East Anglia ONE North and East Anglia TWO Offshore Windfarms

Submission of Oral Case

Issue Specific Hearing 2 on 2nd and 3rd December 2020: Onshore Siting, Design and Construction

Applicants: East Anglia TWO Limited and East Anglia ONE North Limited
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Applicable to East Anglia ONE North and East Anglia TWO

Revision Summary				
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Description of Revisions			
Rev	**Page**	**Section**	**Description**
001	n/a	n/a	Final for Deadline 3 submission

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Glossary of Acronyms

BEIS	Department for Business, Energy and Industrial Strategy
DCO	Development Consent Order
ExA	Examining Authority
ISH	Issue Specific Hearing
MMO	Marine Management Organisation
NE	Natural England
NPS	National Policy Statement
RSPB	Royal Society for the Protection of Birds
SoCG	Statement of Common Ground

Glossary of Terminology

Applicants	East Anglia ONE North Limited and East Anglia TWO Limited
East Anglia ONE North project	The proposed project consisting of up to 67 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 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.
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 substation	The substation (including all of the electrical equipment within it) necessary to connect the electricity generated by the proposed East Anglia TWO / East Anglia ONE North 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.
Projects	The East Anglia ONE North project and the East Anglia TWO project.

1 Introduction

1. This document is applicable to both the East Anglia ONE North and East Anglia TWO applications, and therefore is endorsed with the yellow and blue icon used to identify materially identical documentation in accordance with the Examining Authority's (ExA) procedural decisions on document management of 23 December 2019. Whilst for completeness of the record this document has been submitted to both Examinations, if it is read for one project submission there is no need to read it again.

2. The Issue Specific Hearing 2 for the East Anglia ONE North Offshore Windfarm and East Anglia TWO Offshore Windfarm Development Consent Order (DCO) Applications (references EN010077 and EN010078, respectively) were run jointly and took place virtually on 2nd December 2020 at 10:00am and 3rd December 2020 at 10:00am (Hearings).

3. The Hearings ran through the items listed in the agendas published by the ExA on 24 November 2020. The Applicants gave substantive oral submissions the Hearings and these submissions are set out within this note.

4. Speaking on behalf of the Applicants were:

    a. Mr Colin Innes, partner at Shepherd and Wedderburn LLP;

    b. Miss Stephanie Mill, senior associate at Shepherd and Wedderburn LLP;

    c. Mr Paolo Pizzolla, project director for EIA and consenting at Royal HaskoningDHV;

    d. Mr Fraser McDermott, principal environmental consultant at Royal HaskoningDHV;

    e. Mr Gavin Greene, engineering department manager at ScottishPower Renewables;

    f. Mr Teo Dimitriadis, principal engineering manager at ScottishPower Renewables;

    g. Mr Brian McGrellis, onshore consents manager at ScottishPower Renewables; and

    h. Mr Simon Martin, associate at Optimised Environments ('OPEN')

    i. Mr Stephen Carter, Senior Heritage Consultant at Headland Archaeology.

2 Agenda Item 2: Context and Update

2.1 Recent Decisions by the Secretary of State BEIS on Energy Proposals in the Eastern and South Eastern Regions

5. Recent decisions by the Secretary of State BEIS on energy proposals in the Eastern and South Eastern regions have been taken into account where relevant in the offshore assessments through clarification notes and updates

- Norfolk Vanguard – updates to ornithological effects through revised project design have been incorporated through use of the Norfolk Boreas Deadline 8 in-combination totals for collision risk
- Hornsea 3 – updates from the Secretary of State's HRA have informed in-combination totals for kittiwake. If updates for other bird species are published by Hornsea 3 during the Examination, the Applicants will update their assessments for these too. It is however anticipated that these figures will be reductions and therefore demonstrates that the figures used at present by the Applicants are conservative.
- Thanet Extension – the refusal of this project has been taken into account through relevant updates to the Norfolk Boreas Deadline 8 in-combination totals for collision risk

6. These projects are not relevant to any other offshore or onshore matters.

2.2 Acceptance of Examination of Proposals for Sizewell C and the Implications of this and any Further Progress in the Decommissioning of Sizewell A and changes to Sizewell B

7. The Projects have provided an updated cumulative assessment for Sizewell C at Deadline 1 (socio-economics) and Deadline 2 (traffic and transport (including air quality and noise), landscape and amenity).

8. It should be noted that the Sizewell C traffic submissions included consideration of Sizewell B therefore these are taken into account in the Applicants' Deadline 2 submissions.

9. The Applicants do not believe that there are any relevant changes to the Sizewell A decommissioning plan.

2.3 Crown Estate Licensing Agreements in Respect of Proposed Offshore Windfarms Including Five Estuaries and North Falls

10. The Applicants note that there are no substantive updates on the progress of North Falls or Five Estuaries since the Applications were submitted.

11. North Falls or Five Estuaries are part of the 2017 Extension leasing round. The Applicants note that all the 2017 Extensions featured in The Crown Estate plan level HRA published in August 2019 and that Sheringham Shoal and Dudgeon Extension received a Scoping Opinion in November 2019 and are expected to proceed to section 42 consultation in April 2021 and Rampion Extension received a Scoping Opinion in August this year. The latest information from the North Falls is that scoping expected early in 2021, with a DCO application is not expected until mid-2023. Five Estuaries have not provided an indicative programme to the Planning Inspectorate at this stage.

12. Overarching NPS for Energy (EN-1) paragraph 4.2.5 states that "*When considering cumulative effects, the ES should provide information on how the effects of the applicant's proposal would combine and interact with the effects of other development (including projects for which consent has been sought or granted, as well as those already in existence)".*

13. ***Advice note seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects*** (AN17) sets out a cumulative assessment process with the stages of longlisting and shortlisting projects, information gathering and assessment.

