

Note on the assessment of options for the connection of ScottishPower Renewables East Anglia ONE North and East Anglia TWO offshore wind farms to the National Grid network

1 Introduction

1.1 This note has been prepared by National Grid as electricity System Operator (SO) to explain why ScottishPower Renewables East Anglia ONE North and East Anglia TWO offshore wind farms are proposing to connect to the national electricity transmission system (NETS) in the Sizewell/Leiston area.

1.2 The note reflects the outcome of a comparative assessment of connection options undertaken in 2017. That assessment, led by the SO as operator of the electricity transmission system across Great Britain, includes input from ScottishPower Renewables as developer acting as the Offshore Transmission Owner (OFTO) and from the Transmission Owner (TO) part of National Grid, which owns the onshore electricity transmission network in England and Wales.

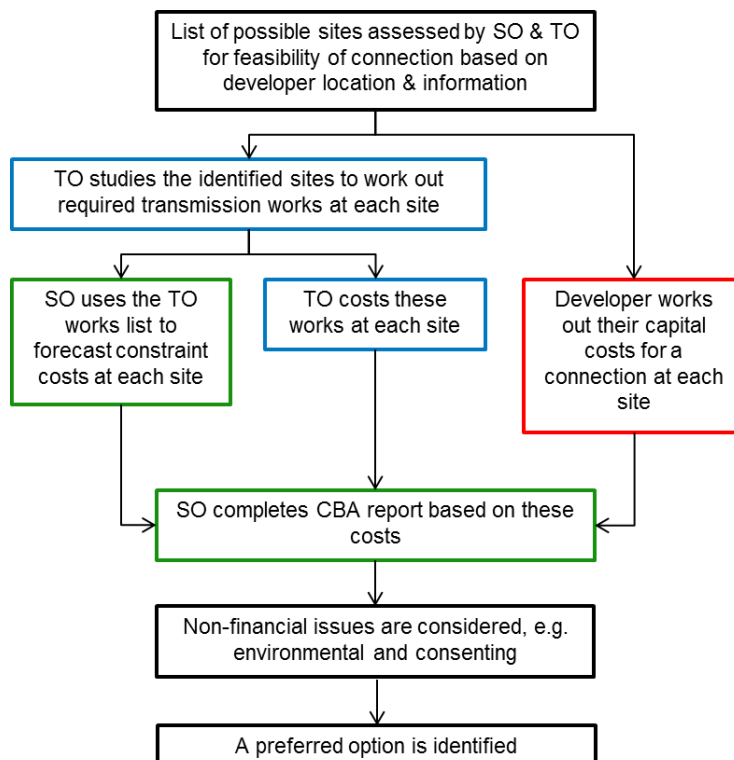
2 How the comparative assessment of options in undertaken

2.1 Developers wishing to connect new electricity generation to the NETS must make a connection application. A modification application is also required when developers' proposals change significantly. When the proposed development is an offshore wind farm or an interconnector project, the connection options are comparatively assessed to identify the most appropriate connection location.

2.2 A guidance note on the National Grid website explains how the assessment is carried out¹. The process looks at technical, commercial, regulatory, environmental, planning and deliverability aspects to identify the preferable connection for the consumer. The Electricity Act 1989 requires National Grid when formulating proposals, to be efficient, co-ordinated and economical whilst also having regard to the environment. When the development being connected is offshore, be that a wind farm or an interconnector, the offshore aspects need to be considered in that evaluation too. The assessment process therefore looks to minimise the total capital and operational cost whilst taking into account other key considerations, as set out above.

2.3 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. The diagram below illustrates the process.

