



Pinewoods Wind Farm Substation & Grid
Connection

Chapter 2: Assessment of Project Alternatives

Pinewood Wind Ltd

Galetech Energy Services

Clondargan, Stradone, Co. Cavan Ireland

Telephone +353 49 555 5050

www.galetechenergy.com



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2.1 Introduction

The presentation and consideration of the various reasonable project alternatives investigated is an important requirement of the EIAR process and the single most effective means of avoiding likely significant effects on the environment. The purpose of this chapter is to document the assessment of the range of alternatives considered in the design process and the main reasons for selecting the development, as proposed.

2.2 Requirements of the EIA Directive

EIA Directive 2014/52/EU requires that an EIAR must include:-

'A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of environmental effects'.

This provision requires an EIAR to present transparent and objective evidence on the range of reasonable alternatives which were examined, analysed and evaluated as part of the iterative EIAR and project design decision-making processes, and which led to the adoption and selection of the final proposed development as described in **Chapter 3**.

The Draft *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2017)* state that it is generally sufficient to provide a broad description of each main alternative, identifying the key issues associated with it, and to demonstrate how environmental considerations were taken into account. A detailed assessment (or 'mini-EIA') of each alternative is not required.

2.3 Alternatives Considered

The consideration of project alternatives is a dynamic process and alternatives may be identified at many levels and stages during the evolution of a project, from strategic site selection through to site layouts, design, technologies and on to mitigation and any monitoring measures. Alternatives that are available for consideration at the earlier stages in the evolution of a project are considered to represent the greatest opportunity for the avoidance of likely significant effects on the environment.

It should be noted that the requirement is to consider 'reasonable' alternatives. In this case, the proposed development is to provide a means to connect the extant permitted Pinewoods Wind Farm to the national electricity grid in order to export renewable electricity generated by the wind farm. Therefore, the consideration of the range of possible alternatives is limited by this circumstance.

Accordingly, the 'Do-Nothing' alternative was not considered a reasonable option. An Bord Pleanála has previously determined that the Pinewoods Wind Farm is in accordance with the proper planning and sustainable development of the area and national policy in respect of the development of sustainable energy sources, and will have no likely significant effect on the environment. As a proven and cost effective technology in the context of Ireland's abundant wind resource, current government policy is strongly supportive of wind energy generation and the Climate Action Plan has set a target of 70% penetration (8.2 gigawatt of onshore wind) by 2030. The latest Environmental Protection Agency (EPA) projections show that only

with full implementation of the Climate Action Plan 2019 can a significant reduction in Ireland's total greenhouse gas emissions be achieved to meet legally binding 2030 EU commitments¹. As described in **Section 1.2 (Chapter 1)** of this EIAR, the originally proposed grid connection for the Pinewoods Wind Farm was omitted by way of condition of consent (Condition No. 4). In the absence of a means of connecting to the national grid (i.e. the 'Do Nothing' alternative), the permitted wind farm will not be able export the renewable electricity generated and therefore is not considered further in this chapter as a reasonable alternative.

The reasonable alternatives considered in undertaking this EIAR were therefore as follows:-

- Alternative grid connections options;
- Alternative substation locations; and
- Alternative substation design technologies.

Each of these alternatives were considered reasonable and relevant to the proposed development and its specific characteristics, and are assessed in further detail below. This includes an assessment and comparison of likely significant environmental effects, and indicating the main reasons for choosing the development, as proposed.

2.4 Assessment of Alternatives

2.4.1 Alternative Grid Connection Options

The method of connection to the national electricity grid is an integral element of renewable energy developments. In Ireland, the point of connection to the national grid is determined by way of a separate and subsequent statutory process under the auspices of Eirgrid/ESB Networks, as grid network operators.

As part of the permitted Pinewoods Wind Farm EIAR/EIS, 2 no. grid connection alternatives were identified as reasonable and viable options, and the provision of either would facilitate connection of the permitted wind farm to the national electricity grid. These options are described below:-

2.4.1.1 Option G1: Underground Line (UGL) along the public road to an existing substation at Ballyragget, Co. Kilkenny

This grid connection option would involve the excavation of a trench and the laying of electricity cables (within ducting) along the public road, backfilling and reinstatement which will be carried out in accordance with the ESBI guidance '*HV Cables – General Construction Methodology*' (PE424-F7001-R00-001-001).

