MULBARTON PARISH COUNCIL

Norfolk Vanguard and Boreas with Hornsea Three

EN010079 Norfolk Vanguard
EN010080 Hornsea Three
EN010087 Norfolk Boreas

16th November 2021

Introduction

This representation is one of two submitted by Mulbarton Parish Council in response to the Secretary of State's Norfolk Vanguard consultation letter of 11th October 2021 and the extension of time announced on 26th October 2021.

It deals with the offshore and coastal environmental impacts identified in the Secretary of State's consultation letters within the context of the Norfolk Vanguard re-determination and the Hornsea Three, Norfolk Boreas, and East Anglia One North and Two projects.

Habitats Regulations Assessments

The Hornsea Three Habitats Regulations Assessment was produced by the Secretary of State in December 2020. It concluded that the assessment was acceptable because there were no alternative means of achieving the aims of the project.[1] Whilst this statement may have been valid for offshore ornithology, it is not applicable to the export cable route.

This distinction also applies to Norfolk Vanguard and Boreas and East Anglia One North and Two. Alternative schemes of grid connection with different export cable impacts are under consideration as part of the OTNR (Offshore Transmission Network Review).

The SPAs (Special Protection Areas) in which the impact of the offshore wind turbines on birds cannot be avoided are: Flamborough and Filey Coast SPA, Greater Wash SPA, North Norfolk Coast SPA, Alde-Ore Estuary SPA, and Outer Thames Estuary SPA.

The SACs (Special Areas of Conservation) where the impact of the export cable routes on sandbanks can be less damaging are: North Norfolk Sandbanks and Saturn Reef SAC, Wash and North Norfolk Coast SAC, Haisborough Hammond and Winterton SAC.

Offshore Transmission Network Review

Appendix 1 contains a submission to the OTNR which demonstrates a 35% reduction in the environmental impact of the export cable, landfall and onshore infrastructure for these projects. The north-south alignment of the export cables potentially eliminates any damage to the Special Areas of Conservation identified in the Vanguard consultation letter.

Conclusion

The Hornsea Three, Norfolk Vanguard and Boreas projects in their present form are not capable of satisfying the requirements of the Habitats Regulations Assessments because there are alternatives that would use much less coastal infrastructure around East Anglia and could be much less damaging to the Special Areas of Conservation listed above.

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1 Hornsea Project Three Habitats Regulations Assessment and Marine Conservation Zone Assessment, EN010080-003267, p115, 31st December 2020.

MULBARTON PARISH COUNCIL **Appendix 1**

East Coast Pathfinder

Implementation

24th May 2021

Introduction

To meet the UK's legally binding emissions targets, it is now necessary to speed up the delivery of offshore wind energy. Much of this will necessarily come from the Round 2 and Round 3 projects off the east coast. Studies have shown that the East Coast Pathfinder is the optimum approach, and this paper sets out a proposed scheme for its implementation.

Offshore aspects

The scope of this implementation programme covers Hornsea Three, Norfolk Vanguard and Boreas, East Anglia One North and Two, and also the Round 2 extension projects for Dudgeon, Sheringham Shoal, Galloper, and Greater Gabbard. It also includes the Dogger Bank zone, and the Round 4 extensions to both Dogger Bank and the Hornsea zone.

The peak output of these projects is expected to be 26GW by 2030. Allowing for a load factor of 46%, this may deliver an average renewable energy supply of 12GW. Peak winter demand in the UK is now approximately 40GW, and is likely to rise slowly. It follows that climate change mitigation is the key priority, rather than energy exports to other countries.

Onshore aspects

Integrated offshore transmission has been studied for more than ten years. The IOTP (East) report of 2015 demonstrated that, for east coast capacity levels of more than 10GW, there are no cases where non-integrated designs show an economic advantage. Equally important, integrated designs can offer higher energy transfers to centres of demand with smaller onshore infrastructure requirements and possibly shorter construction timescales.[1]

Equinor has adopted integrated offshore transmission for the Dudgeon and Sheringham Shoal Extension projects, and is well placed to lead on a broader scale of implementation. The Hornsea Three, Norfolk Vanguard and Boreas projects have adopted HVDC designs for their export cables, which facilitates an integrated approach. Key onshore transmission network reinforcements, such as the Bramford to Twinstead Tee upgrade, are now moving forward, and the East Coast Pathfinder scheme provides further out-of-region transmission capacity offshore to facilitate undergrounding along the more sensitive areas of this route.

Climate change mitigation

To meet climate change goals it is not enough to construct large wind farms out at sea; it is also necessary to ensure that renewable energy reaches the main centres of demand as early as possible, and without unnecessary curtailment due to network constraints. The East Coast Pathfinder project aims to eliminate local out-of-region transmission constraints whilst reducing costs and minimising onshore environmental impacts. This helps to ensure the most rapid progress towards the UK's legally binding climate change mitigation targets.

Supporting details and working assumptions are set out overleaf.

1 The IOTP (East) report was produced by National Grid and the developers of the Dogger Bank, Hornsea, and East Anglia zones: the Forewind consortium (including Equinor), Smartwind and Orsted, and Scottish Power Renewables and Vattenfall. The overall cost benefit analysis was carried out by National Grid.

Round 2 extensions

Two alternative schemes of integrated offshore transmission are proposed by Equinor for the Dudgeon and Sheringham Shoal extension projects. The two projects, with different legal ownership structures, will use one of the following schemes of connection:

(a) Two grid connections, two offshore substations, and an offshore HVAC transmission link between the two projects (i.e. a ring or loop configuration). This increases the reliability of power transmission and may reduce the scale and impact of onshore infrastructure.

(b) One grid connection, and one offshore substation, shared between the two projects on a commercial basis (i.e. a spine configuration). This may reduce offshore impacts and project costs, but may not improve onshore impacts or power transmission reliability.

The existing Dudgeon and Sheringham Shoal offshore wind farms are connected to the grid at Necton and Salle respectively. These are also the simplest onshore grid connection points for the extension projects, because local surveys and community consultations have already been completed, and many relevant issues have already been brought to light.

The shorter distances from the offshore platforms to the grid connection points lead to the use of HVAC connections. These are typically at 66kV for the inter-array cables, and 220kV for the export cables and for the offshore transmission link between the projects.

The same approach is proposed for the Galloper extension (now called Five Estuaries) and the Greater Gabbard extension (now called North Falls). The original grid connection points for these projects are at Leiston and Sizewell. The extension projects are assumed to use the same locations, with a 220kV offshore transmission link between the projects.

These smaller scale extension projects will mostly supply local needs, and they do not add significantly to the total of out-of-region transmission capacity requirement.

