CLEVE HILL SOLAR PARK

ENVIRONMENTAL STATEMENT

VOLUME 1 - CHAPTERS

CHAPTER 4 - SITE SELECTION, DEVELOPMENT DESIGN AND CONSIDERATION OF ALTERNATIVES

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4 SITE SELECTION, DEVELOPMENT DESIGN AND CONSIDERATION OF ALTERNATIVES

4.1 Introduction

1. This chapter of the Environmental Statement (ES) provides an overview of the site selection process undertaken to identify the Development site. It also provides a description of the evolution of the Development design so far and the main alternatives considered.

2. This information meets the requirements of Regulation 14(1)(d) of the EIA Regulations which states that an ES should include:

> *"a description of the reasonable alternatives studied by the applicant which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment".*

3. Relevant planning policy for the Development is set out in Chapter 6: Legislation and Planning Policy Context and also in the Planning Statement (DCO Document Reference 7.4).

4. This chapter includes the following sections:

- Site Selection. An overview of the site selection process undertaken for the Development;
- Development Design. A description of the iterative design process undertaken for the Development and how it has responded to consultation comments; and
- Consideration of Alternatives. A description of the main alternatives to the Development and the selection of the Development as the preferred option.

5. The chapter is supported by the following figures provided in Volume 2:

- Figure 4.1 Preliminary Layout;
- Figure 4.2 Scoping Layout; and
- Figure 4.3 PEIR Layout.

6. The chapter is also supported by ES Technical Appendix A4.1: Sequential Test Analysis.

7. Other technical assessments within the such as ES Chapter 9: Ornithology, ES Chapter 10: Hydrology, Hydrogeology, Flood Risk and Ground Conditions, ES Technical Appendix A10.1: Flood Risk Assessment, and the Report to Inform an Appropriate Assessment (RIAA) (DCO Document Reference 5.2), are required under relevant legislation to undertake sequential test analysis of specific relevance to the discipline. These separate analyses are not repeated in this chapter.

4.1.1 The Need for the Development

8. The DCO Application is accompanied by a Statement of Need (DCO Document Reference 7.3) and a Planning Statement (DCO Document Reference 7.4) both of which set out the reasons why a solar PV electricity generating facility and an energy storage facility are needed in the context of the national need for energy related infrastructure set out in the relevant National Policy Statements (NPS). This chapter should be read in conjunction with that Statement of Need.

9. Chapter 6: Legislation and Planning Policy also sets out key policy that is relevant to the need for the Development. This policy sets out the consideration of alternatives to new NSIP-scale electricity generation capacity and although measures such as demand reduction, smart demand management and interconnections will have a role to play,

the UK's legal obligations in respect of climate change targets are not achievable without new electricity generating capacity.

10. The Development will help the UK meet its legally binding carbon emissions targets, and has the potential to support operation and balance of the National Electricity Transmission System through the delivery of an integrated electricity storage capability. This smart demand management has the potential to support further decarbonisation of the electricity sector through facilitating greater use of renewably generated electricity during peak periods.

11. As well as addressing the requirements of the EIA Regulations set out in section 4.1 of this chapter, this chapter addresses the requirement set out in section 4.4, Alternatives, of NPS EN-1.

4.1.2 Consultation

12. Under Section 42 of the Planning Act, consultation with the relevant bodies on the preliminary environmental information was undertaken. The following consultees made comments with respect to site selection. The comments and the responses as to how these have been addressed are set out in Tables 4.1 and 4.2.

Table 4.1 Key Section 42 Consultation Responses Regarding Site Selection and Consideration of Alternatives

Consultee	Response	Applicant Response
Canterbury City Council	Chapter 6 sets out how alternatives have been considered as per the recommendations in Section 4.4 of the EN-1, which states that applicants are obliged to include in their ES information about the main alternatives they have studied, and whilst paragraph 7 refers to an extensive site search exercise having been carried out with a large number of sites identified and the reasons for selecting the site at Cleve Hill, a list of these sites does not appear to have been provided along with the reasons why they were discounted.	Section 4.4 of this chapter (supported by Technical Appendix A4.1) presents the alternative sites considered. Section 4.2 of this chapter presents the reasons for selecting the site at Cleve Hill.
Graveney with Goodnestone Parish Council	3. Site identification We are concerned that the PEIR provides no clear justification for a solar power generating facility of this huge size (which is far in excess of anything previously seen in the UK), but then uses that extreme size to make the argument that "the only suitable site available is Cleve Hill", since it will provide the required connection capacity to the National Grid. This is a circular argument.	The DCO Application is supported by a Statement of Need which presents more detail in respect of the viability and benefits of the Development. Section 4.4 of this chapter (supported by Technical Appendix A4.1) presents the alternative sites considered.
	We ask that CHSP explain the justification for a development of this size and provide more information on why Cleve Hill was chosen, including the site selection criteria adopted and the alternative sites which have been examined and rejected. For example, have large decommissioned power station sites – such as Kingsnorth, near Rochester – been examined?	The DCO Application is supported by a Statement of Need which presents more detail in respect of the viability and benefits of the Development. Section 4.4 of this chapter (supported by Technical Appendix A4.1) presents the alternative sites considered. Section 4.4.5 sets out brief analysis of the specific sites identified.
	We would also like more information on why a solar farm (or a number of farms) of smaller capacity – presumably with a much wider choice of locational options and a much less intense	The DCO Application is supported by a Statement of Need which presents more detail in respect of the viability and

Consultee	Response	Applicant Response
	local environmental impact – cannot be considered.	benefits of the Development. Section 4.4 of this chapter (supported by Technical Appendix A4.1) presents the alternative sites considered. Section 4.4.3.3 considers alternative patterns of generation.
GREAT Graveney	The PEIR states that "the only suitable site available is Cleve Hill", since it will provide the required connection capacity to the National Grid. This basis provides no independent ground or evidence for the conclusion that the only site available is Cleve Hill.	Section 4.4 of this chapter (supported by Technical Appendix A4.1) presents the alternative sites considered.
	Has a solar farm of a smaller capacity been considered?	The iterative design process has sought to continually appraise the limits of the project in response to consultation responses. At each stage of consultation the Development design has reduced in scale with smaller areas of the Development site made available for development. This iterative design process is explained in section 4.3 of this chapter. The Statement of Need also considers a range of different capacity solar parks and provides justification for a large-scale generating station in this location.
	The Hive developer reported that a site on Canvey Island was suitable for a solar farm – what are the reasons that this is not being pursued?	Hive Energy has never pursued a solar farm on Canvey Island. Canvey Island is considered as a potential location in section 4.4.5.3 of this chapter.
	What other sites were identified and what were the reasons for their rejection?	Section 4.4.3 of this chapter is supported by Technical Appendix A4.1 which presents the alternative sites considered.
Kent Wildlife Trust	In Section 4 it is stated that "*A large number of sites had been identified by a team of project developers via direct approaches and a network of land agents across the country*" though these do not appear to be provided in the supporting appendices.	The CHSPL JV partners continually appraise opportunities to develop or acquire sites all over the UK and this quote from the PEIR is a reference to this ongoing process. These sites are commercially sensitive and therefore a list will not be provided, however, information is available on Hive Energy and Wirsol's operational and development sites in section 1.4 of Chapter 1 - Introduction which represents the other outcomes of their ongoing site selection exercises. The text within section 4.2 of this ES chapter has been updated to make this clearer.
	While we understand that the spare capacity at the Cleve Hill substation presents an opportunity, and is a principle driver in the selection of the development site (Section 4.2), this does not negate the need for full and proper consideration of alternatives. In the context of national renewable energy generation, we would expect a full and proper consideration of alternatives to include not just alternative locations, but alternative patterns of generation, i.e. multiple,	Section 4.4.3 of this chapter (supported by Technical Appendix A4.1) presents the alternative sites considered. Section 4.4.4 considers alternative types of generation. The Statement of Need explains why the available capacity at Cleve Hill substation provides a rare opportunity and that it is in

