Gate Burton Energy Park Environmental Statement

Volume 1, Chapter 2: The Scheme
Document Reference: EN010131/APP/3.1
January 2023

APFP Regulation 5(2)(a)
Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Gate Burton Energy Park Limited

Quality information

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2.1 Introduction

2.1.1 This chapter provides a description of the physical characteristics of the Scheme and the key activities that would be undertaken during the construction, operation and decommissioning stages. The description contained within this chapter informs each of the technical assessments provided in **Chapters 6 to 14 [EN010131/APP/3.1]**.

2.1.2 In this chapter, the 'Order limits' (also referred to as 'the Site') is defined as comprising both the Solar and Energy Storage Park and the Grid Connection Corridor.

2.1.3 This chapter is supported by the following **ES Volume 2: Figures [EN010131/APP/3.2]**:

- **Figure 1-2**: Site Boundary;
- **Figure 2-1**: Environmental Constraints;
- **Figure 2-2**: Public Rights of Way (PRoW);
- **Figure 2-3:** Substation Arrangement;
- **Figure 2-4**: Indicative Site Layout Plan; and
- **Figure 2-5**: Grid Connection Access Locations and Construction Compounds.

2.1.4 This chapter is supported by the following **ES Volume 2: Appendices [EN010131/APP/3.3]**:

- **Appendix 2-A:** BESS and Substation Description; and
- **Appendix 2-B:** Grid Connection Construction Method Statement.

2.1.5 A glossary and list of abbreviations are defined in the **Chapter 0: Contents, Glossary and Abbreviations** of the ES **[EN010131/APP/3.1].**

2.2 The Order limits and Surroundings

The Order limits

2.2.1 The Order limits (**ES Volume 2: Figure 1-2 [EN010131/APP/3.2]**) straddle the boundary between the counties of Nottinghamshire and Lincolnshire, within the districts of Bassetlaw and West Lindsey.

2.2.2 The land included within the DCO Application is shown on **ES Volume 2: Figure 1-2 [EN010131/APP/3.2]**.

Existing Conditions Within and Surrounding the Site

2.2.3 The landscape features within the Order limits consist of agricultural fields interspersed with individual trees, woodlands, hedgerows, linear tree belts, farm access tracks, and local transport roads. The figures supporting **Chapters 6** to **16** of Environmental Statement, shown in **ES Volume 2 [EN010131/APP/3.2]**, show the location of existing baseline features in relation to the Order limits. Key environmental constraints are summarised in Figure 2-1a and 2-1b **[EN010131/APP/3.2]**.

2.2.4 Villages in proximity to the Solar and Energy Storage Park comprise:

- Gate Burton approximately 50m to the west;
- Knaith approximately 200m to the west;
- Marton approximately 500m to the south west;
- Willingham by Stow 700m to the east; and
- Kexby 1.8km to the east.

2.2.5 The Grid Connection Corridor passes through largely agricultural land, to the immediate south and east of Marton, 400m to the north of Brampton in Lincolnshire, then 50m to the north of Cottam and 300m east of Rampton to connect with Cottam Power Station in Nottinghamshire.

2.2.6 There are limited industrial or commercial land uses within the immediate vicinity of the Order limits. The A1500 (Stow Park Road/Till Bridge Lane) and A156 (Gainsborough Road) cross to the south and west, intersecting the Grid Connection Corridor, contrasting with the north-south alignment of the River Trent (crossed by the Grid Connection Corridor) and the railway line connecting Lincoln and Doncaster (which intersects the Solar and Energy Storage Park). The B1241 intersects the northern part of the Solar and Energy Storage Park, Marton Road and Willingham Road border the southern extent of the Solar and Energy Storage Park.

2.2.7 Neither the Order limits nor the immediate surrounding area are covered by any statutory landscape designations, i.e. National Parks, or Areas of Outstanding Natural Beauty (AONB).

2.2.8 There are no SSSIs, SACs, SPAs, scheduled monuments or listed buildings within the Order limits. For further details refer to **Chapter 7: Cultural Heritage** and **Chapter 8: Ecology and Nature Conservation [EN010131/APP/3.1]**.

2.2.9 There are five areas of ancient woodland within 2km of the Order limits, these include:

- Burton Wood, circled by the Solar and Energy Storage Park, although excluded from the Order Limits;
- Stag Wood is approximately 190m to the north of the Solar and Energy Storage Park;

- Thurlby/Caistor's Wood is approximately 825m north of the Solar and Energy Storage Park;
- Lea Wood (includes replanted woodland) approximately 1.9km to the north of the Solar and Energy Storage Park; and
- Unnamed ancient woodland (includes replanted woodland) approximately 1.9km to the north of the Solar and Energy Storage Park.

2.2.10 Within a 10km radius of the Order limits, there are a number of statutory designated nature conservation sites, including Ashton's Meadow Site of Special Scientific Interest (SSSI) located 540m to the west of the Order limits and Lea Marsh SSSI located 1.9km north west of the Order limits. There are 15 non-statutory sites designated for nature conservation within 2km of the Order limits, all are designated Local Wildlife Sites.

2.2.11 There are no Scheduled Monuments within the Order limits and there are 7 Scheduled Monuments within 3km of the Order limits. The site of Heynings Priory (NHLE 1008685) is located just outside the northern boundary of the Solar and Energy Storage Park Site; the Roman fort south of Littleborough Lane (NHLE 1004935) is located on the eastern side of the River Trent; the scheduled Roman town of Segelocum (NHLE 1003669) is on the western bank of the River Trent; the remains of a medieval Bishops palace (NHLE 1019229) are located at Stow Park; the site of a college and Benedictine Abbey (NHLE 1012976) is located at St Mary's Church in Stow; the Hermit Dam moated site (NHLE 1016110) is located north of Knaith Park; Coates medieval settlement and moated site (NHLE 1016979) is located on the south-eastern edge of the 3km study area; and a medieval settlement and open field system to the south-east of Low Farm (NHLE 1017441) is located west of the River Trent.

2.2.12 There are no listed buildings within the Order limits and there are 65 listed buildings within 3km of the Order limits, comprising four Grade I, four Grade II* and 57 Grade II listed buildings. These listed buildings are largely grouped in the settlements of Gate Burton, Lea, Upton, Brampton, Marton, Willingham, Stow and Torksey.

2.2.13 The Order limits are not within a Conservation Area and there are no Conservation Areas within 3km of the Order limits.

2.2.14 There are no other designated heritage assets recorded within the 3km study area, including World Heritage Sites, Registered Parks and Gardens, or Registered Battlefields.

2.2.15 The Solar and Energy Storage Park is located predominantly within Flood Zone 1[1], with areas of Flood Zone 2[2] in the north. To the east of the Site there

[1] Flood Zone 1 refers to land and property with a low probability of flooding (less than 1 in 1,000 annual probability of river or sea flooding).

