SPR EA1N and EA2 PROJECTS

UPDATED SASES PATHFINDER CLARIFICATION NOTE

Interested Party: SASES **IP Reference Nos.** 20024106 and 20024110

Date: 15 April 2021 **Issue:** 5

1. Introduction During 2020 the BEIS Offshore Transmission Network Review undertook detailed evaluation of possible economies and environmental benefits resulting from the offshore coordinated connection of windfarms, rather than continuance of the existing radial approach to connections. This work, which was largely undertaken by National Grid ESO on behalf of BEIS, was presented in a webinar on 17th December 2020.

The BEIS Review reported potential capital cost savings in excess of £6bn resulting from coordination of offshore transmission works, provided the earliest possible start was made (around 2025). Stakeholders were requested by BEIS to come forward with proposals for Pathfinder projects capable of early implementation to verify the anticipated benefits.

SASES considers that coordination of the SPR EA1N and EA2 projects would make a very suitable candidate for such a Pathfinder by allowing a much reduced number of cables and trenches to an existing National Grid substation site, at which the applicant already owns suitable land, thereby substantially reducing onshore environmental impacts. And this Pathfinder is understood to be compliant with the existing Ofgem regulatory environment.

2. Original Proposal At OFH3 a proposal was made ([REP1-227], p175) for the alternative delivery of the output of the EA1N and EA2 windfarms by a coordinated 1.7GW HVDC Bipole link from an offshore platform to Bramford NGET substation, via a single cable trench from Bawdsey landfall to Bramford NGET substation.

This proposal was reiterated by SASES at ISH4 [EV-055] as a possible “Pathfinder” project in support of the BEIS OTNR review, but was only described in outline. Some clarification was provided in [REP5-107] whilst this updated document provides significant additional information and clarification about the proposal.

3. Bawdsey to Bramford Cable Route At the time of approval of the Applicant’s East Anglia One (EA1) project it was agreed that a cable route comprising six cable trenches with two ducts/HVDC conductors per trench (12 ducts in total) would be constructed between Bawdsey and Bramford. However, following the CfD auction for EA1 the cable route design was modified to that shown in Figure 1 below to allow the use of HVAC for EA1 using two trenches.

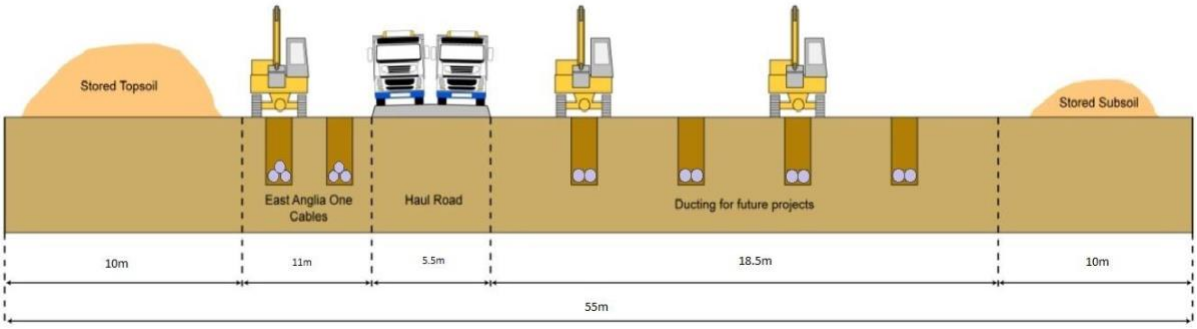


Figure 1 Cable route after CfD auction changes

The remaining four trenches were expected to be used for use by subsequent projects, including EA3, with HVDC Symmetric Monopole at 600MW being the proposed technology. EA3, specified at 1.2GW at that time, was planned to use two of the trenches, with an HVDC converter station at Bramford on an 2.85ha site. This converter site would house two adjacent 600MW converters, the combined output of which would deliver 1.2GW to one or more customer bays at the adjacent NGET substation. This was shown as in Figure 2 below in the EA3 application documents.

