Drumlins Park Wind Farm Substation & Grid Connection

Chapter 2: Assessment of Project Alternatives

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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 Drumlins Park 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. The Planning Authority (Monaghan County Council) has previously determined that the Drumlins Park Wind Farm is acceptable, accords with the provisions of the Monaghan County Development Plan 2019-2025 and seeks to help to secure a number of objectives set out from a regional and national policy context with regard to renewable energy and climate change targets. 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 commitments[1]. 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 Drumlins Park Wind Farm EIAR, 3 no. grid connection alternatives were identified as reasonable and viable options, and the provision of any of these alternatives would facilitate connection of the permitted wind farm to the national electricity grid. These options are described below.

2.4.1.1 Option G1: 38kV On-site Substation and OHL/UGL to Clones 38kV substation

This option would comprise the construction of a 38kV on-site substation consisting of a single-storey control building and an external electrical equipment compound located in the townland of Crossbane. The control building and compound houses equipment such as grid transformers, circuit breakers, earth fault meters, metering equipment, computers and servers, designed and constructed to comply with ESB Networks' specifications.

Following an assessment of the intervening landscape between Clones and the permitted wind farm site to assess environmental, infrastructural and technical constraints; it was determined that a 5km Overhead Line (OHL) route across private agricultural lands and including minor sections of UGL at either end of the route would be the optimum configuration as illustrated in **Figure 2.1** below (reproduced at **Annex 2.1**).

