



East Anglia TWO Offshore Windfarm

Outline Onshore Substation Design Principles Statement

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Glossary of Acronyms

AIS	Air Insulated Switchgear
AONB	Area of Outstanding Natural Beauty
CABE	Commission for the Architecture and Built Environment
CCS	Construction Consolidation Sites
COCP	Code of Construction Practice
DAS	Design and Access Statement
DCO	Development Consent Order
DTS	Distributed Temperature Sensing
EIA	Environmental Impact Assessment
ES	Environmental Statement
ETG	Expert Topic Group
FO	Fibre Optic
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
HVAC	High Voltage Alternating Current
GIS	Gas Insulated Switchgear
LAT	Lowest Astronomical Tide
NPS	National Policy Statement
OLEMS	Outline Landscape and Ecological Management Strategy
O&M	Operation and Maintenance
PEIR	Preliminary Environmental Information Report
PID	Public Information Day
PRoW	Public Right of Way
SF6	Sulphur hexafluoride
SPA	Special Protection Area
SR	Scoping Report
SSSI	Site of Special Scientific Interest

Glossary of Terminology

Applicant	East Anglia TWO Limited.
Cable sealing end compound	A compound which allows the safe transition of cables between the overhead lines and underground cables which connect to the National Grid substation.
Cable sealing end (with circuit breaker) compound	A compound (which includes a circuit breaker) which allows the safe transition of cables between the overhead lines and underground cables which connect to the National Grid substation.
Construction consolidation sites	Compounds associated with the onshore works which may include elements such as hard standings, lay down and storage areas for construction materials and equipment, areas for vehicular parking, welfare facilities, wheel washing facilities, workshop facilities and temporary fencing or other means of enclosure.
Development area	The area comprising the onshore development area and the offshore development area (described as the 'order limits' within the Development Consent Order).
East Anglia TWO project	The proposed project consisting of up to 75 wind turbines, up to four offshore electrical platforms, up to one construction, operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia TWO windfarm site	The offshore area within which wind turbines and offshore platforms will be located.
European site	Sites designated for nature conservation under the Habitats Directive and Birds Directive, as defined in regulation 8 of the Conservation of Habitats and Species Regulations 2017 and regulation 18 of the Conservation of Offshore Marine Habitats and Species Regulations 2017. These include candidate Special Areas of Conservation, Sites of Community Importance, Special Areas of Conservation and Special Protection Areas.
Horizontal directional drilling (HDD)	A method of cable installation where the cable is drilled beneath a feature without the need for trenching.
HDD temporary working area	Temporary compounds which will contain laydown, storage and work areas for HDD drilling works.
Jointing bay	Underground structures constructed at intervals along the onshore cable route to join sections of cable and facilitate installation of the cables into the buried ducts.
Landfall	The area (from Mean Low Water Springs) where the offshore export cables would make contact with land, and connect to the onshore cables.
Link boxes	Underground chambers within the onshore cable route housing electrical earthing links.
Mitigation areas	Areas captured within the onshore Development Area specifically for mitigating expected or anticipated impacts.
National electricity grid	The high voltage electricity transmission network in England and Wales owned and maintained by National Grid Electricity Transmission
National Grid infrastructure	A National Grid substation, cable sealing end compounds, cable sealing end (with circuit breaker) compound, underground cabling and National Grid overhead line realignment works to facilitate connection to the national electricity grid, all of which will be consented as part of the proposed East Anglia TWO project Development Consent Order but will be National Grid owned assets.
National Grid overhead line realignment works	Works required to upgrade the existing electricity pylons and overhead lines (including cable sealing end compounds and cable sealing end (with circuit