East Anglia Offshore Wind

VATTENFALL SCOTTISHPOWER RENEWABLES

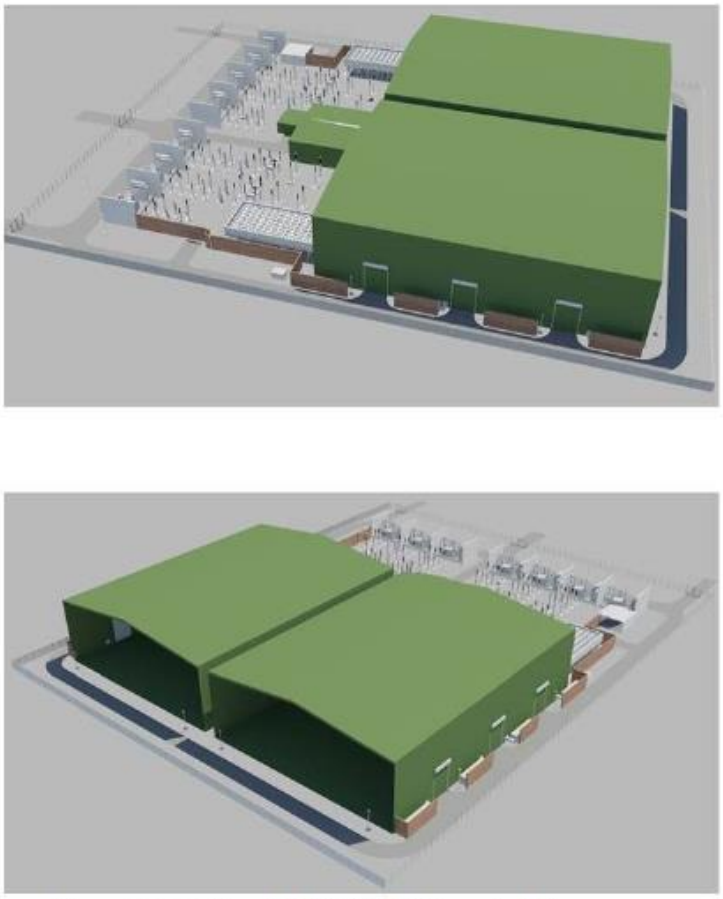


Diagram 5.22 Typical Layout of a 1000MW HVDC Converter Station

5.6.13 Onshore Substation (s) construction methods

5.6.13.1 Site Establishment and Laydown Area

463. During construction of the substation(s), site establishment and laydown areas would be required. The following would be required during the construction works:

- Temporary construction management offices;
- Canteen;

Figure 2 Original EA3 Converter Station Design

However, the Applicant subsequently gained a relaxation of the DCO Regulation 29 order for EA1 to provide that only three cable trenches in total should be built, not the six originally committed to. The Discharge documentation for EA1 shown on page 24 of http://content.yudu.com/web/2it8t/0A4226m/CMS/html/index.html?page=24 illustrates the revised cable configuration for EA1 and EA3 as being that shown in Figure 3 below, now with three ducts/cables in just one trench allocated to EA3.

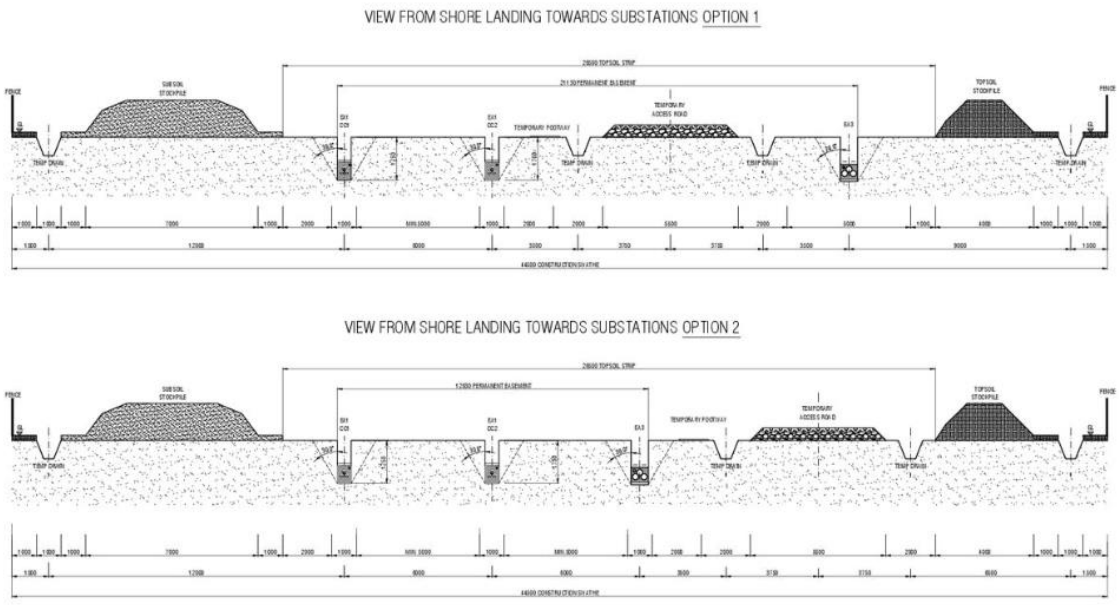


Figure 3

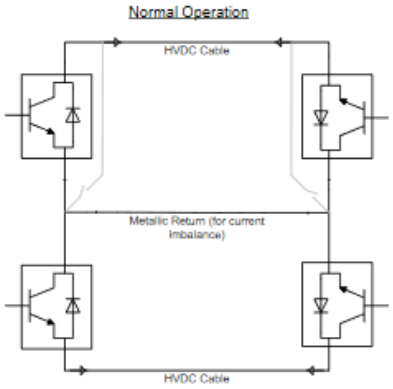
SASES initially presumed that the provision of three ducts in one trench was to allow the use of HVDC Bipole to connect the EA3 project to Bramford but recently published information (the Drawing from Ref. 1) records that the Applicant has chosen to use HVDC Symmetric Monopole, which will require only two of the three ducts.