The underground cables would be of a solid polymeric construction with either aluminium or copper conductors. Cable installation trenching will be by a mechanical digger, with full reinstatement of the top layer to its original wearing course. Cable ducts are laid in a granular bed and backfilled with surround material. This material offers protection to the cables and the contrasting material helps identify location should the need arise later. The depth of the cable trench is approximately 1 metre and the width of the cable trench is 50 centimetres. Following the completion of a ducting section (c. 650m-750m), the electrical cabling is pulled through and joined. The installation of the ducting and cabling would be constructed in agreement with the respective local authorities, including a bond for

¹ http://www.epa.ie/pubs/reports/air/airemissions/ghgprojections2019-2040/2020-EPA-Greenhouse-Gas-Emissions-Projections_final.pdf

reinstatement works. It is estimated that the total construction phase would be 9 – 12 months in duration.

One of the advantages of laying cables under a roadway is that there is typically no permanent effect on the environment additional to that caused by the presence of the roadway. When an underground cable is laid under an existing roadway there is a short-term temporary impact during the construction phase only.

2.4.1.2 Option G2: Connection to the permitted and immediately adjacent 110kV Laois-Kilkenny Grid Reinforcement Project electricity transmission line via a 110kV 'loop-in/loop-out' substation

One of the distinct advantages of this grid connection option, from an environmental impact and technical perspective, is that the permitted 110kV Laois-Kilkenny Grid Reinforcement Project² passes immediately adjacent to the permitted Pinewoods Wind Farm. The proximity to the national grid was a key reason for selection of the subject site for the development of a wind farm. The permitted transmission line has also been subject to full EIA and AA. Following detailed discussions with Eirgrid, it has been agreed that the proposed development can break directly into this 110kV line via a substation at the subject site, thereby providing an extremely convenient means to export the renewable electricity generated by the wind farm.

At the time of preparation of the Pinewoods Wind Farm EIAR/EIS (**Volume III**), it was considered that due to the proximity of Option G2 to the wind farm site, this represented the most advantageous alternative from an environmental impact and technical efficiency perspective. This option would result in a reduced likelihood of significant environmental effects, including in respect of *inter alia* land and soil; water; and transport and access. It was for these reasons that this grid connection option was selected as the preferred alternative and assessed throughout the submitted EIAR/EIS (**Volume III**) and included in the plans and particulars submitted with the planning application.

An Bord Pleanála subsequently granted planning permission for the Pinewoods Wind Farm and determined that, on its own or in-combination with other permitted or proposed developments in the vicinity would have no likelihood of significant direct, indirect, secondary or cumulative effects on the environment. However, as described above, permission for the substation was excluded by way of condition of consent for procedural reasons.

2.4.1.3 Assessment of Alternative Grid Connection Options

Following the Board's decision to grant planning permission for the Pinewoods Wind Farm, the Applicant once again carried out a comprehensive *de novo* evaluation of all reasonable grid connection alternatives. This evaluation, which included further discussions with Eirgrid, confirmed that Options G1 and G2, as described above, remain reasonable alternatives of connecting the permitted wind farm to the national grid.

In addition, upon further consideration, it was determined that a further alternative involving the installation of an UGL along the public road network to the permitted Coolnabacky substation also represented a possible option (**Option G3**). The

² An Bord Pleanála Reference PL11.VA0015

construction methodologies associated with Option G3 are identical to Option G1, as described above.

Each of the abovementioned grid connection options are illustrated at **Figures 2.1, 2.2** and **2.3** below; and provided at **Annex 2.1 (Volume II)**. A comparative assessment of each option in respect of each environmental factor included in this EIAR is provided in tabular format at **Table 2.1** below.