¹ The Connection and Infrastructure Options Note (CION) Process Guidance Note Issue 3
<https://www.nationalgrid.com/uk/electricity/connections/applying-connection>

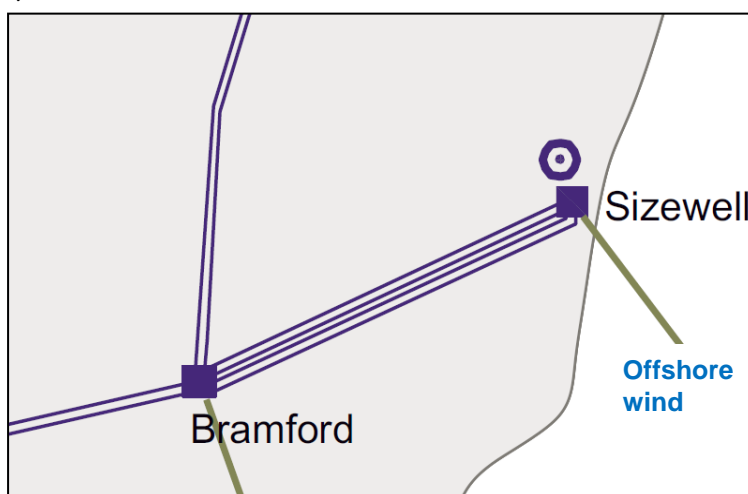


3 Existing generation connected in the Sizewell/Leiston area

3.1 Three electricity generators are currently connected to the NETS at Sizewell and Leiston:

- Sizewell B nuclear power station (EDF) – 1216 MW (megawatts)
- Greater Gabbard offshore wind farm (SSE) – 500 MW
- Galloper offshore wind farm (Innogy) – 350 MW

3.2 The electricity these produce is transported on two existing National Grid transmission lines which form part of the NETS. Each of those existing overhead lines carries two electrical circuits, one on each side of the pylons. In total therefore, there are four existing electrical circuits connecting the Sizewell/Leiston area.



3.3 Four electrical circuits were originally built there to provide a secure connection to the Sizewell A (Magnox) and Sizewell B nuclear power stations, rather than four being needed for power carrying capacity reasons.

3.4 Sizewell A stopped generating in 2006 and there is spare capacity to connect additional generation in the four electrical circuits from Sizewell/Leiston. Sizewell B is also currently expected to close around 2035.

4 Proposed new generation in the Sizewell/Leiston area

4.1 EDF are developing plans and have been consulting for a number of years on their proposals for the new Sizewell C nuclear power station. Contractually when Sizewell C is expected to connect to the NETS has changed over time. Getting everything in place to construct EDF's first new nuclear power station in the UK at Hinkley Point C in Somerset has taken longer than originally anticipated and they have been developing and consulting on their plans for Sizewell C. Whilst there isn't a confirmed date yet therefore for when Sizewell C is likely to start generating, it is widely expected to be around the 2030's².

4.2 More recently, ScottishPower Renewables have re-configured some of their East Anglia offshore wind farm project zones. What was East Anglia FOUR and TWO have been re-configured with some residual capacity from East Anglia ONE, to form East Anglia ONE North and East Anglia TWO. With the reconfiguration of their offshore projects, Scottish Power requested a review of connection locations. Following a comparative assessment of options using the process outlined in Section 2, the Leiston area was identified as the most appropriate location to connect East Anglia ONE North and East Anglia TWO. The reasons why and the alternatives considered are explained in Section 6.

4.3 More recently again, applications to connect to the NETS have also been made by National Grid Ventures³ for two proposed electricity interconnectors with continental Europe. The Nautilus Interconnector is proposed between the UK and Belgium and the Eurolink interconnector is proposed between the UK and the Netherlands. The reasons why the Leiston area is also the preferred connection location for those connections and the alternatives considered is explained in a separate note addressing those projects.