Consultee	Response	Applicant Response
	smaller, decentralised generation.	the national interest to fully utilise that capacity.
	Kent Wildlife Trust believes that the best use of the development site would be to accommodate managed realignment. This would benefit both the environment through habitat creation and local communities through the provision of recreation and ecotourism opportunities, and potentially reduction in local flood risk. It is the best location within The Swale SPA for such an undertaking, and this is reflected in proposals within the Environment Agency's Medway Estuary and Swale Strategy [MEASS]. The solar park proposals are incompatible with this.	Section 4.4.1 of this chapter includes an assessment of the 'Do Nothing' scenario. This includes consideration of the potential for the MEASS to be implemented on the Cleve Hill site.
Swale Green Party	A more appropriate scheme for this site would be to exploit the spare capacity available in the existing London Array sub-station at Cleve Hill to build the second phase of the London Array offshore wide farm that was cancelled. Development in the efficiency of offshore wind turbines may make this scheme more viable than it was when phase one of the London Array was built.	CHSPL understands that Phase 2 of the London Array Offshore Wind Farm has been abandoned for technical reasons and the area of seabed in question surrendered back to the Crown Estate. Section 4.4 of this chapter (supported by Technical Appendix A4.1) presents the alternative sites considered including alternative forms of low-carbon energy generation.
	Inadequate consideration of alternative sites.	Section 4.4.3 of this chapter is supported by Technical Appendix A4.1 which presents the alternative sites considered in more detail than was available in the PEIR.
	The developers have not considered any alternative site. Therefore, there is no analysis of why Graveney Marshes has been selected in preference to the available alternatives. This approach is unjustifiable and would not be permitted for any other form of development (for example, housing development).	Section 4.4 of this chapter (supported by Technical Appendix A4.1) presents the alternative sites considered.
	The most suitable site for an industrial development such as the one proposed, would be on a brown-field site, rather than in an environmentally-sensitive greenfield site in the countryside. There are more suitable sites available in Kent that already have the appropriate access to the National Grid. For example, the site of Kingsnorth coal-fired power station on Hoo Peninsular which was demolished this earlier this year. Another suitable location is available on the Isle of Grain on the site of a former oil-fired power station (demolished in 2015) and the site of a former oil refinery. The former Richborough power station provides an example in Kent of the site of a redundant power station being used for low-carbon power generation. An international example is provided by the 1 GW solar farm being constructed on the site of the former nuclear power station at Chernobyl, Ukraine.	Section 4.4 of this chapter (supported by Technical Appendix A4.1) presents the alternative sites considered. Section 4.4.5 sets out brief analysis of the specific sites identified.
The Faversham	There are numerous alternative brownfield sites – even in this corner of the country. Kingsnorth and the Hoo Peninsular are obvious candidates.	Section 4.4 of this chapter (supported by Technical Appendix A4.1) presents the

Consultee	Response	Applicant Response
Society	The Faversham Society needs clarification about why the Cleve Hill site has been chosen above others. If – as has widely been rumoured – it is attractive to developers solely because of the spare capacity on an existing and underused national grid connection, we do not believe that this is sufficient justification for the devastation which such a large - albeit solar - power station will create.	alternative sites considered. Section 4.4.5 sets out brief analysis of the specific sites identified. The Statement of Need explains why the available capacity at Cleve Hill substation provides a rare opportunity and that it is in the national interest to fully utilise that capacity.

Table 4.2 Key Section 42 Consultation Responses Regarding the Development Design

Consultee	Response	Applicant Response
GREAT Graveney	Mitigation of Cleve Hill/Graveney Hill is not possible, would the developers therefore introduce set back of the whole hill?	Section 4.3 sets out the Development Design changes since the publication of the PEIR. All of the solar panels which identified on the sloping parts of the Development site around Cleve Hill and Graveney Hill (Fields Y and Z in the PEIR) have been removed following consultation.
	Have any agreements in relation to setback of solar panels been made with individual householders?	The Applicant has met with, or offered to meet with, all of the residents of the closest households to the Development site. Responses at these meetings have informed the setbacks utilised in the final submission.
	What further draw back of the solar panels would the developers make to ensure that the most visible and sensitive parts of the landscape are protected from an industrialised view?	Section 4.3 sets out the Development Design changes since the publication of the PEIR. Following each stage of consultation, the areas where solar panels can be located have reduced and been set back from publicly accessible areas.
	What other future changes would the developers present in the DCO application that they view to be acceptable?	Section 4.3 sets out the Development Design changes since the publication of the PEIR.
Swale Borough Council	I acknowledge that the first draft proposals included the possibility of solar panels across both Field Y and further east, both up to Cleve Land and beyond public footpath ZR488. The revised candidate design still indicates proposals to erect panels on the relatively steeply sloping southern side of Cleve Hill which will be visible from far greater distances than would panels erected on the flat low lying land that comprises the vast majority of the development site. These panels will be visible from as far as Harty Ferry on the Isle Of Sheppey (albeit in the context of clear views of the wider solar farm from this position) but also from the south and east.	Section 4.3 sets out the Development Design changes since the publication of the PEIR. The solar panels identified on the sloping southern side of Cleve Hill referred to on plans as 'Field Y' have all been removed from the Development Design.
	The diagram on page 5-9 of the PEIR makes clear the awkward and restless visual impact of panels arranged on sloping ground, which compares very unfavourable to the muted and more easily absorbed visual impact of panels	

Consultee	Response	Applicant Response
	running continuously across flat land. Field Y is such a small part of the overall proposal, but its negative visual impact will be out of all proportion to its benefits and I urge you to re-consider its inclusion in the scheme.	
	The northern foot of Cleve Hill marks the first change from open flat land to that with any form of contour. Views westwards across the site from Seasalter Road north of Cleve Hill are not interrupted by anything of any great height. The high embankments around the proposed substation compound will significantly intrude into these views; creating a prominent and intrusive element in these long views. I have seen no analysis of why the substation compound could not be located to the south of the pylons, in fields P or Q; drawn back from the unobstructed views, and sheltered from view by Cleve Hill Itself.	The reasons why the electrical compound is considered to be in a suitable location are set out in section 4.4.2.3 of this chapter.
	I accept that this would require the substation to be slightly further from the National Grid switchgear, but I see no reason why a slightly longer connection would be impractical. The advantages of this in repositioning of the substation would be significant in landscape terms, better preserving the distinctive relationship between Cleve Hill and the flat marshland towards the coast. The substation would be seen between Cleve Hill and more developed areas to the south where it could be better assimilated, especially if its outline followed existing linear ground features and was less regular and artificial. I urge you to give significant further thought to this part of the proposals.	The reasons why the electrical compound has been sited in the location shown in the Application layout are set out in section 4.4.2.3 of this chapter.
Swale Green Party	The Green Party supports deployment of renewable energy. We recognise that international agreement for action to restrict global warming to under 2°C is a very considerable challenge. Renewable energy needs to be rapidly deployed at scale if we are to meet our international legal obligations. It is important in meeting this challenge that the right schemes are built in the right place. We do not believe that very large scale solar farms are the most appropriate deployment of renewable energy. There is no advantage to deploying solar at very large scale. An equivalent number of panels located on roofs (domestic, commercial and industrial) would provide a more efficient use of the energy generated. Furthermore, we do not believe that the Nagden, Cleve and Graveney Marshes provide an appropriate	The Planning Statement (DCO Document Reference 7.4) includes section 4.6 on the IPCC Special Report on Global Warming of 1.5°C published in October 2018[1]. The report finds that a global warming of 1.5°C (the Paris Agreement's aspirational target) will be damaging, but is far less damaging than a 2°C increase in global temperature. A target of 1.5°C will still have significant negative impacts on the factors highlighted, but these will be less severe and more easily reversed. The Special Report states that to achieve the aspirational target of 1.5°C, there will need to be rapid and far-reaching transition in energy, land, urban and infrastructure (including transport and buildings), and industrial systems. Global model pathways limiting global warming to 1.5°C are projected to involve the annual average investment needs in the energy system of

