Powering Up Offshore South Coast - Update Report

Powering Up Offshore South Coast

12/11/24

EirGrid

Contents

Table of Figures

List of Tables

1. Executive Summary

Ireland has a government target to install at least 5 GW capacity of offshore wind generation. The Powering Up Offshore South Coast project will seek to connect offshore wind projects to contribute to this target. This report identifies the work undertaken in Step 1 and Step 2 as part of EirGrid's six-step end-to-end process for all grid development projects, from their conception, where the need of the projects are identified to develop the electricity transmission grid, and to the projects eventual construction and subsequent energisation.

The area identified for development was defined by the South Coast Designated Maritime Plan (SC-DMAP), published by the Department of Environment, Climate and Communications (DECC) in May 2024[1] and approved by the Irish Government on the 10th October 2024. The SC-MAP identified 4 maritime areas (A-D), with Area A (Tonn Nua) planned to be developed first and which is consequently the subject of this report. The ORESS 2.1 auction will provide offshore wind developers with the opportunity to develop a total of 900 MW of offshore wind in Area A.

As per the Irish Government Policy Statement on the Framework for Phase Two Offshore Wind[2] for accelerating offshore wind deployment in Ireland, Phase 2 will be plan-led, meaning EirGrid will design, develop and construct the grid to connect to state designated sites. The grid will consist of offshore substations, subsea and terrestrial transmission cables and onshore substations.

In development of an offshore electricity transmission system, EirGrid have identified that the current capacity of the national grid would require the 900 MW of electricity generated by offshore wind in Area A to be split equally between two grid interface points, one in the Cork region and one in the Waterford/Wexford regions. With a number of offshore transmission cable landfall locations and land grid connection points previously identified by EirGrid, this report documents the work undertaken in following the EirGrid Have Your Say[3] document for Steps 1 and 2 of the six-step approach set by EirGrid. Step 1 identifies the "need" and Step 2 identifies and then qualitatively analyses the offshore transmission cable landfall and onshore grid interface point options against agreed criteria.

The Step 2 assessment is broken into two parts, Part A and Part B, each representing an iteration of the qualitative screening. In the first iteration, that of Part A, nine (9) landfall locations were identified in Cork and twenty-two (22) in the Waterford/Wexford regions. The Step 2 Part A assessment of offshore transmission cable landfalls are scored against technical and economic criteria and led to six (6) options for the Cork region being excluded, with three (3) options carried forward. For the Waterford/Wexford region, seventeen (17) options are excluded, leaving five (5) options to carry forward. At Step 2 Part B, the remaining options carried through from Part A are scored against the same criterion but in addition scores are also allocated against environmental performance, deliverability performance and socio-economic performance. The objective is to refine the list of options, using the criteria above, to identify the overall best performing landfalls options. Following completion of Step 2 Part B the list of potential offshore transmission cable landfalls has been further refined, with the remaining landfalls presented Table 1-1.

Table 1-1 : Landfall zones identified by Step 2 Part B

Cork Region		Waterford / Wexford Region	
1	Inch Beach	1	Bunmahon Beach (West of Waterford)
2	Ballycroneen	2	Carnivan Beach (East of Waterford)
3	Ballycrenane	3	The Long Gap (East of Waterford)
		4	Blackhall Beach (East of Waterford)

[1] The South Coast Designated Maritime Area Plan for Offshore Renewable Energy
[2] Policy Statement on the Framework for Phase Two Offshore Wind
[3] EirGrid Have Your Say

The assessment of the land grid interface points for the Cork and Waterford/Wexford regions has followed the same Step 2 process. Initially the longlist identified eight (8) grid interface points for the Cork region and three (3) for the Waterford/Wexford Region. The analysis significantly refined this list, with the shortlisted resulting grid connection points presented in Table 1-2.