Round 3 projects

As shown in the IOTP (East) feasibility study, Hornsea Three is assumed to use a 2GW HVDC export cable to its original grid connection point at Walpole, whilst the other three Hornsea zone projects (1, 2 and 4) retain their current grid connections in East Yorkshire.

The Norfolk Vanguard and Boreas projects, originally part of a single East Anglia zone, are assumed to connect to the grid at Bramford using HVDC export cables. This in turn will require completion of the Bramford to Twinstead Tee upgrade. Figure 1 shows the effect of this upgrade as identified by the Offshore Wind Industry Council in November 2019.[2]

To minimise demands on the Bramford to Twinstead route, the East Anglia One North and Two projects are assumed to connect to the grid at Isle of Grain, again using HVDC.[3]

The Bramford to Twinstead upgrade is treated here as an extension of the offshore wind farm export cables, and therefore automatically uses underground construction techniques throughout to reduce planning delays and speed up the delivery of offshore wind energy.[4]

Offshore transmission links are then added between the project zones towards the end of the offshore construction period so that out-of-region capacity constraints are eliminated and all the available offshore wind energy reaches the main centres of demand. This stage of development of the East Coast Pathfinder project is shown in Figure 2.

2 Offshore Wind Industry Council - Evidence to Ofgem, November 2019, Figure 2.3, page 6.
3 See also: Bramford to Twinstead Scoping Report, National Grid, EN020002-000333, May 2021, page 2.
4 See also: Undergrounding high voltage electricity transmission lines, National Grid, issued January 2015.

Offshore integration

Recognising the need for additional north-to-south transmission capacity, each project is assumed to provide its own export cable, and an offshore transmission link towards the south. The link from Dogger Bank to Hornsea is therefore provided by Equinor and the link from Hornsea Three to Norfolk Vanguard and Boreas is provided by Orsted. Each link is approximately 100km and can readily be provided using conventional HVAC at 220kV.

On the same basis, the Vanguard and Boreas projects use an export cable to Bramford, including undergrounding from Bramford to Twinstead, and also provide the very short link from Norfolk Vanguard to East Anglia One North. This link is assumed to be provided by Vattenfall using HVAC at 220kV. The offshore link from the East Anglia projects to Grain is the export cable for East Anglia One North and Two, and is therefore provided by Scottish Power Renewables as HVDC. This scheme places all projects on a broadly equal footing.

After completion, the offshore links between the zones are assumed to be transferred to licensed offshore transmission operators under the existing OFTO regulatory regime.

Overall capacity and timescales

Two further offshore lease allocations have recently been announced in Round 4 for the Dogger Bank and Hornsea zones, with expected completion by 2030. After the completion of all of these projects, the total East Coast offshore wind capacity is as follows:

	2025	2030
Dogger Bank zone		
Projects A, B & C	2.4	3.6
Project D (Sofia)		1.4
Leasing Round 4		3.0
Hornsea zone		
Projects 1 & 2	2.6	2.6
Project 3	1.2	2.4
Project 4		1.0
Leasing Round 4		1.5
East Anglia zone		
Dudgeon and Sheringham Shoal	0.7	0.7
Galloper and Greater Gabbard	0.8	0.8
Round 2 extension projects		1.6
Norfolk Vanguard & Boreas	1.8	3.6
East Anglia 1 & 3	2.1	2.1
East Anglia 1N & 2		1.7
Total capacity (GW)	10.1	26.0

This summary shows that the Round 3 and Round 2 extension projects are the principal opportunity for East Coast integrated offshore transmission in the period up to 2030.

Point to point links

If the integrated approach is not adopted, then the scheme of connection for Round 3 offshore wind projects is likely to be as shown in Figure 3. This fragmented approach does not begin the process of integration, and does not seem to be capable of meeting the need for climate change mitigation with maximum efficiency and minimum cost to consumers.