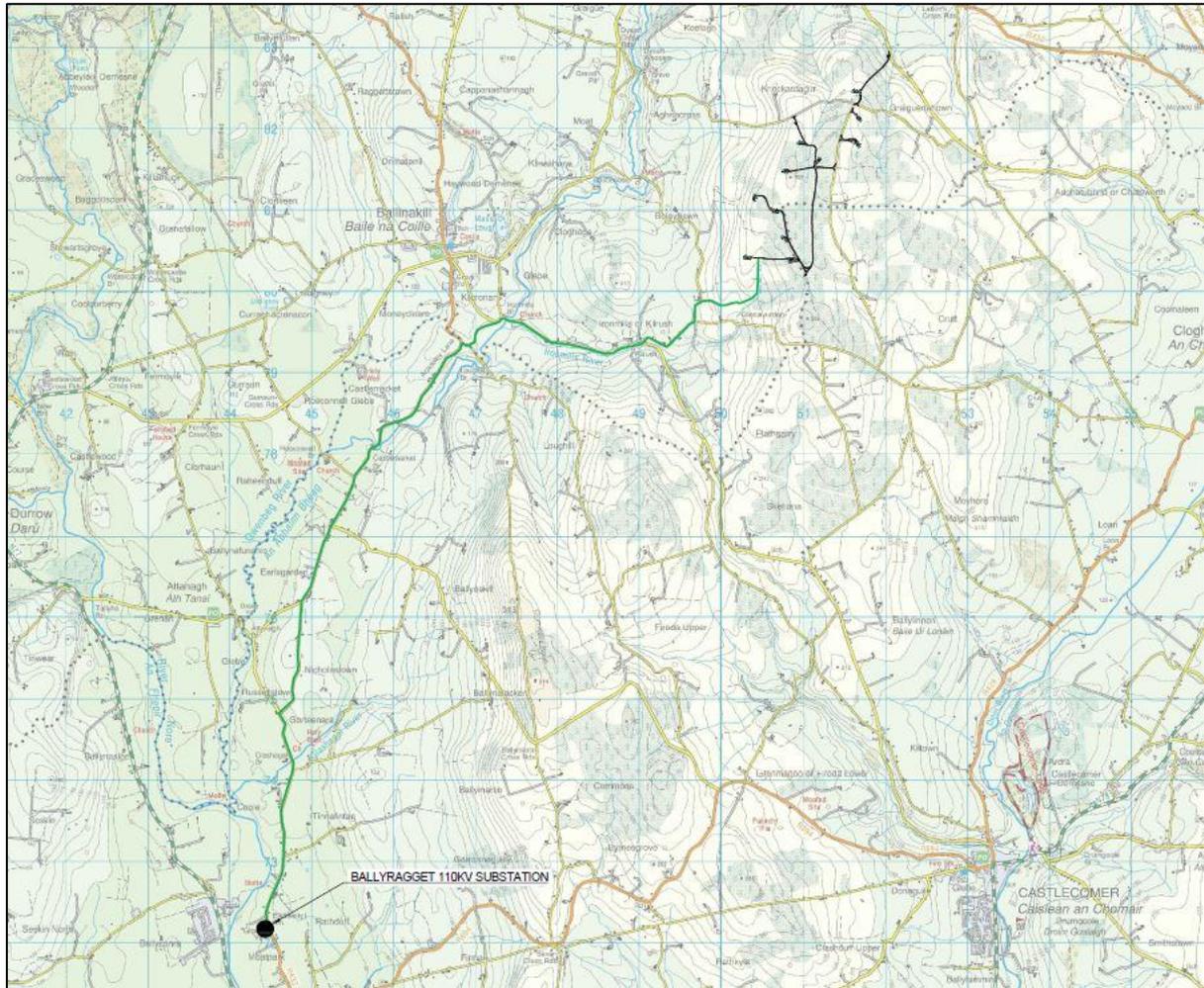


Figure 2.1: Option G1 – UGL Grid Connection to existing Ballyragget substation

