White Hill Wind Farm Electricity Substation & Electricity Line

Environmental Impact Assessment Report

Chapter 2: Assessment of Project Alternatives

White Hill Wind Limited

Galetech Energy Services

Clondargan, Stradone, Co. Cavan Ireland

Telephone +353 (0)49 555 5050

www.galetechenergyservices.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. As described in **Chapter 1**, the EIAR process is highly iterative involving a constant interchange between project designers and competent experts, with designers continually adjusting the design in response to identified environmental constraints, and vice versa, including with the embedding of mitigation measures in the emerging project design. The purpose of this chapter is to record the key outcomes of this process and to document the assessment of the range of alternatives considered.

The EIA Directive 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, and which led to the adoption and selection of the final project as described in **Chapter 3**. The *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA, 2022) state that it is generally sufficient to provide a broad description of each of the main alternatives considered, identifying the key issues associated with each of them, and to demonstrate how environmental constraints were taken into account. A detailed assessment (or 'mini-EIA') of each alternative is not required.

2.2 Alternatives Considered

The consideration of alternatives is a dynamic process, and alternatives may be identified at many levels and stages during the evolution of a project, from strategic site location 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 of a project, particularly at the design and scoping stages, are considered to represent the greatest opportunity for the avoidance of likely significant effects on the environment. As environmental issues emerged during the EIAR/project design process, alternative designs were also considered, and additional mitigation options considered towards the end of the process.

In this case, the purpose of the project is to provide a means of connecting the extant permitted White Hill 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 however, for completeness, has been addressed below. An Bord Pleanála has previously determined that the White Hill Wind Farm is in accordance with the proper planning and sustainable development of the area, accords with the provisions of the *Kilkenny City and County Development Plan 2021-2027* and the *Carlow County Development Plan 2022-2028;* will have no likely significant adverse environmental

effects; and contributes securing a number of objectives set out in regional and national policy regarding the delivery of renewable energy and climate change targets. The reasonable alternatives considered in undertaking this assessment were therefore as follows:-

- Alternative substation locations;
- Alternative substation design technologies;
- Alternative electricity line routes; and,
- Alternative construction material haul routes.

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

2.3 Assessment of Alternatives

2.3.1 'Do Nothing' Alternative

Current national Government policy in respect of energy production and the reduction of greenhouse gas emissions are all collectively very strongly supportive of the rapid, increased generation of renewable electricity, including wind energy, to reverse climate breakdown and the transition of energy production away from fossil fuels.

The *Climate & Low Carbon Development (Amendment) Act 2021* provides for one of the most ambitious decarbonisation pathways anywhere in the world. To achieve a 51% reduction in greenhouse gas emissions by 2030, the statutory *Climate Action Plan 2024* commits to a renewable energy generation target of at least 80% by 2030. It is acknowledged that onshore wind will continue to play a vital role in achieving this target, particularly over the next five years, with an installed capacity target of 6 gigawatts (GW) by 2025 and 9GW by 2030.

Accordingly, due to the critical importance of connecting permitted onshore wind energy developments to the national electricity network to enable the transition to a low carbon economy in accordance with all national, regional and local policies; and the recognised imperative of generating electricity from renewable sources, as outlined above; the 'Do Nothing' alternative was not considered a reasonable alternative.

In the 'Do Nothing' alternative, the status quo in terms of the local environment of the project site would remain unchanged with gradually evolving managed farmland remaining the prominent land use.

2.3.2 Alternative Substation Locations

As detailed in the accompanying planning application documentation, the purpose of the project is to facilitate the connection of the permitted White Hill Wind Farm to the national electricity network. It was initially anticipated, as identified in the EIAR for the White Hill Wind Farm, that the wind farm would connect to the existing Kilkenny 110kV electricity substation. However, following further, more recent, evaluations of the available electrical capacity within this substation, it has been concluded that this connection point is no longer optimal.

In the first instance, the Developer commenced an appraisal of existing 110kV electricity substations in the region to determine the feasibility of connection and, separately, an assessment of existing transmission lines to determine the possibility of connecting directly to a transmission line. Following this assessment, and for a range of technical (electrical) reasons, it was concluded that the most appropriate means of connecting the White Hill Wind Farm to the national electricity network is via a new electricity substation located along the Kellis-Kilkenny 110kV overhead transmission line.

Strategic site selection to avoid intrinsic environmental sensitivity is the principal mitigation option for projects. Some locations have more inherent environmental sensitivities than others and an assessment of alternative locations can therefore avoid such locations in favour of locations which have fewer constraints and more capacity to sustainably assimilate a project.