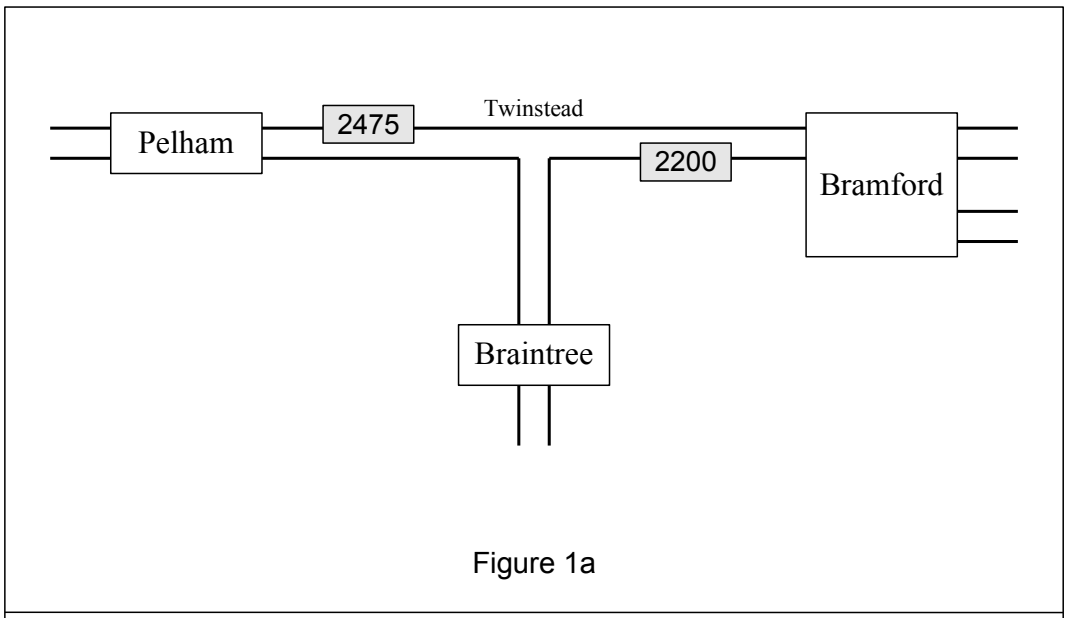

Figure 1a

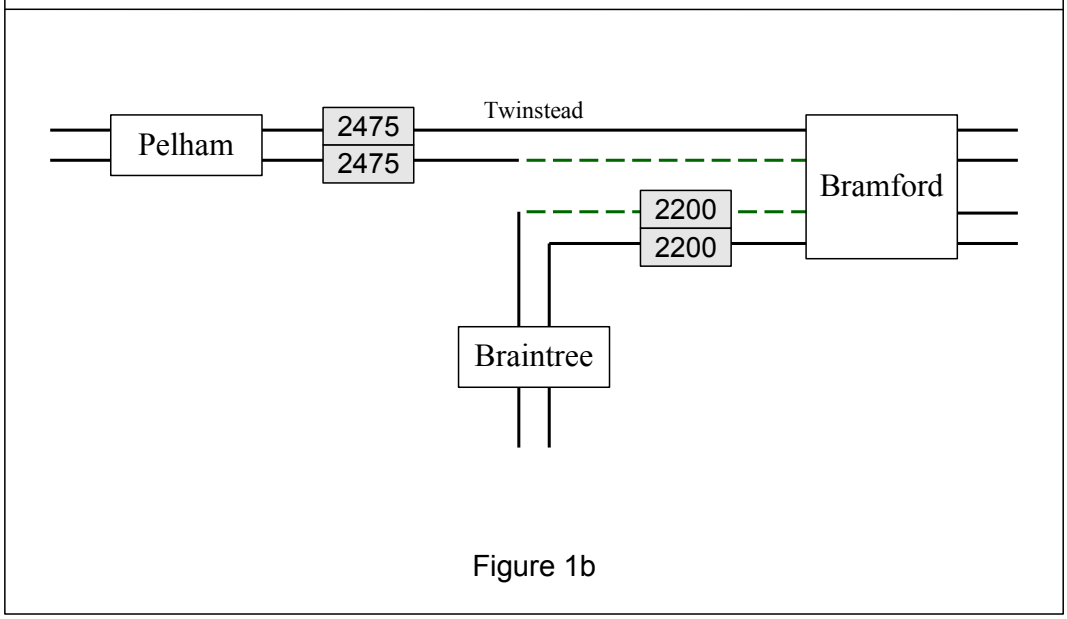

Figure 1b

Figure 1: Bramford to Twinstead

Notes:

Figure 1a above shows that out-of-region transmission capacity at Bramford is currently limited to 4,675MW (4.7GW), consisting of 2,475MW towards Pelham, and 2,200MW towards Braintree.

Figure 1b shows that after completion of the Bramford to Twinstead Tee upgrade, the available out-of-region capacity at this point is doubled from 4.7GW to 9.4GW, and reaches a level similar to that available at Walpole. There are no plans to increase the out-of-region capacity from Walpole.

Using the approach of East Coast Pathfinder project, the out-of-region capacity requirement is significantly reduced and the maximum use is made of underground construction techniques. As in the case of wind farm export cables, this reduces planning delays and speeds up delivery, and the additional cost is small in comparison to the total lifetime costs of the renewable energy projects.

If this approach is not followed, then the total out-of-region transmission capacity requirement at Bramford is significantly increased, and the use of multiple new overhead lines can be expected to further increase planning challenges, and delay the availability of renewable offshore wind energy.

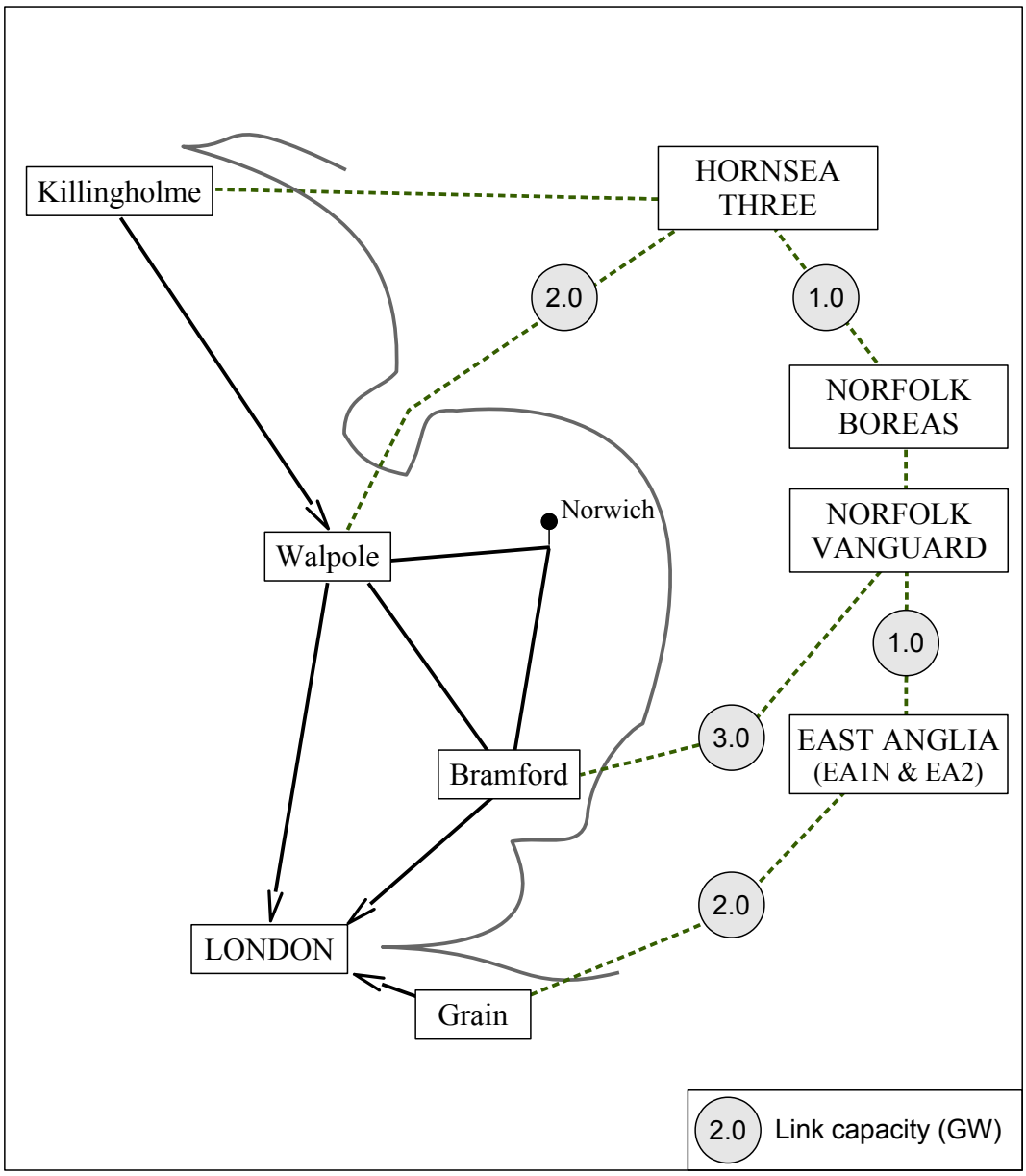

Figure 2: Offshore transmission

Notes:

Each offshore project is initially connected with a radial link, thus reducing risk and speeding up delivery. Additional offshore transmission links are added between project zones, and the Bramford to Twinstead upgrade is brought forward as complementary onshore transmission infrastructure.