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

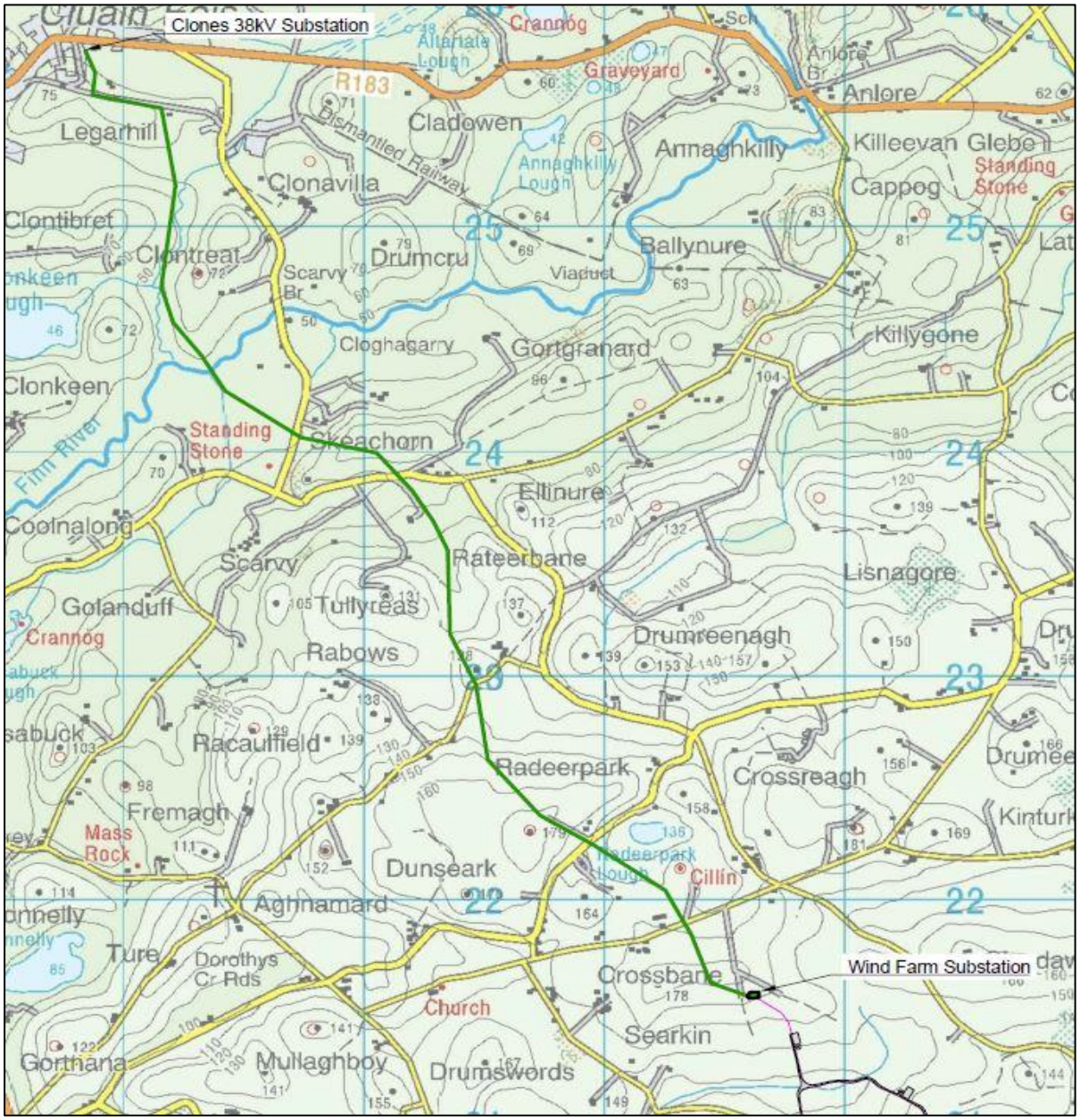

Figure 2.1: Option G1 – OHL/UGL Grid Connection to Clones 38kV substation

2.4.1.2 Option G2: 38kV On-site Substation and OHL to Shankill 110kV substation

Similar to Option G1, this option would comprise the construction of a 38kV on-site substation comprising a single-storey control building and an external electrical equipment compound, but this time located in the townland of Lislongfield. The substation would be connected to the Shankill 110kV substation by way of a 16km OHL as illustrated in **Figure 2.2** below (and reproduced at **Annex 2.1**).