In the first instance, a strategic examination of lands along the entirety of the Kellis-Kilkenny 110kV overhead electricity transmission line was undertaken to identify potentially suitable sites which, in the first instance, did not display any fundamental environmental constraints and, secondly, could accommodate a development of this scale. While not a fundamental criteria of the identification process, site locations which were closer to the permitted White Hill Wind Farm were deemed to be preferable as they would result in a reduced requirement for interconnecting underground cabling and, consequently, reduced effects on traffic, transport and the road network.

On the basis of this examination, 2 no. possible locations were identified as potentially suitable for the development of an electricity substation in this general area, as follows:-

- **Option L1:** Kellymount, Paulstown, County Kilkenny; and,
- **Option L2:** Shankill, Paulstown, County Kilkenny

Each of these options were consequently selected for further detailed technical and environmental assessment, as detailed below. The alternative locations are illustrated at **Annex 2.1**.

Table 2.1 below provides an overview of a comparative assessment of environmental constraints and opportunities associated with both alternative locations and the emerging preferred location based on each environmental factor. In undertaking this assessment, the criteria provided in Schedule 7 of the Planning Regulations together with the general environmental factors included in Article 3(1) of the EIA Directive were used as a framework for analysis.

Location / Factor	Option L1	Option L2	Emerging Preferred Option
Population & Human Health	Low density of dwellings in vicinity of the identified substation location. Available separation distances to residential dwellings reduces likelihood of significant population, human health, noise and vibration effects.	Low density of dwellings in vicinity of the identified substation location. Available separation distances to residential dwellings reduces likelihood of significant population, human health, noise and vibration effects.	Option L1 or L2
Biodiversity	The identified substation location comprises heavily managed	The identified substation location comprises heavily managed	Option L2

	agricultural pasture and bounded by hedgerows. To the west the site is bounded by the Paulstown stream which provides a strong hydrological connection to the River Barrow and River Nore candidate Special Area of Conservation (cSAC).	agricultural pasture with occasional hedgerows; and does not exhibit any particular ecological sensitivities. A small watercourse/stream is located to the north of the substation site which provides a weak connection to the River Barrow and River Nore cSAC.	
Land & Soil	The identified substation location is mapped as being underlain by 'Shales and Sandstones Till' which is not assessed to be particularly sensitive to development. The topography of the site is sloping, generally from northeast to southwest, and substantial excavations are likely to be required to create a level platform for the substation.	The identified substation location is mapped as being underlain by 'Limestone Till' which is not assessed to be particularly sensitive to development. The site is generally flat and is unlikely to require extensive excavations.	Option L2
Water	The identified substation location is immediately adjacent to the Paulstown stream which provides a connection to the River Barrow and River Nore cSAC. The site is located immediately adjacent to an area identified as 'Bedrock at Surface' which may result in interactions with groundwater. The Paulstown stream is mapped as being at risk of flooding; however, the mapped flood extents do not affect the subject site.	The identified substation location is within close proximity of a small watercourse which provides a hydrological connection to the River Barrow and River Nore cSAC.	Option L2
Air Quality & Climate	No constraints identified. The project would result in a positive overall effect.	No constraints identified. The project would result in a positive overall effect.	Option L1 or Option L2
Landscape	The identified location is within the Transition Zone landscape character type and the Castlecomer Southern Transition Zone landscape character area as set out in the *Kilkenny City & County Development Plan 2021-2027*. Scenic view 11 is located within proximity to the substation location. The site is visible from the L2625 to the north and does not have substantial boundary screening.	The identified location iswithin the Transition Zone landscape character type and the Castlecomer Southern Transition Zone landscape character area as set out in the *Kilkenny City & County Development Plan 2021-2027*. Scenic view 11 is located within proximity to the substation location. The site is not particularly visible in the landscape and avails of significant vegetative screening.	Option L1 or L2
Cultural Heritage	There are a number of cultural heritage features located within and/or immediately adjacent to the identified site including a religious house, a church and a graveyard.	There are a number of cultural heritages features located within proximity to the identified substation location. However, the footprint of the project does not impinge on any feature.	Option L2

Noise & Vibration	There are a low number of receptors (dwellings) in the vicinity of the identified substation location and, with available separation distances, significant construction and operational phase effects are assessed as unlikely.	Due to the limited number (and less than Option L1) of receptors (dwellings) in the vicinity of the identified substation location and the availability of separation distances, significant construction and operational phase effects are assessed as unlikely.	Option L2
Material Assets (Transport & Access; Aviation; and Telecommu-nications)	No likely significant transport constraints identified. Location can be readily accessed via national and local roads. Existing telecommunication masts in wider vicinity of identified location but no likely significant telecommunications constraints identified. Due to the low altitude of the proposed infrastructure, no effects on aviation are anticipated.	No likely significant transport constraints identified. Location can be readily accessed via national and local roads. Existing telecommunication masts in wider vicinity of identified location but no likely significant telecommunications constraints identified. Due to the low altitude of the proposed infrastructure, no effects on aviation are anticipated.	Option L1 or Option L2

Table 2.1: Environmental Assessment of Alternative Locations

Based on this analysis, it was determined that both locations are generally capable of accommodating a project of the type proposed and that neither exhibit any significant environmental constraints. However, due to a stronger hydrological connection to the River Barrow & River Nore cSAC, ground conditions and topography, reduced visual screening and the presence of recorded archaeological features; it was concluded that Option L2 was a more suitable location for a project of this overall size and scale.