[2] Flood Zone 2 refers to land and property with a medium probability of flooding (between a 1 in 100 and 1 in 1,000 annual probability of river flooding, or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.

is an area of Flood Zone 3[3] associated with Padmoor Drain. To the west there is an area of Flood Zone 2 and 3 which is associated with the River Trent.

2.2.16 The Grid Connection Corridor is located predominantly within Flood Zone 3, with a small area located within Flood Zone 1 in the vicinity of Marton.

2.2.17 Other infrastructure within the surrounding area includes 400kV overhead powerlines carried by pylons. These extend from Cottam Sub Station within the Grid Connection Corridor.

2.3 Design Parameters

2.3.1 The design of the Scheme is an iterative process, based on environmental assessments and consultation with statutory and non-statutory consultees. **Chapter 3: Alternatives and Design Evolution [EN010131/APP/3.1]** describes this process further, including options that have been considered and discounted or amendments made to the Scheme design in response to the environmental studies and consultation feedback.

2.3.2 A number of the design aspects and features of the Scheme cannot be confirmed until the tendering process for design and construction has been completed. For example, enclosure or building sizes may vary within the DCO Parameters, depending on the applicant selected and their specific configuration and selection of plant.

2.3.3 Use of design parameters is therefore adopted to present a likely worst-case assessment of potential environmental effects of the Scheme that cannot yet be fixed. Wherever an element of flexibility is maintained, the likely worst-case impacts are reported in this ES.

2.3.4 The EIA has therefore been undertaken adopting the principles of the 'Rochdale Envelope', as described in the Planning Inspectorate Advice Note 9 (Ref 2-1). This involves assessing the maximum (and where relevant, minimum) parameters for the Scheme where flexibility needs to be retained.

2.3.5 Table 2-1 sets out the parameters that have been assessed within this ES.

2.3.6 Each technical chapter within the ES has assessed the design considered to be the likely worst-case scenario for that discipline to determine significance of effect.

Table 2-1 Design parameters used for the environmental assessments

Scheme Component	Parameter Type	Applicable Design Principle
PV Tables (i.e. the mounting structure) and PV Panels	Maximum height of Solar PV Panel above ground level (AGL)	The maximum height of the highest part of the PV Panel will be 3.5m AGL.

[3] Flood Zone 3 refer to land or probability with a high probability of flooding (greater than 1 in 100 annual probability of river flooding, or greater than 1 in 200 annual probability of sea flooding).

Scheme Component	Parameter Type	Applicable Design Principle
	Minimum height of the flood sensitive equipment AGL	The minimum height of the lowest part of the PV Panel will be 0.8m AGL except in zones of higher flood risk where they will be 1.1m AGL.
	Indicative footprint	Approximately 80m length x up to 9m wide per PV table.
	Indicative slope and orientation of the PV Tables from the horizontal	The PV Tables will slope towards the south, at a fixed angle of 5 to 45 degrees from horizontal.
	Indicative PV Panel colour	The PV Panels will be dark blue, grey, or black in colour.
	Panel Coating	Anti-reflective coating (ARC)
	PV Mounting Structure	Will be galvanised steel or anodised aluminium poles driven or screwed into the ground. Indicative maximum depth of 2m.
	PV foundation	Galvanised steel or aluminium poles to be driven or screwed into the ground. Indicative maximum depth of 2m. Use of concrete pad foundations in areas identified for no beneath ground intrusion.
Solar PV Array Area	Location	The proposed area for the Solar PV Array (see **Figure 2-4 [EN010131/APP/3.2]**).
	Indicative separation distance between rows of PV Tables	2m at the closest point and 15m at the furthest point.
Power Conversion Unit	Type	A Power Conversion Unit comprises an inverter, a transformer, and switchgear, which can be grouped together or distributed throughout the Site.
	Indicative number of Power Conversion Units	Up to 143 subject to detailed design.
	Indicative number of string inverters	Approximately 1,430 subject to detailed design.

Scheme Component	Parameter Type	Applicable Design Principle
	Indicative dimensions	When the Power Conversion Unit is enclosed in a single container, the maximum dimensions will be up to 40 square meters footprint and up to 3.5m height. When the Power Conversion Unit components are procured independently, their collective square footage may be larger due to spacing between the items. The maximum individual footprints are listed below.
	Colour	Externally finished in a colour in keeping with the prevailing surrounding environment, often with a green painted finish.
	Inverters (these convert the direct current electricity collected by the PV panels into alternating current):	
	Type of inverter	Centralised or string inverters. The former is grouped together in a few locations, whereas the latter are located next to each PV row or attached to the rear of the PV Tables. Both options are assessed.
	Indicative dimensions of inverters	For string inverters, the maximum parameters will be 1.5m length by 0.5m depth by 1m in height. These are small enough to be mounted underneath the panels. For central inverters the maximum parameters will be 6m by 3m and up to 3.5m in height.
	Transformers (these control the voltage of the electricity generated before it reaches the on-site Substation):	
	Type of transformer	Transformers may be standalone units or pre-assembled with inverters and switchgear to form a single contained unit (i.e. enclosed).
	Indicative dimensions of transformers	A maximum footprint of 4m x 3.5m and 3.5m in height for an outdoor solution, and a maximum footprint of 8m x 5m and with a height of 3.5m for an indoor solution. The footprint

Scheme Component	Parameter Type	Applicable Design Principle
		is reduced when combined with an inverter and switchgear (refer PCU).
	Colour of transformers	Typically finished in a colour in keeping with the prevailing surrounding environment, often with a grey or green painted finish.
	Switchgear (this is a combination of electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electrical equipment)	
	Type of switchgear	The switchgear may be an individual standalone unit within its own enclosure or may be pre-assembled with transformers and inverters to form a single contained unit.
	Indicative dimensions of switchgear	Maximum footprint of 3m x 3.5m and up to 3.5m in height.
	Colour of switchgear	Typically finished in grey.
Low Voltage Distribution Cables	Type	Low voltage cables, which transmit electricity from the Power Conversion Stations or BESS to the on-site substation. All cable circuits will be secured to the PV Tables or will be buried within underground trenches.
	Indicative cable trench dimensions	Maximum dimensions: 0.8 – 1.6m depth and up to 1.2m wide.
BESS Compound (compound to house the BESS Battery Containers)	Type	The compound will include up to a maximum of 156 battery storage containers, battery inverters, transformers and switchgear and access tracks.
	Indicative dimensions	BESS to be installed in compound with a maximum footprint up to 200m x 180m.
	Foundations	Concrete base or monolith plinth. Maximum depth of 2m.
Battery Energy Storage System	Dimensions	Maximum dimensions of one container: up to 4.5m in height, 12.5m by 2.5m footprint.