4.4 There are therefore a number of new sources of electricity proposing to connect in the Sizewell/Leiston area in addition to the existing Sizewell B, Greater Gabbard and Galloper generation that is already connected. The current position in March 2018 is as follows:

- Sizewell C (EDF) – 3340 MW – contracted to connect in 2020 but likely to be in the 2030's
- East Anglia ONE North (SPR) – 860 MW – connecting in 2027
- East Anglia TWO (SPR) – 860 MW – connecting in 2026

² <https://www.thetimes.co.uk/article/sizewell-c-nuclear-power-to-come-on-stream-in-2031-35nw6wwsv>

³ <https://www.nationalgrid.com/group/about-us/what-we-do/national-grid-ventures>

- Nautilus (NGV) – 1500 MW – contracted to connect in 2025 but likely to move back a couple of years to align with consenting timescales in Belgium
- Eurolink (NGV) – 1600 MW – connecting in 2025

5 National Grid works required to connect the proposed generation

5.1 Under normal operating circumstances with all four electricity transmission circuits in operation, the existing and proposed generation can be accommodated without building new transmission lines. Based on current contracted dates, the conductors (wires) on the four transmission circuits between Sizewell/Leiston and Bramford will need replacing with larger current carrying capacity conductors by around 2027 in order to accommodate the planned generation.

5.2 With up to two of those circuits out of operation for unplanned reasons, those re-conducted lines would still be likely to be able to accommodate the anticipated output from the existing and planned generation based on realistically credible output scenarios.

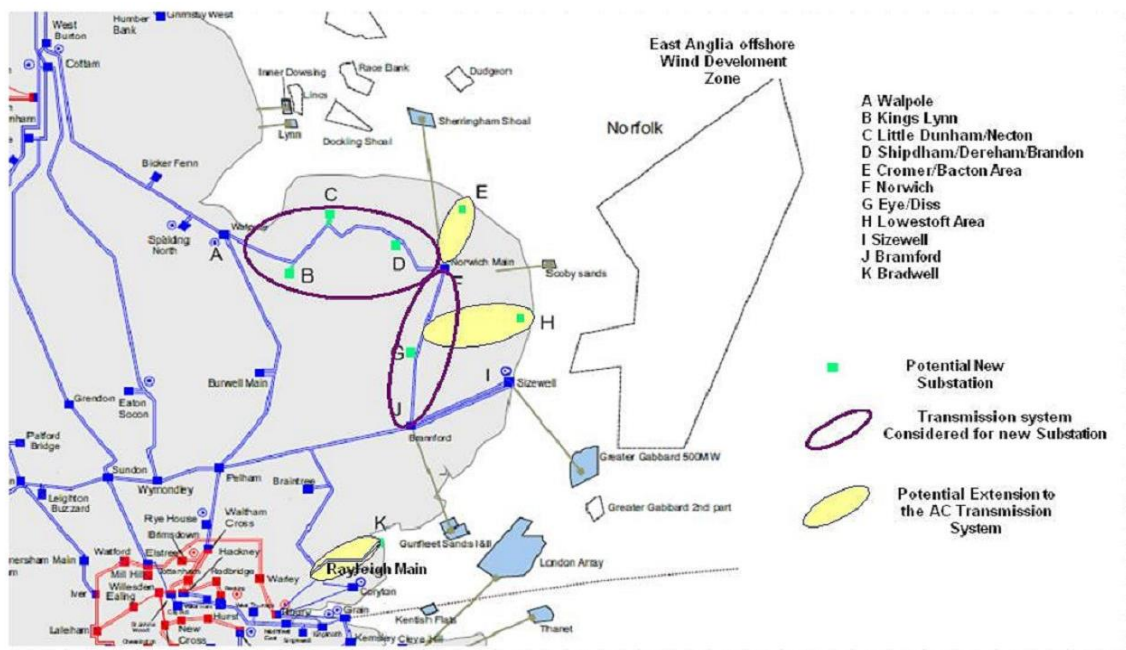
5.3 When looking to take transmission circuits out of service temporarily for planned maintenance, National Grid works closely with the generators connected to those circuits to look wherever possible, to align those works with periods when the generators themselves are planning not to generate or reduce the amount of electricity they're generating while they carry out their own maintenance activities. Additional system control measures are also available to manage the transmission system during temporary abnormal conditions, such as intertrips and pre-fault constraints.

