SUNNICA ENERGY FARM

Preliminary Environmental Information Report

Chapter 4: Alternatives

Sunnica Ltd

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Contents

4. Alternatives and Design Evolution

4.1 Introduction

4.1.1 This chapter of the PEI Report describes the consideration of alternatives and design evolution in relation to the Scheme (***Chapter 3: Scheme Description***).

4.1.2 Schedule 4 (2) of the EIA Regulations (Ref 4-6) requires "*A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects*" to be presented in the Environmental Statement.

4.1.3 National Policy Statement (NPS) EN-1 (Ref 4-1) paragraph 4.4.1 states that "*as in any planning case, the relevance or otherwise to the decision-making process of the existence (or alleged existence) of alternatives to a proposed development is in the first instance a matter of law, detailed guidance on which falls outside the scope of this NPS*". The NPS confirms that from a policy perspective there is no general requirement to consider alternatives or to establish whether a development represents the best option. It does, however, highlight that in addition to the requirement under the EIA Regulations set out above and referred to in the first bullet of paragraph 4.4.2 of NPS EN-1, there are other specific legislative requirements and policy circumstances which require the consideration of alternatives. These include a requirement under the Habitats Directive, as transposed into UK law by the Conservation of Habitats and Species Regulations 2017, and also in relation to avoiding significant harm to biodiversity and geological conservation interests; flood risk; and development within nationally designated landscapes set out in sections 5.3, 5.7 and 5.9 of the NPS. Paragraph 4.4.3 states "*where there is a policy or legal requirement to consider alternatives the applicant should describe the alternatives considered in compliance with these requirements*".

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

- alternative sites;
- alternative technologies;
- alternative layouts;
- alternative cable route corridors; and
- alternative locations for upgrading Burwell substation.

4.1.5 Consideration of 'no development' as an alternative to the Scheme has not been considered further. This is because 'no development' is not considered to be a reasonable alternative to the Scheme as it would not deliver the additional electricity generation and storage proposed.

4.2 Need for the Scheme

4.2.1 The Scheme's objective is to generate low-carbon electricity for an operational period of 40 years, to meet the UK's growing need for low-carbon electricity.

4.2.2 The inclusion of electricity storage assets in this Scheme provides a means of further enhancing the utility of the power generated by the Scheme by providing energy balancing capability and other services to support the operation of the National Electricity Transmission System.

4.2.3 The Government, through the Climate Change Act 2008, made the UK the first country in the world to set legally binding carbon budgets, aiming to cut emissions (versus 1990 baselines) by 34% by 2020 and at least 80% by 2050. This is to be achieved *'through investment in energy efficiency and clean energy technologies such as renewables, nuclear and carbon capture and storage'*. In October 2018, following the adoption by the UN Framework Convention on Climate Change of the Paris Agreement, the Intergovernmental Panel on Climate Change ('IPCC') published a 'Special Report on the impacts of global warming of 1.5°C above pre-industrial levels' (Ref 4-4). This report concludes that human-induced warming had already reached approximately 1ºC above preindustrial levels, and that without a significant and rapid decline in emissions across all sectors, global warming would not be likely to be contained, and therefore more urgent international action is required.

4.2.4 In response, in May 2019, the Government's independent expert Climate Change Committee (CCC) published 'Net-Zero: The UK's contribution to stopping global warming' (Ref 4-5). This report recommended that the UK Government extend the ambition of The Climate Change Act (2008) and that '*The UK should set and vigorously pursue an ambitious target to reduce greenhouse gas emissions (GHGs) to 'Net-Zero' by 2050, ending the UK's contribution to global warming within 30 years*.' In June 2019, the Government announced the laying of a statutory instrument in Parliament, which amends the Climate Change Act 2008, in order to implement the CCC's recommendation into law, and the UK became the first major economy to pass laws to end its contribution to global warming by 2050.

4.2.5 Because electricity can be generated from low-carbon sources, the decarbonisation of non-electric sectors (transport, heat, industrial process, etc) will cause a significant increase in electricity demand. This means that the capacity of electricity generation in the UK must grow to meet that demand. Emerging energy vectors, such as hydrogen electrolysis and large scale electricity storage, are earmarked to enable the decarbonisation of traditionally hard-to-reach sectors, such as chemical processing and freight transport. The need for a significant growth in new low carbon generation assets, including well-proven renewable technologies such as wind and solar, is therefore clear.

