



# 110KV GRID CONNECTION FEASABILITY STUDY

**Gortloughra Wind Farm**

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## 1.0 Overview

TLI Group were engaged by Statkraft to identify and analyse potential 110kV grid connection options available for the Gortloughra Wind Farm Project which is currently being developed by the Client. This analysis was to examine the various underground cable (UGC) options available for a 110kV grid connection to the existing Carrigdangan 110kV Substation.

The purpose of this document is to identify and assess the technical feasibility of a possible grid connection option, considering the arrangements required to carry the Maximum Export Capacity (MEC) from the windfarm to the connecting node.

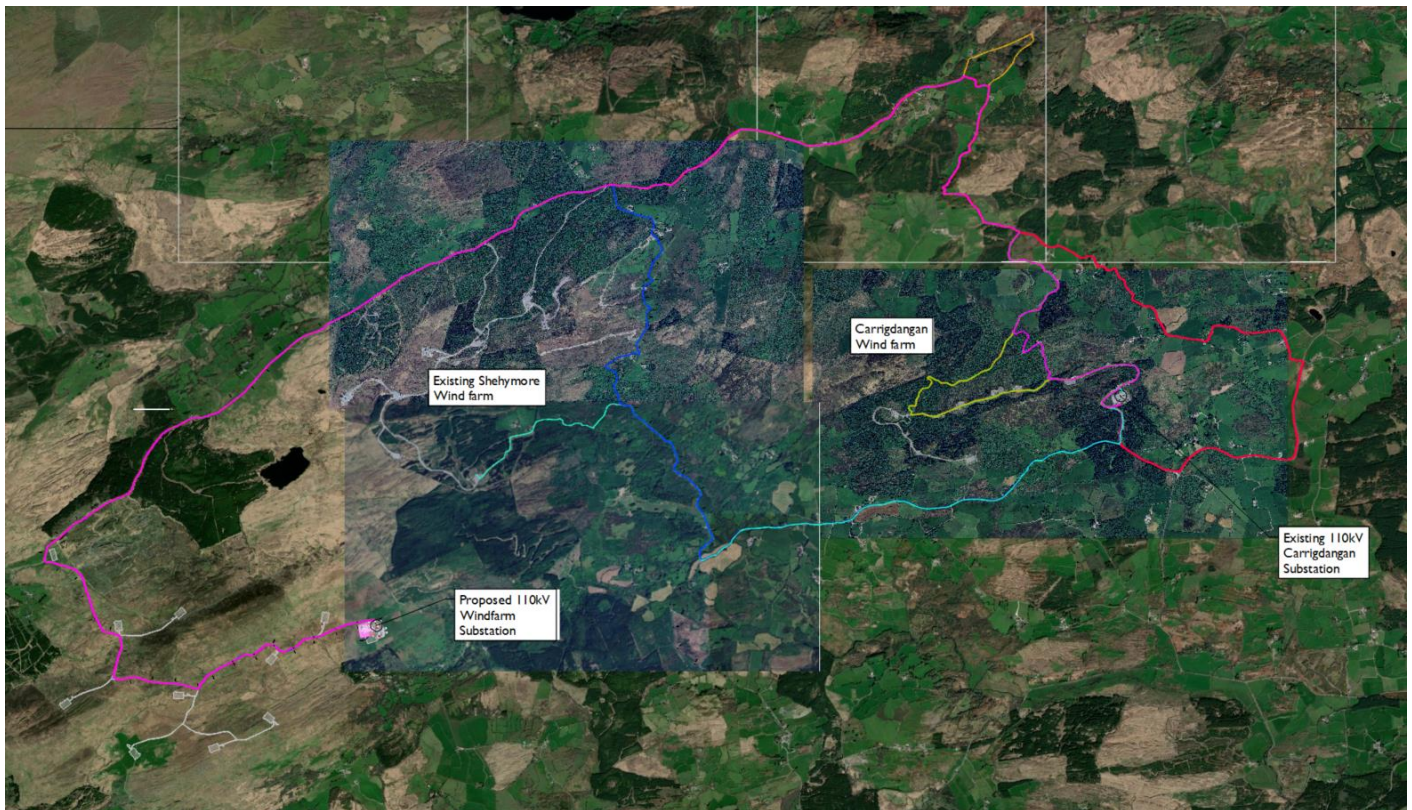


Figure 1 – Gortloughra WF Grid Connection Site Overview

## 2.0 Route Development Overview

In order to identify potential route corridors between the windfarm site and the 110kV Carrigdangan substation location, a detailed study area constraints map was created in AutoCAD. The study area map combined data from numerous sources including Tailte Eireann mapping, aerial imagery, protected areas, river networks, ESB network data, existing turbine locations, existing private wire cables routes, architectural heritage and monuments data.

A desktop analysis was carried out using the study area constraints map to identify potential underground cable routes between the windfarm site and Carrigdangan substation.

Initially the following preliminary grid connection options were identified from the desktop analysis:

### Carrigdangan 110kV Substation to Gortloughra Wind Farm Substation location

- UGC Route Option 1 (Red) – 21.5km
- UGC Route Option 2 (Blue) – 18.9km
- UGC Route Option 3 (Green) – 19.7km
- UGC Route Option 4 (Magenta) – 19.3km
- UGC Route Option 5 (Orange) – 22.3km

Surveys of the preliminary route options identified were carried out onsite in order to examine the feasibility of each route corridor and identify any additional constraints which were not visible during the desktop analysis (i.e. ground conditions, additional infrastructure, etc.) The proposed routes were analysed and altered based on the site conditions in order to select the most feasible route corridors available.