Hornsea Three is restored to its original connection at Walpole; Norfolk Vanguard and Boreas are connected at Bramford; and East Anglia One North and Two (EA1N & EA2) are connected at Isle of Grain. Offshore transmission links provide significant additional north-to-south capacity, and there are alternative pathways in the event of export cable failure or interruption for maintenance.

Compared to point-to-point links, the scale of onshore infrastructure in East Anglia is reduced by up to 35% and environmental impacts are minimised. The total available out-of-region transmission capacity is well-balanced against the overall requirements and can be developed further.

This approach ensures that as much renewable energy as possible reaches the main centres of demand in London and the south east, speeds up early progress towards the UK's climate change mitigation targets, and minimises overall costs for final electricity consumers.

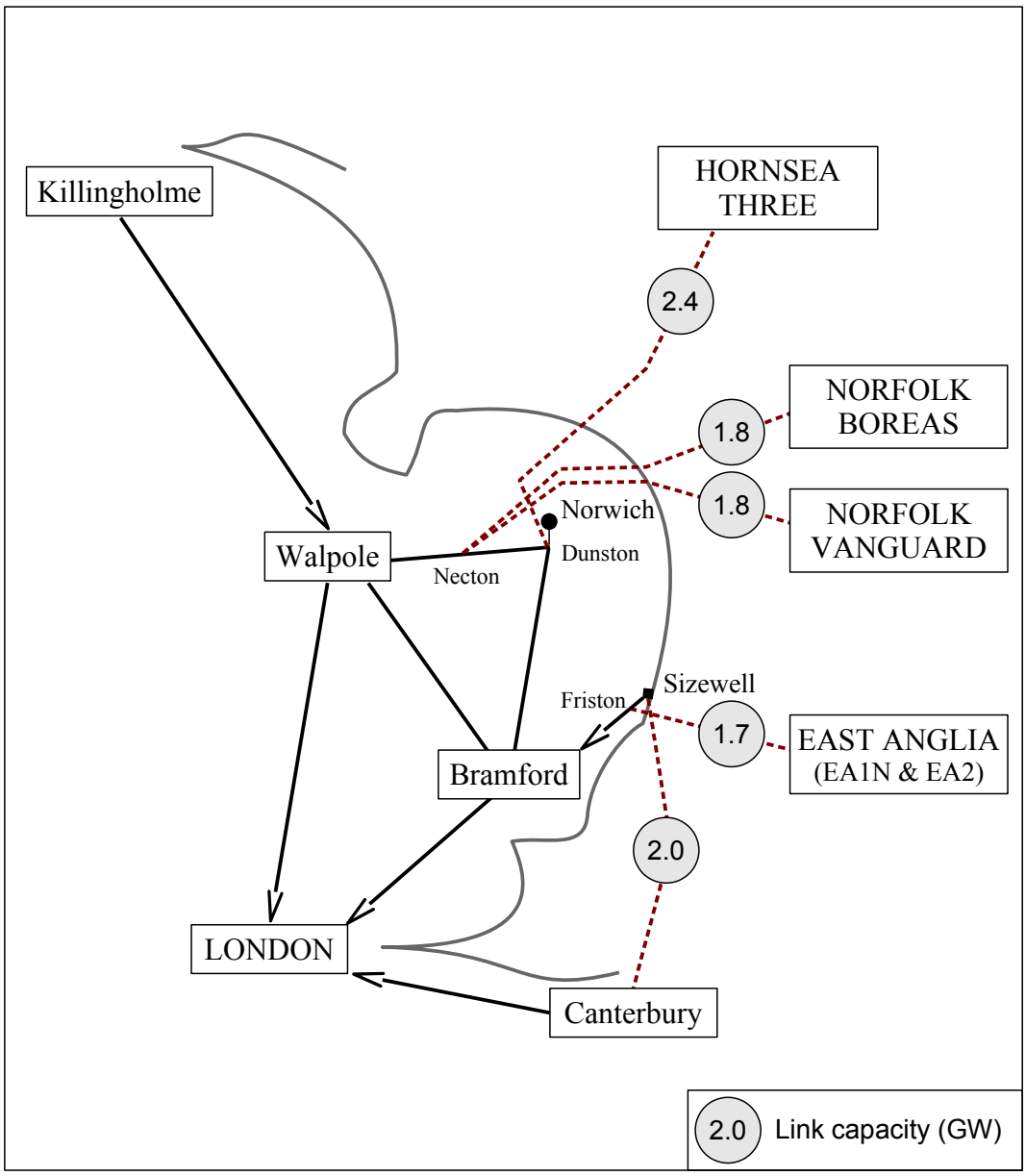

Figure 3: Point-to-point links

Notes:

Without integrated offshore transmission, the grid connection for Hornsea Three is transferred to Dunston (Norwich Main), and the Norfolk Vanguard and Boreas projects are connected at Necton; this displaces the grid connections for the Dudgeon and Sheringham Shoal extension projects from Necton to Dunston. The grid connections are moved to the far side of capacity restrictions between Necton and Walpole, and between Norwich and Bramford. The out-of-region transmission capacity requirement is increased, and an additional coastal link from Sizewell to Canterbury is required.

The onshore infrastructure is up to 35% larger than for integrated offshore transmission, and is only used up to an average loading of 50% in winter and 25% in summer. There is no alternative path if an export cable fails or needs maintenance, and the lack of any offshore transmission links prevents the cables from being used to augment onshore grid capacity. This increases curtailment and leads to less transmission of renewable wind energy to the main centres of demand.

This approach would tend to delay progress towards the UK's climate change mitigation targets, maximise environmental impacts, and increase costs for final electricity consumers.

MULBARTON PARISH COUNCIL

Norfolk Vanguard and Boreas with Hornsea Three

EN010079 Norfolk Vanguard
EN010080 Hornsea Three
EN010087 Norfolk Boreas

18th November 2021

Introduction

This representation is one of two submitted by Mulbarton Parish Council in response to the Secretary of State's Norfolk Vanguard consultation letter of 11th October 2021 and the extension of time announced on 26th October 2021.

The first of these representations (16th November 2021) demonstrates the relationship between the Habitats Regulations Assessments for Hornsea Three, Norfolk Vanguard and Boreas, East Anglia One North and Two, and the Offshore Transmission Network Review.[1]

It shows that both offshore and onshore environmental impacts can be minimised by the use of integrated offshore transmission and includes an example of implementation which has been described in detailed submissions to the Review over the last twelve months.