4.2.6 Not only will new assets be required to meet additional anticipated demand, but they will also be needed to replace existing generation capacity which is

due to close over the next decade, either because of environmental regulation or technological lifetime limits.

4.2.7 A diverse renewable generation fleet (i.e. consisting of many different technologies) in the UK will play an important role in the resilience of the UK's electricity system from an adequacy and system operation perspective; diversity improves the resilience of low-carbon supplies against the uncertainty of when they will be generated.

4.2.8 In June 2020, the CCC made recommendations for BEIS to "deliver plans to decarbonise the power system to reach an emissions intensity of 50 gCO_2/kWh by 2030, with at least 40 GW of offshore wind and a role for onshore wind and large-scale solar power, with a clear timetable of regular auctions"

4.2.9 Large-scale renewable generation is already very competitive against other forms of conventional and low-carbon generation, both in the UK and more widely; and the UK already has successfully incorporated over 35GW of wind and solar generation into its electricity mix, (25% of all electricity generated in 2019. The case is clear for the need for these capacities to be increased.

4.3 Alternative Sites

4.3.1 The selection of the Scheme's location followed a systematic step-by-step process.

4.3.2 This step-by-step process is explained in the following sections. A report setting out the assessment of alternative sites will be submitted with the DCO application.

Stage 1 – Defining the area of search for potential solar development

4.3.3 Irradiation (sunlight) levels and topography are key factors when determining the location of solar development. Solar developments are currently found across the UK, however their efficiency is determined by the levels of irradiation at their location. In addition, topography is an important factor for locating solar development, with flat land being optimal for construction and less visually intrusive. It also limits the shading between arrays; provides opportunities for better screening of the development compared to sloping land; and enables the panels to be optimally configured for best production levels.

4.3.4 Given these key characteristics Sunnica considers East Anglia to be an optimal region of the UK within which to locate a large scale solar farm due to its high levels of irradiation, in comparison to other parts of the UK, and its topography, which is predominantly made up of large flat open expanses of land.In addition, East Anglia is well located to high demand centres for electricity (Cambridge and London) and so locating solar development in this region would also place the generation close to areas of high demand.

4.3.5 Following the identification of East Anglia, a search for a Point of Connection (POC) within this region is undertaken. This involves

discussions with UK Power Networks, Eastern Power Networks and National Grid to identify available capacity in the region.

4.3.6 This POC search in consultation with UK Power Networks, Eastern Power Networks and National Grid identifies Burwell as a location which has available capacity with reinforcement that could be completed within a reasonable timeframe and cost and is therefore deemed to be a suitable location to be the POC.

4.3.7 The identification of Burwell as the POC narrows the area of search within East Anglia to within the vicinity of Burwell within which to locate a solar development.

4.3.8 Having determined that Burwell constitutes a suitable POC, the area of search is narrowed further through the consideration of the following key local factors:

- maximum distance from the POC in terms of a suitable radius 'as the crow flies'; and
- the total length of interconnection cable and the cost of delivering this connection.

4.3.9 From the POC at Burwell a 15km radius is considered by Sunnica Ltd to be the maximum viable distance for the area of search based on cost estimates provided by their independent connection provider/contractor. It is assumed that the cable would not run in a straight line, particularly if a development is spread over more than one site and so the length of the cable could be up to 1.5 times the radius. Sites closer are more economic as they have lower connection costs and minimise land required. They also have reduced installation and construction impacts.

4.3.10 This results in a 15km area of search from the Burwell POC within which to identify suitable solar development areas.