Scheme Component	Parameter Type	Applicable Design Principle
(BESS) Battery Containers	Colour	Typically finished in white, green or grey.
Battery Energy Storage System (BESS) Switchgear & Control Room	Dimensions	Maximum dimensions: Up to 4.5m in height, 12.5m by 2.5m footprint.
	Colour	Typically finished in white, green or grey.
On-site substation	Indicative dimensions	Footprint of up to 220m x 130m in plan and up to 13m in height.
	Location	The on-site substation will be located to the west of the railway line within the area shown in **ES Volume 2: Figure 2-4 [EN010131/APP/3.2]**.
Control building and Office	Dimensions	Maximum parameters: 20m by 20m footprint and 6m in height, adjacent to the BESS Compound.
Warehouse and storage building	Dimensions	Maximum parameters: 36m by 15m and 7.2m in height.
Grid Connection (from On-Site Substation to National Grid Connection at Cottam substation)	Max width (construction)	The circa 7.5km cable route will require an approximate 30m wide working area for the purposes of HDD construction, increasing where there are constraints including up to 120m working area where it is aligned with the proposed West Burton and Cottam connections. The connection will be located within the Grid Connection Corridor described below. For open trench excavation, the trench will be up to a maximum of 1.42m width.
	Max depth (construction)	For open trench excavation, up to 2.5m subject to design and ground conditions. For horizontal directional drilling, up to 25m depth subject to design and ground conditions.
National Grid Connection	Point of Connection	At the existing National Grid substation at Cottam Power Station.

Scheme Component	Parameter Type	Applicable Design Principle
	Substation	Minor modification work within the footprint of the existing substation.

2.4 Components of the Proposed Scheme

2.4.1 The Scheme will consist of the principal infrastructure described in Table 2-1 and further below. To ensure that the likely significant environmental effects of the Scheme are no worse than those assessed in the EIA and the effect of the Scheme has been robustly assessed, the parameters set out in this chapter are the basis upon which the Scheme has been assessed, following the Rochdale Envelope approach.

2.4.2 The use of the Rochdale Envelope approach will ensure that the likely significant effects of the Scheme do not exceed the reasonable worst-case scenario presented in the ES accompanying the DCO application.

2.4.3 The Scheme components comprise:

- PV tables (mounting structures) and panels;
- Inverters;
- Transformers;
- An on-site Substation;
- Onsite cabling;
- A Battery and Energy Storage System (BESS);
- An underground 7.5km 400kV electrical connection to the National Grid Substation at Cottam Power Station;
- Fencing and security measures;
- Access tracks; and
- Landscaping and biodiversity enhancement.

2.4.4 During the construction phase, one main construction compound and three secondary compounds will be established as well as mobile welfare units and smaller compound areas together with temporary roadways to facilitate access to all land within the Solar and Energy Storage Park.

Solar PV modules

2.4.5 Solar PV modules convert sunlight into electrical current (as direct current (DC)). Individual panels are typically up to 2.5m long and up to 1.5m wide and typically consist of a series of PV cells beneath a layer of toughened glass (as shown in Plate 2-1 and Plate 2-2). Other PV technologies are developing rapidly and may be available at the time of construction. The module frame is typically built from anodised aluminium or steel.

2.4.6 Each module would likely have a DC generating capacity of between 400 and 850 watts peak (Wp), or more depending on advances in technology at the time of construction (the latest technology under development is up to 850 Wp). The modules are fixed to a mounting structure in groups known as 'strings'. Various factors will help to inform the number and arrangement of modules in each string, and it is likely some flexibility will be required to accommodate future technology developments.

2.4.7 The number of PV Panels which will make up each PV Table is not yet known. Various factors will help to inform the number and arrangement, and it is likely some flexibility will be required to accommodate future technology developments. For this reason, the assessment will be based on the parameters outlined in Table 2-1.

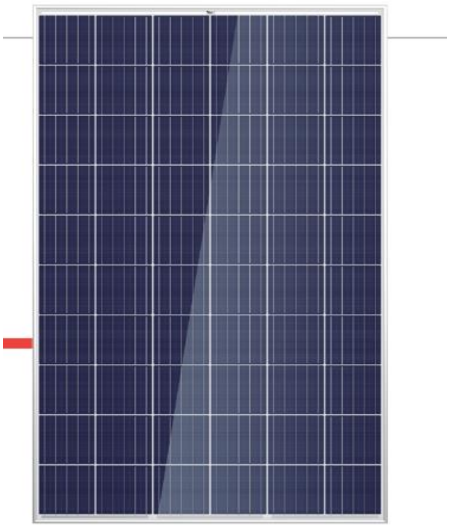

Plate 2-1 60 cells solar panel

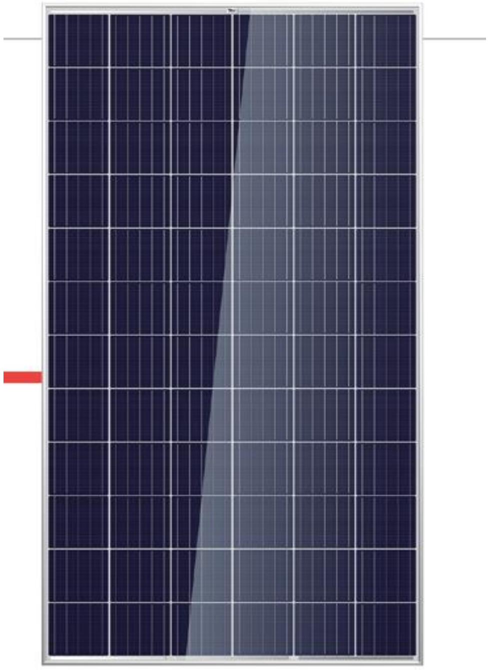

Plate 2-2 72 cells solar panel

2.4.8 The PV Tables will slope towards the south at a fixed angle of 5 to 45 degrees from horizontal. For the purposes of assessment, both a 5 degree and a 45 degree tilt is considered and forms the basis of the assessment of effects (predicted worse-case) for Glint and Glare and Landscape and Visual.

Module Mounting Structures

2.4.9 Each string of modules will be mounted on a metal rack, known as a frame. In all fixed panel options, the frames are usually supported by galvanized steel poles typically driven 1m - 2m into the ground. This is the most common solution on existing UK solar farms.

2.4.10 For a south facing configuration, between each row of frames, the separation distance will range from approximately 2m to 15m, dependent upon angle and length of slope, to allow for appropriate maintenance and to minimise inter-row shading.

2.4.11 The panel modules across the Solar and Energy Storage Park will be mounted on structures with a clearance AGL of up to 1.1m, and an upper height of up to 3.5m AGL. The final elevations of the racks will be influenced by various design factors such as local topography, flood risk and configuration.