[1] IPCC (2018). Global Warming of 1.5°C. Available online at: http://www.ipcc.ch/report/sr15/ [accessed 30/10.2018]

Consultee	Response	Applicant Response
	location. The site is prone to flood; surrounded by areas designated for their wildlife of international significance; and provides a much-loved amenity for local people. The development would substantially change the character of views from Saxon Shore Way, a long-distance footpath that runs along the edge of the site.	around 2.4 trillion USD2010 between 2016 and 2035 representing approximately 2.5% of the world GDP. The Statement of Need explains that there are a number of advantages to be gained in the public interest by developing large-scale solar PV and energy storage facilities generally and on this site. The DCO application includes a flood risk assessment, which has the support of the Environment Agency. Section 4.4.4 of this chapter addresses the alternatives considered including smaller scale solar development.
	The proposed solar farm has a load factor of less than 11%. This is, on average over a year the power generated is equivalent to only 11% of the peak output. In comparison off-shore wind has a load factor of more than 30%. The most recent offshore wind farms have a load factor approaching 50%. Therefore, the proposed solar farm is a very inefficient use of the site compared to alternative methods of renewable generation.	Section 4.4.3 of this chapter (supported by Technical Appendix A4.1) presents the alternative sites considered. Section 4.4.4 considers alternative types of generation.
The Faversham Society	The Faversham Society enthusiastically supports the development of all forms of renewable energy. We recognise the importance of using wind, solar and tidal technologies for power generation to reduce the use of carbon fuels and meet the UK commitments to reduce levels of greenhouse gasses. However, we have grave concerns about the negative environmental and amenity impact of the solar power station being proposed at Cleve Hill and across the surrounding marshes. There are alternative brownfield sites available, and distributed generation is both possible and more desirable.	Section 4.4.3 of this chapter (supported by Technical Appendix A4.1) presents the alternative sites considered. Section 4.4.5 sets out brief analysis of the specific sites identified.

4.2 Site Selection

15. The Development site is described in Chapter 5: Development Description. The area of land in which the solar photovoltaic (PV) array, electrical compound (including the energy storage facility and Development substation) and habitat management area is to be located is a sub-set of the area within the draft DCO Order Limits and is referred to here as the "Solar Park".

16. The Solar Park site was selected through an extensive site search exercise undertaken on an ongoing basis by Hive Energy for large-scale, ground mounted solar PV developments. Since Hive Energy was formed in 2009, a large number of potential sites have been identified and considered for solar PV development by a team of project developers, via direct approaches and a network of land agents across the country. The south of England is of particular interest due to the higher levels of solar irradiation experienced relative to other parts of the UK. To date, no other sites have been identified in the south of England in close proximity to the 400 kV National Grid Electricity Transmission (NGET) network with available capacity, the ability to accommodate similar generation capacity to the Development (approximately

350 MWp) and with the other positive characteristics to facilitate solar PV development which are discussed in this section.

17. A range of technical, environmental and economic factors are considered when investigating and assessing any potential site for ground-mounted solar PV development. Key factors for consideration include:

- Solar irradiation levels;
- Proximity to an available grid connection;
- Proximity to local population;
- Topography;
- Field size / shading;
- Access to the site for construction;
- Archaeological interest;
- Agricultural land classification;
- Landscape designations and visual impact;
- Nature conservation designations;
- Flood risk; and
- The potential for a commercial/land agreement with a landowner.

18. Following consideration of the above factors as set out in the following sections, the area in which the Solar Park has been located was identified as having very good potential for an NSIP scale ground mounted solar PV array.

4.2.1 Solar Irradiation Levels

19. The current (2014) UK annual average solar resource is 101.2 Wm^{-2} with the highest levels of 128.4 Wm^{-2} found in the south of England[2]. Solar irradiation receipts could increase in the southeast of England due to the effects of climate change, as set out in ES Chapter 15: Climate Change.

20. The south of England was therefore considered a suitable and optimal location to site a NSIP-scale ground mounted solar PV array in the UK.

4.2.2 Proximity to an Available Grid Connection

21. In order to export the electricity generated by a solar PV array, there must be available grid capacity for the Development in close proximity, or a local energy user with a consistent demand for electricity that exceeds the maximum generation capacity of the solar PV array.

22. The vast majority of solar PV arrays are connected into the 'local' distribution network. A "transmission" connection, into National Grid's infrastructure, is usually more costly but gives the opportunity for greater amounts of electricity to be exported than would be possible on the local network. The Statement of Need also explains how transmission connected generation offers National Grid greater visibility and control over generating capacity and NETS balancing.

23. Through discussions with the Applicant and the Applicant's grid consultants, Xero Energy, it was determined that a maximum distance of 5 km is likely to be at, or beyond, the limit of viability for a transmission connection. 5 km was therefore used as the area of search for alternative solar PV electricity generating facilities with the ability to connect to the existing infrastructure at Cleve Hill Substation as set out in section 4.4.3 of this chapter.

[2] Burnett, D, Barbour, E & Harrison, G 2014, 'The UK solar energy resource and the impact of climate change' Renewable Energy, vol 71, pp. 333-343. DOI: 10.1016/j.renene.2014.05.034

24. The Solar Park is adjacent to the existing Cleve Hill Substation, constructed between 2009 and 2011, which provides a connection from London Array Offshore Wind Farm to the National Grid.

25. The existing Cleve Hill Substation was built with sufficient capacity to serve an offshore wind farm of up to 1,000 MW delivered in two phases. Phase One is the existing 630 MW offshore wind farm operational since in 2011. Phase Two was to be an additional 370 MW of wind farm capacity but was granted consent conditional upon a suite of additional surveys which were ultimately not undertaken due to a range of additional technical constraints and environmental uncertainties[3]. In 2014 London Array formally terminated the agreements with The Crown Estate for Phase Two and cancelled the remaining grid capacity reserved at the existing Cleve Hill Substation. The National Grid Electricity Transmission (NGET) substation within Cleve Hill Substation was built with the necessary infrastructure to connect Phase Two of London Array and therefore now has spare capacity and the necessary infrastructure for the Development to connect directly to the transmission network.

26. The 400 kV network in the southeast of England is extremely congested and, as the Statement of Need explains, it is rare to have access to an existing connection point to the transmission network with the necessary infrastructure already in place.

27. In addition, NGET are likely to resolve local constraint issues through the procurement of constraint management services rather than network upgrades[4], and an energy storage facility as proposed as part of the Development could therefore play a key role in providing grid management facilities to the transmission network in the southeast of England.

28. 400 kV connections are expensive and potentially complex depending on the nature of environmental receptors along the cable route and whether overground or underground cables are used. A short connection to the transmission system is also likely to be more reliable.

29. Were the connection more than a few hundred metres long, NGET would potentially also need to build a new 400 kV switching substation next to the Development, increasing costs and environmental impacts.

30. Close proximity to a NGET substation also improves commercially viability. This is particularly relevant in the current scenario of no subsidies or other funding support being available for NSIP-scale ground mounted solar PV developments, and the Government's policy to reduce the cost of energy.

4.2.3 Proximity to Local Population

31. For any energy generating development, developers should seek to minimise local impacts. A range of environmental factors are considered in terms of the effect on population and minimising effects on people is more straightforward with lower population densities around sites. Energy developments are therefore often located in rural and agricultural areas for this reason.

32. The location of the Solar Park, coastal on the north and west sides, with open land to the east and agricultural land immediately to the south is favourable for development. The above characteristics limit the number of properties adjacent to or within 200 m of the Solar Park to less than 10 dwellings. The low-lying nature of the Solar Park and the generally flat nature of the topography means that longer distance views from properties not immediately adjacent to the Solar Park boundary are very limited in number and extent, and where there are dwellings in proximity to the Solar Park, there

[3] Available online: http://www.londonarray.com/the-project-3/phase-2/ [Accessed 15/05/2018]
[4] Xero Energy, Pers. Comm.

is space to set back the solar PV arrays and add screening planting. In addition, the substantial flood defences which surround the Solar Park on the western and northern boundaries offer visual screening from areas to the north and west.

