan, an Outline Soil Management Plan sits as an appendix to the Outline Construction and Environmental Management Plan (document reference 7.7 / AS-025) to ensure that the soil structure and quality are not degraded as part of the construction process.

4.5.29 The physical area needed for the laying of the grid route is a swathe 25m wide. An area wider than this 25m swathe is being considered to ensure flexibility within the design and allow micro siting to allow for ground conditions and other environmental constraints, see Figure 4.12 – 400kV Trench Working Swathe (document reference 6.2.4/ APP-119). Wider areas are required to facilitate the drilling rig associated with directional drilling, a launch pit of 30m x 30m is allowed within the design.

4.5.30 Along the length of the Cable Route Corridor for the Off-Site Grid Connection there are 32no. indicative drill locations. The locations of these are shown in Figure 4.2- Indicative Drill (or similar technology) Locations (document reference 6.2.4 / APP-109).

At these locations trenchless techniques, such as boring[4], micro-tunnelling[5] or moling[6] methods are likely to be undertaken. These locations have been determined either through the findings of baseline assessments for the EIA or design conclusions. Table 4.2a and Table 4.2b and Figure 4.2 show the indicative 46No. onsite locations and 32No. offsite locations. The final locations will depend on the results of ground investigations and final detailed design.

4.5.31 Examples of a typical directional drill crossing section is included at Figure 4.13 – Indicative HDD Crossing Sections (document reference 6.2.4 / APP-120). Crossing watercourses may be possible using a pump and dam method, and example of this is shown at Figure 4.14 – Watercourse Crossing Configuration (Dam and Pump Method) (document reference 6.2.4 / APP-121). Lastly an example of a road crossing, which would be open cut is included at Figure 4.15 (document reference 6.2.4 / APP-122). For each location where a directional drill may be required a launch pit will have to be created to ensure the equipment can be used safely and the cable installed correctly. The maximum extent of these launch pits would be 30m x 30m (Figure 4.9: Indicative Launch Pit design (document reference 6.2.4 / APP-116). A Method Statement for the cable crossing locations can be found at Appendix 4.1 (document reference: 6.4.3.1 / AS-017).

Table 4.2a Potential Locations of Crossings within the Energy Park

Crossing ID (Refer to Figure 4.2)	Likely crossing scenario within the Energy Park site	Crossing	Indicative OS Grid Ref.
1	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	IDB Watercourse	TF1952146419
2	Potential HDD (or similar technology)	Gas Main	TF1977846414
3	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF1973646414
4	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	IDB Watercourse	TF1953746178
5	Potential HDD (or similar technology)	Gas Main	TF1978546171

[4] Boring is the process of enlarging a hole that has already been drilled (or cast) by means of a single point cutting tool (or of a boring head containing several such tools), such as in boing a gun barrel or an engine cylinder.

[5] Micro-tunnelling is a digging process that uses a remotely controlled microtunnel boring machine (MTBM) combined with the pipe jack-and-bone method to directly install pipes underground in a single pass.

[6] During the moling process, a pneumatically-driven machine known as a mole forces its way through the soil along the desired path of the pipe.

Crossing ID (Refer to Figure 4.2)	Likely crossing scenario within the Energy Park site	Crossing	Indicative OS Grid Ref.
6	Potential dam and pump Worst case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF1975446173
7	Potential open cut Potential dam and pump Worst case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF2002446150
8	Potential dam and pump Worst case HDD (or similar technology)	Onsite drainage ditch	TF2025946332
9	Potential dam and pump Worst case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF2027246111
10	Potential HDD (or similar technology)	IDB Watercourse depending on crossing location – currently at the end of the IDB maintained stretch	TF2081546049
11	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF1906145989
12	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	IDB Watercourse	TF1953346009
13	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF2081245800
14	Potential HDD (or similar technology)	IDB Watercourse	TF1908445702
15	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	IDB Watercourse	TF1955645759

Crossing ID (Refer to Figure 4.2)	Likely crossing scenario within the Energy Park site	Crossing	Indicative OS Grid Ref.
16	HDD (or similar technology) or dam and pump	Onsite drainage ditch/watercourse	TF2029845579
17	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF2078245514
18	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	Onsite drainage ditch	TF2075745486
19	Potential dam and pump Worst case HDD (or similar technology)	Onsite drainage ditch	TF1906645461
20	Potential HDD (or similar technology)	IDB Watercourse	TF1940645498
21	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	IDB Watercourse	TF1955445415
22	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	IDB Watercourse	TF1957545442
23	Potential HDD (or similar technology)	IDB Watercourse	TF1969345414
24	Potential HDD (or similar technology)	Gas Main	TF1980345393
25	Potential HDD (or similar technology)	IDB Watercourse	TF2003845338
26	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	Onsite drainage ditch/watercourse, at the end of the IDB maintained drain	TF2028745278
27	Potential dam and pump Worst case HDD (or similar technology)	Onsite drainage ditch	TF2043445253

Crossing ID (Refer to Figure 4.2)	Likely crossing scenario within the Energy Park site	Crossing	Indicative OS Grid Ref.
28	Potential dam and pump Worst case HDD (or similar technology)	Onsite drainage ditch	TF2053945230
29	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF2073645265
30	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF2075145213
31	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF2074645168
32	Potential dam and pump Worst case HDD (or similar technology)	Onsite drainage ditch	TF1908145051
33	Potential dam and pump Worst case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF1942945124
34	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	IDB Watercourse	TF1957745216
35	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF2068544734
36	Potential dam and pump Worst case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF2066644582
37	Potential open cut trench using existing gaps and culverts	IDB Watercourse	TF1958844998

Crossing ID (Refer to Figure 4.2)	Likely crossing scenario within the Energy Park site	Crossing	Indicative OS Grid Ref.
	Worst Case HDD (or similar technology)		
38	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF1943744862
39	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	IDB Watercourse	TF1958444839
40	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	IDB Watercourse	TF1959244780
41	Potential HDD (or similar technology) - or dam and pump	Onsite drainage ditch/watercourse	TF1926944820
42	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	IDB Watercourse	TF1960944563
43	Potential HDD (or similar technology)	Gas Main	TF1986444499
44	Potential dam and pump Worse Case HDD (or similar technology)	Onsite drainage ditch	TF1996844481
45	Potential HDD (or similar technology) - or dam and pump	Onsite drainage ditch/watercourse	TF2034044548
46	Potential open cut trench using existing gaps and culverts Worst Case HDD (or similar technology)	Onsite drainage ditch/watercourse	TF2064644307

Table 4.2b Potential Locations of Crossings along the Offsite Cable Route Corridor

Crossing ID (Refer to Figure 4.2)	Likely crossing scenario along Offsite Cable Route Corridor	Crossing	Indicative OS Grid Ref.
A1	Open Cut (plate if required) and Dam and Ditch	Holland Dike – dry ditch and track	TF2093244041
A2	Potential HDD (or similar technology)	Viking Link	TF2105344019
A3	Potential HDD (or similar technology)	IDB Watercourse	TF2113643995
A4	Potential HDD (or similar technology)	Triton Knoll and drainage ditch (not IDB)	TF2137443934
A5	Potential HDD (or similar technology)	IDB watercourse	TF2143543826
A6	Open Cut (plate if required)	Overhead Line (WPD)	TF2140843648
A7	Potential dam and pump Worst case HDD (or similar technology)	Ditch not IDB	TF2138643495
A8	Potential HDD (or similar technology)	Watercourse, BT Telecoms, Water Main & A17 Road	TF2134643324
A9	HDD	Watercourse, track, Grantham to Skegness Railway Line, South Forty Foot Drain, BT Telecoms, Overhead Line (WPD)	TF2133242750
A10	Potential dam and pump Worst Case HDD (or similar technology)	Watercourse – Not IDB	TF2118942238
A11	Open Cut (plate if required)	Overhead Line (WPD)	TF2088941995
A12	Potential HDD (or similar technology)	Triton Knoll Access Track (private road), Overhead Line (WPD (now NGED)) & IDB watercourse	TF2087241951
A13	Open Cut (plate if required)	Overhead Line (WPD), BT Telecoms, Timms Drove, (public highway), Water Main	TF2075241654
A14	Potential dam and pump	Watercourse – not IDB	TF2073941621