5.4 The proposals for the new Sizewell C nuclear power station include a new National Grid 400kV substation, which will be located adjacent to the existing National Grid substation connecting the Sizewell B power station. With spatial and environmental constraints at both the existing and new Sizewell site, it would not be possible to connect any single one of the East Anglia ONE North, East Anglia TWO, Nautilus and Eurolink projects there. A new National Grid 400kV substation will therefore be required somewhere in the Leiston area, beyond the Sizewell site, to connect the two proposed wind farms and the two proposed interconnectors.

5.5 National Grid is proposing a single new 400kV substation which, subject to consent being granted, would connect all of these new sources of generation to the NETS. The wind farms and interconnectors would each have buried cables connecting their individual developments into that new 400kV substation.

6 Comparative assessment of connection options for East Anglia ONE North and East Anglia TWO

6.1 The map below shows the location of the National Grid network in East Anglia and the connection locations considered in the review of options for East Anglia ONE North and East Anglia TWO.



6.2 Connecting in the Bacton, Bradwell and Lowestoft areas on the coast, would require the extension of the National Grid transmission network out to the coast in addition to the construction of a new National Grid substation. A new double circuit overhead line, at minimum, from the existing 400kV network out to the coast across Norfolk, Essex or Suffolk - this would carry significant consenting and environmental challenges. Identifying route options, consulting about those, obtaining consent for them and then building new transmission lines would be environmentally challenging and would not be deliverable within the timescales the wind farms are looking to connect. For these reasons, connecting in the Bacton, Bradwell or Lowestoft areas was discounted.

6.3 Options to connect to the transmission network in North Norfolk, near Brandon, Shipdham, Dereham, Necton, Little Dunham, Kings Lynn or Walpole, were parked in the assessment, as other options compared more favourably in environmental and cost terms. Each of these parked⁴ options would require much longer OFTO connecting cables in addition to new National Grid substations, with resultant greater environmental impacts and costs, as they are further from the offshore wind farms compared to other options.

⁴ 'Parked' means that the option is not subject to further analysis as there are better alternative options which have a similar system impact. It can still be reconsidered if the alternative(s) were later discounted due to reasons that are not affecting the parked options.

6.4 Options to connect at Eye/Diss in Norfolk were similarly parked⁴ because of the longer distance. Those locations are further inland giving rise to greater environmental impact and cost associated with running OFTO cables from the wind farms to that location.

6.5 A connection at Norwich Main would require the extension of the existing substation and a new overhead transmission line from Pelham on the Hertfordshire/Essex border to Necton in Norfolk. The OFTO cables would also need to either navigate through the Norfolk Broads or north around the Norwich conurbation, to reach Norwich Main, with high consenting risks and a longer route than other connection options. There are also multiple offshore conservation zones between the wind farm and land falls towards Norwich.

6.6 Bramford was originally selected as the grid connection point for the East Anglia ONE offshore windfarm and two future East Anglia offshore projects. The onshore cable corridor for these projects was consented under the East Anglia ONE DCO consent. Following a design review of the East Anglia offshore projects (including the cable technology to be used to make the East Anglia ONE grid connection), it is only possible to accommodate the grid connections for East Anglia ONE and East Anglia THREE within the consented cable corridor. Any further connection at Bramford would require new cable routes to be developed and constructed.

6.7 The assessment initially indicated that connecting at Sizewell is the preferred option. This would have required the extension of the existing substation. However the substation is within the nuclear security perimeter zone, requiring the option to be under the rules of Civil Nuclear Constabulary. In addition to that, the potential site is highly constrained both physically and environmentally. Connecting there is therefore unlikely to be achievable.

6.8 A connection in the Leiston area is close to Sizewell and the coast, avoiding a longer cable route penetrating further inland through Suffolk to Bramford or elsewhere on the transmission network. A short cable route means the interaction between the project and other parties, such as crossings, protected areas and settlements, can be minimised.

6.9 For these reasons, when considering connections efficiency, coordination, economic and environmental impacts, the Leiston area compares more favourably than other connection options and forms the basis of the connection offers for the East Anglia ONE North and East Anglia TWO projects.