Table 1-2 : Grid Interface Points identified by Step 2 Part B

Cork Region		Waterford / Wexford Region	
1	Option 4: – Loop-in connection between Aghada - Knockraha 1&2 circuits	1	Option 9: – At Great Island substation
		2	Option 11: – Loop-in connection between Great Island and Kellis circuit

2. Introduction

The Irish Government is taking major steps to make Ireland carbon neutral by 2050. These steps include a commitment to increase the proportion of electricity generated from renewable sources. The Climate Action Plan (CAP) 2024 [4] places offshore wind power at the centre of the state's commitment to producing up to 80% of our energy from renewable sources. This equates to installing around 5 Gigawatts (GW) of grid connected offshore wind capacity in the maritime area. Offshore wind phase 1 followed a developer-led planning approach, culminating in the ORESS 1 auction in 2023 which resulted in the procurement of over 3 GW of offshore wind. Having procured approximately 3 GW of offshore wind capacity through ORESS 1, additional offshore capacity is needed to meet the government's 5 GW target by the end of the decade which resulted in the establishment of Phase 2 Offshore Wind, herein referred to as Phase 2.

A key difference between Phase 1 and Phase 2 is that Phase 1 followed a developer led approach while Phase 2 will follow a plan led approach. This means that in Phase 2 the state, not individual developers, will determine the appropriate location of all future offshore windfarms and grid infrastructure. As part of the Powering Up Offshore South Coast project, EirGrid plans to initially develop an offshore transmission system which can transfer at least 900 MW of electricity from offshore wind farms off the south coast of Ireland to the onshore grid. The development will comply with the provisions of Irish Statute Book (ISB) Maritime Area Planning Act (MAPA) 2021 [5] and Department of Environment, Climate and Communications (DECC), Policy Statements on the Framework for Ireland's Offshore Electricity Transmission System [6].

EirGrid analysis confirms that the onshore national grid can accommodate an additional capacity of 900 MW on the grid located near the south coast of Ireland. Due to constraints on the grid, connecting 900 MW would need to be achieved at two separate grid interface points. Therefore the 900 MW of offshore wind capacity would be split into two grid interface points of 450 MW each to connect into onshore grid connection sites at two locations (Cork region and Waterford/Wexford region).

EirGrid has been designated as the Offshore Transmission System Owner and Offshore Transmission System Operator in the Maritime Area Planning Act 2021. EirGrid are responsible for the development, planning, design, consenting, construction and operations of the offshore transmission system, including the Offshore Substation (OSS), offshore and onshore transmission cables and the Onshore Compensation Compound (OCC). An offshore wind farm operator will be responsible for generating and delivering the power to the Transmission System Operator's (TSO) offshore substation. A generic offshore wind energy schematic is shown in Figure 2-1.

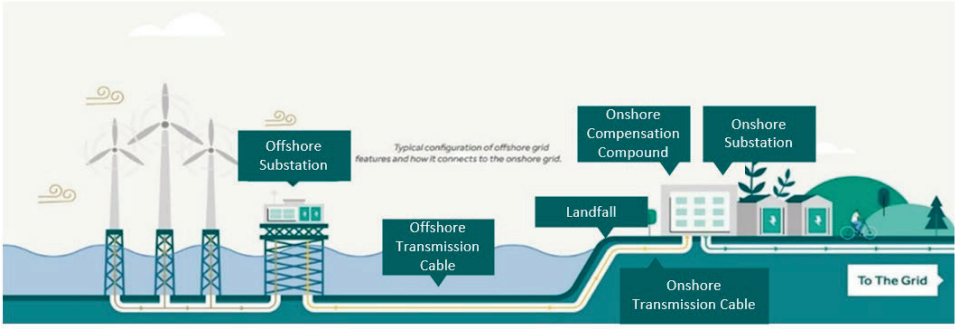

Figure 2-1 : Generic Offshore Wind Energy Schematic

An area of interest, Figure 2-2, was initially identified for study prior to the South Coast Designated Maritime Area Plan (DMAP) Proposal [7]. The Department of the Environment, Climate and Communications

[4] Climate Action Plan 2024
[5] Maritime Area Planning Act 2021
[6] Policy Statements on the Framework for Ireland's Offshore Electricity Transmission System

[7] South Coast Designated Maritime Area Plan Proposal

(DECC) Draft South Coast Designated Maritime Area Plan for Offshore Renewable Energy (SC-DMAP) was published on 3rd May 2024 which was approved by the Irish Government on 10th October 2024.