Plate 2-3 Solar panels with south facing configuration

Supporting Infrastructure (Inverters, transformers, and switchgear)

2.4.12 The supporting infrastructure comprises inverters, transformers, and switchgear, which will be mounted on concrete foundations. This infrastructure is referred to as 'Power Conversion Units (PCUs)'. The PCUs fulfil a number of functions, including converting the direct current to alternating current and stepping up the voltage, as well as containing isolators and monitoring equipment.

2.4.13 Two options are under consideration for the Power Conversion Units, as described below.

Power Conversion Units

2.4.14 A Power Conversion Unit (PCU) comprises the inverter, transformer, and switchgear. It could consist of the inverter, transformer and a switchgear being located separately (an "Outdoor Solar Station") or enclosed within a single container (referred to as "Indoor Solar Station"), as illustrated in Plate 2-4 and Plate 2-5.

2.4.15 The Power Conversion Units will be located within the Solar PV Array area. A reasonable worst-case scenario has been assessed based on maximum parameters outlined in Table 2-1. It is anticipated that plant would be installed on compacted gravel and concrete bases.

Plate 2-4 Indoor equipment exterior (image reproduced courtesy of Power Electronics)

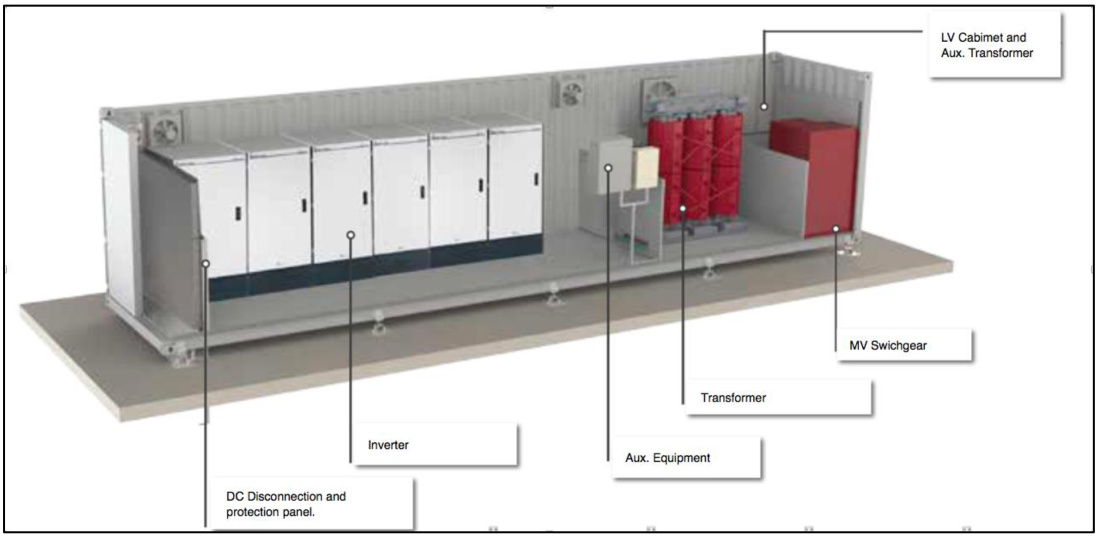

Plate 2-5 Indoor equipment interior (image reproduced courtesy of Power Electronics)

Inverters

2.4.16 As the Scheme design develops the likely configuration of equipment will be determined based upon environmental and technical factors, with string or central inverters being used. One single string inverter unit could be utilised, for example, for every 20 to 40 strings. String inverters are small enough to be mounted underneath the modules, as shown on Plate 2-6 and would be protected with mesh if sheep are to graze the site.

Plate 2-6 Typical string inverter (image reproduced courtesy of Huawei)

2.4.17 Central inverters are much larger because there are fewer of them and require their own electrical cabinet enclosures. These would be located at regular intervals amongst the PV arrays, and they occupy an area that depends on such intervals. Typically, this area is 6m x 3m and can be up to 3.5m in height.

Transformers

2.4.18 Transformers are required to step up the voltage of the electricity generated before it reaches the Substation. Transformer cabins will therefore be located across the Solar and Energy Storage Park at regular intervals and would be outdoor or indoor.

2.4.19 The maximum footprint of an outdoor transformer would be up to 4m x 3.5m and 3.5m in height.

2.4.20 Indoor transformers can be installed in a cabin, jointly with indoor switchgear, typically with a footprint of 8m x 5m and with a height of 3.5m, as shown in Plate 2-7. Transformer cabins would be externally finished in keeping with the prevailing surrounding environment, often with a green painted finish. Alternatively, as described above, transformers can be installed in a high cube container together with an inverter and switchgear as part of an indoor solar station.

Plate 2-7 Typical transformer cabin (including switchgear) (alternative option for Solar Station) (Image reproduced courtesy of Selma)

Switchgear

2.4.21 Switchgear are the combination of electrical disconnector switches, fuses or circuit breakers used to control, protect and isolate electrical equipment. Switchgear is used both to de-energise equipment to allow work to be done and to clear faults downstream.

2.4.22 Switchgear has a typical footprint of 3m x 3.5m and up to 3.5m in height. Switchgear can be also located in a cabin together with the transformer and inverter.

Energy Storage Facility

2.4.23 The Scheme will include a battery energy storage system (BESS). The BESS area is located adjacent to the sub-station (refer **ES Volume 2: Figure 2-4 [EN010131/APP/3.1]**). Within the BESS area, this ES considers provision of the BESS infrastructure as described below as well as the provision of PV panels in the area in the event that not all of the BESS is built out, with each discipline assessing the worse case scenario.

2.4.24 The BESS is designed to provide peak generation and grid balancing services to the electricity grid. It will do this primarily by allowing excess electricity generated from the solar PV panels to be stored in batteries and dispatched when required. It may also import surplus energy from the electricity grid.

2.4.25 Batteries will be located within up to a maximum of 156 individual enclosures or housed within a larger building or buildings. The precise number of individual battery storage enclosures will depend upon the level of power capacity and duration of energy storage that the Scheme will require.

2.4.26 The BESS will have a heating, ventilation, and cooling (HVAC) system to ensure the efficiency of the batteries, which are integrated into the containers. This may involve a HVAC system that is external to the containerised unit located either on the top of the unit or attached to the side of the unit. If this uses air to heat and cool it will have a fan built into it that is powered by auxiliary power.

2.4.27 The Switchgear/Control Room operates, isolates, and controls the exported power from the energy storage system. This would comprise a building of similar dimensions to the containers; either an adapted container or built from glass reinforced plastic (GRP), located within the main battery energy storage system compound.

2.4.28 Fire water would be stored within onsite water tanks and allowance made for fire water storage.

2.4.29 Water will be supplied either via a connection to the existing water pipeline adjacent to the A156 to the west or Willingham Road to the south or delivered via truck.