4.2.4 Topography

33. Flat land is advantageous for solar PV development as construction is more straightforward, shading between arrays is limited and more consistent and flat land is generally less visible than slopes where the surrounding topography is also flat or has gentle gradients.

34. The vast majority of the Solar Park is flat, with little or no gradient, and so is well suited to the Development.

4.2.5 Field Size / Shading

35. Large open fields without vegetated boundaries reduce the impact that small fields can have on a solar PV layout design. Typically, buffers are left around field edges to vegetation due to shading, tree root protection zones and other constraints such as ditches which have an impact on the installed capacity of a solar PV array. So significantly less capacity can be sited within a group of smaller fields compared to fewer larger fields.

36. The Solar Park consists of a small number of very large fields, separated by drainage ditches rather than hedgerows and trees and so is well suited to the Development.

4.2.6 Access to the Site for Construction

37. In order to construct a NSIP-scale ground mounted solar PV array, appropriate access for construction must be available. It is possible to access solar PV sites via single track lanes using traffic management, however it is preferred to have an available two-way access road, particularly for larger developments.

38. The Solar Park is adjacent to the existing Cleve Hill Substation which was built between 2009 and 2011. The access for the existing substation is the same access which is proposed to be used for the construction of the Development, and the same construction traffic route is proposed to be used. A Construction Traffic Management Plan will be implemented to control traffic on the roads between the site and the strategic road network (ES Technical Appendix A14.1).

39. The previous utilisation of the existing access and the relatively short route from the strategic road network indicated that construction access was viable to the Solar Park.

4.2.7 Archaeological and Heritage Interest

40. It is preferable for solar PV development sites to have low levels of archaeological interest and a lack of designated sites, such as scheduled monuments, listed buildings and conservation areas within or adjacent to the site. Assets within or adjacent to a development site could have an impact on the location and design of a PV array.

41. The Solar Park does not contain any scheduled monuments, listed buildings or conservation areas either on or immediately adjacent to the boundary. A search of the historic environment records database identified some undesignated heritage assets within the Solar Park, and these features are subject to assessment of potential direct effects in Chapter 11 of the ES.

42. There are designated assets beyond the Solar Park boundary which are subject to assessment of indirect effects (on setting) in chapter 11 of the ES.

4.2.8 Agricultural Land Classification

43. Proposals for solar PV developments on best and most versatile agricultural land generally require additional justification to be consented. Best and most versatile agricultural land is Grade 1, Grade 2 and Grade 3a.

44. Approximately 95% of the land within the Solar Park where development could take place is classified as Grade 3b, which is not best and most versatile agricultural land, *i.e.*, it is of lower agricultural quality, and so is well suited to the Development. The findings of the Agricultural Land Classification Survey are reported in Technical Appendix A13.1 to the ES. Technical Appendix 4.1 to this chapter sets out alternative sites in proximity (5 km) to the existing Cleve Hill Substation, including consideration of agricultural land quality.

4.2.9 Landscape Designations

45. When assessing a potential solar PV site, national landscape designations such as national parks and areas of outstanding natural beauty are generally avoided as site locations.

46. Although the Solar Park is locally designated as an Area of High Landscape Value within the Swale Local Plan[5], it is over 4 km from the nearest nationally designated landscape, the Kent Downs AONB (section 7.3.1 and Figure 7.8 of Chapter 7: Landscape and Visual Impact Assessment).

4.2.10 Nature Conservation Designations

47. When assessing a potential solar PV site, national and international nature conservation designations such as Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar wetland sites and nature reserves are generally avoided as site locations. Areas adjacent to such designations may have potential for development depending on the nature of the designation and of the land potentially subject to development.

48. Although land adjacent to the Solar Park is designated as SSSI, SPA and a Ramsar site, the land where the infrastructure associated with the Development will be built is not designated or subject to any restrictions relating to nature conservation in respect of agricultural management.

49. The Solar Park site is known to have the potential to support birds associated with the SPA designation and bird surveys were undertaken very early on in the development process (2014) in order to investigate the use of the Solar Park to inform the development process. The majority of bird species associated with the SPA designation were recorded predominantly in habitats offsite. The bird species recorded using the site itself are largely dependent upon a range of factors such as crop availability and weather. It was therefore considered following the initial surveys and as data continued to be gathered that there was potential to mitigate the impact of the Development on the bird species that do use the site through land use management, to continue to provide the same baseline resources, albeit within a smaller enhanced area. It was recognised that the longer-term variability of land use and bird use of the species was an important factor and therefore bird surveys continued between 2014 and 2018 to continually inform the assessment contained in Chapter 9: Ornithology of this ES. Mitigation is proposed to ensure that the Development will not have an adverse impact on the integrity of the Swale nature conservation designations.

[5] Bearing Fruits 2031: The Swale Borough Local Plan, Full Council Item, 26th July 2017 and Technical Paper No.6

4.2.11 Flood Risk

50. Although solar PV developments are not strictly flood sensitive infrastructure, some ancillary elements of a solar PV array are flood sensitive, such as the substation and transformers and electrical connections across the array. Flood zone 1 is preferable for development, however it is possible to locate development in flood risk areas through applying appropriate protection and mitigation measures.

51. The Solar Park is within Flood Zone 3a, but in an area benefiting from existing coastal defences, and protected by those defences against a 1 in 1,000 year flood event. It was therefore expected that through design mitigation and incorporation of flood resistance and resilience into the project design, the flood risk onsite could be mitigated.

52. Further detail on how the Development has been designed in respect of flood risk is provided in Chapter 10: Hydrology, Hydrogeology, Flood Risk and Ground Conditions and Technical Appendix A10.1: Flood Risk Assessment.

4.2.12 Commercial Agreement with the Landowner

53. In order to implement a solar PV development, the agreement of the landowner is required. In the case of an NSIP development it could be possible to proceed without this, however in the case of the Development, commercial terms have been agreed with the landowner of the Solar Park site for the construction and operation of a solar PV and energy storage facility on the land. CHSPL expects to enter into relevant agreements with other parties required to access the land, connect the Development to the National Grid, and to protect the Solar Park from flooding. The DCO application will include powers of compulsory acquisition and temporary possession to ensure that the Development can be delivered in the event those negotiations are not successful.

4.3 Development Design

54. The purpose of solar PV development is to harness the power of the sun to generate electricity. The optimum design is therefore to locate solar PV arrays in areas exposed to the highest levels of solar irradiation.

55. The identification of environmental effects is an iterative process, running in tandem with the design process. As environmental effects and sensitivities have been identified, the layout of the Development has undergone a series of modifications to avoid or reduce potential environmental effects through careful design.

56. Specific environmental factors are considered in the final design parameters of the Development, such as constraints avoided. Typically this is referred to as "development design mitigation" or "embedded mitigation", which is set out in the various technical chapters of the ES.

57. The Development layout has evolved throughout the EIA and pre-application consultation processes. This iterative approach has allowed the results of consultation along with results from the environmental studies carried out to inform the EIA to guide the evolution of the Development and allowed the design to be modified in order to avoid or minimise environmental effects where possible.

58. This is achieved through detailed assessments of the environmental effects, consideration of the identified spatial constraints, combined with consideration of the appearance of the Development from sensitive viewpoints to take account of landscape and visual considerations.

59. A series of design meetings with project team input and site visits have been held to inform the design process. These involved members of the EIA and technical team who provided information on potential constraints following the baseline assessments. This

process led to the candidate Development design presented in Chapter 5: Development Description of this ES.

60. The initial focus of design was on locating the solar PV arrays outside more sensitive areas. The initial layout was tested against environmental and technical constraints.

61. Constraints included:

- Landscape character and visual impact;
- Residential amenity including visual outlook from residential properties and potential noise effects from the operation of the Development;
- Existing land-use;
- Ecologically and archaeologically designated sites, and sensitive undesignated features; and
- Separation distances from overhead power lines.