### 3.0 Grid Connection Option

The following potential 110kV grid connection route options have been identified for Gortloughra Wind farm at this stage of the Feasibility Study based on desktop analysis and initial site surveys.

The route feasibility study was completed based on the wind farm site boundary which was provided by the Client and routed options to the existing Carrigdangan 110kV substation. It has been assumed that once the routes reach the site boundary that the final section of the route to the Wind Farm substation can be identified at a later stage once the wind farm internal road network is frozen.

#### 3.1 Route Option -1 (Red)

Option 1- Carrigdangan to Gortloughra Wind farm site location – 21.8km

Route Option 1 is approximately 21.8km in length and is estimated to exit Carrigdangan substation from the entrance to the south of the station. The UGC route will carry within the public road network (**L-8535-0**) initially where the presence of a EirGrid cable connecting this Carrigdangan node to Dunmanway 110kV Substation.

Noting also the presence of existing collector cable infrastructure within the access track and road network. The UGC breaks out onto the local road **L-4607-55** and carries northwards for 1.95km. At this point the UGC continues in a westerly direction along a surveyed tertiary roadway **L-8537-0**. Two bridges were identified and surveyed to establish if cover was achievable within the deck coverage of the structures. Neither offered to required coverage whilst in addition to provided difficult crossing potential given both are situated on sweeping bends. Figures 2 and 3 can be seen below. For circa 3.2km along this tertiary road, it was noted that the roadway is very undulating in parts, a number of sharp bends and would be a difficult route from a build perspective were Construction passing bays would be needed in high frequencies.



Figure 2 - First Bridge encountered (Red route)



Figure 3 - Second bridge on sweeping bends

Continuing for an additional 0.820km, the UGC will approach another sweeping bend with a downward gradient and recently resurfaced roadway **L-8536-40**. The consultant is only highlighting this bend but doesn't view it as a difficult obstacle.