On-Site Cabling

2.4.30 Low voltage on-site electrical cabling connects the PV modules and battery energy storage system to inverters (typically via 1.5/1.8kV cables), and the inverters to the transformers on-site (typically via 0.4/1 kV cables). The dimension of the trenches will vary depending on the number of ducts they contain but would typically be up to 1.2m in width and 0.8m to 1.2m in depth, to a maximum 1.6m depth depending on ground conditions.

2.4.31 Medium voltage cables (around 33kV) are then required between the transformers and the switchgear and from switchgear to the on-site electrical infrastructure. The dimension of the trenches will vary depending on the number of circuits they contain but could be typically up to 1.2m in width and up to 1.6m depth. Where possible, the higher voltage cables will share trenches with the lower voltage cables on the same route.

2.4.32 Cabling between PV modules and the inverters will typically be required to be above ground level (along a row of racks), fixed to the mounting structure, and then underground (between racks and in the inverter’s input).

2.4.33 In identified archaeologically sensitive areas, cables will be installed to avoid or minimise disturbance below ground level.

2.4.34 Data cables will be installed, typically alongside electrical cables in order to allow for monitoring during operation, such as the collection of solar data from pyranometers and inverters.

Substation

2.4.35 A new on-site Substation will be located within the Solar and Energy Storage Park which will include transformers, switchgear and metering equipment required to facilitate the export of electricity to the National Grid.

2.4.36 The Substation would have up to four transformers and would have a maximum footprint of up to 220m by 130m and up to 13m in height.

2.4.37 The Substation would also include a warehouse and storage building with a maximum footprint of 36m by 15m and a height of 7.2m and a control building, which would be up to 20m by 20m in plan, and up to 6m in height. This will include office space and welfare facilities as well as operational monitoring and maintenance equipment.

2.4.38 The Substation will be connected to the PV modules and BESS via Medium Voltage Distribution Cables in order to collect electricity (at 33kV) from those components of the Scheme. The Substation will convert the electricity to 400 kV for onward transmission to Cottam Substation via the Grid Connection Cable.

Fencing and Security

2.4.39 A security fence will enclose the operational areas of the Solar and Energy Storage Park. The fence will be similar to a deer fence or other mesh security fencing, approximately 2.5m to 3m in height. Pole mounted internal facing closed circuit television (CCTV) systems will be deployed around the perimeter of the operational areas of the Site. It is anticipated that these would be 5m high. CCTV cameras would be aligned to face internally and along the fence.

2.4.40 To comply with British Standard (BS) EN 62271-1:2017 (Ref 2-2), if outdoor transformers are used, they will be surrounded by a secure wire mesh fence. This fence would be 1.8 to 2.5m in height.

2.4.41 Lighting sensors for security purposes will be deployed around the electrical infrastructure and potentially at other pieces of critical infrastructure. No areas are proposed to be continuously lit. It is anticipated that the lighting will be controlled via infrared.

2.4.42 The Substation will also be fenced. This will be metal palisade fencing, approximately 2.5m in height.

Site Access and Access Tracks

Solar and Energy Storage Park

2.4.43 The proposed construction accesses for the Solar and Energy Storage Park are shown on **ES Volume 2: Figure 2-4 [EN010131/APP/3.2]** and are listed below:

- A156 Gainsborough Road North (primary access located to the north of Gate Burton);
- Kexby Lane North (secondary access located between Knaith Park and Kexby);
- Kexby Lane South (secondary access located between Knaith Park and Kexby); and

- Marton Road (secondary access located by Willingham by Stow, utilising an existing farm access and track).

2.4.44 During the construction phase, access from the A156 to the main construction compound (refer **ES Volume 2: Figure 2-4 [EN010131/APP/3.2]**) and onwards to the substation and BESS, will comprise an asphalt surfaced road designed to deliver heavy loads such as the transformers and to allow provision of emergency access during operation. The arrangement (i.e. whether the road will be a single lane with passing places or a lane in both directions) of the road is subject to further design. For the purposes of assessment, a maximum 8m width asphalt surface is assumed for the construction and operational phase which provides flexibility for both arrangements.

2.4.45 Access tracks will be established within the Solar and Energy Storage Park. These would typically be 3.5m to 6m wide compacted stone tracks with 1:2 gradient slopes on either side. Wherever possible, existing access tracks will be used and upgraded. The access tracks shown on **ES Volume 2: Figure 2-4 [EN010131/APP/3.2]** are indicative locations for the purposes of assessment. The locations and alignments of the internal access tracks within the Solar and Energy Park are likely to change depending on the final layout design and the construction methodology.

2.4.46 Refer to **Chapter 13: Transport and Access [EN010131/APP/3.1]** for further information and the traffic and transport assessment.

Grid Connection Corridor

2.4.47 The proposed construction accesses (**Figure 2-5 [EN010131/APP/3.2]**) for the Grid Connection Corridor are as follows:

- A1500 Stow Park Road North (located east of Marton);
- A1500 Stow Park Road South (located east of Marton);
- A156 High Street East (located circa. 600m south of Marton);
- A156 High Street West (located circa. 1.4km south of Marton);
- Headstead Bank East (located circa. 100m south of Broad Lane);
- Headstead Bank West (located circa. 130m south of Broad Lane);
- Cottam Road North (located west of Cow Pasture Lane);
- Cottam Road South (located west of Cow Pasture Lane); and
- Cow Pasture Lane East (located circa. 550m north of Cottam Road).

2.4.48 It is envisaged that the majority of the above accesses will be retained during the operational phase, although these will be gated to prevent any unauthorised access during the lifetime of the Scheme, and it is expected these will be used infrequently for the purposes of maintenance.

Surface Water Drainage

2.4.49 An outline Drainage Strategy has been developed and is provided within **ES Volume 3: Appendix 9-C [EN010131/APP/3.3].** The strategy outlines how surface water will be managed in order to prevent any increase in flood risk. It describes measures to manage drainage from new infrastructure (e.g. PV panel arrays, access tracks and areas of hardstanding across the Site) and manage any required changes to existing land drainage arrangements. The strategy will be developed into a detailed drainage strategy prior to construction.

2.4.50 Infiltration drainage design will be in accordance with Building Research Establishment (BRE) Digest 365: Soakaway Design (Ref 2-3).

2.4.51 The design of new drainage systems will be based on the Flood Risk Assessment (FRA), the preliminary results of which are provided within **Chapter 9: Water Environment [EN010131/APP/3.1]**.

Biodiversity and Landscaping

2.4.52 The Scheme will involve new planting, field boundary enhancement and planting of seed mixes within the solar PV area as shown in **ES Volume 2: Figure 2-4 [EN010131/APP/3.2]**. Planting will also be used to provide screening. The enhancements and planting would increase biodiversity and contribute to the Scheme achieving Biodiversity Net Gain (BNG) in line with the principles in the Environment Act 2021, NPPF and local planning policy: Central Lincolnshire Local Plan (Ref 2-9), and Bassetlaw District Council Core Strategy and Development Management Policies DPD (Ref 2-10). Further information is provided within **Chapter 8: Ecology and Nature Conservation** and **Chapter 10: Landscape and Visual Amenity [EN010131/APP/3.1]**.