This second representation comments further on the environmental impacts, the use of integrated offshore transmission, and the Norfolk Vanguard redetermination process.

It concludes that the 'Split DCO' approach is now the only reasonable way forward.

Environmental impacts

The Wildlife Trusts have said that, based on the scale of the cumulative impacts from current projects going through the consenting process, it is not acceptable to consider compensation on a project by project basis. This seems to be confirmed by the evidence. The Secretary of State has in fact now taken a combined view of the overall environmental impacts across the East Coast projects but the issues have not yet been resolved.

For Hornsea Three the applicant has established consultation groups to consider the proposals for SPAs (Special Protection Areas) and SACs (Special Areas of Conservation) affected by the project. In our view, there is room for doubt as to the effectiveness of the proposed arrangements, and for Norfolk Norfolk Vanguard and Boreas, there seems to be some uncertainty in connection with the Haisborough Hammond and Winterton SAC. The Secretary of State should therefore ensure that cumulative environmental impacts are considered within the HRAs (Habitat Regulations Assessments) for these three projects.[2]

The Habitat Regulations Assessments should also take into account the alternatives for the export cable routes and associated onshore infrastructure as described in Appendix 1.

1 These East Coast offshore wind projects are specifically identified in the Secretary of State's consultation letter for Norfolk Boreas of 22nd September 2021 and the clarification letter of 24th September 2021.

2 Details may be found in the relevant supporting documents: EN010080-003613 and EN010080-003614 for Hornsea Three, and EN010079-004381 for Norfolk Vanguard.

Integrated offshore transmission

Longer term offshore environmental impacts arise from the installation of the offshore wind turbines. There are clearly no alternatives to the installation of wind turbines within the seabed lease areas if renewable wind energy is to be produced, and the installation of the wind turbines and their interconnecting array cables supports the government's target of 40GW of offshore wind by 2030.

To contribute to the target of Net Zero by 2050, however, renewable wind energy needs to reach the main centres of demand as quickly and efficiently as possible so that it is used to reduce emissions. This is dependent upon the export cables and onshore infrastructure.

Appendix 1 shows that integrated offshore transmission is necessary to maximise the transfer of renewable energy to the main centres of demand with the minimum number of export cables, landing points, cable trenches, converter halls, substations, battery storage sites and new overhead pylon routes at the lowest cost to the final electricity consumer.

The IOTP (East) feasibility study was carried out by the Forewind consortium (including Equinor), Smartwind and Orsted, and Scottish Power Renewables and Vattenfall, working with National Grid, and supervised by Ofgem. The overall cost benefit analysis was carried out by National Grid and the feasibility study report was issued in August 2015.

The report makes clear that there is no compelling public interest, or IROPI (Imperative Reasons of Overriding Public Interest), to support the currently proposed export cable and onshore infrastructure for Norfolk Vanguard, Norfolk Boreas and Hornsea Three based on the use of non-integrated point-to-point links.

The example illustrated in Appendix 1 shows that the number of landfall points can be reduced from eleven to seven, and the scale of the export cable and onshore infrastructure can be reduced by approximately one third from 22.5GW to 14.8GW.

It follows that the Habitat Regulations Assessment for Hornsea Three may be valid for offshore ornithology, but may not be valid for coastal and onshore environmental impacts. The same conclusion is likely to apply prospectively to Norfolk Vanguard and Boreas.

The IOTP (East) study report was submitted by the applicant to the Norfolk Vanguard and Norfolk Boreas examinations and was duly accepted by each Examining Authority.[3]

Two years ago in September 2019 the Examining Authority for Norfolk Vanguard stated:

> 'The development of an offshore ring main to facilitate the bringing onshore of electricity generated offshore is something which appears to require co-ordination between projects. As such it is not an alternative which can be considered within the confines of the examination of a single offshore wind farm project.' [4]

Since then it has become apparent that co-ordination between projects, both offshore and onshore, is required and is being considered as part of the redetermination. It would be unreasonable not to extend this co-ordination to the main purpose of the projects. Only then will it be possible to determine whether the environmental impacts, other than those due to the offshore wind turbines themselves, are justified by progress towards Net Zero.

3 The report was submitted to the Vanguard examination as EN010079-003084 (REP8-063) on 30th May 2019, and to the Boreas examination as EN010087-001737 (REP5-050), Appendix 4 in February 2020. The appendices were submitted to the Boreas examination in EN010087-002546 on 7th October 2020.

4 Report of the Norfolk Vanguard Examining Authority, EN010079-004268, page 45, 10th September 2019.

Redetermination procedure

Several interested parties have observed that the redetermination procedure for Norfolk Vanguard, as initially proposed by the Secretary of State in April 2021, did not appear to fully respect the High Court's judicial review decision, as it would have considered only the cumulative landscape and visual impacts of proposed installations at Necton. There seems to be no evidence so far that even these limited issues have been properly addressed.

It seems that the Secretary of State is, however, now carrying out a redetermination of the cumulative environmental impacts for Norfolk Vanguard and Boreas, Hornsea Three, and East Anglia One North and Two. This has effectively re-opened the examination of both offshore and onshore environmental impacts for these projects.

As shown in Appendix 1, the adoption of integrated offshore transmission is essential to allow these projects to proceed with maximum efficiency, minimum environmental impact, and at the lowest cost to the final electricity consumer.

Recommendation

In our view the 'Split DCO' approach as set out in Appendix 2 should now be adopted to retain the offshore wind generation elements and their respective approvals to date, whilst minimising the environmental impact of export cable routes and onshore infrastructure by the use of integrated offshore transmission.[5]

5 This recommendation was submitted to the Offshore Transmission Network Review on 20th August 2021.

Appendix 1

Integrated offshore transmission

The Offshore Transmission Network Review was launched more than one year ago on 5th July 2020 in response to the evident failure of the planning and regulatory framework for connecting offshore wind farms to the onshore transmission grid.

A very similar consultation for the Offshore Transmission Coordination Project (OTCP) was conducted by Ofgem ten years earlier. Most of the key issues were addressed at that time, including anticipatory investment, and the final report was published in March 2012.[6]

Because of the critical importance of the Round 3 East Coast offshore wind projects, the very large investment costs, and the recognised weakness of the transmission network in East Anglia, this was followed by the Integrated Offshore Transmission Project feasibility study, IOTP (East), which published its final report in August 2015. It concluded that:

> "In no circumstance does the radial connection design offer economic advantage, even when coupled with a £870m onshore reinforcement package. Where IOTP (East) wind capacities of 10GW or more exist these results look stable."[7]

This conclusion was temporarily set aside on the grounds that less than 10.0GW of East Coast wind projects might come forward. Within six months, however, the UK accepted the Paris Climate Agreement of 12th December 2015 and it was reasonably foreseeable that East Coast offshore wind deployments of greater than 10.0GW would be required by 2030 to meet the UK's international climate change commitments.