**Figure 4 - Sweeping bend along L-8536-40**



**Figure 5 - Continuation of bend swept**

The UGC route carries northwards along the **L-8536-40** for an additional 1km. On continuation for circa 0.800km would mean that the UGC would approach a very difficult hair pin turn to continue along the **L-4608-0**. Alternative to this, the consultant has assessed an option to traverse an existing arable agricultural passageway, Folio number - CK65996F (John Lucey)



**Figure 6 - Arable passageway (CK65996F)**



The UGC reemerges from this section of private track and converges onto the **L-8540-0** and heads in a westerly direction towards the wind farm site. Continuing in this section of roadway for approximately 2.15km, the UGC will encounter a third bridge across the Lagneeve riverine feature. From field survey works, there was found to be insufficient cover in this bridge deck to install cable ducting with minimum 450mm cover above the ducts. It was established the riverbed depth to the road level was circa 3m so the mobilization of a Horizontal Directional drill (HDD) could be easily executed.



**Figure 7 - Bridge structure across the Lagneeve watercourse**



**Figure 8 - Side profile of bridge taken from field work survey**

On continuation, very little obstacles were encountered along the **L-8544-33**, some arterial drains and culverts were identified with a section of 2.2km before encountering a fourth bridge crossing across the Gortnarea watercourse respectively. During field work, the option to access the side profile wasn't achieved to gather the deck dimensions to establish if cover was available. The mobilization of a HDD could be exercised here or alternatively, raising the depth of the road coverage by 250mm that may provide sufficient deck coverage. A structural bridge assessment



maybe required to assess the existing condition and adding additional loading through the structure. The vegetative state around the bridge did provide difficulty during field work activities and could prove again in assessing the structural integrity of the bridge.



**Figure 9 - Bridge across the Gortnarea watercourse**



**Figure 10 – Culvert crossing of Cornaire watercourse**



**Figure 11 - Second Culvert crossing of Cornaire  
watercourse**

Continuation in the direction of the wind farm site, the UGC will encounter culverted arterial drains beneath the **L-8544-0** and **L-8544-33** road, traversing through the townland of Garryantornora. Two additional bridges will be encountered through the townland of Cloghboola, that allows the Cloghboola stream to pass beneath. Please refer to figures 11 & 12.

The final section carries the grid up to the boundary extents of the Wind farm, existing internal and new turbine haul route will be required to carry the remainder of the Grid to the proposed Substation site.



**Figure 11 - Bridge crossing of the Garryantornora watercourse**



**Figure 12 - Bridge Crossing of the Cornaie watercourse**

**Option 1 Constraints:**

- *Second longest Grid route assessed as part of this scope*
- *Existing Carrigdangan to Dunmanway 110kV Grid cable infrastructure within access track and public road*
- *Existing Shehymore 33kV collector cable within access track*
- *Initial section of the route will encounter steep incline/ declines and sharp bends*
- *Rocky terrain on approach to Wind farm site.*
- *Landowner consent for section traversing arable agricultural passageway, Folio number - CK65996F (John Lucey)*
- *Existing ESB UGCs installed at the entrance of Carrigdangan Substation.*
- *Further bridge assessment of Nr. 4 (Gortnarea Bridge)*
- *Carrigdangan Substation is encompassed with a landowner boundary (CK184327) – Barna Wind Energy (B.W.E) Ltd. And awaiting ownership rights to be taken over by ESB Networks*
- *Resurfacing works along the L-8536-40 and L-8537-0*



### 3.2 Route Option - 2 (Blue)

#### Option 2 - Carrigdangan to Gortloughra Wind farm site location – 18.9km

Route Option 2 is approximately 18.9km in length and will exit Carrigdangan substation from the entrance to the south of the station. The UGC route will carry within the public road network initially where the presence of a 33kV collector cable infrastructure within the access track and road network where the UGC breaks out onto the local road **L-8535-12** and carries westwards for 4km. in this road network, the presence of the 33kV cabling will exist with the grid connection cable required to be laid in parallel to this circuit. Carrying northwards along this secondary road **L-8542-28**, the UGC again laid in parallel to the 33kV collector network will encounter a second bridge after circa 1.8km again crossing the Caha River. The UGC carries for an additional 2.6km until the UGC converges onto the **L-8542-59** and carries within the aforementioned **L-8544-0** and **L-8544-33**, navigating the Cloghboola streams culverts, Gortnarea and Garryantornora bridges respectively.