62. The Design Principles and the candidate Development design described in Chapter 5: Development Description has been achieved following a number of key layout iterations, which are summarised in Table 4.3, and shown in Figures 4.1 to 4.3, and Figure 5.2 (the Application layout). Although the summaries in Table 4.3 reflect discrete designs, small refinements to, and testing of new locations within these general stages has been undertaken throughout the EIA process as new information and feedback became available.

Table 4.3 Main Design Iterations

Iteration	Parameters	Comment
Preliminary Layout (August 2015)	South facing arrays 15º fixed tilt 262.8 MWp DC 750,708 modules 350 Wp modules 146.38 ha area of modules	The initial layout design was produced in the absence of detailed data from environmental assessments. No buffers were applied to any features or topography other than ditches, and panels were located to maximise the number of arrays within the developable area. Access tracks were proposed linking all of the fields within the site. A substation compound of approximately 1.5 ha was allowed for in the design. The expected progression in PV module output was acknowledged in this design with 350 Wp modules being used for the design. Other preliminary designs were produced at this time which began to take account of environmental constraints, reducing the available area for solar PV array development.
Scoping Layout (December 2017)	East and west facing arrays 8º fixed tilt Tables of 2.5 to 4.5 m in height AGL 407.4 MWp DC 1,131,648 modules 360 W modules 215.5 ha area of modules 8 ha electrical compound (including battery storage)	The scoping layout design was produced at the start of the EIA process. Bird survey data had been collected by this time and early indications suggested that an area of the site should be kept free of modules and managed to be of benefit to overwintering bird species. This land was located in an area of the site where some of the highest numbers of birds had been recorded. The London Array Wind Farm export cable also crosses this area of the site which forms a constraint to development on that part of the site. An east-west orientation was proposed to maximise the MWp capacity of modules that could be accommodated within the site. An optimum balance of modules to mounting structure materials was developed resulting in the table arrangements described in the Scoping Report (Appendix

Iteration	Parameters	Comment
		A3.1). Similar to the preliminary layout, all of the site area was used to maximise the output capacity of the Development. No buffers were applied to any features or topography other than ditches, and panels were located to maximise the number of arrays within the Developable area. The overhead lines which traverse the site (400 kV and 11 kV) were buffered to a precautionary extent in the Scoping Layout ahead of consultation with NGET and UKPN. The habitat management area of approximately 42 ha previously included in the preliminary layout was retained. A buffer strip was retained on the south-western boundary to avoid PV modules being directly adjacent to the Saxon Shore Way. A spine road running though the site parallel with the 400 kV overhead line was included, with roads accessing the transformers in each field running from the spine road. No fences were included in the design at scoping.
PEIR Candidate Layout Design (May 2018)	East and west facing arrays 8º fixed tilt Tables of 3 m to 4 m in height AGL 375.8 MWp DC 988,960 modules 380 Wp modules 191.2 ha area of modules 8 ha electrical compound (including battery storage)	The PEIR candidate Development design was developed from the scoping layout using the feedback received in the Scoping Opinion, during Phase 1 consultation, and in a series of informal meetings with near neighbours, local stakeholders and statutory consultees. The key changes to the design from Scoping to PEIR included: • Removal of modules from the south west of the site to the north east of Nagden to reduce visibility from the properties at Nagden and for users of the rights of way at Nagden. • Removal of modules from the sloping land north of Nagden to reduce visibility from Nagden and from the Saxon Shore Way on both sides of Faversham Creek. • Removal of modules from the land immediately north of Warm House on the southern boundary to reduce visibility from the property, and replacement with grass/scrub land. • Removal of modules from Field Z, southeast of public right of way ZR488 that crosses the south-eastern corner of the site to reduce visibility of the Development from Graveney including the Cleve Hill Road area and Sandbanks Road. • Removal of modules from above the 12 m AOD contour on Graveney Hill (Field Y) to reduce the potential for modules to be visible above the crest of the hill, both from the areas described above, but also for the properties accessed from Cleve Hill Road, Crown Cottages and Graveney Hill Farm. • Removal of single tables and addition of half tables, to increase the separation between tables around ditches to promote the use of

Iteration	Parameters	Comment
		these habitats by birds, such as marsh harrier, to improve the coherence of the Development design where visible and maximise the generation capacity where possible. • Introduction of landscaping, in the form of native species buffer planting and lowland meadow planting to boundaries in the south of the site (the Landscape and Biodiversity Management Plan has more detail on this, in Technical Appendix A5.1). • Application of 5 m buffers from the bank top of ditches to take account of the need for a perimeter fence, and access to the inside and outside of the fence or to the area between ditches and panels where there is no fence. Internal Drainage Board (IDB) ditches were also taken into account with a minimum 8 m buffer to the bank top. • Application of various buffers to NGET infrastructure and 6 m buffers either side of the UKPN wooden pole line infrastructure following consultation. • The spine road was retained but the rest of the Development site is proposed to be accessed by grassed tracks only, reducing the need for aggregate to be delivered during construction. • The shape of the electrical compound was changed, to avoid conflict with the existing 400 kV overhead line and to accommodate up to 350 MWh of battery storage within the compound as well as the necessary substation infrastructure to export the electricity generated by the Development to the National Grid. • The existing flood defence was included within the Order Limits in response to consultation with the Environment Agency.
DCO Application Layout	East and west facing arrays Tables of 3 m to 3.9 m in height AGL 349.3 MWp DC 884,388 modules 395 Wp modules 176.4 ha area of modules 8 ha electrical compound (including energy storage)	The Application candidate Development design has been developed from the PEIR layout using the feedback received during Section 42 consultation, during Phase 2 consultation, and in a series of informal meetings with near neighbours, local stakeholders and statutory consultees. The key changes to the design from PEIR to the Application design include: • Removal of all panels from the sloping parts of Cleve Hill and Graveney Hill (Field Y) in direct response to requests received during consultation. • An increase in the minimum separation between the solar PV arrays and the bank top of ditches from 5 m on either side (or 8 m for IDB drains) at PEIR to 15 m on either side on the main north-south ditches that cross the Development site representing the majority of ditches overall. • A commitment to underground the existing 11 kV overhead line that traverses the south of the Development site. This adds capacity within

Iteration	Parameters	Comment
		the Development site, away from the boundaries, to compensate to an extent for the losses in capacity through other design changes. • The previous field boundaries have been broadly maintained ensuring that no solar panels could be higher than was proposed at PEIR. • All of Field J, and the eastern 50 m of Fields H and I have been removed from the solar PV array areas. This is to increase the size, and therefore the capacity of the arable reversion habitat management area for overwintering waders (birds) associated with the Swale SPA. The area is now approximately 56 ha in size, to provide a minimum of 50.1 ha of functional land for wintering waders after areas the birds would be less likely to favour because of proximity to structures are removed (50 m buffer). • Following consultation with the residents, the land between Warm House and the Development will be planted as a woodland, rather than grass/scrub land. • An updated landscaping scheme to reflect the above design changes. This includes a new area of planting adjacent to public footpath ZR488 which crosses between fields Y and Z. • The spine road has been reduced in length as it was unnecessary for the spine road to run the length of Field A. • Mammal friendly culverts have been proposed for new and upgraded ditch crossings. • An area within the existing Cleve Hill Substation has been proposed as a habitat management area to offer complementary management for biodiversity in support of the adjacent freshwater grazing marsh and arable reversion habitat management areas. • A definition of flood defence maintenance has been agreed with the Environment Agency and the Marine Management Organisation. • Introduction of an alternative access route to the south of the existing substation. Overall, the Application layout represents a c. 10% reduction in the number and coverage of solar PV modules across the site from the PEIR layout. This loss in capacity has been partially mitigated through the modelling of a solar PV module with greater generating capacity. It is hoped that solar PV module capacities will continue to increase prior to construction to maximise the generation potential of the Development site within the maximum area of modules set by the Outline Design Principles (DCO Document Reference 7.1).

4.4 Consideration of Alternatives

4.4.1 Do Nothing Scenario

The Development site has been identified by the Environment Agency (EA) as a potential 'managed realignment' site in the consultation draft of the Medway Estuary and Swale Strategy (MEASS)[6]. It is therefore appropriate to summarise briefly in this section what the potential implications for the Development site are in the 'do nothing' scenario, and with respect to the MEASS, as this is an issue that has been raised throughout the consultation process for the Development.