14. Information gathering "*requires the applicant to gather information on each of the 'other existing development and/or approved development' shortlisted at Stage 2. As part of the Stage 3 process the applicant is expected to compile detailed information, to inform the Stage 4 assessment. The information captured should include but not be limited to:*

- *Proposed design and location information;*
- *Proposed programme of construction, operation and decommissioning; and*
- *Environmental assessments that set out baseline data and effects arising from the 'other existing development and/or approved development"*

15. For the projects highlighted by IPs (i.e. Nautilus, Eurolink, North Falls, Five Estuaries, SCD1 and SCD2) little to none of this information is available. SCD1 and SCD2 were not featured in the January 2019 Network Options Assessment (NOA), were first mentioned in the January 2020 NOA, and within that assessment SCD2 is on hold.

16. This would not be robust and would effectively be assessing or prejudging another developer's project.

17. For illustration, consider East Anglia FOUR which was originally proposed by EAOW to be developed in parallel with East Anglia THREE. It was ultimately consented by Vattenfall in an amended form as part of the Norfolk Vanguard project.

East Anglia FOUR, original plans versus consented project (as Norfolk Vanguard East)

Parameter	Planned (taken from EA4 Scoping Report, EAOW 2012)	Consented
Name	East Anglia FOUR	Norfolk Vanguard East
Capacity	1200MW	900MW (of 1800MW Norfolk Vanguard project)
Grid connection awarded	Yes	Yes
Grid connection location	Bramford, Suffolk	Necton, Norfolk
Consent awarded	2016 (planned)	2020
Wind farm area	359km^2	297km^2
No. of turbines	120 - 240	79
Turbine height (max)	245m	350m
Onshore cable corridor route	37km	60km
Converter station footprint	2.85ha	7.5ha (for 1800MW project total)
Converter station height	25m	19m

18. Note that even though East Anglia FOUR was scoped and a great deal of detailed information was in the public domain, because plans for the project changed it was not included in the CIA for East Anglia THREE. None of the stakeholders at the time (including SCC, Natural England, Historic England) objected or considered this inappropriate. Had East Anglia FOUR been included in the East Anglia THREE CIA, the assessment would have been very precise (due to the level of detail available) but wholly inaccurate (due to the project design and location subsequently brought forward).

2.4 National Grid Structure, Policy and Plans in the Local Area

19. This question is directed primarily at National Grid ESO and Transmission. The Applicants are not involved in the discussions regarding any other future use of National Grid substation that is proposed at Friston.

20. As set out in the Regulatory Context Note (REP2-003), these are matters which are of a confidential nature. The Applicants are aware that National Grid Ventures have signed connection agreements for two potential Interconnectors and that National Grid Ventures wish to retain the ability to potentially connect at Friston. National Grid Ventures have confirmed in their ***Draft Statement of Common Ground*** (REP1-062) that "at the date of this SoCG neither the

Nautilus or EuroLink projects are at a sufficient stage or project definition to confirm whether the National Grid substation will present a viable option for their connection to the national electricity grid."

21. This was further confirmed by National Grid Ventures at the Hearing.

22. In the context of the BEIS review, none of the other projects are at an advanced stage of consenting and have yet to seek scoping opinions. The application in respect of Sizewell C has no bearing on the grid issues associated with the projects. In the circumstances, the future connections can only be described as speculative and uncertain.

2.5 BEIS Review

2.5.1 Background to the Review

2.5.1.1 Study on Integrated Offshore Transmission, 2015

23. National Grid, in conjunction with offshore developers including ScottishPower Renewables, coordinated a study to look at an offshore ring main. In 2015, the group published its report 'Integrated Offshore Transmission Project (East) Final Report: Conclusions and Recommendations, August 2015'. It examined, in the context of the East Anglia, Hornsea and Dogger Bank Round 3 Zones, the potential for offsetting the need for new onshore infrastructure by establishing an integrated design approach to the connection of these generation zones. This approach would include the use of inter-connection between offshore zones (via offshore transmission assets) and optimising connections to the onshore transmission system.

24. The findings outlined a number of issues associated with a potential offshore ring main and concluded that in relation to an offshore ring main, *"… the project team does not believe it would be economic and efficient to progress with the development of an integrated design philosophy or delivery of anticipatory assets at this time".*

2.5.1.2 National Grid – Delivering your future electricity transmission system, December 2019

25. National Grid published its "business plan" – "National Grid – Delivering your future electricity transmission system" in December 2019. Pages 59 - 60 deal specifically with potential east coast offshore wind coordination:

"There is potential for a further 37 GW of offshore wind and interconnectors to be developed off the east coast of England in the next 10 to 15 years. These connections imply a high number of cable route corridors, onshore substations, converter stations, and reinforcements to the existing onshore network. To address this challenge, the onshore transmission network could be built around the east coast, reducing the number of circuits required.

This approach, as shown in figure 7.19, would expand the existing transmission network on the east coast by building a loop of circuits to shore, providing connection sites for currently contracted offshore wind, interconnectors and anticipated (Round 4) projects."

2.5.1.3 National Grid ESO – Network Options Assessment, January 2020

26. National Grid ESO's Network Options Assessment states at Page 29, paragraph 3.3.10: *"Our licence condition C27 obliges us to undertake early development work for offshore wider works. In 2015, we published the Integrated Offshore Transmission Project which concluded that creating an integrated offshore transmission network wasn't worthwhile. There is now more drive towards integration because of more expansion of offshore wind, such as round 4. There is also a need to avoid several parties trying to gain consents in the same land corridors to bring their connections to the onshore transmission system. The benefits of integration are that it provides boundary capability and can connect offshore wind and interconnectors.*

For NOA 2019/20, our approach has been to investigate the economic benefit of simple HVDC links connecting parts of the onshore system. We will investigate the benefits of connecting offshore generation as part of next year's NOA."