Figure 13 - Bridge crossing the Caha River



Figure 14 - 33kV network strapped to the side of this bridge across Caha River.





**Figure 15 – Second bridge crossing of the Caha River.**

Option 2 Constraints:

- Existing Carrigdangan to Dunmanway 110kV Grid cable infrastructure within access track
- Existing Shehymore 33kV collector cable for the majority of the Grid Connection route,
- Rocky terrain on approach to Wind farm site.
- Landowner consent for section traversing arable agricultural passageway, Folio number - CK65996F (John Lucey)
- Existing ESB UGCs installed at the entrance of Carrigdangan Substation.
- Further bridge assessments of all bridge where 33kV are strapped to parapets,
- Carrigdangan Substation is encompassed with a landowner boundary (CK184327) – Barna Wind Energy (B.W.E) Ltd and awaiting ownership rights to be taken over by ESB Networks.

### 3.3 Route Option - 3 (Green)

#### Option 3 - Carrigdangan to Gortloughra Wind farm site location – 21.2km

Route Option 3 is approximately 21.2km in length and is intended to carry the grid route initially northwards, within existing wind farm access tracks. Wrapping around the existing Carrigdangan 110kV Substation, the grid begins to climb a slight upward gradient to traverse past the Wind turbine machines in situ. Cable markers are placed along the verge of this access track in parts to identify the marked position of existing radial cables, Fig 17.



Figure 16 - Photo of the northern periphery of Carrigdangan Substation.



Figure 17 - WTG Radial cable markers



Traversing the wind farm access road for approximately 2.7km, some sections under the ownership of Coillte, the UGC will continue through forestry access track, propertiered by Folio Nr. CK182311F Commonage. The UGC carries through existing maintained plantation tracks for circa 1.5km, before emerging onto existing access tracks for the arable agricultural lands. Continuing to the public road network after an additional 1.38km of off-road access tracks, traversing land parcels propertiered by Coillte, Creeds and Coakleys respectively.

The UGC routes turns left to carry within the **L-8537-0** and follows the remainder of the aforementioned UGC Option 1 (Red) for the remaining 15.6km on approach to the proposed Gortloughra Wind farm substation.



Figure 18 – Route through Coford forestry track



Figure 19 - Access track through arable lands

#### Option 3 Constraints:

- Existing Wind farm radial cables for the initial section of the Grid Connection route,
- Rocky terrain within the wind farm sites (Carrigerierk & Gortloughra)
- Increased number of Landowner consents for sections traversing Carrigerierk Wind farm, Coillte tracks/roads arable agricultural lands on approach to the public road network
- Carrigdangan Substation is encompassed with a landowner boundary (CK184327) – Barna Wind Energy (B.W.E) ltd and awaiting ownership rights to be taken over by ESB Networks.
- Most number of landowner consents required, 13 Nr. estimates
- Resurfacing works along the L-8536-40 and L-8537-0

### 3.4 Route Option - 4 (Magenta)

#### Option 4 - Carrigdangan to Gortloughra Wind farm site location – 19.3km

Route Option 4 is approximately 19.3km in length which has a slight variation to the discussed UGC Option 3 (Green). This route is intended to carry the grid route initially northwards of Carrigdangan 110kV Substation, within existing wind farm access tracks. After traversing approximately 1.45km of this access track, the UGC route is proposed to cut across an area where new conifers have been planted, Figure 20. This area is propertiered by the Commonage area (CK189014F).



**Figure 20 - Proposed route through planted lands**

Continuing onto existing tracks, the UGC carries on a downward gradient for approximately 0.840km and reemerging onto a bell mouth area where the Grid follows the remainder of the aforementioned UGC Option 3 (Green) for the remaining 17.6km on approach to the proposed Gortloughra Wind farm substation.