For clarification Ref. 1 states on page 4 that "*The infrastructure to be installed for EA THREE, therefore, comprises:*

- *The landfall site with one associated transition bay location with two transition bays containing the connection between the offshore and onshore cables;*
- *Two onshore electrical cables (single core);*
- *Up to 62 jointing bay locations each with up to two jointing bays;*
- *One onshore converter station, adjacent to the EA ONE Substation;*
- *Three cables to link the converter station to the National Grid Bramford Substation;*
- *Up to two onshore fibre optic cables; and*
- *Landscaping and tree planting around the onshore converter station location."*

4. Clarification of SASES Pathfinder Proposal SASES Pathfinder proposal remains as described in para 2 above. The onshore cable route would comprise a single cable trench with three ducts in it similar to that constructed for EA3 but all three ducts would have conductors installed to comprise an HVDC Bipole connection. The HVDC Bipole onshore converter station at Bramford would be similar in principle to that in originally proposed in the EA3 design (see Figure 2 above) but scaled in total power (and footprint if necessary) to 1.7GW, with two adjacent 850MW converters on one site, rather than the two 600MW converters shown in Figure 2. The technology requirements of these two converters should be no greater (and may potentially be less) than currently proposed for EA3, which is apparently now constructing just one much more powerful HVDC converter to handle the whole of the 1.4GW output of the windfarm. Figure 3 below shows a simplified HVDC Bipole arrangement by way of further clarification. The use of a Bipole Metallic Return configuration is proposed, using the third cable duct. The boxes on the left indicate the offshore HVDC

equipment, whilst the boxes to the right show (all much simplified) the onshore HVDC converters, all connected by just three conductors, which would be in one cable trench.



Bipole, metallic return
The bipole arrangement utilises a single return path for two poles. An equal and opposing voltage from each pole means that the return path will carry only minor current due to any imbalance between the two poles. The return path can be provided by either a metallic conductor or sea/earth electrodes if consent can be gained for their use.

- Figure 3 - Bipole Converter Arrangements
- Table 2 Summary of Converter Arrangements

Arrangement	Converter Requirements	Cable Requirements	Availability
Monopole Metallic Return	1 x Rectifier, 1 x Inverter	1 x HVDC 1 x LVDC	Zero output during cable or pole outages. Increased losses.
Symmetric Monopole	2 x Rectifier, 2 x Inverter	2 x HVDC	Zero output during cable or pole outages
Bipole Metallic Return	2 x Rectifier 2 x Inverter	2 x HVDC 1 x LVDC	Half capacity during cable or pole outages.
Bipole without Earth Return	2 x Rectifier 2 x Inverter	2 x HVDC	Half capacity during pole outages. Zero output during cable outages

Table 2 provides a summary of the main converter arrangements and a high level indication of availability during a cable or pole outage.

The options identified in Table 2 could be increased if it is considered that a system reliant on ground return through the earth or sea could be viable on an environmental basis. Whilst such schemes are operating successfully in Scandinavia and New Zealand the assumption made here is not to consider a ground-return system making use of earth or sea return.

Figure 3 HVDC Bipole configuration

5. Loss of Connection Issues The Applicant has expressed concern that the NGESO SQSS Infeed Loss requirement, applicable to wind farms, would be breached by SASES 1.7GW coordinated proposal. However, National Grid ESO has told SASES that so long as the system design does not have a single point of failure which could lead to an Infeed Loss of greater than 1320MW then use of HVDC Bipole to deliver 1.7GW should be acceptable. The text in Figure 3 above clarifies that Bipole with Metallic Return would lose only half capacity (850MW) during a single pole or cable outage so should be compliant. And in any case the 1320MW SQSS Infeed Loss limit is under review as a result of the BEIS OTNR and may well be increased to around 1800MW.

5. Ofgem Compliance During questioning the Ofgem representative advised the Examiners at ISH2 [EV-034u] that the Pathfinder configuration as described could be

compliant with the existing Ofgem regulatory regime as both wind farms were in the same ownership.

6. Environmental Issues The environmental impacts of the Bawdsey to Bramford cable route were fully considered during the EA1 approval process and no new issues are anticipated from this proposal. The Applicant is understood to have investigated the feasibility of constructing four new cable trenches from Bawdsey to Bramford during early investigation works for a HVAC connection to Bramford for EA1N and EA2 and SASES has found no reports of this not being possible.

7. CION Compliance NGESO have previously confirmed acceptance of the power output of both the EA1N and EA2 projects at Bramford (early CION assessments refer) so there should be no NGESO issue with this Pathfinder proposal.

8. Cable Trench and Cabling Reduction It is important to note that this Pathfinder proposal requires only ONE cable trench containing THREE ducts/conductors, compared with the FOUR cable trenches containing a total of TWELVE conductors, as originally proposed for the EA1N and EA2 connection from Bawdsey to Bramford, and as is currently proposed for the connection of those same wind farms to Friston. This must represent a huge saving in cable and cable trench costs which would not have been taken into account in the original CION assessments, providing further support for the appropriateness of this Pathfinder proposal.

END