2.5.1.4 Context for BEIS Review

27. The potential for changes to the offshore transmission network are therefore increasingly being recognised and discussed by National Grid and other bodies. This is in the context of current government policy which demonstrates an ever-increasing ambition for offshore wind, including a target of delivering 40GW of offshore wind by 2030. Whilst there is now further recognition of potential grid options for offshore wind, such discussions remain at early stages of development.

2.5.2 BEIS Review

28. On 15 July 2020, the UK Government announced a review into the way that the offshore transmission network is designed and delivered. The Applicants welcome this announcement. This review aims to address the barriers the regime presents to further significant deployment of offshore wind, with a view to achieving net zero ambitions. This review will be led by the Department for Business, Energy & Industrial Strategy (BEIS) and is split into two workstreams with different timescales. These are defined as medium term and long term workstreams.

29. The medium term workstream will seek to:

- identify and implement changes to the existing regime to facilitate coordination in the short-medium term;

- assess the feasibility and costs/benefits of centrally delivered, enabling infrastructure to facilitate the connection of increased levels of offshore wind by 2030;
- explore early opportunities for coordination through pathfinder projects, considering regulatory flexibility to allow developers to test innovative approaches
- focus primarily on projects expected to connect to the onshore network after 2025.

30. The long term workstream will seek to:

- conduct a holistic review of the current offshore transmission regime and design and implement a new enduring regime that enables and incentivises coordination while seeking to minimise environmental, social, and economic costs;

- consider the role of multi-purpose hybrid interconnectors in meeting net zero through combining offshore wind connections with links to neighbouring markets and how the enduring offshore transmission regime can support the delivery of such projects;

- focus on projects expected to connect to the onshore network after 2030.

31. On 24 August 2020, BEIS and Ofgem wrote to developers of offshore wind generation, electricity transmission licensees, and other interested parties inviting their views on potential barriers (including those of a legal, commercial or regulatory nature) and where changes in regulatory arrangements could facilitate coordination or if sider change is needed. The letter states that *"this information will be used by both Ofgem and BEIS to help us capitalise on early opportunities that will deliver benefits for consumers and the wider energy system, as well as to inform future policy development relating to an enduring regime for connections post 2030."* Responses were invited by 30 September 2020.

32. An update on the BEIS review is due to be published by the end of this year, with a view to providing clarity for an enduring approach in 2021. No such update has been published as yet. No date is provided as to when the outputs of the review will be published or implemented.

2.5.3 Recent Developments - Ten Point Plan

33. On 18 November 2020, the UK Government published its "Ten Point Plan for a Green Industrial Revolution". It states the intention for the UK to "lead the world into a new Green Industrial Revolution" by investing in clean technologies including wind energy. It restates the UK's legally binding obligation to reach net zero greenhouse gas emissions by 2050.

34. The first point in the Ten Point Plan relates to "advancing offshore wind". It states: *"Offshore wind is a critical source of renewable energy for our growing economy, with the UK already leading the world. By 2030 we plan to quadruple our offshore wind capacity so as to generate more power than all our homes use today, backing new innovations to make the most of this proven technology and investing to bring new jobs and growth to our ports and coastal regions."* The Ten Point Plan emphasises the key role of offshore wind in meeting targets and states that *"To offer further commitment to the industry and help further reduce costs, next year, we will aim to deliver up to double the amount of renewables we procure through our next Contract for Difference auction. And by 2030, we aim to produce 40GW of offshore wind".*

35. The Ten Point Plan does not provide further substantive information on the BEIS review, but it does state: *"To integrate clean technologies like offshore wind, we must transform our energy system, building more network infrastructure and utilising smart technologies like energy storage. Our Offshore Transmission Network Review will set out our strategy to connect offshore wind in a clean and cost-effective way, and we will outline our plans for smart systems and introducing competition in onshore networks in the forthcoming Energy White Paper."* It also states that the BEIS review *"will publish an update by the end of the year, with a view to providing clarity for an enduring approach in 2021".* Neither the Energy White Paper nor the update on the BEIS review has been published.

2.5.4 Relevance of the BEIS Review to the Projects

2.5.4.1 Status of the Applications

36. The timetable for the significant reform required to establish a new regulatory and technical framework for an offshore transmission network is likely to take a number of years. The Applications for the Projects were submitted in October 2019. The Examinations for the Projects commenced on 6 October 2020 and are well underway.

2.5.4.2 Letters from the Energy Minister

37. The Applicants note recent correspondence between the Energy Minister, Kwasi Kwarteng MP, to SASES and SEAS (submitted to the Examination in the Applicants' Comments on Written Representations Volume 3: Individual Stakeholders (REP2-017), at Appendix 2 and 4). The Energy Minister has issued two letters dated 1 September and 18 September 2020. These letters clarify the position as regards the BEIS review.

38. The letter of 1 September 2020 provides as follows:

- *"The ToR [of the BEIS review] clearly establishes two separate strands of the review, one to focus on the medium term to explore what can be*

done within the existing framework, and one to design and implement an enduring regime for the longer term. This approach is designed to account for the different stages of development of projects already in the pipeline. Due to the long lead times for offshore wind projects (8-10 years) many projects connecting before 2025 are either already consented or nearing the end of the consenting process. Introducing regulatory uncertainty and changing plans for well advanced projects would increase costs for consumers and make meeting ambitious 2030 and 2050 targets even more challenging. However, the review does commit to consider opportunities for projects at an earlier stage of development, and how these can be incentivised."