In the absence of proposals for the Development, it is assumed that the site would continue to be managed as it is currently, as arable farmland. The future baseline would include this, along with the effects of climate change, as set out in Chapter 15: Climate Change. All effects that the Development would have, both adverse and beneficial, including those assessed in this ES as well as effects in terms of meeting planning and energy policy and effects on the electricity market, would not occur.

4.4.1.1 Draft Medway Estuary and Swale Strategy

63. The Applicant has undertaken extensive consultation with the Environment Agency regarding its strategic proposals for managed realignment at the Cleve Hill site, and its consultation on the draft MEASS carried out in winter 2017/18. The draft MEASS included a proposal for managed realignment in Epoch 2, 20 to 50 years in the future, between 2038 and 2068. Further detail on this is given in the Consultation Report (DCO Document Reference 5.1).

64. The managed realignment proposals at Cleve Hill remain subject to a high degree of uncertainty over at least the next 20 years with or without the presence of the Development. The EA's proposals were pushed into Epoch 2 rather than being proposed sooner, as there are a number of critical infrastructure assets within the site which would increase the costs associated with works and complicate the managed realignment option.

65. The EA proposes that, should the Development go ahead, as a "Plan B" the EA will cease to maintain the flood defences that currently protect the site, this responsibility will fall to the Applicant and the other beneficiaries of the defences, and the proposals for managed realignment can be proposed in the longer term, within Epoch 3, 50 to 100 years from 2068 to 2118.

66. Due to the uncertainty outlined above, it remains uncertain if, how, or when managed realignment could take place on the Cleve Hill site, and the draft MEASS proposals have therefore been considered as a strategic aim, rather than as part of the future baseline or as an alternative proposal to the Solar Park for the Development site.

4.4.2 Consideration of Alternative Designs

67. Chapter 5: Development Description sets out where the Development proposal includes alternatives as an integral part of the candidate design, i.e., where the design includes options. This includes:

- Site Access – the northern and southern routes are both included;
- Energy storage – two alternative designs, battery pack and containerised are included; and
- A potential extension to the solar park is included within the electrical compound area should the energy storage facility either not be built, or reduce in size.

[6] Environment Agency (2017). Draft Medway Estuary and Swale Strategy for Consultation. Available online at: https://www.gov.uk/government/publications/medway-estuary-and-swale-flood-and-coastal-risk-management-strategy/medway-estuary-and-swale-flood-and-coastal-risk-management-strategy [accessed 30/10/2018]

68. As all of the options above have been considered as part of the Rochdale Envelope candidate design they have not been considered further in this Chapter. This section focusses on alternative design options which have been considered and discounted.

4.4.2.1 East – West vs South Facing

69. Early in the Development design process, a decision was required in respect of the orientation of the solar PV modules in the Development layout. An east-west layout has become an increasingly viable option because of the decreasing costs of solar PV modules.

70. The preliminary layouts described in Table 4.3 utilised a south facing array design more commonly seen in the UK.

71. A south facing orientation can potentially deliver more energy per solar PV module than an east-west array, potentially as much as 10% more, however the angle of tilt to achieve this, and therefore the spacing between arrays results in a south facing array delivering less energy per unit area of a Development site.

72. Using the examples in Table 4.3, the initial south facing layout did not take into account environmental constraints and covered most of the arable land available for development 358.5 ha, approximately 92% of the 387.6 ha arable land) but only at a density of approximately 41%[7]. Therefore although all of the land was utilised for Development, the ratio of solar PV module area to developed area of the site was low.

73. The DCO Application layout includes solar PV arrays in fields with environmental considerations taken into account, including an approximately 56 ha habitat management area for overwintering birds associated with the SPA, 13.3 ha of lowland grassland meadow habitat management where panels were previously proposed in fields Y and Z and with greater set backs from ditches, and from the closest residential receptors across the Development site. Removal of these areas from the Development area results in the fields where panels are situated covering 232.3 ha, approximately 60% of the total 387.6 ha arable land. Within these fields, there is a much greater density of solar PV modules (the ratio of solar PV module area to developed area is approximately 76% within the fields). A high ratio of solar PV module areas to developed area of the site enables greater site capacity to be achieved in a smaller area. This more than compensates for the reduction in the energy generated by each individual solar PV module.

74. The east-west orientation has allowed the Development to respond to environmental constraints and issues raised throughout consultation, whilst continuing to maximise the amount of clean energy that can be produced by the Development.

75. The calculations above are relatively crude, but they demonstrate the point that a south facing array would require a much greater area to produce the same energy as an east – west facing array. There would be a significant reduction in total energy generation for a south facing array relative to east-west layout on the same developable area.

76. This may not be the case for all solar farms in the UK, but the flat land at Cleve Hill, and the relatively high levels of solar irradiation in the south-east of England mean that this particular site is ideally suited to an east-west array. The immediately adjacent and large available grid connection capacity also doesn't constrain the electrical output of the Development allowing energy generation to be maximised.

77. An initial consideration of the differences between the environmental impact of a south facing and an east-west array were considered, and in the main, other than subjective preferences, there is minimal difference between the two designs other than the density of panels in an east-west array resulting in a greater percentage of the ground

[7] area of modules (not accounting for slope) ÷ total available area for development = percentage density

being covered. This factor resulted in the Applicant commissioning the Micro-climate and Vegetation Study, Technical Appendix A5.3 to inform the technical assessments in the ES. Following consideration of that study, in the context of the arable baseline, no assessments have identified significant environmental effects that could be attributed to the east-west orientation of the solar PV modules.

78. From a visual perspective, the position of the viewer, and the orientation of a view have more impact than the orientation of the solar PV modules, for example, viewing the edge of an east west array from the west, looking east at the level of the array, would not be greatly discernible from looking towards the north at a south facing array, i.e., the view is predominantly of solar PV modules rather than mounting structures. This is a factor at Cleve Hill where one of the key receptors identified at an early stage of Development was the Saxon Shore Way footpath, which is elevated above the ground level which the Development is situated at and for the majority of its passage around the Development, presents views across the Development site from the north looking south.

79. It is the opinion of the landscape architect that undertook the LVIA (Chapter 7: LVIA of the ES) that a south facing array would present a more complex visual vista, predominantly of mounting structures, from the Saxon Shore Way looking south, and also towards the southwest and southeast along the backs of the arrays. This is as opposed to the more homogenous and more easily read appearance of the proposed east-west array where mounting structures are visible in views due south, but as the viewer turns to look towards the east and west, a simpler, and more homogenous vista of solar PV modules would be visible.

80. East-west facing arrays are well suited to large flat sites. South facing arrays can be better suited to more undulating topography where they can more closely mimic the existing landform. This was one of the reasons for removing the solar PV arrays from the sloping land at Cleve Hill and Graveney Hill in the south east of the Development site.

81. The benefits of the additional energy generated by the Development and the absence of significant effects which could be mitigated by altering the orientation of the solar PV modules provides clear justification for the east-west orientation selected. Further information regarding the benefits of the Development in respect of factors such as maximising the energy generated are set out in the Statement of Need (DCO Document Reference 7.3).

4.4.2.2 Construction Transportation Methods

82. In the early stages of Development, the Applicant considered alternative ways of accessing the site for construction to reduce the effects of construction traffic on the local road network. The alternatives considered included:

- Marine access, such as a temporary jetty or pontoon in the Swale;
- A new rail freight hub;
- New haul road access to bypass existing roads; and
- Air freight, such as helicoptering materials in, or using an air balloon or similar.

83. All of these options were discounted on account of increased cost, increased environmental impact (all would have introduced additional environmental impacts over and above road transport, including impacts on the SPA and other designated areas and impact on local residents) and increased risk to the deliverability of the scheme (e.g., due to short tidal windows, weather delays etc).