	breaker) compound) to transport electricity from the National Grid substation to the national electricity grid.
National Grid overhead line realignment works area	The proposed area for National Grid overhead line realignment works.
National Grid substation	The substation (including all of the electrical equipment within it) necessary to connect the electricity generated by the proposed East Anglia TWO project to the national electricity grid which will be owned by National Grid but is being consented as part of the proposed East Anglia TWO project Development Consent Order.
National Grid substation location	The proposed location of the National Grid substation.
Natura 2000 site	A site forming part of the network of sites made up of Special Areas of Conservation and Special Protection Areas designated respectively under the Habitats Directive and Birds Directive.
Onshore cable corridor	The corridor within which the onshore cable route will be located.
Onshore cable route	This is the construction swathe within the onshore cable corridor which would contain onshore cables as well as temporary ground required for construction which includes cable trenches, haul road and spoil storage areas.
Onshore cables	The cables which would bring electricity from landfall to the onshore substation. The onshore cable is comprised of up to six power cables (which may be laid directly within a trench, or laid in cable ducts or protective covers), up to two fibre optic cables and up to two distributed temperature sensing cables.
Onshore development area	The area in which the landfall, onshore cable corridor, onshore substation, landscaping and ecological mitigation areas, temporary construction facilities (such as access roads and construction consolidation sites), and the National Grid Infrastructure will be located.
Onshore infrastructure	The combined name for all of the onshore infrastructure associated with the proposed East Anglia TWO project from landfall to the connection to the national electricity grid.
Onshore preparation works	Activities to be undertaken prior to formal commencement of onshore construction such as pre-planting of landscaping works, archaeological investigations, environmental and engineering surveys, diversion and laying of services, and highway alterations.
Onshore substation	The East Anglia TWO substation and all of the electrical equipment within the onshore substation and connecting to the National Grid infrastructure.
Onshore substation location	The proposed location of the onshore substation for the proposed East Anglia TWO project.
Transition bay	Underground structures at the landfall that house the joints between the offshore export cables and the onshore cables.

Outline Onshore Substation Design Principles Statement

1 Introduction

1.1 Background

1. This Outline Onshore Substation Design Principles details the design principles which underpin the design of the operational onshore substation of the proposed East Anglia TWO project. The Applicant will use this outline document as the foundation for developing the final Onshore Substation Design Principles post-consent, as part of the discharging of requirements of the draft DCO.
2. This document should be read in conjunction with the Outline Landscape and Ecological Mitigation Strategy (OLEMS) (document reference 8.7). Principles relating to “overall site design” are dealt with in this document and would be delivered via either the Ecological Management Plan (EMP) or Landscape Management Plan (LMP).
3. The draft DCO states that certain details of the onshore substation design must be submitted to and approved by the relevant Local Planning Authority prior to the commencement of construction. This document sets out the principles which could be included in that submission.
4. The detailed design parameters onshore requirement of the DCO states:
 - (1) No stage of Work No. 30 may commence until details of the layout, scale and external appearance of the onshore substation have been submitted to and approved by the relevant planning authority. Work No. 30 must be carried out in accordance with the approved details.
 - (2) Any details provided by the undertaker pursuant to paragraph (1) must accord with the outline onshore substation design principles statement and be within the Order limits.
 - (3) To the extent comprised within the onshore substation —
 - (a) Buildings must not exceed a height of 15 metres above finished ground level;
 - (b) External electrical equipment, with the exception of lightning protection masts, must not exceed a height of 18 metres above finished ground level;

- (c) Lightning protection masts must not exceed a height of 25 metres above finished ground level; and
- (d) The maximum number of lightning protection masts must not exceed six.
- (4) For the purposes of paragraph (3), ‘finished ground level’ will be defined in accordance with the outline onshore substation design principles statement.
- (5) The fenced compound area (excluding its accesses) for the onshore substation must not exceed 36,100 m².