- *"Our intention regarding the enduring regime is to communicate the direction of travel during 2021; as you rightly state, this is a very complex issue that touches on many policy areas across several organisations. We do, however, expect that a significant portion of the work will be completed during 2021, so that clarity can be provided for those projects connecting after 2030."*

- *"Finally, regarding the current DCO applications [the Projects], as these will be for the Secretary of State to determine, I cannot comment on these specific applications. However, as outlined above, the timing of the review and the outputs are not expected to have an impact on projects at an advanced stage in the planning process."*

39. The letter of 18 September 2020 clarifies further as follows:

- *"The ambition of the medium-term work stream is to enable and incentivise as much coordination as possible within the bounds of the existing regime. However, as you will appreciate, it is not possible for us to mandate projects to alter existing plans given that they have been designed and funded based on the existing regime. Not only would changes to some projects at a later stage of development incur significant additional costs for consumers, it could also have a detrimental impact on investor confidence in the UK offshore wind industry and jeopardise our long-term goal to achieve net zero emissions by 2050."*

- *"As previously mentioned, we are not in a position to mandate changes to projects already in the pipeline under the existing regime and it will be up to individual developers as to whether or not they wish to make changes. This will need to be considered in terms of the costs and delays that will be incurred for a specific project, versus the potential benefits that may be realised."*

2.5.4.3 National Policy Statements

40. The Overarching National Policy Statement for Energy (EN-1) states at paragraph 3.3.15: "*In order to secure energy supplies that enable us to meet*

our obligations for 2050, there is an urgent need for new (and particularly low carbon) energy NSIPs to be brought forward as soon as possible, and certainly in the next 10 to 15 years, given the crucial role of electricity as the UK decarbonises its energy sector."

41. The National Policy Statement for Renewable Energy Infrastructure (EN-3) states at paragraph 2.6.34 that *"Applicants for consent for offshore wind farms will have to work within the regulatory regime for offshore transmission networks established by Ofgem. Under the regime offshore transmission will be a licensed activity regulated by Ofgem"*.

42. The Applicants have progressed the Projects in line with the regulatory regime for offshore transmission networks established by legislation and Ofgem. The Applicants have provided a Regulatory Context Note setting out the current regulatory context at Deadline 2 (REP2-003) to assist parties to the Examinations.

2.5.5 Conclusion

43. Changes to a coordinated approach on offshore transmission would require significant regulatory change to deliver it. There are also technological and economic barriers. Given the considerable time periods that would be involved in developing a different regime, the Applicants have a legitimate expectation that the Applications will be considered within the current regulatory framework in light of paragraph 2.6.34 of NPS EN-3, and as confirmed by the letters of 1 and 18 September from the Energy Minister. In the circumstances it is not envisaged that the review will lead to opportunities or outcomes which would be relevant the delivery of the projects.

3 Agenda Item 3: Strategic Siting - Approach

3.1 Choice to Make a New Onshore Connection

3.1.1 CION Process - Overview

44. The Connection and Infrastructure Options Note, CION, process evaluates the respective transmission options required which leads to the identification and development of the overall efficient, coordinated and economical connection point, onshore connection design and, where applicable, offshore transmission system / interconnector design in line with obligation to develop and maintain an efficient, coordinated and economical system of the electricity transmission network.

45. The Connection and Infrastructure Options Note (CION) records the outcome of a comparative assessment of grid connection options for the East Anglia TWO project and the East Anglia ONE North project (the Projects)

46. This assessment, led by National Grid as the operator of the electricity transmission system across Great Britain (now National Grid Electricity System Operator Limited), included input from ScottishPower Renewables (representing the Applicants and the Offshore Transmission Owner (OFTO)), and from the Transmission Owner part of National Grid (now National Grid Electrify Transmission plc), which owns the onshore electricity transmission network in England and Wales.

47. The CION process considered technical, commercial, regulatory, environmental, planning and deliverability aspects to identify the preferable connection for the Projects. The Electricity Act 1989 requires National Grid, when formulating proposals, to be efficient, co-ordinated and economical whilst also having regard to the environment, and, where the development being connected is an offshore windfarm, the offshore aspects must to be considered in that evaluation also.

48. The assessment process therefore looks to minimise the total capital and operational cost whilst taking into account other key considerations, as set out above. The connection options are then comparatively assessed to identify the most appropriate connection location.

49. Triggers for the review of the CION process (extract from CION Guidance)

- Material triggers are any changes that affect the overall design or connection point that will require for the need to review the connection

option. If these changes are deemed material by the CION parties, then any re-assessment of the design option will fall under the Modification Process as defined in the CUSC and STCP 18-1. The process can be initiated by NGESO, the developer or the TO(s) and this shall take the form of a Modification Application or a Modification Notice as appropriate. In an event that the CION parties can't agree that a change is material then this is refer to Ofgem for determination.

- Examples of material changes which could affect the onshore connection point, or the onshore or offshore transmission designs include:
    - Changes in SO assumptions – such as significant changes in the Construction Planning Assumptions (CPA) or generation background.
    - Changes in TO assumptions – such as changes in generation background that impact on TO investments and affects the Construction Planning Assumptions that form the basis for the TO Construction offer to NGESO.
    - Changes to the developer assumptions – such as changes in Transmission Entry Capacity (TEC), changes in offshore technology, etc.

3.1.2 CION Process - Costs Review

50. The CION process reviews cost information for analysis for the selection of the overall preferred connection options for the Projects, the choice of which directly impacts on the underlying economics, timescale and ultimately the business case of the Projects from the Applicants' perspective.

51. The total cost of connecting to each location is worked out based on Transmission Capital Costs + Developer Capital Costs + System Operator Constraint Costs. Constraint Costs are the costs of increasing generation from some power stations and decreasing it at others to balance the system. It then considers how the various options compare in cost terms against a range of future energy scenarios, which is known as the cost benefit analysis (CBA) process. Through the CBA assessment a recommended option is identified in economic terms. The cost of the options is then evaluated against the other key considerations to determine the preferred option, which can change as more detailed information is obtained.