Plate 2-8 Image showing enhanced planting surrounding the boundary of a PV farm (AECOM, 2021)

2.5 Construction

Construction Programme

2.5.1 Subject to being granted consent and following a final investment decision, construction is anticipated to start in Q1 2025 and will require an estimated 24 to 36 months, with operation therefore anticipated to commence around Q1 2028.

Construction Activities

2.5.2 Construction activities will include:

- Site preparation including setting up access, compounds and security;
- Import of construction materials, plant and equipment to site;
- Diversion of existing 11kV overhead power lines where required;
- Diversion and installation of utilities as required;
- Upgrading of existing site tracks/access roads and construction of new tracks;
- Marking out the location of infrastructure;
- Import of components to site;
- Erection of PV Mounting Structures;
- Mounting of PV Panels;

- Installation of electric cabling;
- Installation of Power Conversion Units (PCU);
- Installation of BESS;
- Construction of on-site Substation;
- Cable installation (including trenching);
- The establishment of mobilisation areas and running tracks;
- Stripping of topsoil in sections for the cable connection, sub-station and BESS area only;
- Trenching in sections;
- Appropriate storage and capping of soil;
- Appropriate construction drainage with pumping where necessary;
- Sectionalised approach of duct installation;
- Excavation and installation of jointing pits;
- Cable pulling;
- Testing and commissioning; and
- Site reinstatement and habitat creation.

Solar and Energy Storage Park construction

2.5.3 The following activities will be undertaken to install the solar PV modules:

- Import of components to site;
- Piling and erection of module mounting structures;
- Mounting of modules. This will be undertaken by hand;
- Trenching and installation of electric cabling; and
- Installation of Power Conversion Units. Cranes will be used to lift equipment into position.

Construction of Electrical Infrastructure

2.5.4 The following activities will be undertaken to construct the onsite electrical infrastructure:

- Site preparation and civils for the BESS Compound;
- Trenching and installation of distribution cables;
- Pouring of the concrete foundation base;
- Import of components to site. Cranes will be used to lift the components into position; and
- Installation of the BESS.

400kV Cable Connection to Cottam Sub-station

- The establishment of mobilisation areas and running tracks;

- Temporary construction compounds (**ES Volume 2: Figure 2-5 [EN010131/APP/3.2]**);
- Stripping of topsoil in sections;
- Trenching in sections;
- Appropriate storage and capping of soil;
- Appropriate construction drainage with pumping where necessary;
- Sectionalised approach of duct installation;
- Excavation and installation of jointing pits;
- Cable joint installation;
- Cable pulling;
- Implementation of crossing methodologies for watercourses, infrastructure (including roads and rail), and sensitive habitats (e.g. Horizontal directional drilling, cable bridging);
- Testing and commissioning; and
- Site reinstatement and habitat creation.

2.5.5 The connection cable will be installed via both open trench and trenchless techniques i.e. through use of horizontal directional drill (HDD). **ES Volume 3: Appendix 2-B Grid Connection Construction Method Statement** shows the areas that will be avoided by the connection cable via use of trenchless technique. Launch and exit pits will be located outside these areas.

On Site Sub-station and BESS Construction

2.5.6 The following activities will be undertaken to construct the on-site Substation and BESS:

- Diversion of existing 11kV overhead power line;
- Topsoil strip and ground levelling;
- Groundworks including piling and drainage installation;
- Construction of foundations;
- Installation of electric cabling;
- Import of components to site;
- Installation of bus-bar, circuit breaker, isolators, earthing switch and transformers;
- Installation of battery, transformers, inverters and switchgear; and
- Installation of office, storage areas and warehouse.

2.5.7 The location of the on-site sub-station and BESS compound is shown on **ES Volume 2: Figure 2-4 [EN010131/APP/3.2]**.

Testing and Commissioning

2.5.8 Commissioning of the Scheme will include testing and commissioning of the process equipment. Commissioning of the solar PV infrastructure will involve mechanical and visual inspection, electrical and equipment testing, and commencement of electricity supply into the grid. Individual sub-systems will be commissioned separately, with each having its own procedures and prerequisite lines, and it may be necessary to commission these elements separately or at the same time, depending on the end technology utilised at the time of construction.

2.5.9 This process will take place prior to operation of the Scheme which is anticipated to commence in 2028.

Construction Staff

2.5.10 At the peak of construction, which is expected to be during 2026, it is estimated that a maximum of up to 400 workers will be required.

Construction Hours of Work

2.5.11 The core working hours are defined in Table 2-2.

Table 2-2 Core working hours

Works	Working hours
Summer	07:00 – 19:00 Monday to Friday and Saturday 09:00-13:00 with no Sunday or Bank Holiday working.
Winter	08:00 – 18:00 Monday to Friday and Saturday 09:00-13:00 with no Sunday or Bank Holiday working.

2.5.12 Some works activities may need to occur out of these hours/times due to activities requiring to be undertaken continuously (such as HDD and cable jointing). Where work outside of times is necessary prior notification will be provided to the relevant local planning authority.

2.5.13 Additionally, quiet non-intrusive works such as the installation of PV modules may take place over longer periods during the high summer and other quiet non-intrusive works such as electrical testing, commissioning and inspection may take place over longer periods throughout the year.

Construction Traffic

2.5.14 It is anticipated that as a worst case during the peak construction period, there would be up to 60 HGV deliveries (120 movements) per day. In addition, there would be an average of approximately 30 Light Goods Vehicles (LGV) (60 movements) per day. There would also be an additional 154 daily vehicles associated with staff/ shuttle services (equating to 308 daily movements) during peak construction periods.

2.5.15 Temporary car parks will be provided within the proposed compound areas. Construction workers will then be transported around site via mini-bus, or similar.

2.5.16 A Framework Construction Traffic Management Plan (CTMP) has been developed and is provided as **ES Volume 3: Appendix 13-E [EN010131/APP/3.3]**. The CTMP contains mitigation to avoid and/or reduce impacts relating to construction traffic including the delivery of materials and transport of staff during the construction phase.

Wheel Wash Facilities

2.5.17 A self-contained wheel wash will be installed near the site exits onsite to be used by vehicles prior to exiting the Site onto the public highway. For loads unable to use the fixed wheel wash, localised wheel washing would be set up to cater for these individually and as required to prevent detrimental effect to the highway.