Crossing ID (Refer to Figure 4.2)	Likely crossing scenario along Offsite Cable Route Corridor	Crossing	Indicative OS Grid Ref.
	Worst case HDD (or similar technology)		
A15	Potential HDD (or similar technology)	Gas Main	TF2068741493
A16	Potential HDD (or similar technology)	IDB Watercourse	TF2061441310
A17	Open Cut (plate if required)	Farm track (private)	TF2050141028
A18	Potential dam and pump Worst case HDD (or similar technology)	Watercourse – not IDB and track	TF2040240784
A19	Potential dam and pump Worst case HDD (or similar technology)	Watercourse – not IDB	TF2028840529
A20	Potential HDD (or similar technology)	IDB Watercourse, BT Telecoms & North Drove	TF2009840126
A21	Potential HDD (or similar technology)	IDB Watercourse	
A22	Potential HDD (or similar technology)	Triton Knoll	TF1976939501
A23	Open Cut	Overhead Line (WPD)	TF1971939405
A24	Potential HDD (or similar technology)	Underground Line (WPD), Bicker Drove, Water Main, BT telecoms, IDB Watercourse & Bicker Fen Wind Farm Connection	TF1966439300
A25	Open Cut	Underground Line (WPD)	TF1938838864
A26	Open Cut	Overhead Line (National Grid)	TF1937238834
A27	Potential HDD (or similar technology)	Watercourse – not IDB	TF1935938808
A28	Potential HDD (or similar technology)	Watercourse – not IDB and overhead line (WPD)	TF1929038625
A29	Potential HDD (or similar technology)	IDB Watercourse – and road to Substation	TF1949238488
B1	Potential HDD (or similar technology)	Bicker Fen Wind Farm Connection and track	TF1965638875

Crossing ID (Refer to Figure 4.2)	Likely crossing scenario along Offsite Cable Route Corridor	Crossing	Indicative OS Grid Ref.
B2	Open Cut	Underground line (WPD)	TF1960038755
B3	Potential HDD (or similar technology)	IDB Watercourse, Overhead Line (National Grid), Underground (WPD) and road to Substation	TF1954538603

4.5.32 Jointing bays will be required every 400-500m to join sections of cable together. At this stage it is anticipated that there will be a maximum of 15 jointing bays along the offsite Cable Route Corridor. For the purpose of this assessment each of these jointing bays would have the maximum dimensions of 20m x 3m and be approximately 2m below ground, see Figure 4.16 – 400kV Joint Bay General Arrangement (document reference 6.2.4 / APP-123).

4.5.33 The design of the cable may require earthing link boxes in order to transpose the cable earthing along the route. For maintenance reasons, it is preferable that these link boxes are installed above ground, but they can be installed below ground if necessary. These link boxes will be installed at each jointing bay (maximum 15 locations) and be up to 2m x 2m.

4.5.34 For the construction process only, it is anticipated that there will be up to 2no. construction compounds located along the length of the Offsite Cable Route Corridor, see Figure 2.3 - Proposed Development (document reference 6.2.2 / APP-081). The locations of these compounds are proposed to the north of the Triton Knoll access track and at Bicker Fen Substation. Each of these compounds will be an area of approximately 80m x 80m and will be made from a removeable material such as crushed aggregate as they will not remain for the operational phase of the Proposed Development. No Figure is provided for these construction compounds, but they will not look dissimilar to Figure 4.17 – Construction Compound Arrangement (document reference 6.2.4 / APP-124).

4.5.35 Up to six construction compounds measuring up to 50m x 50m are proposed across the Energy Park and will provide laydown areas, offices and welfare facilities – these could be a maximum height of 6m, see Figure 4.17 – Construction Compounds (document reference 6.2.4 / APP-124).

4.5.36 A Cable Crossing Method Statement can be seen in Appendix 4.1 (document reference 6.4.3.1 / AS-017). This method statement considers the known variables for the new high voltage cable to cross infrastructure including the High-Pressure Gas Pipeline, which is within the Energy Park, and the Triton Knoll and Viking Link cables which are within the Offsite Grid Route Corridor.

4.5.37 During operation the areas previously used as construction compounds on the Energy Park could be used for solar panels, spares storage, or gatehouses, see Figure 4.18 – Gatehouse Elevation (document reference 6.2.4 / APP-125) and Figure 4.19 - Spares Container Elevation (document reference 6.2.4 / APP-126). The gatehouses are proposed near the main site entrance, on Six Hundreds Drove, and near Elm Grange. Spares containers could be located around the Energy Park, and at the remaining three compound areas. The maximum height of these spares storage or gatehouses will be 4m. Where compounds are not required the land may be used for solar panels. The compounds would comprise well compacted clean crushed stone with the potential to use lime stabilisation, or surface bog mats if needed for a shorter timeframe.

Onsite 400kV Substation

4.5.38 The 400kV substation compound is located within the area marked as 'Site Main Substation / Energy Storage Compound' on Figure 2.1 Indicative Site Layout (document reference 6.2.2 / APP-078). Within this area, the land to be used for the 400kV substation plus working/ welfare and lagoon areas is 6.6ha. The area for just the 400kV substation is 3ha. The Main Substation area, see Figure 4.20 – Proposed Site Elevations of substation (document reference 6.2.4 / APP-127) will include up to 3no. main step-up Transformers (15m x 10m x 12m), one of which will be an on-site spare; 4no. Auxiliary Transformers (4m x 4m x 4m); 4no. Distribution Substations (15m x 5m x 4m); 8 lighting column each less than 1m in area with a height of up to 6m; 1no. substation control room (12m x 5m x 4m) – see Figure 4.22 – Substation Control Room Elevation (document reference 6.2.4 / APP-129) and one central control room (20m x 10m x 4m), see Figure 4.21 – Central Control Building Elevation (document reference 6.2.4 / APP-128). Within these control rooms, office space and welfare facilities will be provided.

4.5.39 Figure 4.1g- Indicative Energy Storage Arrangement (document reference 6.2.4 / APP-108) details the onsite 400kV substation location.

Fencing, Security and Lighting

4.5.40 A fence will enclose the operational areas of the Energy Park site. The fence is likely to be a metal mesh fence of approximately 3m in height. Both welded metal mesh and deer fencing have been considered by the technical authors as at this stage it is not yet known which will be preferred by insurers, and therefore a worst case assumed where relevant – such as landscape which considered welded metal mesh. Pole mounted closed circuit television (CCTV) system, which will face towards the Energy Park and away from any land outside of the Energy Park site will also be deployed around the perimeter, and in key locations, around the Energy Park site. These cameras will be mounted on poles of up to 3.5m height located within the perimeter fence, see Figure 4.23 – Fencing, Gates and CCTV Elevations (document reference 6.2.4 APP-130). It is anticipated that there will be approximately 620 CCTV cameras installed on the perimeter fence. The anticipated length of the installed fence within the Energy Park site is approximately 44.5km.

4.5.41 As can be seen within Figure 2.1 – Indicative Site Layout (document reference 6.2.2 / APP-078) the fencing is not just around the external perimeter of the Energy Park site. The fence design also runs around the perimeter of certain field boundaries which are inside the main Energy Park site.

4.5.42 The design of the security fencing has taken into account the design constraints of the onsite gas pipeline and the IDB's requirement that no fencing can cross their drains/ditches. As these ditches and the gas pipeline run north-south through the Energy Park site, a single, complete perimeter fence could not be designed. Instead, the Energy Park site has been split into a series of fenced areas, which ensure access into the Energy Park site is controlled, but still enables the operators of the gas pipeline and the IDB access to their assets on the land. A reduced length of 41.2km is possible with two crossings of the gas pipeline, whereby gates would be provided for access by the operator.

4.5.43 The final design of the fencing and/or means of enclosure is to be approved by the relevant planning authority, as secured by Requirement 10 of the draft Development Consent Order (document reference 3.1 / APP-015).

4.5.44 It is likely that lighting on sensors for security purposes will be deployed around the ESS area and potentially at any other pieces of critical infrastructure. No areas of the

Proposed Development are proposed to be continuously lit during the operational phase of this development.

4.5.45 Figure 4.1a – Current Assets on Energy Park Site (document reference 6.2.4 / APP-102) details the assets within the Energy Park.

