Client: Suffolk County Council

Project: Sizewell C Export Connection Review

Project number: 105000625

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Report history

Ver.		Checked status	Sign	Approval	Sign
0	Initial release	15/07/2020	PB	15/07/2020	AC
1	Client comments incorporated	16/07/2020	PB	16/07/2020	AC
2	Document references added	28/07/2020	PB	28/07/2020	AC

1 Introduction

On 27 May 2020, EDF Energy submitted an application to the Planning Inspectorate for a Development Consent Order to construct and operate a new nuclear power station, Sizewell C, on the Suffolk coast, immediately adjacent to the existing Sizewell B nuclear power station.

Suffolk County Council ("SCC", the "Client") engaged AFRY to provide technical assistance to inform and support SCC's representations to the Planning Inspectorate in response to EDF Energy's application, through the review of the EDF submission, and reporting on their findings. This report considers EDF Energy's submission titled "Power Export Connection Technical Recommendation" and dated 20.03.2020, which presents options for connecting the two Sizewell C 1800 MW generators to the National Grid 400 kV GIS substation.

In addition to the power export connection review report, the following main documents from the DCO Submission were reviewed during the preparation of this report:

Title	Book 2, 2.05 Plans – Pylons
URL	https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010012/EN010012-001638-SZC_Bk2_2.5_Pylons_For_Approval.pdf
Review scope	Complete document
Title	Book 8.4 Planning Statement Appendix A Site Selection Report
URL	https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010012/EN010012-002209-SZC_Bk8_8.4_Planning_Statement_AppxA_Site_Selection_Report.pdf)
Review scope	Pages 45-55 / paras 3.2.75 - 3.2.102

The EDF Energy report seeks to justify the adoption of overhead transmission lines as has been the solution applied at the companion Hinkley Point C nuclear power station.

Objections have been raised by Suffolk County Council in respect of the visual impact of a number of transmission towers of up to 65 m height that will be visible from the coast.

2 Conclusion

The use of EHV cable has been explored. It is stated that to achieve the required current rating the cables will have to be installed in galleries and this is problematic in terms of space; an option to employ surface level concrete troughs was not considered. The use of cables will involve six cables per circuit with straight joints in the case of the longer route – this is less reliable than the alternatives and the joint bays take up considerable space. We support the view that this is not a preferred solution.

The use of Gas Insulated Line has been considered but was not carried through for detailed consideration. This option would satisfy the planning requirements in respect of visual impact. It also has the highest availability/reliability of all the options. We consider that the dismissal of this technically attractive solution is not justified and should be explored further in respect of any installation difficulties, as it satisfies all the technical requirements. The review of reasons for excluding each of the proposed installation methods for GIL was cursory and lacks rigour, and it does not appear that any consideration was given to combining the proposed installation methods to overcome technical challenges presented in effecting the export connection.

The preferred solution put forward by EDF Energy is to use overhead transmission line connections. All three alternatives have transmission towers that are visible to outside parties from the Suffolk shoreline; we don't have an opinion on which of the two proposed solutions has the least visual impact. The reliability impact of using outdoor insulators in close proximity to the North Sea has not been mentioned.

3 Export Connection Technical Review

Three options have been considered for making the connections between the generators (generator transformers) and the 400 kV Gas Insulated Substation owned and operated by National Grid.

The generators are amongst the largest capacity in the world and at 400 kV the output requires a current carrying capacity of circa 3,000 A. The options considered were:

1. Underground cable (directly buried, in ducts, or in galleries) – current rating is a challenge requiring at least 2 cables/phase (6 cables per circuit) with the largest cable sizes.
2. Gas Insulated Line (GIL) (in troughs, above ground, or in galleries) – current rating is not a problem
3. Overhead Line (OHL) – current rating is not a problem.

The options are considered in turn.

3.1 Underground cable solutions

3.1.1 Direct buried cables

We do not agree with the two reasons given for ruling out the use of direct buried cables. However we do recognise that direct burial of cables is rarely adopted and would not suggest exploring this option further.

3.1.2 Cables in ducts

EDF Energy has stated that the cables in ducts would need to be buried at a depth of at least 2 m due to structures along the route. The evidence presented appears to be reliable and we therefore concur that the thermal rating of the largest sized cables is likely to make this option unfeasible.