Public Rights of Way

2.5.18 PRoW are show on **ES Volume 2: Figure 2-2 [EN010131/APP/3.2]**. There is one PRoW crossing the Solar and Energy Storage Park, and three further PRoW which run in close proximity to its boundary. These PRoW are as follows from north to south.

2.5.19 Footways within the Grid Connection Corridor are limited to the northern side of Cottam Road and the western side of Town Street both near and through the village of Cottam, as well as both sides of Torksey Ferry Road within the village of Rampton.

2.5.20 Any potential diversions due to the Scheme will be managed using the Outline PRoW Management Plan within the Framework CTMP) **Appendix 13-E [EN010131/APP/3.3]**.

Construction Compounds

2.5.21 Construction compound locations are shown on **Figure 2-4**. The main construction compound is located on the western site boundary with access from the A156. Secondary compounds are located off Kexby Lane and off the B1241 (Gainsborough Road).

2.5.22 In addition to the main compound and the secondary compounds, smaller short-term use construction compounds will be located across the Site. The compounds will be approximately up to 150m x 150m and will contain a site office, mobile welfare units, generators, canteen facility, a fenced area for storage and waste skips and space for short-term parking, storage, download and a turning area. The compounds will be converted to solar PV or landscaping at the end of their use.

2.5.23 The grid connection corridor construction compounds are shown on **Figure 2-5**. There will be two main compounds adjacent to Cottam Road and Broad Lane. At each of the grid connection access points there will be 50m by 50m compound and lay-down areas. The compound area footprint will take into consideration topography, drainage and heritage and environmental constraints. The compounds will allow construction vehicles to turn off the public highway and park safely. They will include parking bays, portacabins, welfare facilities, unloading and storage areas and power generators. The areas will be secured using heras fencing and security cameras. Upon completion of construction, the compound areas will be removed and the land reinstated.

Storage of Plant and Materials

2.5.24 No long-term onsite storage of materials is required during the construction phase. Materials will be delivered via HGVs at regular intervals to the construction compounds and transported directly to where it is required within the Order limits using smaller LGVs.

2.5.25 Short term storage of materials and plant will be accommodated within the construction compound until required.

Spoil Management

2.5.26 There will be no site wide reprofiling required; however, there will be a need to level areas in a number of locations including the Sub-station and BESS. This is unlikely to create excess spoil. At the Solar and Energy Storage Park site, it is not expected that spoil would be removed from the Order limits.

2.5.27 During construction of the grid connection, spoil will be stored temporarily within designated areas adjacent to the cable route and within the construction compounds. The spoil will be utilised to backfill the launch and exit pits, reinstate the temporary construction compounds and any temporary access roads.

2.5.28 It is estimated that a maximum of 3,024 tonnes of spoil would be removed from the grid connection corridor. However, it is highly unlikely that this amount will be reached and is therefore a worst case scenario.

Construction Lighting

2.5.29 During winter months, mobile lighting towers with a power output of 8kVA may be used during construction in isolated work areas. There will also be lighting at the main construction compounds while construction is underway.

Onsite Fuel

2.5.30 Fuel for machinery and generators will be delivered to site by a fuel truck and stored in above ground fuel storage tanks of 10–36 m^3 capacity. The fuel storage tank will be sheltered, secured from unauthorised access, and equipped with a spill protection bund capable of holding 110% of the volume of the tank. Spill kits will be available at the fuelling point and other strategic locations of the construction site to allow for prompt clean up to limit soil and water contamination. Construction workers will be trained in spill kit use.

Utilities

2.5.31 At the three secondary compounds, generators will be used for the provision of power. At the main compound, for the purposes of assessment both generators and provision of an electricity connection to the local electrical distribution network are considered. Provision of electricity would be via a connection to the existing 11kV line that runs on the western side of the railway line.

2.5.32 To facilitate construction of the Substation and BESS, the existing 11kV overhead power line located west of the railway line will be diverted around the Substation and BESS area.

2.5.33 Based on an assumed 20 litres/day/person, an estimated 2,200m^3 (1,700m^3 for welfare and 500m^3 for wheel washes) of water will be required during construction to support welfare facilities onsite and other uses. The water will either be transported to the Order limits by road from an existing nearby licenced water abstraction source and stored on site in tanks of up to 10m^3 (10,000 litres) capacity or supplied through a connection to the existing mains located on the A156. The alignment of the water connection options to the main compound are shown on **ES Volume 2: Figure 2-4 [EN010131/APP/3.2]**.

Waste

2.5.34 Solid waste materials generated during construction will be segregated and stored onsite in containers of up to 30m^3 capacity prior to transport to approved, licensed third party landfill and recycling facilities. During construction, removal of waste is estimated to require up to a maximum of 400 HGV loads over a period of 12 months, which equates to an average of just over 1 load per day. This will fluctuate with the largest waste numbers being the removal of pallets and recyclable cardboard during delivery of the PV modules.

Construction Environmental Management Plan and Construction Resource Management Plan

2.5.35 A **Framework Construction Environmental Management Plan** (CEMP) has been prepared **[EN010131/APP/7.3]**. The CEMP describes the framework of mitigation measures to be followed and to be carried forward to a detailed CEMP prior to construction. The aim of the CEMP is to avoid and/or reduce environmental impacts from:

- Construction traffic (including parking and access requirements) and changes to access and temporary road or footpath diversions (if required);
- Use of land for compounds;
- Noise and vibration;
- Utilities diversion;
- Dust generation;

- Soil removal;
- Lighting; and
- Waste generation.

2.5.36 The detailed CEMP will be produced by the Applicant prior to the start of construction. This is a Requirement of the DCO. The CEMP will identify the procedures to be adhered to and managed by the Applicant and its contractors throughout construction.

2.5.37 Contracts with companies involved in the construction works will incorporate environmental control, health and safety regulations, and current guidance and will ensure that construction activities maximise opportunities for the incorporation of sustainability principles and that all contractors involved with the construction stages are committed to agreed best practice and meet all relevant environmental legislation including: Control of Pollution Act 1974 (COPA) (Ref 2-5), Environment Act 1995 (Ref 2-6), Hazardous Waste (England and Wales) Regulations 2005[4] (Ref 2-7) and the Waste (England and Wales) Regulations 2011[5] (Ref 2-8).

2.5.38 Records will be kept and updated regularly, ensuring that all waste transferred or disposed of has been correctly processed with evidence of signed Waste Transfer Notes (WTNs) that will be kept on-site for inspection whenever requested. Furthermore, all construction works will adhere to the Construction (Design and Management) Regulations 2015 (CDM) (Ref 2-4).

Site Reinstatement and Habitat Creation

2.5.39 Prior to and during the construction phase, and following construction, a programme of site reinstatement and habitat creation will be implemented.