84. In some cases, it may also have been the case that to create the infrastructure required to facilitate delivery by alternative means would have resulted in significant volumes of construction traffic in its own right (e.g., a new rail hub).

85. In addition, it was demonstrated through the construction of the Cleve Hill Substation between 2009 and 2011 that the construction traffic route has the ability to accommodate the types and numbers of construction vehicles necessary to undertake this type of development. All of the alternative options were therefore readily discounted relative to the most commonly used option of road transport.

4.4.2.3 Electrical Compound Location

86. During Section 42 consultation, Swale Borough Council queried why the electrical compound had been located where it has.

87. The irregular shape of fields P and Q, the distance from the NGET Cleve Hill Substation, and the wish to avoid the introduction of views of the electrical compound from higher ground associated with All Saints Church, Graveney, and the conservation area it lies within all contributed to the selection of the preferred location shown in Figure 5.2: Site Layout.

88. The selected location also links the Development substation with the existing substation in the closest way possible, so that the two compounds are visible together rather than separately as would be the case if the electrical compound were located in fields P or Q, reducing visual impact.

4.4.2.4 Permissive Footpath

89. Following proposals made in the PEIR and feedback from the public through consultation, one permissive path is proposed through the Recreation Core Study Area, as shown on Figure 13.1. This would be available as a footpath only, given that public rights of access to either end are also as Public Footpaths (ZR488 and ZR484/CW55), rather than bridleways.

90. A second permissive path was suggested by the Applicant during consultation on the PEIR, but there was little support received for this through consultation, and as it would have required approximately 2 km of additional fencing and would not have opened up additional access which is not broadly available through existing public rights of way anyway, it has not been progressed further.

4.4.2.5 Community Orchard

91. Provision of a community orchard was suggested to the Applicant as a potential enhancement during the first round of public consultation, and was then proposed within the PEIR. Substantial negative feedback on this idea from the local community, in the form of both a lack of enthusiasm, the perception that it was an unwanted burden and the perceived potential for it to become a location for anti-social behaviour, led to the removal of this aspect from the Development proposals. The area where the community orchard was proposed now forms part of the wider lowland grassland meadow habitat management area covering Fields Y and Z.

4.4.3 Consideration of Alternative Sites to Connect to the existing Cleve Hill Substation

92. Technical Appendix A4.1 sets out analysis of sites with the potential to locate an economically viable large scale solar PV facility to utilise the connection capacity available at the existing Cleve Hill Substation. An area of search of 5 km was used to inform this study on the basis of the 400 kV grid connection being uneconomic beyond 5 km[8].

93. Areas subject to statutory landscape designation, nature conservation designations, and agricultural land classification of higher quality than the Development site (i.e., greater

[8] This is the reason for 5 km being referred to as a viable area of search in other sections of this chapter. Technical Appendix A4.1 provides an explanation off why this range is considered appropriate.

than Grade 3) were excluded from the search. The remaining areas were then subject to more detailed analysis to determine whether they offered a viable alternative to the Development.

94. This study identified that there are no other viable sites for a large-scale ground mounted solar park within a 5 km radius of the existing Cleve Hill Substation.

4.4.4 Consideration of Alternative Low-Carbon, Subsidy-Free Forms of Electricity Generation

95. Alternatives for utilising the existing Cleve Hill substation connection capacity were considered from the following energy development types: an onshore wind farm or an offshore windfarm. Other forms of generation were discounted for the following reasons.

96. Tidal power, such as a tidal lagoon is not considered to be currently viable. The UK's first transmission-scale tidal project to receive consent, Swansea Bay Tidal Lagoon is not economically viable without subsidy which has not yet been secured. Swansea also benefits from significantly greater tidal resource than the north Kent coast. Other forms of tidal and wave power are not yet commercially viable at transmission scale, and the marine designations covering the Swale would present significant environmental challenges to the development of such projects.

97. Pumped storage hydroelectric power is capable of transmission network scale electricity generation, but relies upon a significant difference in height between two water bodies, a characteristic which is not available in the southeast of England.

98. No other form of low carbon renewable electricity generation is currently available at transmission network scale.

99. Nuclear power was not considered as an alternative, because of:

- Potential impacts of water used in the nuclear process on the adjacent ecological designations, which are water-based: the Swale SPA/SSSI/Ramsar site;
- The high cost of electricity, which is likely to be approximately double the cost of electricity from the Development[9]; and
- It is also likely that the available grid connection at Cleve Hill Substation could not accept the power that would be generated by a conventional nuclear reactor.

4.4.4.1 Wind Farm – Onshore

100. Typical onshore wind turbines have a maximum power output of 2.5 – 3 MW[10], and a capacity factor of c. 25%. Solar farms in the UK have a capacity factor of c. 10%. Therefore, it would be expected that c. 45 to 55 wind turbines would be needed to produce annual electrical output approximately equivalent to the Development.

101. Wind turbines require adequate separation to prevent turbulence adversely affecting the operation of turbines downwind. The total site area required for a wind farm of c. 45 to 55 turbines is c. 300 hectares, which is approximately the size of the Development site proposed to be occupied by solar panels. However, constraints to the placement of wind turbines would preclude locating such a wind farm within the Development site. These are principally:

[9] Based on the Contract for Difference (CfD) price agreed by the Government for the proposed Hinckley C reactor (£92.50/MWh in 2012 prices), compared to the typical wholesale electricity price of c. £50/MWh (as an average over the year up to August 2018: https://www.ofgem.gov.uk/data-portal/electricity-prices-day-ahead-baseload-contracts-monthly-average-gb) [accessed 30/10/2018].

[10] Wind Europe (2018). Wind Energy - The Basics. [online] Wind Energy. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/228866/7686.pdf [Accessed 10 Jul. 2018].

- Separation from the 400 kV overhead transmission line through the Development site (c. 500 m);
- Separation from the areas used by birds associated with the Swale Special Protection Area, to reduce collision risk, disturbance and displacement to acceptable levels (a minimum of c. 600 m has been acceptable elsewhere);
- Separation from residential properties to protect residential amenity from visual and noise effects (typically more than 1 km for a large windfarm);
- Indirect effects on settings of heritage assets, but principally All Saints Church;
- Access to the site for large wind turbine components along public roads; and
- Visual impacts on local communities and users of local public rights of way.

102. Similar constraints applied to the wider area would also be prevent the installation of 45 to 55 wind turbines within 5 km of the existing Cleve Hill Substation.

103. If these factors could be overcome, and a smaller scale onshore wind farm of less than 45 wind turbines could be developed in the area, the resultant reduced-scale development following the application of environmental constraints would generate significantly less electricity per year than the Solar Park.

4.4.4.2 Wind Farm – Offshore

104. The existing Cleve Hill Substation was built to accommodate Phase Two of the London Array Offshore Wind Farm, but this scheme was not progressed because of anticipated impacts on red throated diver (a bird species), combined with "*known technical challenges surrounding the Phase Two site – such as shallow water, longer cable routes and an exclusion zone for aggregates operations*"[11]. In 2014 London Array formally terminated the agreements for Phase Two and cancelled the remaining grid capacity reserved at the existing Cleve Hill Substation.

105. Offshore wind farms in UK waters require leases from the Crown Estate, following the above, no undeveloped lease areas are held or available in the vicinity of Cleve Hill Substation. There are currently no proposals to extend London Array or any other offshore wind farm site that could potentially connect to Cleve Hill Substation[12].

106. Therefore no offshore wind farm opportunity currently exists or could be brought forward as an alternative in the timescales of the Application for the Development.

4.4.4.3 Distributed small-scale solar PV development

107. The Statement of Need submitted with the Application (DCO Document Reference 7.3) sets out alternative scenarios for a greater number of smaller solar PV facilities to meet the same total generating capacity (Chapter 6, Section (iv)). The most fragmented of these scenarios is 10 x 35 MW sites to achieve 350 MW of generation capacity. This could obviously be taken further and 70 x 5 MW sites could be considered (for example), however 35 MW is considered to be appropriate scale to consider in the current commercial environment. The analysis in the Statement of Need finds that the lifetime unit cost per MWh is over 10% higher for 10 x 35 MW sites compared to a single 350 MW site.