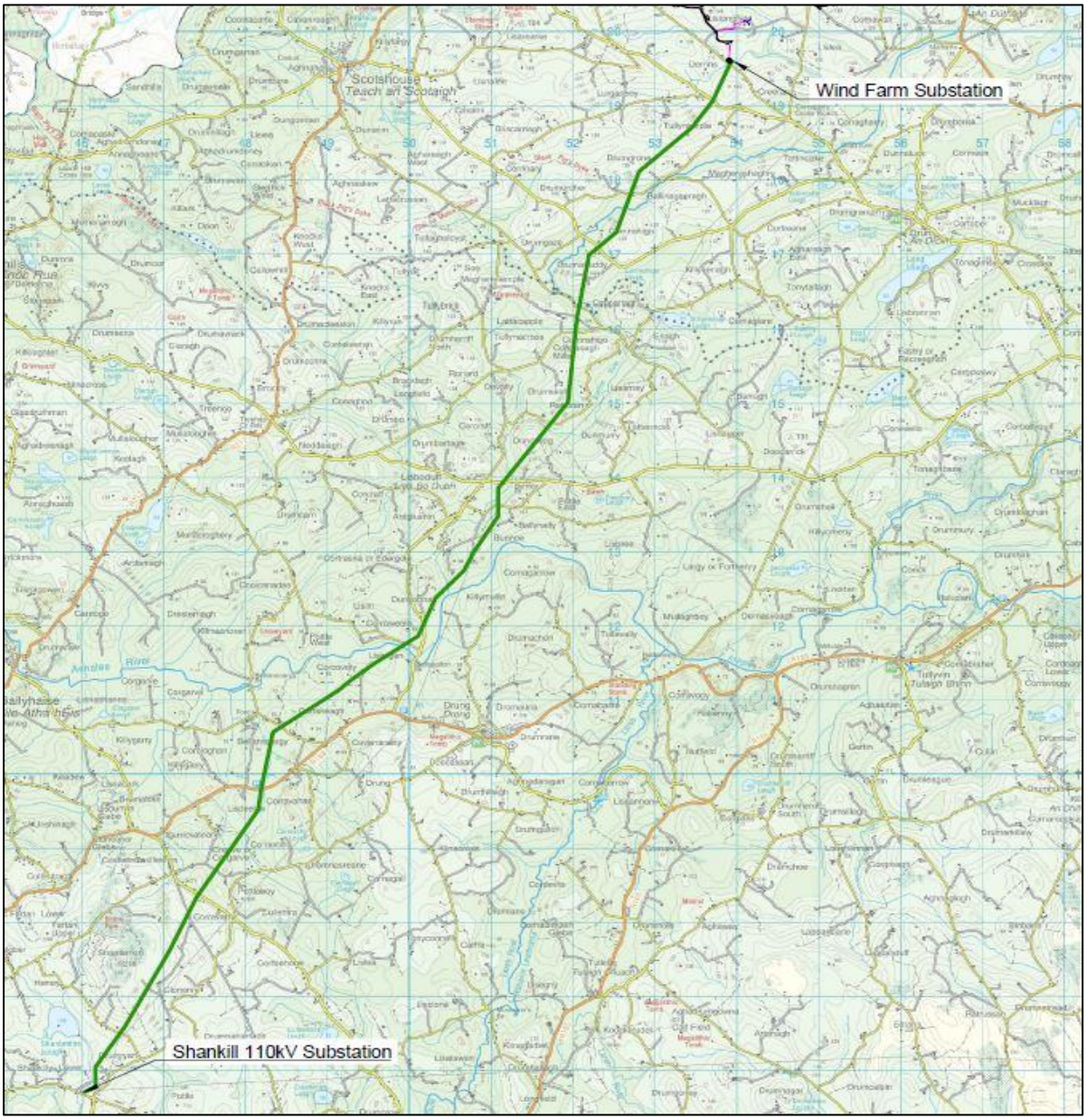

Figure 2.2: Option G2 – OHL Grid Connection to Shankill 110kV substation

2.4.1.3 Option G3: New 110kV 'Loop In/Loop Out' Substation

A connection to the existing Lisdrum-Shankill 110kV overhead electricity transmission line was also evaluated to be a feasible method for connecting to the national grid. This method of connection would require the construction of a new 110kV 'loop-in/loop-out' substation adjacent to (or as close as possible to) the existing 110kV OHL which would be connected to the proposed development by way of low voltage cabling located underground.

Given the fixed location of the permitted Drumlins Park Wind Farm *vis-à-vis* the fixed alignment of the existing Lisdrum-Shankill 110kV overhead electricity transmission line, and the requirement to locate the electricity substation as close as possible to the existing overhead line, the range of possible substation locations is limited. An appraisal of the local area along the alignment of the existing transmission line was undertaken having regard to topography (to avoid extensive groundworks or reprofiling of ground levels), separation distances to dwellings, ease of access and

avoidance of surface water features to select a location which was sufficiently proximate to the respective developments (i.e. wind farm and electricity transmission line) to avail of technical efficiencies arising from such proximity and to avoid, insofar as possible, any likely significant environmental effects.

Following this evaluation, the location of this alternative, as illustrated at **Figure 2.3** (reproduced at **Annex 2.1**), was selected.

Figure 2.5: Option G3 –110kV substation

2.4.1.4 Assessment of Alternative Grid Connection Options

At the time of preparation of the Drumlins Park Wind Farm EIAR (**Volume III**), it was considered that none of the 3 no. identified options were likely to result in significant effects on environmental receptors. Each option, whichever was constructed, comprises infrastructure which is commonplace in the Irish landscape and each could be constructed and operated without resulting in any significant environmental effects.

Following further examination, it is concluded that these alternatives remain the most appropriate and feasible options of connecting the Drumlins Park Wind Farm to the national electricity grid. As a result, a further more detailed environmental

evaluation of each of the 3 no. options has been completed and is provided at **Table 2.1** below.