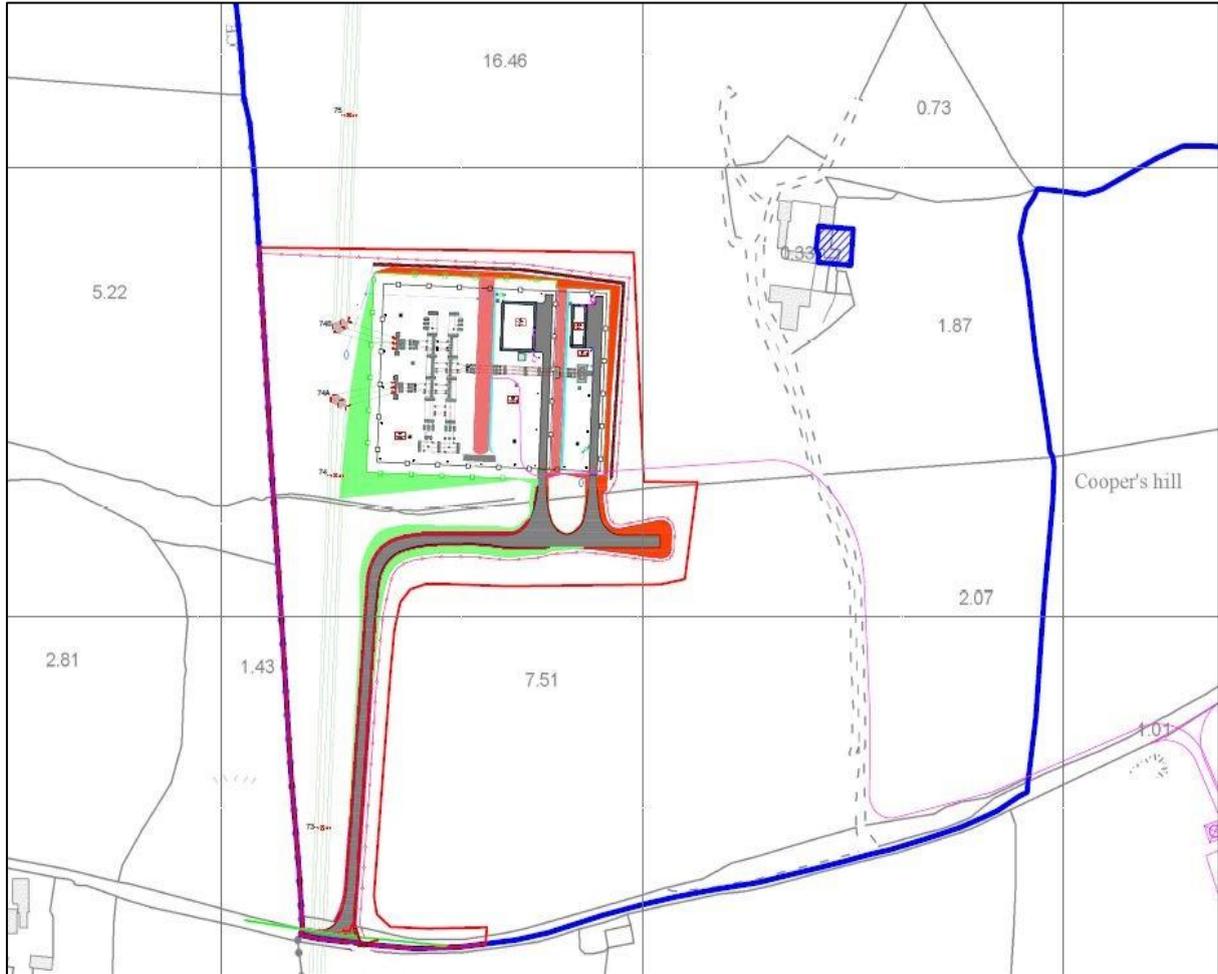


Figure 2.2: Option G2 – 'Loop-in/Loop-out' connection to Laois-Kilkenny Grid Reinforcement Project