108. It is also unlikely that 10 or more smaller sites of 35 MW could be developed in sufficiently close proximity to each other and to the existing Cleve Hill Substation to take advantage of the available grid connection at this location, as demonstrated in Technical Appendix A4.1.

[11] London Array (2018). Phase Two. Available at: http://www.londonarray.com/the-project-3/phase-2/ [accessed on 29/10/2018]
[12] Kentish Flats 1 and 2 Offshore Windfarm and the existing Thanet Offshore Windfarm (incl. its proposed extension) connect to onshore substations at Herne Bay and Richborough respectively.

109. In addition, the cumulative environmental impacts of 10 solar parks smaller than Cleve Hill, but still relatively large scale, would require assessment, taking into account their locations and their respective connections to the local electricity distribution network, and could be significant.

110. Some members of the public have suggested that solar panels should be put on the roofs of new houses instead of being ground-mounted. The government has promoted financial incentives to encourage home owners to install solar PV systems, so clearly this is considered to be a desirable activity. However, this is not considered as an alternative to the Development, because such houses are both consumers and generators of electricity, and therefore do not help provide low carbon and renewable alternatives to conventional sources of electricity production at grid scale. In essence, roof-mounted solar panels should be deployed in addition to large scale solar farms, rather than instead of them.

111. There is a clear and urgent need for further renewable energy capacity, and this will likely include more distributed generation across the electricity distribution network, however the Development presents a single, large-scale generating asset which addresses the project aims of delivering clean, cheap electricity to the consumer whilst making a significant contribution to the fulfilment of the UK's legally binding climate change commitments set out in the introduction to this chapter. More, smaller-scale solar PV developments therefore are indeed required, however they do not represent an alternative to the Development.

4.4.5 Consideration of Specific Alternative Sites Proposed in Section 42 Consultation Responses

112. The consultation responses in section 4.1.2 of this chapter included three specific suggestions of alternative sites, which included:

- Kingsnorth Decommissioned Coal-Fired Power Station Site / Kingsnorth and the Hoo Peninsula;
- Isle of Grain on the site of a former oil-fired power station and the site of a former oil refinery; and
- Canvey Island.

113. NPS EN-1 states at paragraph 4.4.3 that:

> *"where (as in the case of renewables) legislation imposes a specific quantitative target for particular technologies… …the IPC should not reject an application for development on one site simply because fewer adverse impacts would result from developing similar infrastructure on another suitable site, and it should have regard as appropriate to the possibility that all suitable sites for energy infrastructure of the type proposed may be needed for future proposals"*

114. As set out in the Statement of Need which accompanies the Application (DCO Document Reference 7.3) there is a clear and urgent need for greater renewable energy capacity and energy storage capability. Therefore if there is potential for renewable energy generation and energy storage to be accommodated on the alternative sites identified, this should be in addition to the Cleve Hill site, not instead of. However, a brief appraisal of the sites raised during Section 42 consultation is included in this section.

4.4.5.1 Kingsnorth Power Station and the Hoo Peninsula

115. Kingsnorth Power Station was a coal and oil-fired power station which was decommissioned in 2012.

116. The National Grid Network Capacity Map[13] indicates that Kingsnorth 400 kV substation has "High Generation Potential", with headroom in excess of 2 GW.

117. The decommissioned power station site itself appears to be up to approximately 60 ha in size (many ancillary buildings are still present) and is currently undergoing remediation and demolition works. There are existing buildings adjacent to the decommissioned site, including Kingsnorth Substation. The area of land adjacent to the Kingsnorth Substation between Hoo, approximately 2 km to the west and the Kingsnorth Industrial Estate to the northeast includes large areas of sand and gravel extraction (Kingsnorth Quarry) and scattered isolated residential properties. The land to the north is less well suited to large scale solar development such as that proposed at Cleve Hill due to the undulating topography, although clearly there is some potential as the 12 MW Malmaynes Solar Farm lies approximately 4 km to the north of the Kingsnorth Substation.

118. The whole Kingsnorth site is adjacent to, or between, areas of the Medway Estuary and Marshes SPA and Ramsar sites.

119. A large-scale ground mounted solar PV facility within 5 km of the Kingsnorth Substation would likely require a grid connection in excess of 2 km and would be unlikely to have the potential to reach the generation capacity achieved by Cleve Hill Solar Park due to environmental constraints. These are principally the scattered residential properties across the area, the undulating topography, an extensive network of public rights of way which cross the area and the proximity to the Medway Estuary and Marshes nature conservation designations (SPA, Ramsar). The required remediation of any contaminated land issues, associated with its former use as a coal fired power station, may render an unsubsidised solar scheme at this location unviable, though this could not be confirmed until intrusive site investigation had been carried out.

4.4.5.2 Isle of Grain

120. The Isle of Grain includes a long history of energy generation and storage. Currently, the area hosts a gas fired power station[14] and the Grain Liquid Natural Gas Terminal[15]. The 1 GW Brit-Ned interconnector also comes ashore at Grain[16].

121. The National Grid Network Capacity Map[17] indicates that Grain 400 kV substation has "High Generation Potential", with headroom in excess of 2 GW.

122. The brownfield land to the southwest of the village of Grain itself is surrounded by the Medway Estuary and Marshes SPA and Ramsar site.

123. Whilst there are parts of the wider Grain area that may have the potential to accommodate some solar PV development, the area remains in industrial use, and contains significant amounts of infrastructure related to its existing uses, even in areas which may appear to be vacant. This is also reflected in planning policy, with Medway Local Plan 2003[18] (saved policies[19]) including references to future industrial and

[13] National Grid (2018). Network Capacity Map available at: https://www.nationalgridet.com/get-connected/network-capacity-map [accessed 30/10/2018]
[14] Uniper website available at: https://www.uniper.energy/company/locations/united-kingdom [accessed 30/10/2018]
[15] Grain LNG website available at: http://grainlng.com/ [accessed 30/10/2018]
[16] BritNed Website available at: https://www.britned.com/ [accessed 30/10/2018]
[17] ibid
[18] Medway Council (2003) Medway Local Plan. Available at: https://www.medway.gov.uk/downloads/file/2400/medway_local_plan_2003 [accessed 30/10/2018]
[19] Medway Council (2007) Medway Saved Policies. Available at: http://www.medway.gov.uk/downloads/download/31/development_plan_saved_policies [accessed 30/10/2018]

employment use of the area, as well as prioritising port related developments at Grain in support of the Thamesport[20] terminal.

124. The Grain area has been suggested speculatively both as a garden city and a new airport serving London over the last ten years.

125. Whilst there may be some potential for a large-scale solar PV electricity generating station at Grain in addition to the Cleve Hill site, this would likely be fragmented by existing infrastructure, industrial installations and services, residential property and nature conservation designations adjacent to the site. This would likely result in a smaller generation capacity than the Cleve Hill site. The required remediation of any contaminated land issues, associated with its former use as a coal fired power station, may render an unsubsidised solar scheme at this location unviable, though this could not be confirmed until intrusive site investigation had been carried out.

126. The other potential future uses of the site, and the level of investment undertaken in strategic transport connections to the Thamesport facility, are likely to result in the strategic value of the site preventing the economically viable development of a solar PV facility in the area due to the large land take and long-term nature of a solar PV development. It is unlikely that the landowners would be prepared to make a long-term commitment to a solar PV facility on the land while there remains potential for potentially more lucrative developments in future.

4.4.5.3 Canvey Island

127. The closest NGET 400 kV substation to Canvey Island is Rayleigh Substation, which has "High Generation Potential" of over 5 GW[21], but lies approximately 8 km to the north, beyond the range of economic viability (as set out in Technical Appendix A4.1).

128. Furthermore, after existing development and the nature conservation designations surrounding Canvey Island are discounted, there is minimal remaining space for a large-scale ground mounted solar PV development.

[20] Thamesport website available at: http://www.londonthamesport.co.uk/ [accessed 30/10/2018]
[21] ibid