3.1.3 The Projects Grid Connection Timeline

52. The following reflects the key timelines of the Projects' grid connection process:

November 2010: East Anglia Offshore Wind Limited signed grid connection agreements with National Grid (system operator) for six off 1.2GW offshore wind projects. Based on the existing and contracted generation background at that time, the most economic and efficient connections (considering environmental and programme implications). At the time Sizewell was ruled out due to lack of connection capacity based on background generation. The connection points identified were**;** Norwich Main Substation a new substation location along the transmission lines from Norwich to Bramford near Eye Airfield and Bramford.

- **February 2015:** The East Anglia ONE Offshore Windfarm was awarded a contract under the first allocation round of the Contract for Difference (CfD) for 714MW capacity, based on a Grid Connection capacity of 680MW. This was due to limits in the CfD auction that limited a bid to around 600MW, our proposed AC solution was pushing the limits of AC technology at the time.
- **August 2015:** The Integrated Offshore Transmission Project (East) – Final Report and Recommendations was published by National Grid, which examined whether the development of integrated offshore networks for offshore generation within the Dogger Bank, Hornsea, and East Anglia zones, could provide benefits. The report concluded that it would not be economic and efficient to progress with the development of an integrated design philosophy or delivery of anticipatory assets at this time.
- **Q1 2016:** A connection agreement became effective, splitting the previous East Anglia ONE project into two separate projects by reducing its capacity to reflect the CfD awarded in 2015; and forming the East Anglia ONE North project with the balance of the contracted capacity for the original East Anglia ONE project.
- **March 2016:** The East Anglia ONE Offshore Wind Farm (Corrections and Amendments) Order 2016 is made, providing the option for the EA1 project to be constructed as either a (up to) 750 MW offshore wind farm with a high voltage alternating current (HVAC) transmission connection; and (up to) 1,200MW wind farm with a high voltage direct current (HVDC) transmission system that was identified for EA3.
- **February 2017:** An agreement to vary the EA2 grid connection agreement became effective, reallocating capacity between EA2 and EA1N (to create an even split of 860MW transmission capacity for each project).
- **May 2017:** SPR engaged with National Grid to determine connection options for the proposed EA2 project (up to 900MW wind farm capacity) and EA1N project (up to 800MW wind farm capacity) based on contracted background at that time and reflecting the Projects' timescales and reduced capacities. This resulted in an updated CION review.

- **October 2017:** Updated CION completed by National Grid (SO), which reviewed all realistic options and reflected the changes to the contracted (gird connection) background, and concluded that the most economic and efficient connections for EA2 and EA1N, while considering environmental and programme implications, was into the circuits in or around Leiston.

53. In October 2017, the Applicants commenced the Projects' Phase 1 Consultation to inform the EIA scoping process, based on the Projects connecting into the circuits in or around Leiston.

54. ***Environmental Statement - Chapter 4 – Site Selection and Assessment of Alternatives*** (APP-052) presents details on the site selection process undertaken to identify the grid connection location for the Projects in or around Leiston.

3.1.4 Updated CION (October 2017)

55. As mentioned above, the updated CION completed by National Grid in October 2017 reviewed all realistic options and reflected the changes to the contracted (gird connection) background, and concluded that the most economic and efficient connections for EA2 and EA1N, while considering environmental and programme implications, was into the circuits in or around Leiston. The following sections present a review of this CION process.

3.1.4.1 Connection Locations Considered

56. The connections points considered in the CION are listed below:

- Bradwell
- Bramford 400kV substation
- Cromer / Bacton area
- Dereham / Shipdham Airfield / Brandon Parva area
- Diss / Eye Airfield area
- Kings Lynn
- Leiston 400kV substation
- Little Dunham / Necton
- Lowestoft area
- Norwich 400kV substation
- Sizewell 400kV substation
- Walpole 400kV substation

3.1.4.2 Initial Options Appraisal

57. To comply with the statutory duties under Section 9 of the Electricity Act, the preferred connection design should be the most economic and efficient when considering both offshore and onshore works. Considering National Grids TO works and the developers' specific OFTO works.

58. The 'initial options appraisal' considered the abovementioned (potential) connection locations based on a high-level assessment of programme, construction complexity, land availability, environmental / consenting issues and cost. Connection locations that were identified to have no benefit over others were 'parked' and those considered unviable were 'discontinued'. Table 1 provides a brief summary of the Initial Options Appraisal results.

Table 1: Brief Summary of the Initial Options Appraisal Results

Interface Point	Considerations	Initial Options Decision
Bradwell	Requires extension of OHL which would result in significant consenting and environmental challenges. The connection would not be available in the developer's required timescale.	Discontinued
Cromer / Bacton area		Discontinued
Lowestoft area		Discontinued
Walpole 400kV substation	Locations offer no benefit in terms of Network Infrastructure savings although given the greater distance from the EA2 project, longer onshore electrical cabling would be required with a resultant greater environmental impact and greater capital cost. A new National Grid substation would also be required.	Parked
Kings Lynn		Parked
Little Dunham / Necton		Parked
Dereham / Shipdham Airfield / Brandon Parva area		Parked
Diss / Eye Airfield area		Parked
Norwich 400kV substation	New OHL circuit from Pelham and Necton would require a DCO. Few existing constraints to extending this substation. Would need to review any local planning policies for any specific requirements relating to this location. Nationally significant designations to the east of Norwich which would be a considerable challenge in terms of a direct route to the substation. However there are routes available to the North and then west of Norwich but considerable circuit lengths would be required. Numerous constraints along the route but can be mitigated by careful routing and / or engineering design	Carried forward
Sizewell 400kV substation	Connection may be available by extending the 400kV substation within the Sizewell B nuclear power station. The presence of the Suffolk Coast and Heaths AONB is noted. The connection could be available in the developer's required timescale.	Carried forward