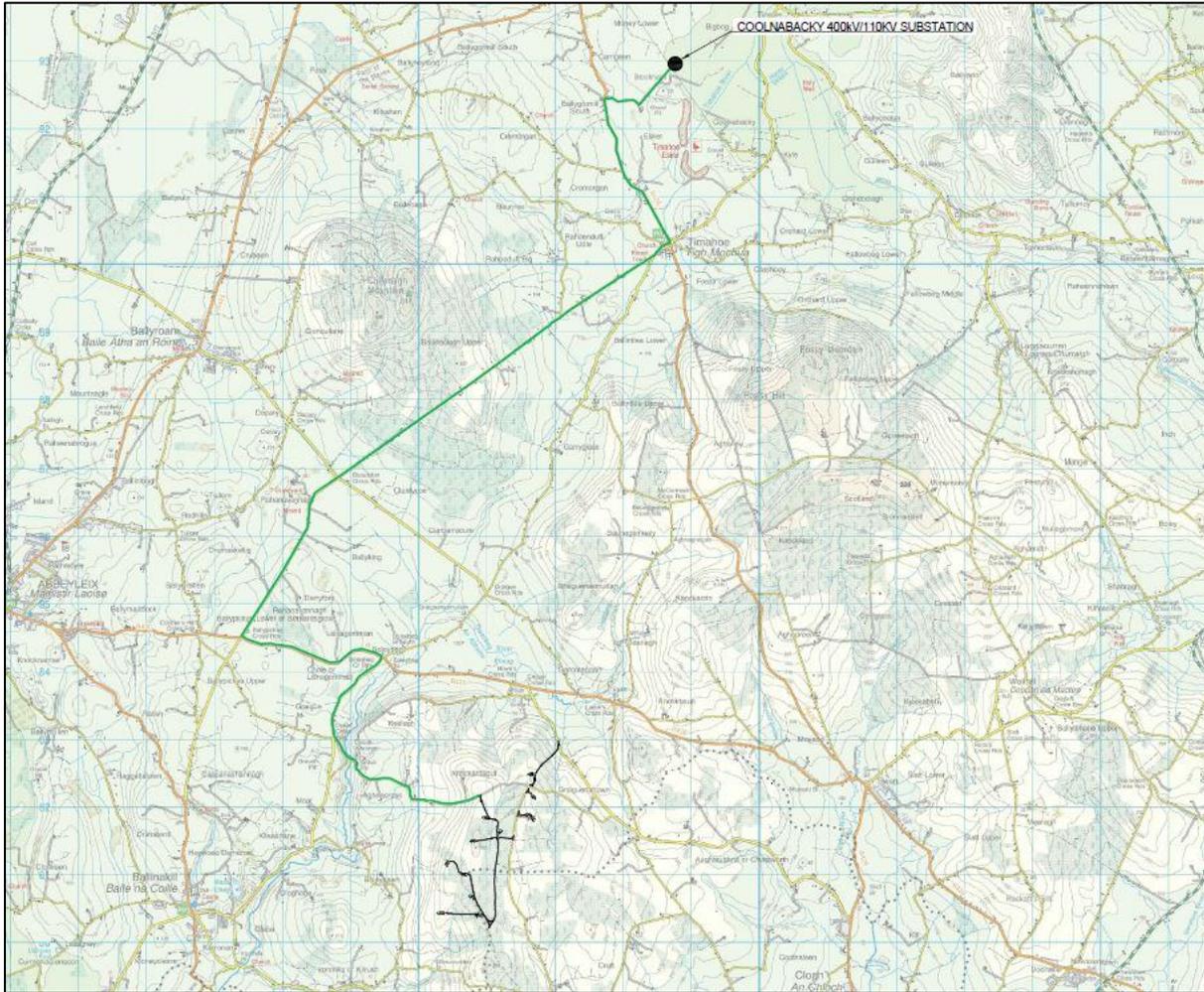


Figure 2.3: Option G3 – UGL Grid Connection to permitted Coolnabacky substation

Location	Option G1	Option G2	Option G3	Emerging Preferred Option
Factor				
Population & Human Health	Relatively low density of dwellings along the route. Likelihood of temporary disruption to local communities during construction works.	Low density of dwellings in vicinity of identified location.	Relatively low density of dwellings along the route but the route would travel through the village of Timahoe. Likelihood of temporary disruption to local communities during construction works.	Option G2
Biodiversity	Identified route is generally not sensitive; but would require the crossing of the River Barrow and River Nore SAC on 3 no. occasions albeit within the public road carriageway.	Identified site is generally not sensitive; however, nearby watercourses ultimately discharge downstream to the River Barrow and River Nore downstream.	Identified route is generally not sensitive; but would require the crossing of the River Barrow and River Nore SAC on 3 no. occasions, albeit within the public road carriageway..	Option G2