2 Design Principles

2.1 National Design Policies

- 5. Existing policy set out within the Overarching National Policy Statement for Energy (NPS-EN-1) makes clear the requirements of good design in energy projects. The Planning Inspectorate is to be satisfied that “*developments are sustainable and, having regard to regulatory and other constraints, are as attractive, durable and adaptable (including taking account of natural hazards such as flooding) as they can be.*”
- 6. EN-1 NPS also states that “Virtually all nationally significant energy infrastructure projects will have effects on the landscape. Projects need to be designed carefully, taking account of the potential impact on the landscape. Having regard to siting, operational and other relevant constraints the aim should be to minimise harm to the landscape, providing reasonable mitigation where possible and appropriate.”
- 7. EN-3 NPS for Renewable Energy Infrastructure states that “*Proposals for renewable energy infrastructure should demonstrate good design in respect of landscape and visual amenity, and in the design of the project to mitigate impacts such as noise and effects on ecology.*”

3 Outline Design Principles

- 8. The Applicant will use the following principles as the foundation for developing the final Onshore Substation Design Principles post-consent, as part of the discharging of requirements of the draft DCO.
- 9. The outline design principles are as follows:
 - Continued engagement with Parish Councils, local residents and relevant authorities (Suffolk County Council and East Suffolk Council) on design and

landscape proposals. Opportunity will be provided through the development of the final design and landscape proposals to seek feedback from local communities who will be directly affected by the development.

- The landscape and building design proposals be subject to design review, in consultation with the relevant local authorities. This could involve the Design Council or Shape East. The output of this design review, if it is appropriate to do so, will form part of the onshore substation procurement or detailed design process.
- Consideration of ‘Good Design’ in line with the requirements of Overarching National Policy Statement for Energy (NPS-EN-1).
- Appropriate building design and materials will be actively sought as part of the procurement process. The onshore substation building for the proposed East Anglia TWO project should be sensitively placed, with visual impacts minimised as far as possible by the use of appropriate design, building materials, shape, layout, coloration and finishes.
- On-site mitigation planting proposals will be undertaken within the onshore development area immediately around the onshore substation, in order to minimise its visual effect and maximise screening opportunities from key viewpoints/receptors, while also responding to local landscape character, pattern and growing conditions. Planting proposals will be considered along with the substation building design and layout of ancillary structures.
- The overall site design should have regard to the potential for embedded ecological mitigation and enhancement. The Sustainable Drainage System (SuDS) solution for the onshore substation, as a minimum will include a ponded area, which could represent habitat creation on the site.
- The overall site design will maximise the opportunity for site won topsoil and subsoil materials to be reused on site within landscape earthworks ‘bunds’. These bunds should support the visual screening of the onshore substation while having a gradual external slope gradient that appears natural and complements the existing terrain (when looking towards the onshore substation).

- The overall site design will seek to deliver gains for public amenity, including enhanced access through Public Rights of Way (PRoW) proposals and areas for landscape planting.
- Species rich grassland areas will be established to provide a low maintenance ground cover which also enhances the local biodiversity in areas that are not to be returned to agricultural use or planted as woodland. The overall site design will identify land around the onshore substation that will be returned to agricultural use during the operational period.

4 Finished Ground Level

10. The maximum heights specified for buildings, external electrical equipment and lightning protection masts relate to heights above finished ground level in the immediate area surrounding buildings, external electrical equipment and lightning protection masts.
11. Based on preliminary engineering design undertaken, the finished ground level in respect of the onshore substation is anticipated to be approximately 21.4m AOD where the onshore substation is located in the eastern area of Work No. 30, and approximately 19.8m AOD where the onshore substation is located in the western area of Work No. 30. The final finished ground level will be established during detailed design post consent.
12. There are a number of factors that could influence the maximum finished ground level, including:
 - Surface water drainage design requirements, to ensure adequate surface water run-off from the onshore substation and a suitable connection to the existing surface water drainage system at Church Road;
 - Existing ground levels and practicable cut and fill requirements, to optimise the cut and fill balance of the onshore substation and minimise the need to import or export spoil material during the onshore substation construction; and
 - Groundwater constraints, to ensure appropriate management and control of groundwater interactions in the design of the onshore substation.
13. Details of the layout, scale and external appearance of the onshore substation (including finished ground levels) will be submitted to relevant the Local Planning Authority for approval prior to commencement of construction of the onshore substation.

5 References

Department of Energy and Climate Change (DECC) (2011). Overarching National Policy Statement for Energy (EN-1). July 2011

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