Site Access and Access Tracks

4.5.46 Currently there are a number of access points into the Energy Park site from the A17. It is proposed to use the existing access point near the 'Build-A-Future East Heckington' facility for the very initial stages of construction. The initial phase of construction will include the construction of a new point of access onto the Energy Park site. An estimated timeframe of eight weeks is proposed.

4.5.47 This new point of access is also on the southern boundary and would form a new access point off the A17. The new point of access is a previously approved point of access that was not built out as it linked to the approved wind farm application for the Energy Park site. This new access point will be used for the remaining stages of the construction process and the operational activities for the Energy Park site. The proposed access is smaller than that approved for the wind park but will be wide enough for two HGVs to pass each other, see Figure 4.24 - Site Entrance Culvert (document reference 6.2.4 / APP-131).

4.5.48 The new access will require the creation of a new T-junction with a visibility splay of 215m, which is commensurate with a 60mph speed limit, even though the A17 is a 50mph road.

4.5.49 Once on to the Energy Park site the access track will continue northwards and minor internal access tracks will be connected to it. These minor access tracks will connect into each parcel of the development. These primary access tracks that traverse the Energy Park site and will likely be made of crushed aggregate or other suitable reinforcement. Inverters and transformers will be located off a number of these internal access tracks. Access to these inverters/transformers will need to be retained for the operational life of the Energy Park and therefore these tracks will remain for the operational life of the scheme. The width of these access tracks will be up to 4-5m, see Figure 4.25 – Access Track (document reference 6.2.4 / APP-132). Smaller accesses into fields from the primary access tracks will likely comprise of matting which can be removed following construction.

4.5.50 Figure 4.1b - Proposed Site Access and Internal Tracks (document reference 6.2.4 / APP-103)) details the access arrangements

Bicker Fen Substation Works

4.5.51 The electricity generated will be exported via a connection from the Energy Park Site to the existing National Grid Electricity Transmission (NGET) 400kV Bicker Fen Substation. This will be done via an underground cable laid within the Cable Route Corridor as provided for within Schedule 1 of the Draft Development Consent Order (document reference 3.1 / APP-015) and shown on the Works Plans (document reference 2.2 / AS-004).

4.5.52 The connection will require an extension to the existing sub-station at the National Grid Bicker Fen Substation. This extension will be to the south-west of the existing substation site. The choice of the location for the extension is determined by National Grid and takes into account the requirements for other customers connecting into the National Grid.

4.5.53 National Grid have requested that there be optionality within the design of the extension to Bicker Fen substation. The extent of the two design options can be seen in

Figure 4.27: Land Use Parameter Plan for the Design Options at Bicker Fen Substation Extension (Document Reference Pre-ExA.ChangeApp.ESFIG4.27.V1). The two design options that are under consideration are:

Air Insulated Switchgear (AIS)

4.5.54 The system already in operation at the Bicker Fen substation is an Air Insulated Switchgear (AIS) Solution. The required extension at Bicker Fen, if AIS technology is the chosen technological solution, would require the installation of switches, fuses, relays, instrument transformers, circuit breakers, disconnectors, busbars, emergency generator, apparatus for the support of electrical conductors and cable sealing ends. This list is not exhaustive and as the design of an AIS solution is finalised additional items of electrical equipment may be needed. If this was the case, the additional equipment would be within the worst-case parameters assessed within this Environmental Statement.

4.5.55 The area of land required for the Heckington Fen element of the extension is up to 145m x 45m and 15m (at its maximum width and height and subject to National Grid's final design). The new equipment for the AIS solution will look similar to the equipment already installed at the National Grid Bicker Fen Substation site and will take up an area of approximately 14,112m^2.

4.5.56 The AIS solution will include a new generation bay, a new generation bay control room amid a section of perimeter access road. Within the new Generation Bay will be electrical equipment required for connection to the Transmission system.

4.5.57 The generator bay control room will contain protection and signal interfaces between the Generator Bay, the Energy Park site and the National Grid. The size is approximately 8m x 5m x 4m. A perimeter road is proposed within the wider design envelope (145m x 45m) which will be approximately 4.5m wide, see Figure 4.26 – 400kV Bicker Fen NG Substation Layout and Section Details (document reference 6.2.4 / APP-133).

4.5.58 Within the PEIR it was stated that if the south-west location was chosen for the new Generation Bay, then an area of plantation woodland would need to be removed. As National Grid have progressed with the design of this substation extension it has been confirmed that if an AIS solution is used the southwestern section of plantation woodland would need to be removed. The extent of the worst-case removal can be seen on Figure 3.8 (document reference: Pre-ExA.ChangeApp.ESFIG3.8.V1).

Gas Insulated Switchegear (GIS)

4.5.59 This is an alternative technology to AIS which may be used to extend the Bicker Fen substation. Its installation would not result in the removal of the operating AIS equipment which is already present at Bicker Fen Substation.

4.5.60 A GIS system requires the same electrical equipment as the AIS technology. The difference is that a GIS consists of equipment where the high voltage components are located in the middle of aluminum alloy pipes and are held in this location by epoxide resin insulators and insulated from earth by a gas. The GIS can save up to 90% of space compared to the AIS solution. It has been determined by National Grid that if a GIS was used at Bicker Fen it would be SF6 free. The latest draft NPS EN-5 strives for applicants to avoid the use of SF6 (see paragraph 2.9.59-64 and 2.10.14-15 of the March 2023 draft)[7]. As any GIS design at the Bicker Fen Substation extension would be SF6 free there

[7] The bulk-use of SF6 is not intended, however SF6-type circuit breakers, which are smaller, isolated pieces of equipment may still be used in the Energy Park.

is no policy requirement for this Environmental Statement to consider the alternative technologies and why they are not technically feasible.

4.5.61 The GIS System will be partially housed inside a building. The maximum indicative dimensions of this building are 30m x 20m x 15m. A plan of the indicative design of this GIS substation barn can be seen in Figure 4.28 (document reference Pre-ExA.ChangeApp.ESFIG4.28.V1). The GIS system will also require electrical equipment to be installed outside of the barn. The maximum area of land required for all items within the GIS solution would be 75m x 75m x 15m.

4.5.62 The GIS solution will include a new generation bay, a new generation bay control room amid a section of perimeter access road. Within the new generation bay will be electrical equipment required for connection to the Transmission system. The generator bay control room will contain protection and signal interfaces between the Generator Bay, the Energy Park site and the National Grid. The size is approximately 8m x 5m x 4m. A perimeter road is proposed within the wider design envelope which will be approximately 4.5m wide.

4.5.63 At this time National Grid have not progressed the GIS design far enough in their internal design process to offer an indicative design of the GIS solution for the assessment within this Environmental Statement. The detail of the assessment is therefore based on the maximum parameters (as advised by National Grid) and that no SF6 gas will be required for the operation of this design solution. National Grid have advised that the traffic movements required for the construction of the GIS system should be assessed as equivalent to the construction traffic movements required for the AIS system.

4.6 DESIGN PARAMETERS

4.6.1 The design of the Proposed Development is an iterative process, based on preliminary environmental assessments and consultation with statutory and non-statutory consultees.

4.6.2 A number of design aspects and features of the Proposed Development cannot be confirmed until the tendering process for the design and construction of the Proposed Development has been completed. For example, the enclosure or building sizes may vary, depending on the contractor selected and their specific configuration and selection of plant.

4.6.3 Use of design parameters is therefore being adopted to present a likely worst-case assessment of potential environmental effects of the Proposed Development that cannot yet be fixed. Wherever an element of flexibility is maintained, the worst-case impacts are assessed within the ES.

4.6.4 The maximum design parameters are set out in **Table 4.3** below. Each Proposed Development component has been described in more detail in Section 4.5 above.

4.6.5 The draft Development Consent Order (document reference 3.1 / APP-015), at Requirement 6, provides that details of the final design must be submitted to and approved by the relevant planning authority prior to commencement of the relevant phase of works.

Table 4.3: Design Parameters used for the Environmental Statement assessment.