2.5.40 The Scheme has been designed to integrate with and enhance the local green infrastructure network, improving ecological connectivity across the Order limits. The initial proposed planting design, shown in **ES Volume 2: Figure 2-4 [EN010131/APP/3.2]**, has responded to the varied character by allowing views to remain open, where tall screening would not be appropriate. New planting would include:

- New native hedgerows;
- Native hedgerow enhancement, gapping up and infill planting;
- New native grassland buffer planting to form ecological corridors;
- Native linear tree belts; and
- New species rich grassland and amenity grassland mixes under the panels and along perimeter buffers.

[4] As amended by the Hazardous Waste (England and Wales) (Amendment) Regulations 2009/507 and the Hazardous Waste (England and Wales) (Amendment) Regulations 2016/336

[5] As amended by the Waste (England and Wales) (Amendment) Regulations 2012/1889 and the Waste (England and Wales) (Amendment) Regulations 2014/656

2.5.41 New species rich grassland will be created in advance of construction so that any displaced bird populations have alternative areas of habitat available during construction.

2.5.42 Embedded mitigation measures for the construction phase are set out in the Framework CEMP, including measures such as construction and exclusion zones in relation to retained vegetation, heritage exclusion zones, lapwing fields, skylark plots, stockpile management, and storing topsoil in accordance with best practice measures.

2.5.43 An **Outline Landscape and Ecological Management Plan** (OLEMP) has been prepared **[EN010131/APP/7.10].** This document sets out the principles for how the land will be managed throughout the operational phase, following the completion of construction. A detailed Landscape and Ecology Management Plan is secured as a Requirement attached to the DCO.

2.6 Operational Activities

2.6.1 During the operational phase, activity on the Solar and Energy Storage Park will be limited and would be restricted principally to vegetation management, equipment maintenance and servicing, periodic replacement of components, periodic fence inspection, and monitoring to ensure the continued effective operation of the Scheme.

2.6.2 Given the 60-year operational life of the Scheme, there will be requirement for periodic replacement of some or all of the Solar and Energy Storage Park elements. **Chapter 15**: **Other Environmental Topics [EN010131/APP/3.1]** of this ES includes an assessment of the likely impact of component replacement (e.g. panels, batteries, inverters, transformers) and outlines measures to be put in place to ensure that these components are able to be diverted from the waste chain.

2.6.3 Operational access will primarily be taken from the A156 Gainsborough Road and via Clay Lane, but will also be achievable via Kexby Lane North, Kexby Lane South and Marton Road (as above) which will all be retained during the operational phase. An additional operational access will also be provided on a separate part of Marton Road at the south-eastern boundary of the Solar and Energy Storage Park.

2.6.4 Operational phase access points are shown on **ES Volume 1, Chapter 13: Transport and Access [EN010131/APP/3.1]**. It is anticipated that there will be up to fourteen permanent FTE staff during the operational phase working on a site and flexible office basis. Operational staff would travel to site by four-wheel drive vehicle or medium/large van. There are expected to be approximately 3-4 visitors per week for deliveries, and periodic replacement of any components.

2.6.5 The design life of the Scheme is 60 years; however, if equipment is still operating successfully and safely, the Applicant may choose to operate beyond the Scheme's originally anticipated design life. This is a common occurrence for generating stations. Many stations operate beyond the design life if they are well maintained.

2.7 Decommissioning

2.7.1 The design life of the Scheme is expected to be at least 60 years, although the operational life could be longer than this; the condition of equipment will be reviewed at the end of the anticipated design life to determine whether it remains in a viable condition to continue operation after that time.

2.7.2 When the operational phase ends, the Solar and Energy Storage Park will require decommissioning. All PV modules, mounting poles, inverters and transformers would be removed and recycled or disposed of in accordance with good practice and market conditions at the time. Buried medium voltage cables would either be removed or left in situ. The majority of the Solar and Energy Storage Park would be returned to the landowner after decommissioning and will be available for its original use. The future of the substations and associated control buildings would be agreed with the relevant Local Planning Authority prior to commencement of decommissioning. A Decommissioning Environmental Management Plan, to include timescales and transportation methods, would be agreed in advance with the relevant Local Planning Authority.

2.7.3 Decommissioning is expected to take between 24 and 48 months and would be undertaken in phases.

2.7.4 The specific method of decommissioning the project at the end of its operational life is uncertain at present as the engineering approaches to decommissioning will evolve over the operational life of the Scheme.

Waste

2.7.5 Removal of waste is estimated to require approximately 1,300 HGV loads over a period of 12 months, which equates to an average of eight loads per day.

Land Reinstatement

2.7.6 The majority of land within the Solar and Energy Storage Park will be available to be returned to its original use after decommissioning with medium voltage buried cables remaining in situ. Any modification work to the National Grid Cottam Substation to facilitate the connection would remain under National Grid’s control. It is not currently known if the buried 400 kV cables would be left in situ or removed. For the purposes of assessment, both scenarios are considered within this ES with the worse case for any given topic assessed.

2.7.7 It is anticipated that some areas of habitat and biodiversity mitigation and enhancement would be left in-situ for species protection. Any required species licences would be obtained for reinstatement works if necessary.

2.8 References

Ref 2-1 Rochdale Envelope: Planning Inspectorate Advice Note 9 (2008). Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/05/Advice-note-9.-Rochdale-envelope-web.pdf

Ref 2-2 British Standards Institute (BSI) (2017) BS EN 62271-1:2017 High-voltage switchgear and controlgear. Common specifications for alternating current switchgear and controlgear. Brussels: BSI.

Ref 2-3 Building Research Establishment (BRE) (2012) Digest 365: Soakaway Design and Sewers for Adoption (7th Edition). Watford: BRE.

Ref 2-4 HMSO (2015) Construction (Design and Management) Regulations 2015. Available at: http://www.legislation.gov.uk/uksi/2015/51/pdfs/uksi_20150051_en.pdf.

Ref 2-5 HMSO (1974); Control of Pollution Act 1974. Available at: https://www.legislation.gov.uk/ukpga/1974/40/pdfs/ukpga_19740040_en.pdf.

Ref 2-6 HMSO (1995); Environment Act 1995. Available at: https://www.legislation.gov.uk/ukpga/1995/25/pdfs/ukpga_19950025_en.pdf.

Ref 2-7 HMSO (2016); The Hazardous Waste (Amendment) Regulations 2016. Available at: http://www.legislation.gov.uk/uksi/2016/336/made.

Ref 2-8 HMSO (2014); Waste (England and Wales) (Amendment) Regulations 2014. Available at: https://www.legislation.gov.uk/uksi/2014/656/contents/made.

Ref 2-9 Lincolnshire County Council, “Central Lincolnshire Local Plan 2012-2036,” Lincolnshire County Council, Lincoln, 2017.

Ref 2-10 Bassetlaw District Council Core Strategy and Development Management Policies DPD 2011. Available at: https://www.bassetlaw.gov.uk/media/1543/cs1adoptedcorestrategy.pdf