**Figure 21 – Route through Coford forestry track**



**Figure 22 - Access track through arable lands**

Option 4 Constraints:

- Existing Wind farm radial cables for the initial section of the Grid Connection route,
- Rocky terrain within the wind farm sites (Carrigerierk & Gortloughra)
- Increased number of Landowner consents for sections traversing Carrigerierk Wind farm, Coillte tracks/roads arable agricultural lands on approach to the public road network
- Carrigdangan Substation is encompassed with a landowner boundary (CK184327) – Barna Wind Energy (B.W.E) Ltd and awaiting ownership rights to be taken over by ESB Networks.
- 10 Nr. Estimated landowner consents required,
- Resurfacing works along the L-8536-40 and L-8537-0

### 3.5 Route Option - 5 (Orange)

#### Option 5 - Carrigdangan to Gortloughra Wind farm site location – 22.3km

Route Option 5 is the longest route in length which has a slight variation to the discussed UGC Option 3 (Green). Traversing the wind farm access road for approximately 2.7km, some sections under the ownership of Coillte, the UGC will continue through forestry access track, propertiered by Folio Nr. CK182311F Commonage. The UGC carries through existing maintained plantation tracks for circa 1.5km, before emerging onto existing access tracks for the arable agricultural lands. Continuing to the public road network after an additional 1.38km of off-road access tracks, traversing land parcels propertiered by Coillte, Creeds and Coakleys respectively.

The UGC routes turns left to carry within the **L-8537-0** and carries along a similar route as the aforementioned UGC Option 1 (Red). The UGC route carries northwards along the **L-8536-40**. This option does consider the very difficult hair pin turn to continue along the **L-4608-0**. Figure 20.

Turning back towards the Wind farm site in a westerly direction along the **L-4608-0** for circa 1.02km, the UGC will carry along the same carriageway and encountering the culverts & bridge detailed for crossing beneath the Gortnarea & Cloghboola watercourses respectively.



Figure 23 – Difficult hair pin turn onto L-4608-0

#### Option 5 Constraints:

- Existing Wind farm radial cables for the initial section of the Grid Connection route,
- Rocky terrain within the wind farm sites (Carrigerierk & Gortloughra)
- Increased number of Landowner consents for sections traversing Carrigerierk Wind farm, Coillte tracks/roads arable agricultural lands on approach to the public road network
- Carrigdangan Substation is encompassed with a landowner boundary (CK184327) – Barna Wind Energy (B.W.E) Ltd and awaiting ownership rights to be taken over by ESB Networks.
- Very difficult hairpin converging onto L
- 11 Nr. Estimated landowner consents required,

## 4.0 Conclusions and Recommendations

At this stage of the process, the constraints encountered during site investigations for the proposed route options associated with Gortloughra Wind farm would be the undulating profile with a land composition of rock for the initial and latter sections of the grid route. Route Option 4 will require some clearing and construction of an access track through Commonage lands. Option route heading north of Carrigdangan Substation will require most landowner engagements, with varied number of landowners option 3,4 and 5 respectively.

Engagement and dialogue with EirGrid & ESB Networks will be required for all routing options on accessing the boundary of Carrigdangan substation and with Carrigarierk for traversing the wind farms access track. The existing substation is built to a “C Type” extendable arrangement with the incorporation and extension of the busbar to allow the future connection along the southern periphery of the substation.

Subject to consultation in relation to all Route Options where consultation is required with third parties, the Consultant therefore recommends that the Client could potentially explore Route Option 4 as the preferred option as there was no major constraints whilst carrying out site investigations. The proposed route carries the shortest in overall length and will result in the most cost-effective method going forward.

**At this stage of the process the Consultant recommends that the client pursues Route Option 4 as shown in Drawing- 051070-DR-100.**