Scheme Component	Parameter Type	Applicable Design Principle
A ground mounted solar photovoltaic generating station with a gross electrical output capacity of over 50 megawatts comprising— **1.** solar PV modules; **2.** solar stations; **3.** inverters; **4.** PV module mounting structures; **5.** a network of cable circuits; and **6.** electrical cables connecting the inverters and transformers to the Onsite Substation.		
Solar PV Array Fields (Work No.1A)	Location	The solar PV array fields will be located as currently shown indicated on **Figure 2.1: Indicative Site Layout** (document reference 6.2.2).
	Scale	The maximum area of the solar PV array fields will be as set out in Appendix 1 the Outline Design Principles document (ODP) (document ref: 7.1), but the area is shown on **Figure 2.1 Indicative Site Layout** (document reference 6.2.2). The maximum total surface area occupied by the Solar PV array will be 292ha.[8]
Solar PV Modules and Mounting Structures (Work No.1A)	Location	All solar photovoltaic modules will be located within the 'fields' marked on **Figure 2.1 Indicative Site Layout** (document reference 6.2.2)
	Scale	The total area of solar PV modules in each field will not exceed the solar PV module areas set out in **Figure 2.1 Indicative Site Layout** (document reference 6.2.2). The total area of solar PV modules in each field will not exceed the solar PV module areas set out in Appendix 1 and a maximum total surface area of 292ha**.**
	Scale	The maximum height of highest part of the solar PV modules will be 3.5m above ground level (AGL) in the north-eastern section of the solar PV module areas and 3.0m above ground level (AGL) in the remainder of solar PV module areas. The areas for these two different heights can be seen on **Figure 2.1 Indicative Site Layout** (document reference 6.2.2)
	Scale	The minimum height of the lowest part of the fixed solar PV modules will be 1.5m AGL in the north-eastern section of the solar PV module areas and 1.0m above ground level (AGL) in the remainder of

[8] There are a total of 32 fields which would house PV arrays within the Energy Park site. These can be seen in Figure 1.4 Field Plan (document reference 6.2.1). The each of these fields, the maximum surface area of PV models in each field, the fenced area in each field and the actual surface area of PV modules within each field can be found in Appendix 1 of the Outline Design Principles (document reference: 7.1).

Scheme Component	Parameter Type	Applicable Design Principle
		solar PV module areas. The areas for these two different heights can be seen on **Figure 2.1 Indicative Site Layout** (document reference 6.2.2)
	Scale	The minimum separation between the external parameters of array tables will be 3-5m.
	Design	The solar PV modules within the fixed frame system will face south.
	Design	The solar PV modules will slope towards the south, at a fixed slope of 10, 15 or 20 degrees from horizontal.
	Design	The arrangement of solar PV modules within a PV table will be the same across all solar PV array within each field
	Design	The solar PV modules will be blue / black in colour (or similar colour).
	Design	The mounting structures will be grey / galvanised steel or aluminium.
	Design	The panel technology will be monofacial and/or bifacial panels.
	Design	Foundations are most likely to be galvanised steel poles driven into the ground. If required, the maximum depth of PV mounting structure piles will be 3m below ground level.
	Design	5.3m minimum clearance shall be maintained in still & conductor swing from Electrical Overhead Lines to the highest point of the PV tables.
Solar Station (a station comprising inverters, transformers, switchgear and associated ancillary and control equipment)	Location	The Solar Stations will be located within the limits of deviation of Work No.1A as shown on the **Figure 2.1 Indicative Site Layout** (document reference 6.2.2) and within a solar station.
	Scale	The maximum parameter of each solar station will be up to a 13m by 4m footprint, and 4m in height.
	Scale	A maximum of 127 solar stations across Works No. 1.
	Design	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.
	Design	A station comprising inverters, transformers, switchgear and associated ancillary and control equipment with each component for each station either: (a) located outside, sitting on either a ground bearing or piled reinforced concrete foundation slab; or (b) housed together within a

Scheme Component	Parameter Type	Applicable Design Principle
		container sitting on either a ground bearing or piled reinforced concrete foundation slab.
	Design	Raised above the flood level.
Inverters (Work No. 1A)	Location	The inverters will be located within the limits of deviation of Work No.1A as shown on the Figure 2.1 Indicative Site Layout (document reference 6.2.2) and within a solar station.
	Scale	The maximum parameters of the inverters (alongside those of the other solar station components) will be limited to the maximum parameters of the solar station.
	Design	The inverters will be centralised at the solar stations, or string inverters will be fixed to the mounting structures.
	Design	All central inverters are located at least 200m away from noise sensitive receptors.
	Design	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white paint finish.
Transformers (Work No. 1A)	Location	The transformers will be located within the limits of deviation of Work No.1a as shown on the Works Plan (document reference 2.2) and within a solar station.
	Scale	The maximum parameters of the transformers (alongside those of the other solar station components) will be limited to the maximum parameters of the solar station.
	Design	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.
Switchgear (Work No. 1A)	Location	The switchgear will be located within the limits of deviation of Work No.1a as shown on the Works Plan (document reference 2.2) and within a solar station.
	Scale	The maximum parameters of the switchgear (alongside those of the other solar station components) will be limited to the maximum parameters of the solar station.
	Design	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.
	Location	The onsite electrical cabling will be located within the limits of deviation of Work No.1A, Work No.1B,

Scheme Component	Parameter Type	Applicable Design Principle
Network of electrical cabling (Work No 1A, 1B, 2 and 4)		Work 2 and Work 4 as shown on the Works Plan (document reference 2.2)
	Scale	Cabling between solar PV modules and solar stations, and solar stations to the onsite substation will be underground with maximum cable trench dimension 0.5m wide and 1.3m deep per circuit and may be deeper for crossing obstacles. Multiple circuits may run together in some areas.
	Design	Cabling will be above ground level between the PV modules. These will be fixed to the mounting structure along the row of racks. Cabling between the PV modules, solar stations will be buried within underground trenches. Cables between solar station to the onsite substation will be buried within underground trenches. No new overhead lines will be constructed.

Table 4.4: Associated Development

Element of Development	Parameter Type	Design Principle
Work No 2: an energy storage facility comprising - a. energy storage cells; b. a network of electrical cable circuits; c. electrical cables connecting to Work No. 1A and Work No. 1B and Work No. 4; d. a structure protecting the energy storage cells and ancillary equipment, being either one container or multiple containers, mounted on a reinforced concrete foundation slab or concrete piling; e. heating, ventilation and air conditioning (HVAC) or liquid cooling systems; f. energy storage stations comprising— i. inverters and transformers; and ii. switchgear and ancillary equipment; g. monitoring and control systems; h. fire safety infrastructure comprising fire suppression system; and i. storage structures for the purposes of firefighting comprising containment tanks or a concrete water storage basin or lagoon for the purpose of firefighting.		
Energy Storage Compound (ESS) (Work No. 2)	Location	The energy storage compound will be located within the limits of deviation of Work No.2 as shown on the **Works Plan** (document reference 2.2)
	Scale	The energy storage compound area will have a maximum footprint of 78,400m^2 (280m x 280m) and infrastructure within the energy storage compound area will be no higher than 6m.
	Design	The energy storage compound area will include energy storage containers and energy storage stations (containing equipment for the storage of electrical energy, inverters, transformers, and

Element of Development	Parameter Type	Design Principle
		switchgear). Energy storage will be grouped in racks, protected by structures / containers which will be located inside the energy storage compound.
	Design	The design of ESS includes a number of design elements to both prevent, detect and control a fire should one occur. These will include: • Energy storage system will comply with relevant national and international standards • The ESS will be controlled by control systems that will detect if a cell is not operating correctly and fire detection systems and suppression systems, will be installed within the containers; • Each container will have dedicated temperature control system which is designed to regulate ambient temperatures to within safe operating conditions which in turn minimise thermal runaway and the risk of fire; • Off-gas detection systems which can detect the gases given off before a thermal runway event can be utilised to shutdown the malfunctioning cell/rack safely. The sensors used to do this are sensitive down to 1ppm (parts per million); and Adequate spacing (5m) between the containers to minimise propagation of thermal runaway, ensure adequate air flow and appropriate operational and emergency access.
	Design	Components of the energy storage compound will utilise concrete pad foundations.
Inverters / Power Converters	Location	The energy storage compound inverters/ power converters will be located within the limits of deviation of Work No.2 as shown on the **Works Plan** (document reference 2.2).
	Scale	There will be a maximum of 100 inverters / power converters within the energy storage compound.
	Scale	The maximum dimensions of each inverter / power converter within the energy storage compound are 6m by 3m in plan and up to 6m in height.
	Design	The inverter / power converter is inclusive of the switchgear within the maximum scale dimensions.
	Design	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.
Transformers	Location	The energy storage compound transformers will be located within the limits of deviation of Work No.2 as shown on the **Works Plan** (document reference 2.2)
	Scale	There will be a maximum of 100 transformers within the energy storage compound