Stage 2 – Planning and environmental constraints mapping

4.3.11 In order to identify potentially suitable areas for solar development within the area of search, planning and environmental policy objectives contained in the National Policy Statement EN-1: Overarching National Policy Statement for Energy (Ref 4-1); National Policy Statement for Electricity Networks Infrastructure EN-5 (Ref 4-3), the National Planning Policy Framework (Ref 4-2) and where relevant, local planning policy are reviewed. This identifies a number of spatial planning and environmental constraints to be applied, using GIS mapping, across the area of search in order to identify potential solar development search areas which are, as far as possible, unconstrained. This includes international and national biodiversity designations; national landscape designations; green belt; and grades 1 to 3 agricultural land classification criteria. Search areas identified through this process are then taken forward to Stage 3 for further refinement.

Stage 3 – Identification of potential solar development areas

4.3.12 This stage involves the application of inclusionary criteria to refine the potential solar development search areas to establish areas that are optimal for solar development. This includes consideration of topography (including slope and aspect) and development area/field size to meet the requirements of the Scheme. Consideration is also given to brownfield land and locations that have been proposed through consultation feedback.

Stage 4 – Assessment of potential solar development areas

4.3.13 Stage 4 comprises an assessment of all areas identified at Stage 3 to establish each area's suitability to accommodate a solar development, taking into consideration planning and environmental factors derived from national and local planning and environmental policy objectives contained in the National Policy Statement EN-1: Overarching National Policy Statement for Energy (Ref 4-1); National Policy Statement for Electricity Networks Infrastructure EN-5 (Ref 4-3),the National Planning Policy Framework (0) and where relevant, local planning policy. These factors include biodiversity, landscape and visual amenity, cultural heritage, flood risk, land use, access for construction, as well as functional factors related to deliverability such as grid connection feasibility.

4.3.14 Sites are assessed by a planning professional having regard to factual evidence from mapping and other available data sources to determine their overall performance against planning, environmental and deliverability factors considered. A statement to support and justify the decision made is recorded in each instance and will be provided in the ASA report to be submitted with the DCO application.

4.3.15 Stage 4 includes assessment of sites in terms of their susceptibility to flooding, having regard to the Flood Zone within which they are predominantly located and provides evidence to demonstrate the Sequential Test requirements (as required by NPS EN-1 Section 5.7 (Ref 4-1) have been met, given small areas of Sunnica East Site A, Sunnica West Site A and Sunnica West Site B fall within Flood Zones 2 and 3.

Summary

4.3.16 The full ASA will be submitted with the DCO application. The application of the step by step assessment process described above confirms that the location of the Scheme:

- maximises the utilisation of low grade, non best and most versatile agricultural land;
- is not located within internationally and nationally designated biodiversity sites and avoids direct impact on locally designated biodiversity sites;
- is not located within or close to Areas of Outstanding Natural Beauty or designated areas of local landscape value;
- is not located within designated green belt;
- avoids direct physical impact on designated heritage assets;

- is predominantly within Environment Agency flood zone 1 and is therefore at a low risk of flooding;
- has good transport access for construction, being adjacent to the strategic road network;
- is of a size and has topography which meets the requirements of the Scheme to generate significant amounts of electricity and store it; and
- has limited land use conflicts with respect to local development plan allocations and displacement of existing businesses.

4.4 Alternative Technologies

4.4.1 As described in ***Chapter 3: Scheme Description***, the parameters of the DCO will maintain some degree of design flexibility to allow the latest technology to be utilised at the time of construction. Notwithstanding this, several technological design options have been considered and preferred options taken forward taking into consideration environmental effects and the Scheme's objectives and need for optimal functionality. Table 4-1 summarises these design alternatives.

Table 4-1 Design technology alternatives

Design technology element	*Considerations*
Type of battery storage technology DC coupling or AC coupling	Although similar in terms of costs, DC-coupling has far greater potential impact than AC coupling in terms of landscape and visual impacts. Therefore, having regard to the potential landscape and visual impacts and non-statutory consultation responses received regarding visual impact AC-coupled has been selected.
Heights for battery storage	The height of the battery storage was originally proposed to be 10m to allow for the containers which house the batteries to be mounted on top of each other. This has been reduced to 6m to reduce the visual impact of the containers. Six meters still allows for the height of a standardised battery storage container, which most technologies use, with some headroom to accommodate all potential technology providers. This height alsoretains flexibility to enable the containers to be mounted on some form of raised structure or foundations to avoid flood risk and / or enable cables to enter from the underside. Heating and cooling infrastructure could also be installed on the top of the containers if necessary.
Solar PV configuration	Two configurations were considered for the Solar PV layout: south-facing vs east-west. The east-west configuration was discounted for the following reasons: - There is a 14.8% less yield in terms of electricity generation using east-west compared to south-facing. - There are less biodiversity benefits derived. This is because there is more land take with east-west