In May 2016 the developer of the Hornsea Three project requested an increase in the size of its existing grid connection. Table 1 below shows that this project marks the point at which the East Coast offshore wind capacity threshold of 10.0GW was exceeded, and the conclusions of the IOTP (East) feasibility study became once more applicable.

Project	Capacity (GW)	Start of formal planning
Dogger Bank Projects A, B & C	3.6	18th February 2014
Dogger Bank Project D (Sofia)	1.2 *	5th August 2014
Hornsea Project 1	1.2	10th December 2013
Hornsea Project 2	1.4	16th June 2015
East Anglia One	1.2	25th June 2013
East Anglia Three	1.2	28th June 2016
Capacity at December 2016	**9.8**	
Hornsea Three	2.4	2nd October 2018
Norfolk Vanguard & Boreas	3.6	10th December 2018
Capacity at December 2018	**15.8**	
East Anglia One North & Two	1.7	6th October 2020
Capacity at December 2020	**17.5**	

* The maximum output of Project D (Sofia) was increased from 1.2GW to 1.4GW in 2019.

Table 1: East Coast offshore wind capacity by year

6 Offshore Transmission Coordination Project, Conclusions Report, 1st March 2012.
7 IOTP (East) feasibility study, Appendix 3, Cost Benefit Analysis, page 35.

The IOTP (East) study evaluated East Coast offshore wind capacity levels from a lower bound of 10.0GW up to the fully contracted grid connection capacity of 17.2GW by 2030.

There is no doubt that the Norfolk Vanguard and Boreas projects raised the East Coast offshore wind capacity level well above the 10.0GW threshold. At the start of the Offshore Transmission Network Review in July 2020, it was clear that the 17.2GW upper bound of the IOTP (East) feasibility study would be met or exceeded by 2030.

Figure 1 shows the IOTP (East) network design for 10.0GW of East Coast offshore wind by 2030. Due to the prevailing westerly wind direction, there is a wide statistical variation of wind energy from north to south. Transmission infrastructure is therefore shared by the three offshore wind farm zones and is also used to relieve onshore network constraints.

This detailed and costed design was produced by the developers of the Dogger Bank, Hornsea, and East Anglia zones working with National Grid. It includes the Eastern Link as part of an integrated offshore transmission network. The design process is consistent with the existing regulatory framework and the outcome is efficient, economic and coordinated.

The economic justification recently submitted for the Eastern Link project shows that the higher cost of offshore construction is more than offset by the avoidance of the constraint payments associated with the onshore alternative. It is equally important to avoid the loss of renewable energy generation which those constraint payments would represent.

Figure 2 shows the fragmented network design developed by National Grid over the last few years. This overall design is not efficient, economic or coordinated, and would lead to:
- grid connections for offshore wind projects moving from locations with high grid capacity and low transmission constraints, to locations with low grid capacity and high constraints;
- increased loss of renewable energy generation, delaying progress towards Net Zero;
- inefficient use of the available sea bed due to the greater number of landing points;
- cables laid at the same time crossing over each other both onshore and offshore;
- higher network access charges for East Coast offshore wind projects;
- new or upgraded overhead pylon routes from Norwich to London;
- unreasonable and unnecessary impacts on local communities;
- additional costs passed on to final consumers of up to £6bn.

The greater number of landing points and the larger scale of export cable infrastructure with an east-west alignment increases the potential for severe damage to coastal habitats.

Due to the use of point-to-point links together with restricted out-of-region transmission capacity from East Anglia to London, battery storage has been proposed on a per-project basis. This adds further cost and potentially severe environmental and safety risks.

Figure 3 shows the benefits of integrated offshore transmission, which brings together both the offshore and the onshore aspects into a fully coordinated design. This approach is already required by the existing legislative, planning and regulatory framework. It reduces the curtailment of renewable energy generation, minimises the use of seabed resources, reduces costs for final consumers, and potentially speeds up progress towards Net Zero.

The total amount of export cable and onshore infrastructure is dramatically reduced, and whilst it is not possible to eliminate the effects of the offshore wind turbine installations on offshore ornithology, the smaller number of landing points and reduction in the number of west-to-east export cable routes can significantly reduce the level of damage to coastal environments. The need for large-scale per-project battery storage, and new or upgraded overhead lines from Norwich to London, is potentially eliminated.