Interface Point	Considerations	Initial Options Decision
Leiston 400kV substation	Connection may be available by the redevelopment of the 400kV substation. The connection could be available in the developer's required timescale.	Carried forward
Bramford 400kV substation	Original Interface Point for 1 project	Carried forward

3.1.4.3 Technology Considerations

59. Power can be transmitted from the offshore wind farms to the onshore substations using different transmission technologies, such as HVAC (High Voltage Alternating Current) or HVDC (Direct Current). HVDC technology can only be considered if it proves to be more technically reliable, commercially viable and reduce costs over an HVAC connection, which, considering the Projects' electrical capacity and distance to the proposed connection points, this is not the case.

60. Key factors in considering the use of HVAC or HVDC are:

- Capacity of the project: The Applicants have defined two separate projects of 900MW and 800MW wind farm capacity in order to retain the necessary flexibility in competing for a CfD position.
- Distance between the wind farm and the onshore substation, where EA1 as an AC project is 120km; EA3 a proposed HVDC is 180km; EA1N is 69km; and EA2 is 59km.
- For the distances considered for HVAC for EA1N and EA2 interim compensation stations are not required.
- Capital costs and operational costs: The key differential being the costs of the onshore and offshore substations (or convertor station) for HVDC are the most significant, whereas for HVAC it is more related to the circuit length. Thus for short connections of lower capacity, the cost balance is significantly in the favour of HVAC technology.
- Cable capacity limits: Where the cable carrying capacity for a HVDC circuit is ca. 1200-1300MW; and for a HVAC circuit is ca. 400-450MW.
- Construction Program: Whereby HVDC has approximately 12-18 months longer lead time and construction over a comparable HVAC system.

AC cables are significantly more efficient for shorter distances. With the evolution of AC cable technology and innovations, offshore AC circuit capacities have improved greatly in the last few years. This has allowed the Applicants to develop the offshore deployment of a 275kv export cable circuits.

3.2 Onshore Site Selection

61. The presentation at the Hearing outlined the key approach taken to site selection of the various onshore infrastructure from landfall to the onshore substation. The presentation also outlined how expert topic groups had been established with key stakeholder participation. This ensured that there was continued input into the process by a broad spectrum of interests. The presentation effectively set out in visual form the site selection process undertaken and reported upon within ***Environmental Statement - Chapter 4 – Site Selection and Assessment of Alternatives*** (APP-052).

62. SASES criticised the site selection process for being predicated on co-location of the onshore substations. This misunderstands how the site selection process was undertaken. Paragraph 32 of ***Appendix 4.2 – Red Amber Green (RAG) Assessment for Onshore Substations Site Selection in the Sizewell Area*** of the Environmental Statement (APP-443) confirms that whilst in general terms it was likely that co-location might be preferable, the initial process was undertaken to identify any preferred location which could locate a single onshore substation. Furthermore, a separate RAG assessment was undertaken in relation to the National Grid substation.

63. It should be noted that the RAG assessment was only used as a comparative tool and that further site visits and evaluation were undertaken as part of the overall site selection process.

64. Further landscape and visual appraisal of the alternative substation zones inside and outside the AONB were considered in more detail and presented in the AONB Appraisal (***Appendix 4.3***) (APP-444) and in the 'Summary Note on Landscape and Visual Impact and Mitigation' in ***ES Appendix 4.5*** (APP-445). These appraisals went beyond the 'high level' scoring of the RAG assessment to a consideration of potential impacts on receptors, including AONB special qualities, and further tested the landscape comparisons between alternative substation zones.

65. Furthermore, the phase 3.5 consultation offered a further opportunity to appraise and compare sites. The consultation arising from this process was taken into account.

66. A fair summary would be that the key issues had been canvased and consulted upon within that process.

67. A process of micro-siting was undertaken to refine the best location for the two onshore substations and National Grid substation. One of the main drivers for the co-location and micro-siting of the substations was to reduce landscape and visual impact. There was a preference for co-locating substations adjacent to

and in parallel to the existing overhead power line. This is in order to minimise wider character change and effects on more visual receptors over a wider area.

68. The function of the substations can be understood when viewed in association with the overhead line, compared to if they were dispersed and separate from each other and the power line. By co-locating substations next to each other, the substations are perceived as one. This is in contrast to when substations are placed several hundred metres apart, which will result in more conspicuous and dispersed effect.

69. This is reflected in the Landscape and Visual Assessment. There are some significant residual effects but they are limited in geographic extent.

3.3 Applicants' Responses to Points Made by Interested Parties under Agenda Item 3

70. The Hearing Actions have raised a number of issues which also raised by interested parties at the Hearing. The Applicants refer to their Answers to actions in respect of those matters (***Applicants' Responses to Action Points*** (document reference ExA.HA.D3.V1). There was one further point raised by Mr Keen, on behalf of SASES, which the applicants wish to respond to. He made submission on section 3A of The Electricity Act 1989. The duties in section 3A have been imposed on both the Secretary of State and the Gas and Electricity Markets Authority. It sets out the principal objective as being to protect the interests of consumers. Those interests are given specification through sub paragraph (1A). These interests include the reduction of electricity supply emissions of targeted greenhouse gases and security of supply. The Act goes on to provide further requirements. These have been summarised in section 2 of the Applicants' Regulatory Context Note. REP 2 -003. It is important to note that these statutory duties underpin the regulatory framework which is then implemented and overseen by Ofgem through the licence obligations. This regulatory framework is fundamental to the procedures and decision making provided by the regulated entities such as National Grid ESO.