3.1.3 Cables in galleries

EDF Energy carried this option forward for evaluation. The evidence presented in their evaluation appears to be reliable, and although it may be feasible to install galleries in certain areas of the site, we concur that it would not be feasible to underground cables in galleries for the full length of the required cable installation.

3.1.4 Cables in surface trough

This option was not considered. Installation in surface trough would overcome the rating issue associated with installation in underground ducts at depths greater than 2 m. The concreted troughs would provide necessary protection for the cables and heavy-duty crossing points can be delineated for vehicular movements.

3.2 Gas insulated line

Reference is made to the use of SF_6 which as a greenhouse gas with an additional environmental risk compared to cable installations. This is true however, one manufacturer uses a mixture of 20% SF_6 and 80% Nitrogen and claims that there is no leakage – sealed for life, no re-filling required. Furthermore, over the last few years National Grid has trialled alternative insulating gasses with global warming potentials ("GWPs") many orders of magnitude lower than SF_6, such as the 2017 commissioning of 420 kV GIL at their Sellindge substation site, using g^3 ™ insulating gas. A 420 kV GIL using the same insulating gas was also installed at Scottish Power's Kilmarnock substation. We therefore do not consider the application of GIL to be insurmountable on the basis of the potential environmental impact of the insulating gas. Other low GWP insulating gasses are available commercially, and have been shown to be effective in numerous installations globally.

Figure 1 - GIL installations in power stations; above ground (left), and underground (right)

3.2.1 GIL in troughs

GIL installation in troughs was ruled out due to access problems and risk of damage to the trough covers. We do not believe that this is an insurmountable issue and established crossing points without covers could be a possible solution.

3.2.2 GIL above ground

This is a solution adopted at several power stations to our knowledge e.g. Teesside Power, PP8 & PP9 Rabigh Saudi Arabia. With this installation approach, the phases can be orientated both in the horizontal and vertical planes, depending on the routing requirements and available space. The height above ground level of 5-10 m quoted is quite feasible and where support leg spacing is an issue for maintenance access, bridges can be provided for larger spans. This is after all the same approach as would be taken for pipelines, of which there are many within a power station.

The requirement for 10 m separation from the boundary fence is given as another reason to rule out this option. We cannot judge where this separation distance might be breached (the sketches in the document are without scale). Furthermore, EDF Energy has characterised above ground installations of GIL within the site as requiring "large swathes of land". We do not consider this a clear enough reason to exclude routing GIL within the site and on the basis of the evidence presented certainly does not meet the standard of being technically insurmountable.

3.2.3 GIL in galleries

This solution is technically acceptable, but it is said that there is insufficient space to accommodate the openings for each change in direction.

3.2.4 GIL Summary

We believe that the GIL solution has not been explored in sufficient detail before ruling it out for further consideration. A combination of all three installation methods could provide a viable solution having no visual impact on the AONB.

3.3 Overhead line

The plans in the DCO submission use overhead transmission lines between the generator transformers and the NG GIS substation. To make the connections between the power transmission platforms and the substation would involve four transmission towers, two at a height of 65m and two at a height of 45m, as well as six monopoles (in two groups located adjacent to the turbine halls) at a height of 45m.

Three options have been presented using overhead transmission line between the generator transformers and the NG GIS substation. One option is ruled out since the future construction of the HHK building would be underneath live conductors, and that this option would constrain construction operations on site.

At the Stage 4 consultation in 2019, two options were presented:

- A four-pylon scheme, two (pylons 2 and 3) at circa 48m in height and two (1 and 4) at circa 65m in height (this option has been taken forward to submission); and
- A five-pylon scheme, four at 48m (pylons 2-5) and one at 65m (pylon 1).

As noted, the Stage 4 consultation showed no conclusive preference between these two options. EDF Energy has presented the views of a landscape and visual impact specialist to support their proposed solution, however we have no opinion on the relative visual impacts of each configuration.

The exposure of the power lines to the environment has not received any consideration. The transmission circuits will be in close proximity to the North Sea and have potential for accumulating saline pollution which could require shutdown for insulator cleaning and tower painting. We don't therefore fully agree with the statement given in Section 4.2.4 of the EDF Energy report, namely "*Therefore the overhead line solution does not have a significant impact on the availability of the power station to operate.*".