Design technology element	*Considerations*
	whereas south-facing would allow greater amounts of land between the solar PV arrays such that grass will be able to grow and provide ecological benefits for the lifetime of the project - There would also potentially be more Heavy Goods Vehicle movements per m2 than south facing due to more PV per m2.
PV array height	The proposed solar module racking height was originally 3.5m to accommodate three panels in portrait; however, this was reduced to two panels in portrait meaning the racking height could reduce to up to 2.5m in height to minimise the potential visual impact of the Scheme. This change still delivers the Scheme's objectives with regard to electricity capacity.

4.5 Alternative Layouts

4.5.1 The layout of the Scheme has evolved iteratively and will continue to evolve through the EIA process taking into consideration environmental effects, the Scheme's objectives and functionality, and feedback from stakeholders and public consultation.

4.5.2 The purpose of this section is to describe the alternative layouts considered for the Scheme to date. The Design Statement, which will be submitted with the DCO application, will explain the design evolution of the Scheme. Table 4-2 summarises the main design layout iterations considered so far for the Scheme. The following figures illustrate the changes in terms of land area:

- Figure 4-1 EIA Scoping boundary;
- Figure 4-2 Non-statutory consultation boundary;
- Figure 4-3 Cable routes pre scoping

Table 4-2 Main Design Iterations for the Sites

Stage	*Proposed Layout*	*Consultation which influenced the proposed layout at this stage*	*Design evolution*
EIA Scoping Layout (March 2019)	Two principal sites covering approximately 1,172ha - Sunnica East Site (approximately 780ha) - Sunnica West Site (approximately 392ha) split into Sunnica West Site (north); and Sunnica West Site (south).	This was prior to extensive consultation with relevant stakeholders and therefore was not influenced by this.	The EIA Scoping Layout was produced with limited data from desk based and preliminary environmental surveys.
Non-Statutory Consultation Layout (June/ July 2019)	Three sites covering approximately 1,373ha: - Sunnica East Site (approximately 809ha) - Sunnica West Site A (formerly Sunnica West Site (south)) (approximately 503 ha) - Sunnica West Site B (formerly Sunnica West Site (north)) (approximately 61 ha) – no change from EIA Scoping.	Landowner discussions and initial discussions with West Suffolk Council identified a land use conflict reducing the eastern side of Sunnica East. Discussions with the operators of Worlington Quarry	The Non-Statutory Consultation Layout was developed with the feedback from the EIA scoping process and ongoing landowner discussions. The eastern area of Sunnica East was reduced due to the removal of the existing operational area of Worlington Quarry and other areas close to the A11 with conflicting land uses. As a result of the outcome of ecological surveys and the siting of solar PV, land to the north-west of Sunnica East (now Sunnica East A) was added for habitat mitigation, if required, and to compensate for the loss of the eastern area of Sunnica East. Land to the east of Sunnica West A around La Hogue Farm shop and to the south of the A11 was added to provide environmental mitigation and deliver the Scheme's objectives regarding electricity generation.
PEIR Layout	Four sites covering	Landowner discussions	Further reduction in land in the eastern area of Sunnica East to remove sites proposed for extensions to Worlington Quarry following discussions with the mineral