2.3.3 Alternative Substation Designs

Following the determination that Option L2 represents the preferred alternative, the Developer 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 limited.

Within EirGrid specifications for 110kV substations, there are currently 2 no. approved designs (see **Annex 2.2**), as follows.

2.3.3.1 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; with AIS units having been extensively used for renewable energy development in recent 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.

2.3.3.2 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 which are located within a sealed enclosure. 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.

2.3.3.3 Assessment of Alternative Substation Design Options

A comprehensive technical and environmental evaluation of Options SD1 and SD2 was undertaken by the Developer to determine which option represented the most suitable and appropriate alternative for the project. 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 design alterations which EirGrid may decide to undertake to ensure the continued efficient operation of the substation.

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, in terms of accommodating any future design alterations, afforded by this design. The increased range of future design options for 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.

2.3.4 Alternative Electricity Line Route Options

Following the identification of a preferred substation location, the Developer examined a number of routes for the installation of the underground electricity line. After an initial evaluation of several potential routes, 2 no. options were identified as being generally viable alternatives, as follows:-

- **Option EL1:** Installation of approximately 8.5km of underground electricity line between Option L2 and the permitted White Hill Wind Farm within private lands and the L6673, L6738, L7120, L7117 and L71172 local public roads; and,
- **Option EL2:** Installation of approximately 8.8km of underground electricity line between Option L2 and the permitted White Hill Wind Farm within private lands and the L6673, L6738, L7117 and L71172 local public roads.

These route options are illustrated at **Annex 2.3** and further evaluated at **Table 2.2** below.

Design & Layout Factor	Option EL1	Option EL2	Emerging Preferred Option
Population & Human Health	Relatively low (and lower than Option EL2) density of dwellings along the route of the underground electricity line due to it being substantially located within private lands (off-road). Likelihood of temporary disruption to local residents and traffic during construction works.	Higher density of dwellings in the vicinity along the route of underground electricity line. In addition, as the route follows the public road network, increased disruption (when compared to Option EL1) will be experienced by local residents, business owners and landowners.	Option EL1
Biodiversity	Identified route is generally not sensitive and largely avoids important habitats. While the route passes through areas of wet grassland and forestry, these habitats are not assessed to be of particular importance. The route traverses a number of watercourses which each discharge to the River Barrow & River Nore cSAC.	Identified route is generally not sensitive due to being predominately located within carriageway of public roads and is assessed as likely to have a lesser effect on natural habitats. The route traverses a number of watercourses which each discharge to the River Barrow & River Nore cSAC.	Option EL2
Land & Soil	No significant constraints identified. The route is mapped as being underlain by 'Limestone Till', 'Shales and Sandstones Tills' and 'Bedrock at Surface'. The route is not mapped as being located within any areas of karst; however, a small localised pocket of peat is mapped as being present adjacent to the L7117 local road.	No significant constraints identified. The route is mapped as being underlain by 'Limestone Till', 'Shales and Sandstones Tills' and 'Bedrock at Surface'. The route is not mapped as being located within any areas of karst; however, a small localised pocket of peat is mapped as being present adjacent to the L7117 local road. As the route is largely located within the public road corridor and within previously disturbed ground, it is assessed to be of reduced sensitivity compared to Option EL1.	Option EL2
Water	The route traverses 3 no. watercourses as mapped by the Environmental Protection Agency; each of which discharge to the River Barrow & River Nore SAC c. 3km downstream.	The route traverses 5 no. watercourses as mapped by the Environmental Protection Agency; each of which discharge to the River Barrow & River Nore SAC c. 3km downstream.	Option EL1
Air & Climate	No likely significant constraints identified. The project would result in a positive overall effect.	No likely significant constraints identified. The project would result in a positive overall effect.	Option EL1 or EL2
Landscape	Landscape effects from electricity line are largely imperceptible due to nature of underground infrastructure.	Landscape effects from electricity line are largely imperceptible due to nature of underground infrastructure.	Option EL1 or EL2
Cultural Heritage	The route of the underground electricity line is located in close proximity (within 100m) to 2 no.	The route of the underground electricity line is located in close proximity (within 100m) to 4 no.	Option EL1