Element of Development	Parameter Type	Design Principle
	Scale	The maximum footprint will be 5m by 3m in plan and a maximum height of 4m, sited within the energy storage compound.
	Design	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.
Energy storage container housing the energy storage cells	Location	The energy storage containers will be located within the limits of deviation of Work No.2 as shown on the **Works Plan** (document reference 2.2).
	Scale	The maximum dimensions of each energy storage container within the energy storage compound are 13m by 4m in plan and up to 6m in height.
	Scale	There will be a maximum of 200 energy storage containers housing the energy storage cells within the energy storage compound.
	Design	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.
	Design	HVAC or liquid cooling systems will be housed either within each of the containers, attached to the side or top of each of the containers, or located separate from but near to each of the containers.
	Design	The energy storage containers will sit on a suitable concrete foundation and / or steel framework foundation.
Energy Storage Stations	Location	The energy storage stations will be located within the limits of deviation of Work No.2 as shown on the **Works Plan** (document reference 2.2)
	Scale	The maximum parameter of each energy storage station will be up to a 12m by 3m footprint, and 6m in height.
	Design	A station comprising inverters, power conversion system, transformers, switchgear and associated ancillary and control equipment with each component for each station either: (a) located outside, sitting on either a ground bearing or piled reinforced concrete foundation slab; or (b) housed together within a container sitting on either a ground bearing or piled reinforced concrete foundation slab.
Internal Energy Storage Fire Suppression System*	Location	The internal energy storage fire suppression system will be located within the limits of deviation of Work No.2 as shown on the **Works Plan** (document reference 2.2)

Element of Development	Parameter Type	Design Principle
	Scale	The water quench, aerosol or foam fire suppression system will be integrated into the design of each energy storage container to a maximum of 6m in height
	Design	Water supply may be integrated into the design of each energy storage container and will be located either within or outside the energy storage container. If located outside, the water supply will either be decentralised and located at each container or centralised and located together with pumping equipment and pipework at a central location(s).
External Tanks*	Location	The external firefighting water tanks will be located within the limits of deviation of Work No.2 as shown on Figure 4.1g (document reference 6.2.4)
	Scale	Maximum of 2000m^3 of firefighting water will be provided for the energy storage compound, stored in up to 8 tanks 10m diameter and a maximum height of 4m. A further 2 tanks of same dimensions will be available to store potentially contaminated water in the event of a fire. The base of the tanks will sit on a suitable concrete foundation.
	Design	Storage will either be in cylindrical steel tanks, partially or wholly sunk below ground level, within the energy storage compound.
Water Containment*	Location	The firefighting water containment will be located within the limits of deviation of Work No.2 as shown on the Figure 4.1g (document reference 6.2.4)
	Scale	A maximum footprint of 3,600m^2 (120m x 30m) lagoon/ water storage area will be provided in the energy storage compound. The lagoon will be contained by a 1m earth bund or kerb. The lagoon will sit on a suitable concrete foundation.
	Design	An energy storage compound area will contain a bunded lagoon to capture fire water run-off from external fire water during a fire incident.
***Included as worse case to ensure Fire and Rescue Service requirements are covered, however final fire suppression system would be subject to detailed design as noted in the Outline Energy Storage Safety Management Plan (document reference 7.11).		
Work No. 3— reception areas, temporary cabins, construction compounds and parking, gatehouses, and service areas in connection with Work No. 1A, Work No. 1B, Work No. 2, Work No. 4, and Work No. 5.		
	Location	The temporary construction compounds will be located within the limits of deviation of Work No.3

Element of Development	Parameter Type	Design Principle
Construction compounds (inclusive of temporary cabins, parking, reception areas, service areas and gatehouse)		and as shown on the **Works Plan** (document reference 2.2)
	Scale	There will be a maximum of 6 temporary construction compounds on the Energy Park Site (within Work No. 3), with maximum dimension of 50m x 50m x 3m.
	Design	Base to comprise crushed aggregate with the potential to use lime stabilisation
Gatehouses	Location	The gatehouses will be located within the limits of deviation of Work No.3 as shown on the **Works Plan** (document reference 2.2)
	Scale	The maximum footprint of a gatehouse will be 5m x 5m footprint and 4m in height. There will be a maximum of one gate house per construction compound.
	Design	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.
Work No. 4— an onsite substation and works in connection with the onsite substation including— a. transformers, including associated cooling equipment, bunding and blast walls; b. switchgear, including circuit breakers, disconnectors and earth switches; c. substation electrical apparatus, including bus-bars, steel supports, insulation posts, cable sealing ends, surge arrestor, instrument transformers; d. harmonic filtering reactive power compensation equipment; e. substation buildings; f. control buildings or containers; g. welfare facilities and hardstanding areas; h. a network of cable circuits; i. electrical cables connecting to Work No. 1A, Work No. 1B, and Work No. 2; and j. flood protection measures.		
Onsite Substation	Location	The 1No. development substation will be located within the areas marked on Figure 2.1 Indicative Site Layout (document reference 6.2.2)
	Scale	The onsite substation components will have a maximum footprint of 20,350m^2 (185m x 110m) and infrastructure within the onsite substation components no higher than 15m AGL.
	Scale	Components of the onsite substation will utilise concrete pad foundations.
	Design	The onsite substation compound will include four HV substations, transformers, switchgear, substation control buildings, welfare facilities, hardstanding areas and electric cabling.
	Design	Where necessary flood protection measures such as increased height of the bunding of the transformer and raised above the maximum flood level.

Element of Development	Parameter Type	Design Principle
	Design	No lighting will be permanently operated. Lighting would be triggered by movement only or manually turned on.
	Design	Externally finished to be in keeping with other infrastructure, most likely grey, galvanised steel.
Central control building or container (inclusive of welfare facilities)	Location	The substation control buildings or containers will be located within the limits of deviation of Work No.4 as shown on the **Works Plan** (document reference 2.2), within the maximum footprint of the onsite substation area.
	Scale	Maximum parameters for the substation central control building are 20m by 10m in plan and 4m in height.
	Design	The control buildings will be a painted block building with external colours and finishes to be confirmed prior to construction, and in keeping with other infrastructure.
Onsite substation- main step-up transformers	Location	The main step-up transformers will be located within the limits of deviation of Work No.4 as shown on the **Works Plan** (document reference 2.2), within the maximum footprint of the onsite substation area.
	Scale	There will be up to 3 main step-up transformers. Maximum parameters for the main step-up transformers are 15m by 10m in plan and 12m in height.
	Design	Externally finished to be in keeping with other infrastructure, most likely grey, galvanised steel.
Onsite substation- auxiliary transformers	Location	The auxiliary transformers will be located within the limits of deviation of Work No.4 as shown on the **Works Plan** (document reference 2.2), within the maximum footprint of the onsite substation area.
	Scale	There will be up to 4 auxiliary transformers. Maximum parameters for the auxiliary transformers are 4m by 4m in plan and 4m in height.
	Design	Externally finished to be in keeping with other infrastructure, most likely grey, galvanised steel.
Onsite substation- distribution substations	Location	The distribution substations will be located within the limits of deviation of Work No.4 as shown on the **Works Plan** (document reference 2.2), within the maximum footprint of the onsite substation area.