Land & Soil	No sensitive land uses or soil types. Excavations required over a large linear distance.	No sensitive land uses or soil types. Excavations confined to a local site.	No sensitive land uses with some localised evidence of peat. Excavations required over a large linear distance.	Option G2
Water	Identified route would require the crossing of a number of watercourses which discharge to the River Nore and to European designated sites for nature conservation.	Proposed development does not require the crossing of any watercourses. Nearby watercourses ultimately discharge to the Nore and to European designated sites for nature conservation.	Identified route would require the crossing of a number of watercourses which discharge to the River Barrow and to European designated sites for nature conservation.	Option G2
Air & Climate	No constraints identified. Development would result in a positive overall effect.	No constraints identified. Development would result in a positive overall effect.	No constraints identified. Development would result in a positive overall effect.	Option G1 or Option G2 or Option G3
Landscape	The proposed development would be located underground and, following construction, would have no surface expression.	No protected landscape designations or designated scenic views in the immediate vicinity. Site is remote and substantially screened from public view.	The proposed development would be located underground and, following construction, would have no surface expression.	Option G1 or Option G3
Cultural Heritage	A moderate number of heritage features identified in the vicinity of the route; particularly within 500m.	1 no. heritage feature identified within 500m of the location.	A moderate number of heritage features identified in the vicinity of the route; particularly within 500m.	Option G2
Noise & Vibration	Construction activities would take place in the immediate vicinity of dwellings along the route.	Limited number of dwellings in the immediate vicinity.	Construction activities would take place in the immediate vicinity of dwellings along the route, particularly in the village of Timahoe.	Option G2
Shadow Flicker	Shadow Flicker cannot be generated.	Shadow Flicker cannot be generated.	Shadow Flicker cannot be generated.	N/A
Material Assets (Transport & Access; Telecommunications)	Short-term effects likely on transport & access during construction due to requirement for temporary road closures and diversions.	No significant effects likely on transport; intermittent, but extremely short-term and temporary disruption possible during delivery of materials.	Short-term effects likely on transport & access during construction due to requirement for temporary road closures and diversions.	Option G2

	No significant effects on telecommunications.	No significant effects on telecommunications.	No significant effects on telecommunications.	
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Table 2.1: Environmental Assessment of Alternative Grid Connection Options

On the basis of the above assessment, it is concluded that none of the 3 no. identified grid connection options are likely to result in significant effects on the environment. However, given the immediacy of the Laois-Kilkenny Grid Reinforcement Project electricity transmission line to the permitted Pinewoods Wind Farm; the significant technical and other efficiencies associated with this option; and the reduced likelihood of significant effects in respect of land and soil; water; cultural heritage; and material assets (transport and access), it is assessed that Option G2 is once again the preferred means for connecting the Pinewoods Wind Farm to the national electricity grid.

2.4.2 Alternative Substation Locations

Given the fixed location of the permitted Pinewoods Wind Farm vis-à-vis the fixed alignment of the permitted Laois-Kilkenny 110kV Grid Reinforcement Project electricity transmission line, reasonable alternative siting options are limited to minor micro-siting based on alternative design technologies, described below. Accordingly, it was not deemed necessary to evaluate additional alternative sites.

2.4.3 Alternative Substation Design Technologies

Following the determination that Option G2 represents the preferred alternative for connecting the Pinewoods Wind Farm to the national grid, the Applicant undertook an analysis of technological design options, including internal electrical equipment and plant, which could be provided for as part of the proposed substation. Depending on the alternative design technologies deployed there will be minor variations in terms of internal substation layout and footprint. The consideration of alternative design technologies was therefore an important consideration in the context of the generally fixed location for the substation in the context of the specific characteristics and topography of the proposed development site.