Stage	*Proposed Layout*	*Consultation which influenced the proposed layout at this stage*	*Design evolution*
(August 2020)	approximately 1,070 ha: - Sunnica East Site A (approximately 222.4ha) - Sunnica East Site B (approximately 323ha) - Sunnica West Site A (approximately 460.2ha) - Sunnica West Site B (approximately 64.2ha)	Non-statutory consultation feedback	operator regarding the programme for mineral extraction and thus impact on its mineral operations. Land for Solar PV in the western area of Sunnica East was removed as a result of landowner discussions. Land was retained to accommodate a cable route crossing linking Sunnica East Site A and Sunnica East Site B. Additional land was included to the north west of Sunnica East (now Sunnica East A) within the land holding already within the proposed DCO Site. These changes were to accommodate environmental mitigation areas particularly for stone curlew and deliver the Scheme's objectives regarding electricity generation. The Scheduled Monument (Bowl barrow on Chalk Hill) within Sunnica East was removed from the proposed DCO Site boundary. This had originally been retained as land for ecological mitigation, but it was decided that this would be removed in response to feedback from the EIA scoping and non-statutory consultation. A strategic environmental design (see Figures 3-1 and 3-2) has been developed for the PEI Report layout to respond to the environmental opportunities and constraints of the DCO Site and non-statutory consultation feedback, particularly in relation to scale, proximity to existing residential areas, visual impact and ecological concerns. This has identified developable areas for solar PV, battery storage and suitable locations for associated infrastructure as well as environmental mitigation and enhancement. As a result of the strategic environmental design process Sunnica East Site A and Sunnica East Site B incorporate the following design principles: - Provision of offsets/buffer zones from existing development e.g. Worlington village and along road corridors to reduce visual impact. Land has been retained within the boundary of the Sunnica East Site A and Sunnica East Site B so that the Applicant can retain control of this land such that the environmental strategy can be realised. - Strategic planting to screen views including woodland and hedgerows, both of which will be cognisant of existing landscape character. - Ecological offset areas principally to allow for stone curlew habitat.

Stage	Proposed Layout	Consultation which influenced the proposed layout at this stage	Design evolution
			- No solar PV and energy storage infrastructure within County Wildlife Sites. - No solar PV and energy storage infrastructure within flood zone 3b and panel heights will be designed to be above flood level in zone 3a. - No solar PV and energy infrastructure within archaeological mitigation areas identified through geophysical surveys. As a result of the strategic environmental design process Sunnica West Site A has incorporated the following design principles: - Offsets from Chippenham Park Registered Park and Garden and planting to screen the Scheme. - No Solar PV and energy storage infrastructure directly affecting the Scheduled Monuments and offset from these assets. - Strategic planting to screen / filter views including woodland and hedgerows, both of which will be cognisant of existing landscape character. - No solar PV and energy infrastructure within archaeological mitigation areas identified through geophysical surveys. - No solar PV and energy storage infrastructure within flood zone 3b and panel heights will be designed to be above flood level in zone 3a. As a result of the strategic environmental design process Sunnica West Site B has incorporated the following design principles: - Ecology corridor to provide continuity of habitat along the River Snail between Chippenham Fen and Snailwell Meadows. - No Solar PV and energy storage infrastructure within flood zones 3b and panel heights will be designed to be above flood level in zone 3a. - No solar PV and energy infrastructure within archaeological mitigation areas identified through geophysical surveys.

4.6 Alternative Cable Route Corridors

4.6.1 An optioneering process has been undertaken to identify the cable route corridors for the Scheme to connect to the Burwell National Grid Substation.

4.6.2 As described in ***Chapter 3: Scheme Description***, the electricity generated by the Scheme is to be imported and exported via interface cables from the onsite substations at Sunnica East Site A, Sunnica East Site B and Sunnica West Site A to the Burwell National Grid Substation. The cable route corridors therefore need to connect the substations to one another; and connect Sunnica West Site B (the closest of the Sites at 5.5km distance) to Burwell National Grid Substation. The cable route corridors considered are therefore across open countryside and require crossings of the railway, watercourses, various utilities, and roads.

4.6.3 Three cable route corridor options (see Figure 4-3) were initially evaluated prior to EIA Scoping. The evaluation considered the criteria outlined in Table 4-3.