Element of Development	Parameter Type	Design Principle
	Scale	There will be up to 4 distribution substations. Maximum parameters for the substations are 15m by 5m in plan and 4m in height.
	Design	Externally finished to be in keeping with other infrastructure, most likely grey, galvanised steel or construction blocks.
Onsite substation- substation control room	Location	The substation control room will be located within the limits of deviation of Work No.4 as shown on the **Works Plan** (document reference 2.2). Within the maximum footprint of the onsite substation area.
	Scale	The substation control room will either be located within the onsite substation control building, or in a separate building within the onsite substation area with maximum parameters of 12m by 5m in plan and up to 4m in height.
Hardstanding Areas	Location	The hardstanding area will be located within the limits of deviation of Work No.4 as shown on the **Works Plan** (document reference 2.2), within the maximum footprint of the onsite substation area
	Scale	The maximum footprint of the hardstanding area for Work No. 4 is 12ha.
Flood Protection Measures	Location	The flood protection measures will be located within the limits of deviation of Work No.4 as shown on the **Works Plan** (document reference 2.2), within the maximum footprint of the onsite substation area.
	Design	Where necessary flood protection measures such as increased height of the bunding of the transformer and raised above the maximum flood level.
Work No. 5— works to lay electrical cables between Work No. 4 and Work No. 6A. **Work No. 5A**— works to lay electrical cables from Work No. 5 at approximately 52° 56¢ 14.1² N, 0° 13¢ 12.0² W, and 52° 56¢ 09.9² N, 0° 13¢ 11.3² E, running in a southerly and south easterly direction to Work No. 5 at approximately 52° 55¢ 51.1² N, 0° 13¢ 19.0² W, and 52° 55¢ 48.7² N, 0° 13¢ 21.2² W. **Work No. 5B**— works to lay electrical cables from Work No. 5 at approximately 52° 56¢ 15.5² N, 0° 13¢ 07.7² W, and 52° 56¢ 09.9² N, 0° 13¢ 11.3² W running in a south east and south westerly direction to Work No. 5 at approximately 52° 55¢ 51.1² N, 0° 13¢ 19.0² E, and 52° 55¢ 50.0² N, 0° 13¢ 17.9² W.		
Cable Route Corridor connecting the Energy Park to National Grid Bicker Fen Substation	Location	The electrical cabling will be located within the limits of deviation of Work No.4, Work No.5 and Work No.6A as shown on the **Works Plan** (document reference 2.2)
	Scale	The electrical cabling will comprise one 400kV cable circuit underground alongside communication and control cabling.

Element of Development	Parameter Type	Design Principle
	Scale	The 400kV cable trench will be 0.6m wide, except from where it meets jointing bays or obstacle crossings. In which case the dimensions described for jointing bays or crossing apply.
	Scale	The 400kV cable trench will be approximately 1.2m deep in agricultural land and deeper for crossing of obstacles.
	Design	Horizontal Directional Drilling (HDD) or similar technology will be used to install the 400kV cables beneath areas of significant engineering difficulties such as the high-pressure gas pipeline, the South Forty Foot Drain and the railway. Furthermore, all Black Sluice Internal Drainage Board (IDB) ditches will be drilled (unless otherwise agreed). The HDD depth will be up to 10m below ground level and subject to agreement with third party asset owners. The cables would be a minimum of 2m plus an additional safety distance (typically 0.5-1m) below the bed of any IDB maintained watercourse in order to prevent risk of any scour exposing the cable.
	Design	A minimum buffer of 8m around watercourses (measured from the water/channel edge under normal flows) will be maintained within which there will be no built development to avoid disturbance of the watercourse bed and banks.
	Design	The 400kV cable will be buried at a minimum depth of 1m when within 50m of receptors sensitive to effects from electromagnetic fields.
Jointing bays within the Cable Route Corridor connecting the Energy Park to National Grid Bicker Fen Substation	Location	The jointing bays will be located within the limits of deviation of Work No.5 as shown on the **Works Plan** (document reference 2.2).
	Scale	Jointing bays will contain 3 joints, one for each cable of the 3 phase 400kV circuit. There will also be an earthing cable and comms and control cables. The connection will have 1 circuit made up of 3 cables (1 cable per electrical phase). The 3 cable joints will sit within one bay 20m in length, by 3m width and 1.2m in depth below ground.
	Design	At each joint bay, earthing link boxes are installed above ground as ground level access points for the cable earthing system. Link boxes will be installed in field margins where possible, or below ground in areas where they would adversely affect land use.

Element of Development	Parameter Type	Design Principle
	Design	Jointing bays will be up to 500m apart.
Work No. 6A— creation of a new generation bay and associated works at the existing substation, including— (a) an electrical bay to connect into the existing network at Work No. 6B, including associated outdoor air insulated switchgear (AIS) or indoor gas insulated switchgear (GIS) and electrical apparatus, circuit breakers, disconnectors and earth switches; (b) substation electrical apparatus, including bus-bars, steel supports, insulation posts, cable sealing ends, surge arrestors, instrument transformers; (c) control building; and (d) underground and above ground electrical cables and electrical connectors, including cables for power, control and communication with electrical bays and to connect into Work No. 6B, including associated outdoor AIS or indoor GIS and electrical apparatus. **Work No. 6B**— an extension to the existing substation, including— (a) outdoor AIS or indoor GIS, including circuit breakers, disconnectors and earth switches; (b) substation electrical apparatus, including bus-bars, bus-section and a bus-coupler, steel supports, insulation posts, cable sealing ends, surge arrestors, instrument transformers; and (c) underground and above ground electrical cables and electrical conductors, including cables for power, control and communication with electrical bays and to connect into Work No. 6A and the existing network within the existing substation, including associated outdoor AIS or indoor GIS and electrical apparatus. **Work No. 6C**— works in connection with the extension to the existing substation, including— (a) a cable sealing end compound and construction of a new circuit bay connecting into the existing substation; and (b) underground and above ground electrical cables and electrical conductors, connecting the existing 400kV transmission tower and the new feeder bay.		
National Grid Bicker Fen Substation Extension	Location	The National Grid Bicker Fen Substation Extension will be located within the limits of deviation of Work No.6A, 6B and 6C as shown on the **Works Plan** (document reference 2.2).
	Scale	The footprint for National Grid Bicker Fen Substation Extension will be approximately 27,160m^{2}, and 15m in height from AGL. .
	Scale	The footprint of the main electrical bay sitting within the National Grid Bicker Fen Substation Extension will be limited to a maximum footprint of 1,650m^{2} (e.g.,55m by 30m), and approximately 15m in height from AGL.
	Scale	If a Gas Insulated Switchgear (GIS) is pursued, it will be in an area of approximately 5,625m^{2} (e.g. 75m by 75m in plan) and 15m in height from AGL
	Scale	If an Air Insulated Switchgear (AIS) is pursued, it will be in an area of approximately 14,112m^{2} and 15m in height from AGL.
	Scale	The footprint for the Cable Sealing End Compound will be approximately 9,041m^{2} and 15m in height.
	Design	Noting that National Grid are yet to carry out any detailed design work for the substation extension. Subsequently there may be a need for flexibility on the final built height of the new electrical equipment. Any variation from the Rochdale

Element of Development	Parameter Type	Design Principle
		Envelope will have to comply with Requirement 5 of the DCO process. Components of either design option for the National Grid Bicker Fen Substation Extension will utilise concrete pad foundations. A piling solution may be required depending on the results of geotechnical surveys.
	Design	Access points will be a minimum of 4.5m in width.
Work No. 7— two temporary laydown areas in connection with Work No. 5 and Work Nos. 6A, 6B, and 6C including— a. areas of hardstanding, compacted ground or tracking matting; b. car parking and access; c. area to store materials and equipment, including electrical cables; d. site and welfare offices and cabins; e. security infrastructure, including cameras, perimeter fencing and lighting; f. site drainage and waste management infrastructure (including sewerage); and g. electricity, water, waste water and telecommunications connections.		
Construction laydown areas	No design principles applicable as temporary infrastructure. The maximum extent of the construction laydown areas is defined by **Works Plan** (document reference 2.2).	
Work No. 8— works to create and maintain a permanent means of access from the A17 to Work No. 1A, Work No. 1B, Work No. 2, Work No. 3 and Work No. 4.		
Site Access	Location	The site access from the A17 will be located within the limits of deviation of Work No.8 as shown on the **Works Plan** (document reference 2.2).
	Scale	The new access from the A17 will be 7m wide to accommodate two HGVs simultaneously, with a bellmouth of up to 43m where it meets the A17.
	Scale	The new access will require the creation of a new T-junction with a visibility splay of 2.4 x 154.48 metres to the west and a visibility splay of 2.4 x 164.23 metres to the east, in accordance with recorded speeds.
Internal access tracks (Further Associated Development)	Location	The internal access tracks will be located within the limits of deviation of Work No. 1, 2, 3, 4 and 8 as shown on the **Works Plan** (document reference 2.2).
	Scale	The internal access tracks are made up of new and existing farm tracks. The total length of internal access tracks will be 19km. The total length of new access track will be 10.3km, with 8.7km being existing farm tracks.
	Design	The only new permanent road of stone construction will be the primary access tracks as shown on Figure 2.1. Other internal tracks will utilise temporary matting.