It is important to note that the design of such substations must accord with Eirgrid specifications and, as such, the scope for installing alternative electrical apparatus and design technologies is very limited. Moreover, the original substation design submitted with the permitted Pinewoods Wind Farm is no longer an accepted Eirgrid specification and has been superseded.

Within Eirgrid specifications for 110kV substations, there are currently two approved designs (see **Annex 2.2**), as follows:-

2.4.3.1 Option SD1: 'Air-Insulated Switchgear' Substation

Air-Insulated switchgear (AIS) substations are conventional switchgear substations which use air between phase-to-ground and phase-to-phase insulation. Air is the primary medium for insulation within these systems. AIS units have been extensively used in the last few decades. Within AIS substations, electrical equipment is located outdoors and is spaced at a sufficient distance from ground and from other equipment to maintain safe electrical and maintenance clearances.

2.4.3.2 Option SD2: 'Gas-Insulated Switchgear' Substation

Gas-insulated switchgear (GIS) substations comprise standard electrical equipment which includes circuit breakers, current transformers, voltage transformers,

disconnect and ground switches, interconnecting busbars, surge arresters, and connections to the electricity grid. GIS enclosures are typically cast or welded aluminium. GIS enclosures are pressure sealed and designed to remain closed throughout the lifetime of the equipment, which is typically 50 years or more. A GIS substation uses Sulphur Hexafluoride (SF₆) at a moderate pressure for phase-to-phase and phase-to-ground insulation. SF₆ has 2-3 times greater insulating ability of atmospheric air at the same pressure which results in a more compact overall substation size. The high-voltage conductors, circuit breaker interrupters, switches, current transformers, and voltage transformers are encapsulated in SF₆ gas inside grounded metal enclosures.

2.4.3.3 Assessment of Alternative Substation Design Options

A comprehensive technical and environmental evaluation of Options SD1 and SD2 was undertaken by the Applicant to determine which option represented the most suitable and appropriate alternative for the proposed development. It was concluded that both options were feasible from a technical standpoint and that neither option was likely to result in significant environmental effects.

GIS substations are, on occasion, developed as part of renewable energy developments and have a slightly smaller footprint. AIS substations are, however, generally considered to be the most appropriate technology for renewable energy projects. The provision of an AIS substation allows for greater flexibility in terms of any future development which Eirgrid may decide to undertake. As Eirgrid have indicated that the proposed development will form a 'node' on the national electricity network to which other projects may seek to connect, it is possible that future expansion of the proposed development site may occur.

Therefore, given that both options were technically feasible and that neither option was evaluated as likely to result in significant environmental effects, it was considered that the development of an AIS substation (Option SD1) was preferable due to the greater flexibility afforded by this design. The increased range of options for future development afforded by an AIS substation was considered to outweigh any minor reduction in environmental effects (e.g. slightly reduced level of groundworks etc) which would arise from the development of a GIS substation.

2.5 Conclusion

This chapter has provided a description of the reasonable alternatives, which are relevant to the proposed project and its specific characteristics, and which have been assessed, evaluated and analysed. The consideration of various alternatives was a recursive process and integral to the iterative and dynamic EIA and project design process. The objective of this process was to avoid any likely significant effects on the environment through the selection of a means of connection to the national electricity grid for the permitted Pinewoods Wind Farm which avoids inherent environmental sensitivities, in favour of a proposed development which has fewer constraints.

Alternative Grid Connection Options, Alternative Substation Locations and Alternative Substation Design Technologies have all been discussed and analysed. An indication of the main reasons for selecting the preferred option, including a comparison of likely significant environmental effects is provided.

The final proposed development evaluated in this EIA and described in **Chapter 3** is therefore based on grid connection Option G2 and substation design Option SD2

which has been assessed to achieve the best balance between the avoidance of any likely significant environmental effects and achievement of the objectives of the project.