Table 4-3 Cable route corridor evaluation

Criteria	*Considerations*
Technical and engineering requirements	Optimising routing so the cable can be laid in a straight line or in shallow curves so that the cable can be pulled through the ducting efficiently. Space for jointing bays and pits. Working area for cable trenching. Areas of working (e.g. pits and construction compounds) for road, rail and river/watercourse crossings. Boring, micro-tunnelling or moling requirements – impacts on hydrology and watercourses and needing to adhere to the Environment Agency's specific guidance on watercourse crossings.
Planning and environmental constraints	Proximity to residential property in Burwell. Avoidance of national ecological designations. Avoidance of national cultural heritage designations. Proximity to local ecological designations and sensitive ecological receptors. Proximity to public rights of way. Flood risk. Sensitivity of watercourse crossings.
Land use and ownership constraints	Affecting a minimum number of landowners. Following field edges in order to minimise possible disturbance for the landowner when farming or using land for other purposes. Where possible reducing interaction on rail network or strategic road infrastructure, utilities and other infrastructure.

4.6.4 Following analysis of the three potential routes taking into consideration the criteria identified in Table 4-3, a preferred cable route corridor was selected.

4.6.5 The preferred cable route corridor was presented at the EIA Scoping stage as two parts shown on Figure 4-1 and described below:

- **Grid Connection Route A** – connecting the Sunnica East Site to Sunnica West Site A; and
- **Grid Connection Route B –** connecting Sunnica West Site A to Sunnica West Site B; and connecting Sunnica West Site B to Burwell National Grid Substation. The route connecting Sunnica West Site B to Burwell National Grid Substation presented two options for crossing the railway line west of Sunnica West Site B, named Railway Crossing 1 and Railway Crossing 2.

4.6.6 Following EIA Scoping, refinements were made to the Grid Connection Route A. This was as a result of more land at the Sunnica West Site A being incorporated. Grid Connection Route B was also amended in response to the EIA Scoping process to avoid the sewage treatment works to the north of Burwell. The grid connection routes incorporating these changes underwent non-statutory consultation.

4.6.7 Since non-statutory consultation, meetings have been held with Network Rail and other stakeholders to discuss Grid Connection Route B and particularly the two options crossing the railway. This has resulted in the removal of railway crossing 2 (see Figure 4-2) which was the southern of the two options presented and an increase in land area for the northern crossing to allow for different crossing point options to the north (see Figure 3-16d). This is in response to feedback regarding the proximity of the route to the existing level crossing and potential conflict with existing land uses to the south of Fordham. West of the railway crossing the cable route corridor has been widened to provide options for crossing agricultural land at this location. This is in response to discussions with landowners.

4.6.8 Details of the cable route corridor optioneering process will be provided as part of the ES to be prepared for the DCO application.

4.7 Alternative locations for upgrading Burwell substation.

4.7.1 As discussed in section 4.3 available capacity has been identified at Buwell National Grid Substation. An extension will be required, to provide a transformer compound to transform the 132kV export voltage from the DCO Site to the National Grid 400kV connection voltage (as shown in Figure 3-17a and 3-17b). Following discussions with National Grid, locations have been identified to accommodate the extension. These need to be in close proximity to the existing substation to reduce the disturbance of land; cost and, in terms of engineering feasibility, for ease of connection to the existing infrastructure. Three areas which are currently in agricultural use but in close proximity to the existing substation have been identified. These are shown on Figure 3-19 and are:

- **Substation extension option 1:** 0.31ha to the east of the existing substation compound adjacent to Weirs Drove, approximately 200m west of Burwell.

- **Substation extension option 2:** 1.58ha approximately 450m north of the existing substation, north of Newnham Drove.
- **Substation extension option 3:**:2.52ha approximately 650m west of the existing substation, north of Newnham Drove.

4.7.2 All the options have been considered with regard to the potential to have landscape and visual, ecological and heritage impacts and consideration given to their access. None of the options are within any designated biodiversity sites and are not expected to result in any physical impact upon any designated heritage assets. Option 1 benefits from existing visual screening compared to the other two options and would be able to gain access off Weirs Drove. Option 1 is also currently within National Grid land ownership and closest to the existing substation. Following discussions with National Grid this land is available and is therefore the preferred location taking into consideration environmental, engineering and landownership constraints.

4.8 References

Ref 4-1 Department of Energy and Climate Change (DECC), (2011) National Policy Statement for Energy (EN-1), Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf [Date Accessed: 08/07/2020].

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