Element of Development	Parameter Type	Design Principle
Work No. 9A— works to create, enhance and maintain green infrastructure and create biodiversity net gain areas, including— a. soft landscaping and planting, including tree planting; b. landscape and biodiversity enhancement measures; c. earth works; d. hard standing and hard landscaping; e. drainage and irrigation infrastructure and improvements or extensions to existing irrigation systems; f. fencing, gates, boundary treatment and other means of enclosure; and g. improvement, maintenance and use of existing private tracks. **Work No. 9B**— works to create a permissive path, including installing up to two footbridges, fencing, gates, boundary treatment and other means of enclosure.		
Green Infrastructure	Location	The green infrastructure will be located within the limits of deviation of Work No.9A as shown on the **Works Plan** (document reference 2.2).
	Design	The green infrastructure will be designed as per the OLEMP (document reference 7.8) in accordance with the requirements of the DCO.
Biodiversity Net Gain Areas	Location	The biodiversity net gain areas will be located within the limits of deviation of Work No.9A as shown on the **Works Plan** (document reference 2.2).
	Scale	A minimum of 16.5ha of biodiversity net gain areas will be located within the limits of deviation of Work No.9A as shown on the **Works Plan** (document reference 2.2).
	Design	There will be no built development associated with the Proposed Development within Work No. 9A (with the exception of any stock proof fencing used to control conservation grazing and any conservation related surface water control structures).
Permissive Path	Location	A permissive path will be located within the limits of deviation of Work No.9B as shown on the **Works Plan** (document reference 2.2).
	Design	A permissive path will be created linking into public right of way Heck/15/1 as part of a loop.
Work No. 10— works to existing streets to facilitate access to Work Nos. 1 to 9B.		
The works to streets will be located within the limits of deviation of Work No. 10 as shown on the **Works Plans** (document reference 2.2) as more particularly described in the relevant Schedule 4 and 5 of the draft DCO and shown on the **Streets and Access Plan** (document reference 2.7)		

Street & Access Plan Reference	Proposed Development Phase			
	Construction	Operation	Decommissioning	Comment
Energy Park				
EP/A	x			Access EP/A will only be used for a temporary period of time

Element of Development	Parameter Type	Design Principle		
				during the construction phase until such time that the Access EP/B is complete.
EP/B	x	x	x	Access EP/B is the primary access to the Energy Park and will be used during all phases.
Offsite Cable Route Corridor				
CR/A	x			The access locations across the Cable Run will be re-instated to their existing condition following the construction phase, save where otherwise agreed; however, the rights to utilise these access points will be retained during operation and secured through the DCO to allow access for maintenance, if required. Access to the Cable Run is not required during decommissioning as the cable and infrastructure will remain in-situ.
CR/B	x			
CR/C	x			Access CR/C and CR/D are existing access junctions on to the A17.
CR/D	x			
CR/E	x			

Element of Development	Parameter Type	Design Principle		
CR/F	x			The access locations across the Cable Run will be re-instated to their existing condition following the construction phase; however, the rights to utilise these access points will be retained during operation and secured through the DCO to allow access for maintenance, if required. Access to the Cable Run is not required during decommissioning as the cable and infrastructure will remain in-situ.
CR/G	x			
CR/H	X			
CR/I	X			
CR/J	X			
CR/K	X			
CR/L	X			
CR/M	X			
CR/N	X			
CR/O	X			
CR/P	X	X		Access CR/P and CR/Q are existing access junction on to Vicarage Drove.
CR/Q	X	X		
Scale	EP/A and CR/ACR/D, CR/E, CR/P and CR/Q access points will utilise existing access points and as existing no improvements are required.			
Scale	EP/B access point will be a minimum of 7m in width.			
Scale	Temporary access points for the Cable Run will be a minimum of 3.5m in width.			

Further Associated Development

In connection with and in addition to Work Nos.1 to 10 further associated development including—

a. works within highways, including—

i. alteration of the layout of any street permanently or temporarily, including increasing or reducing the width of the carriageway of any street by increasing or reducing the width of any kerb, footway, cycleway, or verge within the street including removal of any vegetation; and altering the level or increasing the width of any such kerb, footway, cycleway or verge within the street including removal of any vegetation; and works for the strengthening, improvement, repair, maintenance or reconstruction of any street;

ii. street works, including breaking up or opening a street, or any sewer, drain or tunnel under it, and tunnelling or boring under a street;

iii. relocation, removal or provision of new road traffic signs, signals, street lighting, road restraints and carriageway lane markings;

iv. works to place, alter, remove or maintain street furniture or apparatus (including statutory undertakers' apparatus) in, under or above a street, including mains, sewers, drains, pipes, cables, cofferdams, lights, fencing and other boundary treatments; and

Element of Development	Parameter Type	Design Principle
v. works to facilitate traffic management and to deliver information relating to the authorised development; and b. other works and development, including— i. works for the provision of fencing and security measures such as CCTV, lighting, communication boxes and access control booths; ii. laying down of internal access tracks, ramps, means of access, footpaths, and roads; iii. bunds, embankments, trenching and swales; iv. boundary treatments, including means of enclosure; v. laying out and surfacing of permissive paths, including the laying and construction of drainage infrastructure, signage and information boards; vi. foundations for structures of buildings being reinforced concrete pad foundations with piled foundations employed in locations where the ground is not sufficiently stiff to allow for pad foundations; vii. works to the existing irrigation system and works to alter the position and extent of such irrigation system; viii. electrical, gas, water, foul water drainage and telecommunications infrastructure connections and works to, and works to alter the position of, such services and utilities connections; ix. works to alter the course of, or otherwise interfere with, non-navigable rivers, streams or watercourses; x. surface water drainage systems, storm water attenuation systems including storage basins, oil water separators, including channelling and culverting and works to existing drainage systems; xi. site establishments and preparation works including site clearance (including vegetation removal, demolition of existing buildings and structures); earthworks (including soil stripping and storage and site levelling) and excavations; the alteration of the position of services and utilities; and works for the protection of buildings and land; xii. landscaping and other works to mitigate any adverse effects of the construction, maintenance or operation of the authorised development; and xiii. tunnelling, boring and drilling works, and further associated development comprising such other works or operations as may be necessary or expedient for the purposes of or in connection with the construction, operation and maintenance of the authorised development but only within the Order limits and insofar as they are unlikely to give rise to any materially new or materially different environmental effects from those assessed in the environmental statement.		
Fencing	Location	Fencing will be located within the limits of deviation of Work No.1-10 as shown on the **Works Plan** (document reference 2.2).
	Scale	Fencing around the Energy Park will not exceed 3m in height AGL.
	Design	Fencing to be a welded metal mesh fence design, or deer fencing assessed with wooden post supports and metal stock fencing.
	Location	All fencing will be a minimum of 15m from all National Grid overhead line (OHL) tower bases.
Security measures including CCTV and lighting	Location	Security measures will be located within the limits of deviation of Work No.1-10 as shown on the **Works Plan** (document reference 2.2).
	Scale	CCTV towers will not exceed 3.5m in height and will up to 620 in number.
	Design	CCTV lighting will be infrared (not visible) during hours of darkness.
	Design	No lighting will be permanently operated.