	cultural heritage features; however, there is no direct encroachment onto the footprint of any recorded feature.	cultural heritage features; however, there is no direct encroachment onto the footprint of any recorded feature.	
Noise & Vibration	Construction activities would take place in the immediate vicinity of dwellings along the route of the underground electricity line. However, as the route is located substantially off-road and due to the transient nature of construction activities, significant effects are not likely.	Construction activities would take place in the immediate vicinity of dwellings along route of the underground electricity line. However, due to the transient nature of construction activities, significant effects are not likely.	Option EL1 or Option EL2
Material Assets (Transport & Access; Telecommunications)	Short-term, temporary effects likely on transport and access during construction due to requirement for temporary traffic management. As the route is substantially located off-road, significant effects are not likely. No likelihood of significant effects on telecommunications.	Short-term, temporary effects likely on transport and access during construction due to requirement for temporary traffic management. As this route is predominately located within the public road corridor; increased effects, when compared to Option EL1, are likely. No likelihood of significant effects on telecommunications.	Option EL1

Table 2.2: Environmental Assessment of Alternative Electricity Line Options

Based on this appraisal, it was concluded that neither Option EL1 nor EL2 was likely to give rise to significant adverse environmental effects. While Option EL1 was considered to be preferential in environmental impact terms, it was not possible to secure the agreement of all private landowners along the route to install infrastructure within their lands and, accordingly, Option EL2 was selected. Notwithstanding that Option EL1 was assessed to be preferential, **Table 2.2** illustrates that there are no significant constraints associated with Option EL2 that are likely to result in significant adverse environmental effects.

2.3.5 Alternative Construction Material Delivery Routes

Electrical and associated equipment; such as underground electrical line and electrical apparatus to be installed at the substation; may be sourced from various suppliers through Ireland. Suppliers of such equipment will be selected, post-consent, through a competitive tendering process and, as such, it is not currently possible to confirm delivery routes. However, given the proximity of Option L2 to the national road network (M9), it is likely that deliveries will predominately utilise the national road network to access the identified location.

The construction phase of the project will require other materials; such as stone aggregates, concrete, tarmacadam, etc.; to be imported to the project site from selected suppliers. A range of potential local suppliers have, therefore, been identified and the potential haul routes to the electricity substation site entrance are illustrated at **Annex 2.4**. Potential suppliers include:-

- Kellymount Quarry (Kilkenny Limestone), Kellymount, Paulstown, County Kilkenny;
- Roadstone Bennettsbridge, Bennettsbridge, County Kilkenny;
- Bennettsbridge Limestone Quarries, Bennettsbridge, County Kilkenny;

- Kilkenny Limestone (James Walshe Quarry), Brachot, Bannagagole, County Carlow;
- Kilcarrig Quarries, Muine Bheag, County Carlow;
- Kilcarrig Quarries, Powerstown, County Carlow; and,
- Dan Morrissey & Company, Clonmelsh, County Carlow.

As with the suppliers of electrical equipment, suppliers of construction materials will also be subject to a competitive tendering process prior to the commencement of development. Therefore, it is not currently possible to determine the precise material haul routes. While it is assessed that there is no likelihood of significant adverse effects on either the road network or third party access as a result of the movement of construction related vehicles using any of the haul routes identified at **Annex 2.4;** in order to reduce any minor effects yet further, the chosen suppliers will be instructed to utilise motorway, national and regional roads, and avoid local roads, insofar as is possible and practicable. Thus, while the indicative haul routes presented at **Annex 2.4** do not necessarily represent the most direct route to the project site, they are deemed to be the most appropriate to ensure the protection of the road network in the region.

Further details related to the appropriate management of construction traffic will be set out in a Traffic Management Plan to be agreed with the Planning Authority prior to the commencement of development.

2.4 Conclusion

This chapter has provided a description of the reasonable alternatives, which are relevant to the project and its specific characteristics which have been assessed, evaluated and analysed, and an indication of the main reasons for selecting the preferred option, including a comparison of environmental effects. The 'Do Nothing' Alternative, Alternative Substation Locations, Alternative Substation Design & Layouts, Alternative Electricity Line Routes, and Alternative Haul Routes have all been discussed and analysed.

The objective of this process was to avoid any likely significant adverse effects on the environment through the selection of a location for the project which avoided inherent environmental sensitivities, in favour of a location which had fewer constraints and greater capacity to sustainably assimilate the project. Once the preferred location was identified, a series of alternative designs and layouts were evaluated through a recursive, iterative design process intended to resolve any likely significant environmental effects through an examination of localised constraints; including in the embedding of mitigation measures in the emerging preferred project design.

The final project assessed in this EIAR has therefore adopted the combination of design and layout options that strike the best balance between the avoidance of any likely significant environmental effects and achievement of the objectives of the project.