4 Agenda Item 4: Local Siting – Impacts and Mitigation

4.1 Design and Impact of the Proposed Landfall and Cable Alignments

4.1.1 Landfall

71. Although the exact cable and landfall design will be completed post-consent (since they are largely dependent upon both onshore and offshore site

investigations, as well as consistent engagement with the supply chain), the applicant has already made "good design" interventions in the design envelope in order to reduce or minimise direct physical disruption with environmental and ecology features, as well as overall project footprint, namely:

- An export cable voltage of 275kV has been selected to transmit the wind farm power to the 400kV National Grid system onshore. This "innovative" approach (no offshore wind farm in the world currently uses 275kV HVAC currently) offers an enhanced efficiency
- HDD has been selected as the installation method for the cables at the landfall. The depth of burial will ensure the risk of de-stabilising the cliff and cable exposure in the foreshore is negligible;
- The commitment from the applicant to bury the cables and have no above-ground infrastructure during the operational lifetime of the projects.

72. An engineering feasibility study was undertaken to review landfall options in terms of construction and cost, including consideration of geology. The rationale of selecting a landfall area north of Thorpeness has been covered elsewhere and is therefore not the objective of this report.

73. Trenchless works at the landfall require special equipment. For example, in the case of the trenchless Horizontal Directional Drilling (HDD) technique, this would reach depths of up to 25m, requiring the cables at the entry point to be further apart than normally associated with a cable installed purely on land due to the thermal impacts of the overlying ground and ability to drill in close proximity. In some cases, the separation at entry can be mitigated by steering the path of the HDD further apart as it descends however this is not always possible in all ground conditions.

74. The below figure indicates the required Landfall area at Thorpeness. If this was to be set up as a HDD drill site, it would include the following facilities:

- Gate and General Security
- Welfare, offices, mess huts, drying room etc.
- Materials storage
- Bentonite Management
- Arisings storage
- Steering Cabin
- HDD Rig (300T)
- Drill pipe
- Power generation
- Supporting Plant

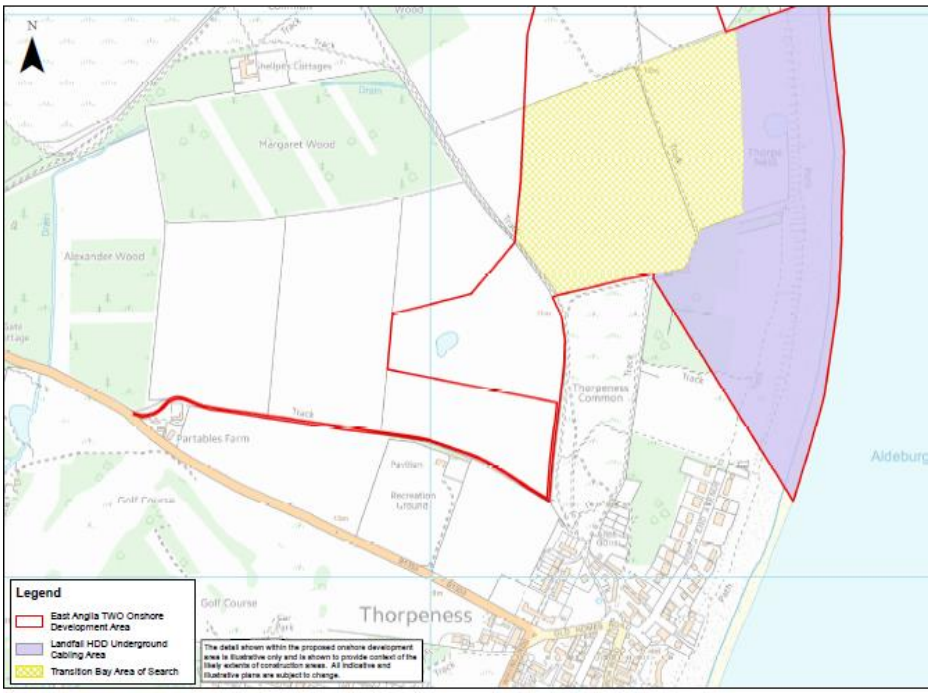

Figure 3

75. In conclusion, the use of a trenchless cable installation technique demonstrates good design as it brings certain benefits to the project, namely:

- Reductions in soil disturbance, particularly at the surface;
- Minimized environmental impact to the surrounding area and ecosystem;
- Reductions in groundwater contamination;
- Reduction in costs;
- Reduced impact of weather on trenching progress;
- Reduced disruption to traffic and other human factors;
- Low-noise operation;
- Use of a single location to install multiple pipes and ducts (directional drilling).

4.1.2 Cable Alignments

76. The Applicants explained how in respect of certain environmental sensitivities it was proposed that the working widths for the installation works would be significantly reduced.

77. This was illustrated first of all in respect of the works where the cables cross the woodland to the west of Aldeburgh Road, at which point the working width of the onshore cable route for a single project is restricted to a maximum of 16.1m and with the commitment to early ducting this would be restricted to a total maximum working width of 27.1m for both Projects. This reflected the objective of absolutely minimising tree loss.

78. Another area with a reduced working width is the SPA crossing in the event that trenching is used. As referenced in the ***Outline SPA Crossing Method Statement*** (REP1-043) the maximum working width would be 16.1m per project, and 32.2m for both Projects.

79. In respect of other locations, the Applicants explained that there may have to be wider working widths extended beyond the standard 32m per project. This was illustrated in respect of a technical matter relating to the exit of the cables from the landfall transition bays. This is because the transition bays may be located more than 32m away from each other and therefore as the cables exit, a wider working width is required initially before the cables converge into the standard 32m working width.