4.7 CONSTRUCTION PHASE

4.7.1 The construction phase of the Proposed Development is currently anticipated to be 30 months but will be dependent on the final design and the findings of the access and traffic assessment. The types of construction activities that may be required include (but are not limited to):

- Importing of construction materials;
- Culverting some ditches on the Energy Park site;
- The establishment of the construction compound(s) – these will likely move over the course of the construction process as each phase is built out, a maximum of 6 are proposed and their proposed locations can be seen on Figure 2.1 Indicative Site Layout (document reference 6.2.2 / APP-078);
- Creation of a new access point for the Site (A17) – this will be one of the first items within the construction programme to ensure that the majority of the construction traffic enters the Energy Park site from this new access point;
- Installing the security fencing around the Energy Park site;
- Importing the PV panels and the energy storage equipment;
- Erection of PV frames and modules;
- Digging cable trenches and laying cables onsite;
- Installing inverter/transformer cabins;
- Construction of onsite electrical infrastructure for the export of generated electricity
- New habitat creation;
- Creation of the permissive loop path;
- Digging of cable trench and laying cables for connection to the National Grid Bicker Fen Substation within the on and offsite Cable Route Corridors;
- Installing above ground grid cable access points along the offsite Cable Route Corridor;
- Improving existing access points off Highways for construction access for Cable Route Corridor;
- Clearance of a section of plantation woodland on land south of the National Grid Bicker Fen Substation;
- Installing new technical equipment within an extension to the National Grid Bicker Fen Substation – required for both AIS and GIS design;
- Planting new Community Orchard; and
- Creating new ecological habitats within the Habitat Enhancement Areas.

Construction Traffic Management Plan

4.7.2 An Outline Construction Traffic Management Plan (oCTMP) (document reference 7.10 / AS-025) has been developed as part of the EIA and will guide the delivery of materials and staff onto the Proposed Development during the construction phase. The principles of the oCTMP will be available for comment during the examination process of the Application so that stakeholders can review the measures.

Construction Compounds

4.7.3 A main temporary construction compound is to be established close to the Energy Park site entrance. Smaller temporary construction compounds will be located across the Proposed Development as the Energy Park site is built out. Once the construction process is complete sections of these construction compounds will remain for the duration of the operation of the Energy Park. These areas will be greatly reduced and are needed to house kit and spares for the ongoing operational process of the Energy Park site. It is likely that solar panels will be installed in the sections of the construction compounds which are not required for the operational phase of the Energy Park.

4.7.4 There will also be a further two construction compounds within the Offsite Grid Connection Corridor Route. These compound areas are only required for the construction phase of the Proposed Development and will not remain when the Energy Park becomes operational.

Temporary Roadways

4.7.5 Depending on weather conditions during construction, temporary roadways (e.g. plastic matting) may be utilised to access parts of the Energy Park site.

Site Reinstatement and Habitat Enhancement

4.7.6 Depending on the season, work needed for habitat enhancement will start before, during or after construction is completed. An Outline Landscape and Ecological Management Plan (oLEMP) (document reference 7.8) has been submitted as part of the DCO application. This document sets out the proposals for the Energy Park site and how they will be managed through the operational life of the scheme. It is proposed that the operational lifetime of this scheme will be 40 years.

Soil Management Plan

4.7.7 An Outline Soil Management Plan sits as an appendix to the Outline Construction and Environmental Management Plan (document reference 7.7 / AS-027) and will be submitted as part of the DCO application. This document has been requested by Natural England and will be set out the proposals for how the soil will be managed through the construction process to ensure that its structure and quality are maintained. Another Soil Management Plan will be required as part of the decommissioning assessment. This will be produced when the Energy Park reaches the end of its operational lifetime as the technology for removal of the solar panels will have been developed by this time.

Construction Staff

4.7.8 At the peak of construction there will be an average of 400 construction jobs on the Energy Park site per day. This number will be less at other times of the construction phase working out to be on average 150 onsite construction jobs during the construction period of 30 months.

Construction Hours of Work

Working hours onsite will run from 08.00am until 18.00pm Monday to Friday. Working days within the working week will be one 12-hour shift. Work may also take place on a Saturday between 08.00am until 13.00pm.

Construction Traffic, Plant and Site Access

4.7.9 An Outline Construction Traffic Management Plan (oCTMP) (document reference 7.10 / AS-025) has been prepared to highlight the access arrangements for the construction process. The transport assessment has determined that over the 30-month construction period there would be on average 12-two-way movements by large vehicles at the Energy Park site per day. There would also be at the start and end of each working day a number of minibus arriving and leaving the Energy Park site with the construction workers. The use of minibuses to bring workers to and from the Energy Park site will reduce the amount of personnel transportation into and around the Energy Park site.

4.8 OPERATION PHASE

4.8.1 During operation of the Proposed Development, human activity on the Energy Park site will be minimal and would be restricted principally to vegetation management, equipment maintenance and servicing, replacement of any components that fail, monitoring to ensure the continued effective operation of the Proposed Development and the shepherd gaining access to the Energy Park site for managing the flock. This flock will only be present on the Energy Park site for a proportion of the year to enable the correct ecological management of the land. There is more detail on the proposed stocking densities of the site within the oLEMP (document reference: 7.8) but is proposed that the planned sheep enterprise could be made up of 4 ewes per hectare, so approximately 2,000 breeding ewes, which in turn could produce on average 3,300 lambs each year. It is anticipated that the operation of the Energy Park will create 5 full time jobs. Those working on the Energy Park site will gain access using light vehicles. HGV movements are not expected unless replacement equipment is required on Site as part of the maintenance programme.

4.8.2 There is a ‘Community Orchard’ proposed as part of the ecological enhancements of the Energy Park site. At this time, it is hoped that students of the new facility called ‘Build-A-Future East Heckington’, as well as other community groups, would be able to access this orchard. The access to the community orchard will be by arrangement.

4.8.3 Figure 4.1e- Proposed Ecological Enhancements for Operational Energy Park (document reference 6.2.4) details the locations of the new community orchard, new hedgerow around the perimeter of the Energy Park site and areas of species rich grasslands within the field margins. The areas under and around the solar panels will also be planted as species rich grass to offer grazing for the proposed ewes whilst offering an ecological gain compared to the current intensive arable farming. Figure 6.2 Landscape Strategy Plan (document reference: 6.2.6) also shows the proposed intended planting within the Energy Park site. There is no proposed new planting within the National Grid Bicker Fen Substation.

4.8.4 Local residents will also be able to use the proposed permissive path that would offer a 4km loop walk extension to the existing footpath in the western section of the Energy park site (Ref: HECK/15/1). See Figure 4.1f- Proposed Permissive Path (document reference 6.2.4 / APP-107) for details the route of the permissive footpath.

4.9 DECOMMISSIONING PHASE

4.9.1 The Proposed Development will be decommissioned at the end of its approved operational phase. All PV modules, mounting poles, cabling above 1m below ground (on and off site) (any cabling buried 1m+ below ground will not be removed at decommissioning), substations, energy storage equipment, inverters, transformers etc would be removed from the Proposed Development. These items would be recycled or disposed of in accordance with good practice and market conditions at the time. An Outline Decommissioning and Restoration Plan (document reference 7.9) has been submitted as part of the DCO application. The decommissioning period is expected to take 6-18 months and transportation methods for the removal and recycling of materials would be agreed in advance with the Local Planning Authority.

4.9.2 It is the intention that after the 40 years of operation the whole of the Energy Park site will revert to its current use and be used by the Landowner likely for agricultural operations of their choice and determined by the global markets at that time. This will include the areas that will have been used for biological diversification over the lifetime of the Energy Park, excluding the Community Orchard which will remain on the Energy Park site after the 40 years of operation. It is the intent that the 4km permissive path would also be closed to public once the Energy Park is decommissioned and the route of HECK/15/1 would remain as currently shown on the definitive map.

4.9.3 The assigned generator bay that will be installed at the National Grid Bicker Fen Substation for the Proposed Development will be removed as part of the decommissioning process. The Substation Extension at Bicker Fen would remain the responsibility of National Grid. There may be potential for the components of the Bicker Fen extension, within the assigned generator bay, to remain after 40 years and be utilised for further electrical connections, subject to agreement with National Grid. It is expected that the new building needed for the GIS solution would remain post decommissioning of the Heckington Fen site as later electrical connections to Bicker Fen will be housed within it. This ES has assessed the scenario where the building associated with the GIS option remains post decommissioning of Heckington Fen Energy Park. Therefore, the final list of other elements to be decommissioned, if any, from the Bicker Fen Substation would be agreed with National Grid as part of the decommissioning process.

4.9.4 If the above and below ground electrical elements remain after 40 years this could result in connection capacity in the future for energy generation schemes beyond the 40-year lifetime of this Proposed Development.

4.9.5 The effects of decommissioning are often similar to, or to a lesser magnitude than, the construction effects and will be considered where possible in the relevant sections of the ES. However, there can be a high degree of uncertainty regarding decommissioning as engineering approaches and technologies evolve over the operational life of the Development.