Location / Factor	Option G1	Option G2	Option G3	Emerging Preferred Option
Population & Human Health	Relatively low density of dwellings along the route.	Relatively low density of dwellings along the route.	Low density of dwellings in vicinity of identified location.	Option G3
Biodiversity	Identified route is generally not sensitive; common habitats; low bat suitability; and low likelihood of effects on birds.	Identified route is generally not sensitive; common habitats with some localised areas of wetlands and fen; low-to-moderate bat suitability; and low likelihood of effects on birds.	Identified site/route is generally not sensitive; common habitats with some localised areas of wetlands and fen; low bat suitability; and low likelihood of effects on birds.	Option G1 or Option G3
Land & Soil	No sensitive land uses or soil types but some localised areas of peat present. Excavations required intermittently over a linear distance.	No sensitive land uses or soil types but some localised areas of peat present. Excavations required intermittently over a large linear distance.	No sensitive land uses. Excavations will be contained within a compact development area.	Option G3
Water	Identified route would require the crossing of a number of watercourses which could potentially result in silt/sediment emissions and a reduction in water quality.	Identified route would require the crossing of a number of watercourses which could potentially result in silt/sediment emissions and a reduction in water quality. The crossing of these watercourses would bring about a hydrological connection with designated European sites for nature conservation.	Identified location/route would not require the crossing of any watercourses thus reducing any likelihood of siltation. No works would be required within c. 100m of the nearest mapped watercourse.	Option G3
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	This alternative would comprise simple 'pole and wire' infrastructure and underground cabling over a linear distance of c. 5km; however is not likely to significantly affect the local landscape.	This alternative would comprise simple 'pole and wire' infrastructure over a linear distance of c. 16km; however is not likely to significantly affect the local landscape. No sensitive landscape	No sensitive landscape designations in vicinity of site. Identified alternative would introduce a greater sense of industrialisation to the local landscape.	Option G1 or Option G2

	No sensitive landscape designations in vicinity of route.	designations in vicinity of route.		
Cultural Heritage	3 no. heritage features located within 100m of the identified route.	7 no. heritage features located within 100m of the identified route.	1 no. heritage features located within 100m of the identified route.	Option G3
Noise & Vibration	Construction activities would take place in the vicinity of a number of dwellings along the route.	Construction activities would take place in the vicinity of a number of dwellings along the route.	Limited number of dwellings in the vicinity of the identified site/route	Option G3
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 increased traffic movements. No significant effects on telecommunications.	Short-term effects likely on transport & access during construction due to increased traffic movements. No significant effects on telecommunications.	Short-term effects likely on transport & access during construction due to increased traffic movements. No significant effects on telecommunications.	Option G1 or Option G2 or Option G3

Table 2.1: Environmental Assessment of Alternative Grid Connection Options

On the basis of the above assessment, it is again 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 existing Lisdrum-Shankill 110kV electricity transmission line to the permitted Drumlins Park Wind Farm; the significant technical and other efficiencies; and the reduced likelihood of significant effects in respect of biodiversity, water, cultural heritage and noise and vibration, it is assessed that Option G3 is the preferred means for connecting the Drumlins Park Wind Farm to the national electricity grid.

2.4.2 Alternative Substation Locations

Given the selection of Option G3 above, and having regard to the assessment of alternative substation locations inherent to its selection, it was not considered necessary to evaluate further alternative substation locations. Reasonable alternative siting options are limited, therefore, to minor micro-siting based on alternative design technologies, described below

2.4.3 Alternative Substation Design Technologies

Following the determination that Option G3 represents the preferred alternative for connecting the Drumlins Park Wind Farm to the national grid, the Applicant undertook an analysis of technological design options, including 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.

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.

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 as 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 (including transformers and line bays) 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, through direct consultation, 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 due to smaller footprint 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 EIAR 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 Drumlins Park 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 EIAR and described in **Chapter 3** is therefore based on grid connection Option G3 and substation design Option SD1 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.