80. A similar approach has been adopted to the crossing of the Hundred River. A wider working width in these circumstances would maximise the effectiveness of the ultimate siting of the works and thereby mitigate potential environmental impacts.

81. The Applicants submit that very careful consideration has been given to cable alignments and that this should give confidence regarding the minimisation of impact. The Applicants have experience in this general environment having undertaken EA1 and the representative of East Suffolk Council confirmed how well this had worked on the ground in the delivery of that project.

4.2 Design and Impact of the Proposed Substations/Transmission Systems Connections

4.2.1 Development of Approach to Good Design

82. The ExA raised queries about in-examination work on the Design and Access Statement and the notion of appointing an independent design champion to oversee the project as a whole. The ExA asked the Applicants to think about these and has added them as an action point for the Applicants to respond to. The Applicants will provide a detailed response will follow at Deadline 4 as agreed with the ExA.

4.2.2 National Grid Substation Insulation Technology

83. Selecting the type of large extremely high-voltage (EHV) switchgear for the onshore substation plays a defining role to the overall substation footprint size.

84. Although Air Insulated Switchgear (AIS) offers a reliable alternative, EA1N and EA2 projects will opt for the Gas Insulated Switchgear (GIS) technology which, due to its compactness (i.e. smaller size and weight of its components), can lead to a reduction in the overall substation footprint of up to 35%.

85. In addition, due to its indoor application, GIS equipment will be fully enclosed thus preventing vandalism, pollution (i.e. equipment less sensitive to salt, sand or snow) and enabling a big part of the substation to be hidden in a building to preserve the aesthetics of the surroundings.

86. However, the Applicants have allowed for both switchgear configurations for the National Grid substation. National Grid substations normally build their substations with AIS technology and therefore this is currently their preferred technology but National Grid are open to both technologies and are continuing to discuss both options. As such, the Applicants have used AIS technology in their assessments as this is the worst case scenario in terms of substation footprint. The Applicants note that the ExA have asked National Grid to expand on this as an action point.

4.2.3 Onshore Substation Design

87. At preconceptual design stage, a comparative assessment of the EA1N/EA2 substation design envelope with that of the already constructed EA1 project was used to determine a preliminary, worst-case onshore substation footprint (of 190x190m). The comparative assessment provided the reasonable worst case scenario of the onshore substation footprint, due to the key similarities the three projects share, mainly due to the transmission technology employed and similar requirements for the substation main electrical equipment.

88. Following the establishment of this reasonable worst-case design envelope, conceptual electrical design (power systems) studies were then carried out to determine key reference parameters to guide the onshore substation concept sizes. The studies were based typically on assumed component parameters (mainly in-house data), early stage supplier engagement information and experience (inclusive of lessons learnt) gained from earlier similar projects (mostly EA One) in order to form the onshore substation conceptual design envelope.

89. More specifically, consideration in the conceptual electrical design studies of the onshore cables, as well as National Grid's Grid Code and Security of Supply requirements, has led to the following key main equipment being selected and sized to manage the expected power flows, fault levels, power quality, voltage levels and noise limits. This forms the basis for the onshore substation design:

- 2x Transformers 400/275kV

- 2x Earthing Auxiliary Transformers 33/0.4kV
- 2x STATCOMs
- 2x Reactors
- Harmonic Filters
- 275kV GIS switchgear
- 400kV AIS switchgear consisting of circuit breakers and disconnect switches as required

90. This review of the conceptual design has allowed the footprint of the onshore substations to reduce to 190x170m (as stated in the ***Project Update Note*** (REP2-007) submitted at Deadline 2).

91. The aforementioned electrical infrastructure will further be refined (e.g. dimensions, weight, siting within substation compound, noise etc.) at detailed design stages through an iterative process between more detailed power systems studies and consistent supply chain engagement in order to determine the optimal design of the onshore substations.

4.2.3.1 Growth Rates and Associated Landscape Treatment

92. There was discussion at the Hearing regarding the potential landscape treatments that could be provided as part of the Outline Landscape and Ecological Management Strategy. These have been revised and submitted in an updated ***Outline Landscape and Ecological Management Strategy*** at Deadline 3 (document reference 8.7) taking into account the modifications of the footprints to the onshore substations submitted at Deadline 2 (***Project Update Note (REP2-007)***).

93. There was also discussion regarding planting mitigation and growth rates. A further response to these matters can be found in the updated ***Outline Landscape and Ecological Management Strategy*** (document reference 8.7) submitted at Deadline 3 which addresses the concerns expressed during the Hearing.

4.2.4 Setting on Heritage Assets

94. There is general agreement between the parties regarding an appropriate methodology for the assessment of impact on the significance of heritage assets due to change in their settings. This is the approach recommended by Historic England in GPA3 (Setting of Heritage Assets, 2017).

95. Analysis of how the setting of a heritage asset contributes to its significance is based on an understanding of the heritage significance of the asset and an appreciation of how it is experienced in its setting. ***Environmental Statement – Appendix 24.7 – Assessment of the impact of Onshore Infrastructure in the Setting of Heritage Assets and Annexes (Part 1 of 2) (APP-519)*** states

that the Applicants' assessment of the assets that are potentially impacted. This broadly identifies that the area to the north of Friston still maintains an essentially agricultural landscape, albeit a modern one. The existing electrical infrastructure exerts a degree of influence.

96. It is acknowledged that there are some differences of opinion on the impacts on certain listed buildings. The differences appeared to relate to a differing of opinion as to the importance of the wider rural setting to the heritage significance of certain assets. The majority of these differences were at the margin of assessment and reflect differing judgement

5 Agenda Item 5: Possible Scope for Changes to the DCO Applications

97. The ExA announced at the beginning of day two of the Hearing that this agenda item would not be covered in ISH2. Instead, it is to be moved to a separate Issue Specific Hearing in January 2021.