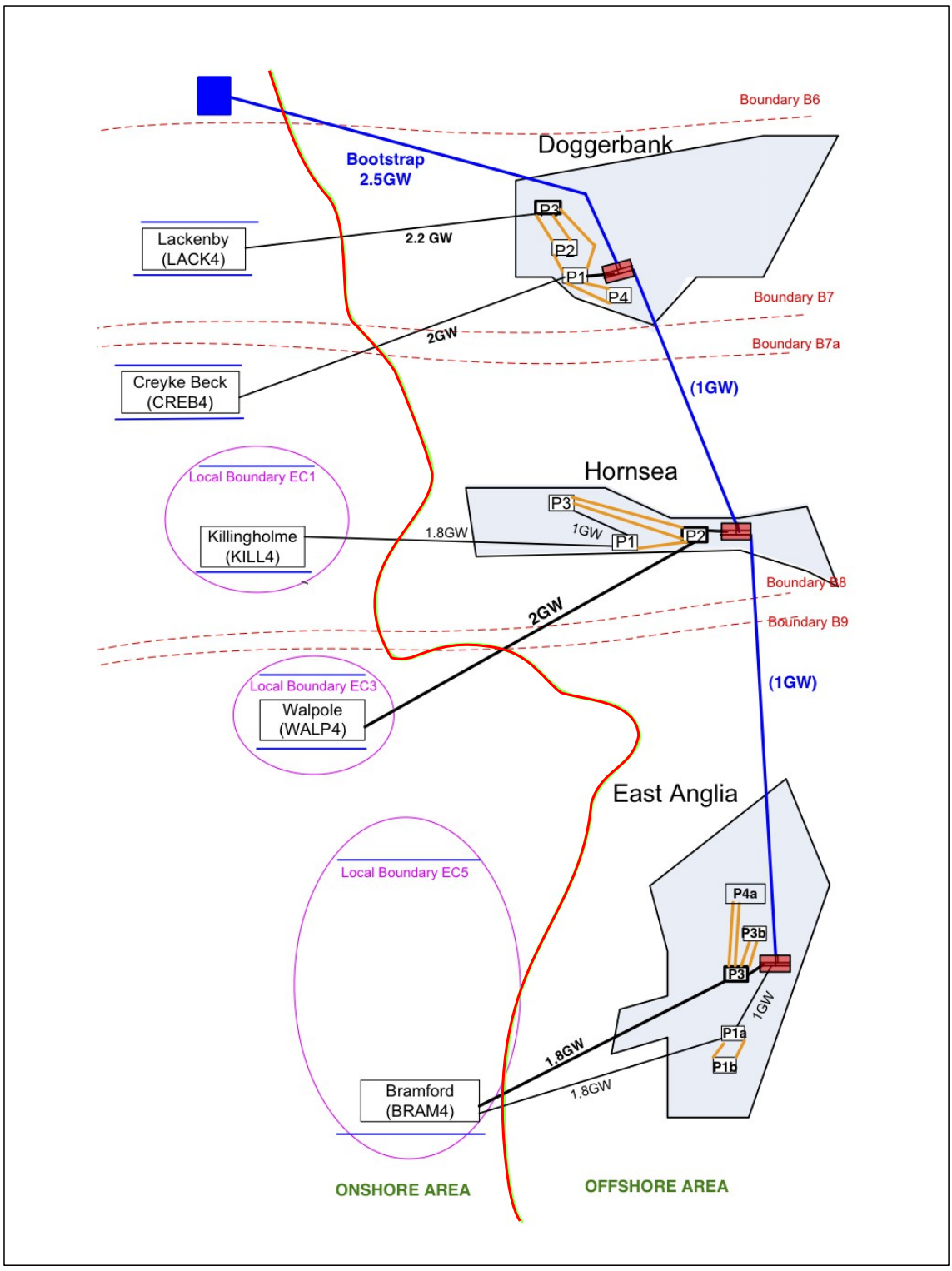

Figure 1: IOTP (East) feasibility study

Notes:

This is the basic network design developed in the IOTP study for the lower bound of 10.0GW of East Coast offshore wind by 2030. The proposed Eastern Link is shown as a 2.5GW bootstrap from Peterhead to the Dogger Bank zone, and the Dogger Bank, Hornsea and East Anglia zones are all interconnected. There is however very limited out-of-region transmission capacity available from East Anglia towards London through the Bramford to Twinstead overhead line route.

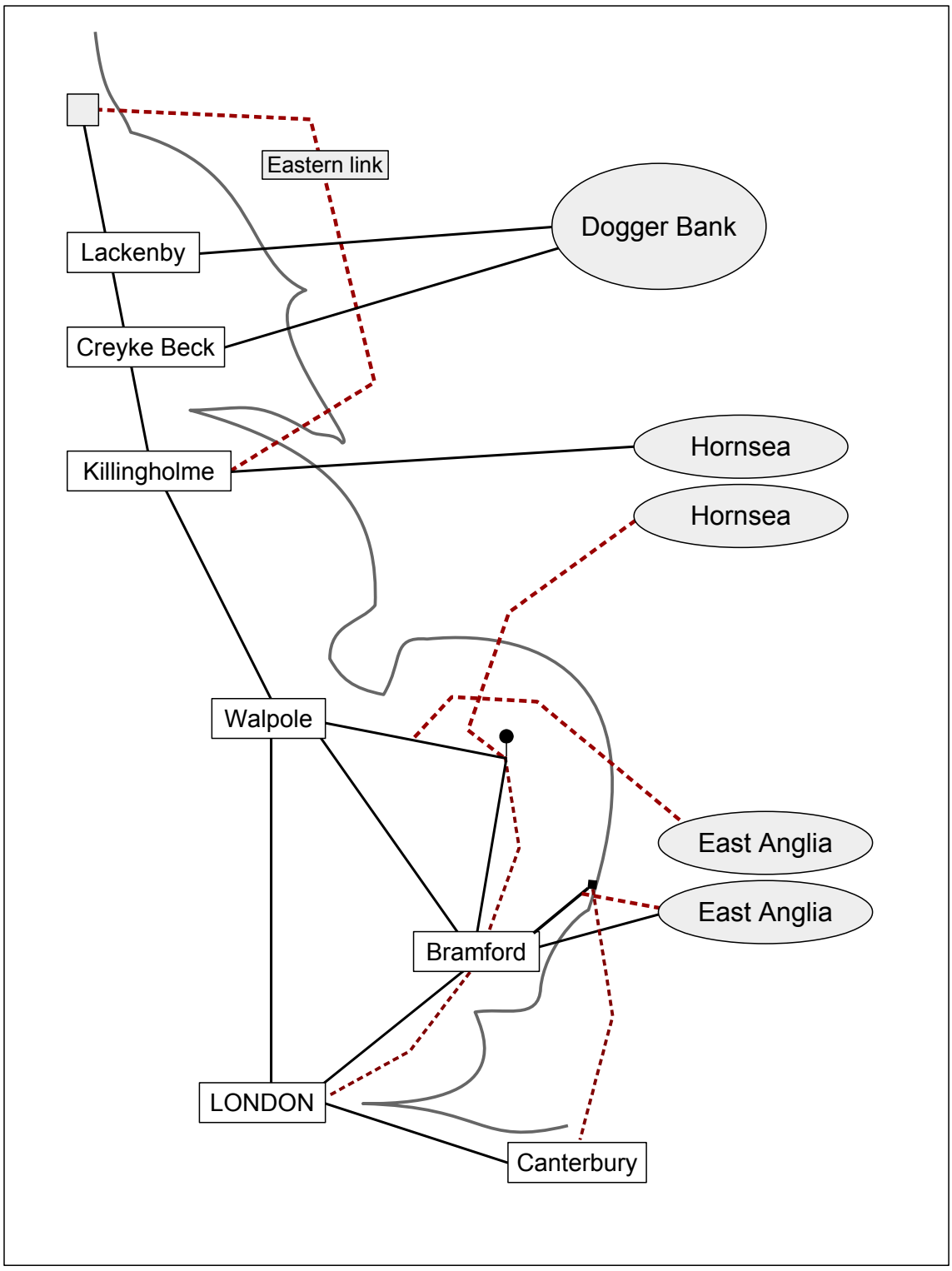

Figure 2: Point-to-point links

Notes:

When non-integrated point-to-point links are used, the Eastern Link fails to relieve the onshore network constraints between Grimsby and the main centres of demand further south. Infrastructure is not shared within or between zones and renewable wind energy is curtailed. Cable crossings are introduced onshore and offshore, new overhead line reinforcements are required from Norwich to London, and costs are increased. There are no economic arguments in favour of this outcome.

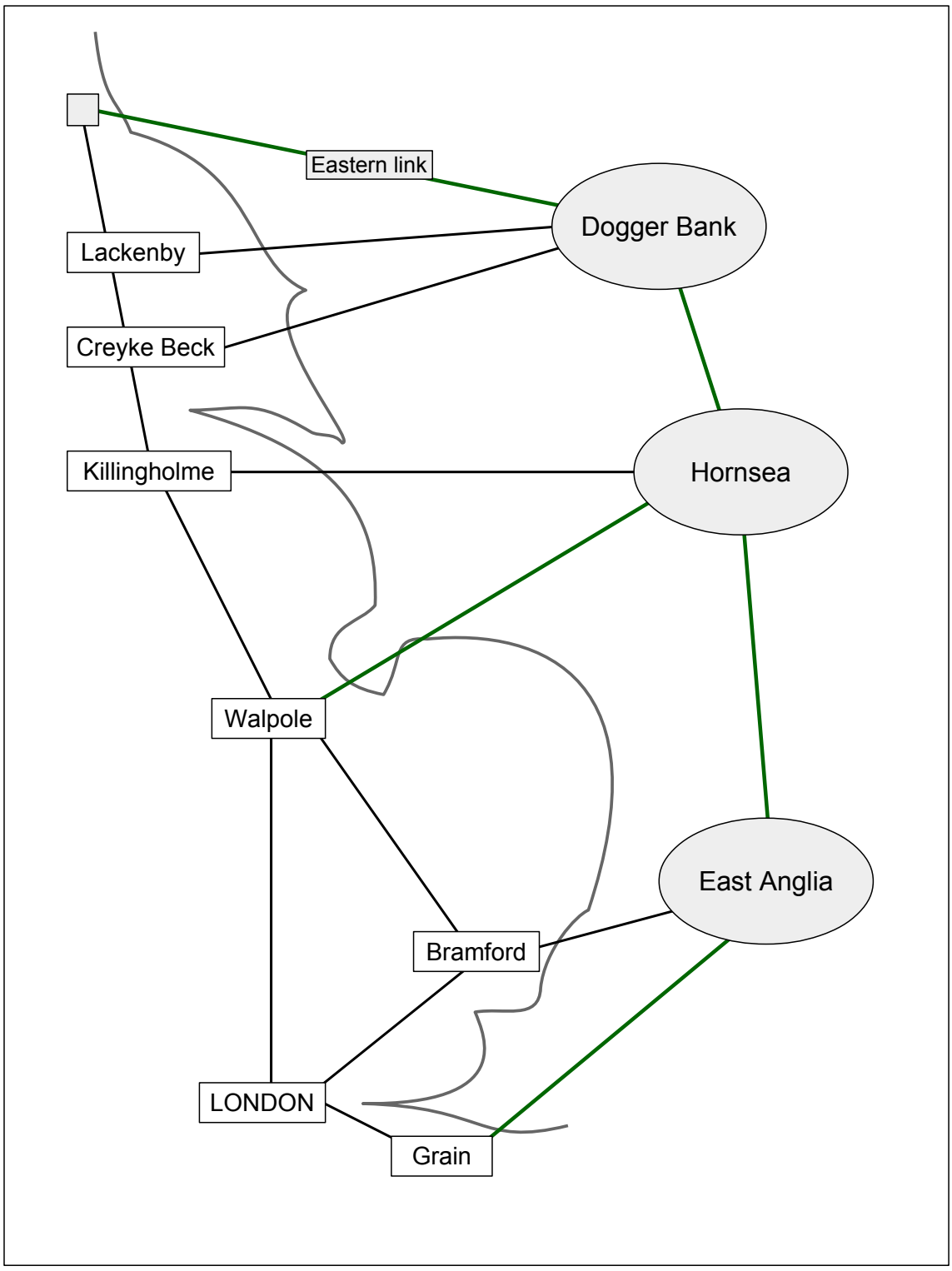

Figure 3: Integrated offshore transmission

Notes:

In this scheme the IOTP (East) reference design of Figure 1 is enhanced by an extension to the Isle of Grain. The need for onshore grid reinforcements from East Anglia to London is minimised, renewable offshore wind energy is not curtailed, and the re-use of infrastructure between offshore wind zones reduces the overall environmental impacts and minimises costs for the final consumer.

Alternatives to the use of Bramford include a former power station at Bradwell in Essex.

Appendix 2

Recommended DCO amendments

Hornsea Three

The examination for this project closed on 2nd April 2019. The Planning Inspectorate's report was submitted on 2nd July 2019 but was not made available until 1st July 2020. The project was recommended for refusal due to the effect upon offshore wildlife. It was then delayed a further six months by the SoS (Secretary of State) until its premature approval on 31st December 2020. The Habitats Regulations Assessment is as yet unresolved.

The actions required for this project are:
- retention of the approved offshore wind generation components only (Work 1);
- material amendment to remove the export cable and onshore substation (Works 2 to12).

Norfolk Vanguard and Boreas

Norfolk Vanguard and Norfolk Boreas constitute a single very large project which may be constructed in several phases. The Norfolk Vanguard application was recommended for refusal by the Planning Inspectorate due to the effect upon offshore wildlife but was approved by the Secretary of State on 1st July 2020. This decision has been quashed by an Order of the High Court on 18th February 2021 and the project does not have consent.

The Planning Inspectorate's report on the Norfolk Boreas examination was submitted on 12th January 2021 but has not yet been released. The SoS's decision has been delayed to no later than 10th December 2021. The draft Development Consent Order is however very similar for each project and the offshore elements can be brought forward for approval.

The actions required for each project are:
- approval of the offshore wind generation components only (Work 1);
- refusal of the export cable and onshore substation (Works 2 to 15).

East Anglia One North and Two

East Anglia One North and Two constitute a single project which may be constructed in several phases. The combined examination of these projects closed on 6th July 2021, and the Planning Inspectorate's report was submitted to the Secretary of State on 6th October 2021. The draft Development Consent Order is similar for each project and the offshore elements can be brought forward for approval by 6th January 2022 without further delay.

The actions required for each project are:
- approval of the offshore wind generation components only (Works 1 to 4);
- refusal of the export cable and onshore substation (Works 5 to 37);
- refusal of the onshore National Grid substation (Works 38 to 43).

Integrated offshore transmission

For each project a material amendment is required to introduce the revised export cable and onshore works needed for integrated offshore transmission. The applications for these amendments will be subject to a further examination with a shorter fixed timescale of four months followed by submission of the Planning Inspectorate's report after two months. The offshore generation aspects do not require any further amendment or examination.