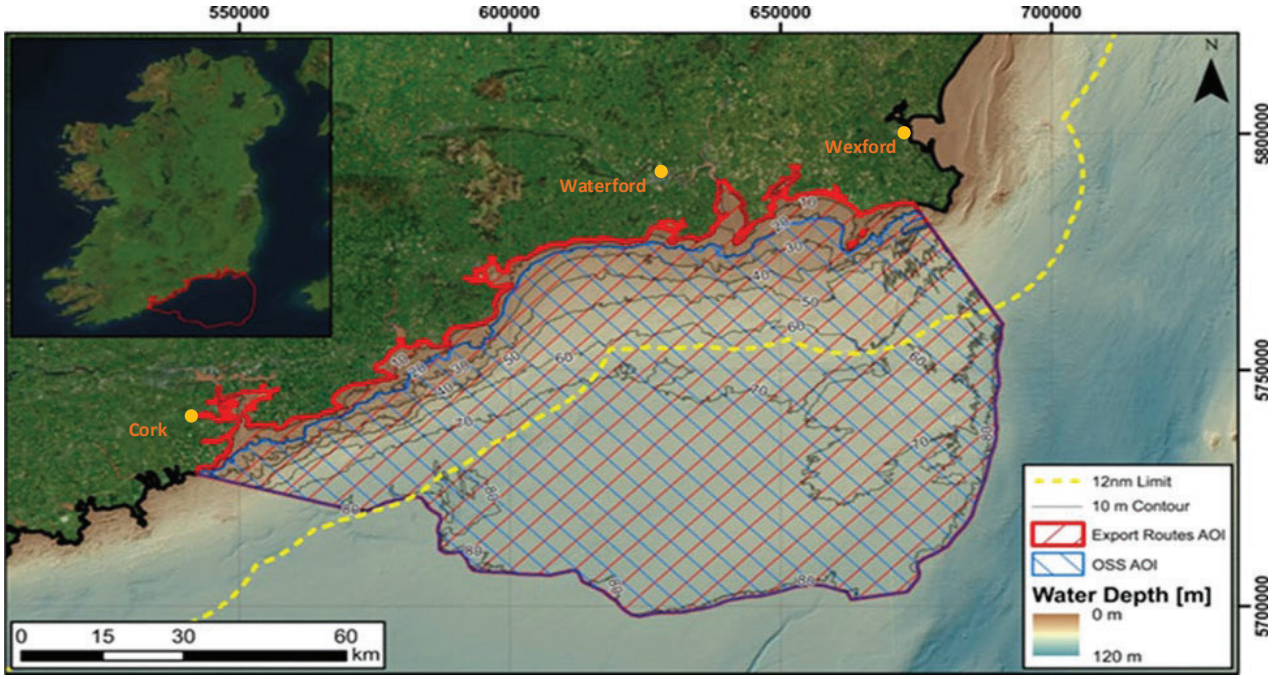

Figure 2-2 : Initial Area of Interest (AOI)

The SC-DMAP (Figure 2-3), approved by the Irish Government identifies four (4) areas for potential future deployments of both grid connected and non-grid connected Offshore Renewable Energy (ORE). Area A will be developed initially, while Areas B, C, and D will be developed subsequently subject to the required project level assessments and consents.

Area A is situated off the coast of County Waterford and encompasses a total marine area of 306 km^2 (Figure 2-3). The distance of Area A's North and West boundaries to shore varies from 12.2 km along the western boundary to 12.4 km along the northern boundary. Area A has a mean water depth of 57 m, with a minimum water depth of 48 m and a maximum water depth of 69 m. Area A is the first area of interest for the future development of the Offshore Renewable Electricity Support Scheme (ORESS) 2.1[8].

The maritime area "Tonn Nua" has considered options with both one (1) or two (2) OSS platforms along the south coast of Ireland to transfer electricity to the Cork and Waterford/Wexford regions, with the current assumption being that the offshore electricity transmission system developed under Phase 2 will include two (2) OSS platforms.

[8] Offshore Renewable Electricity Support Scheme (ORESS)

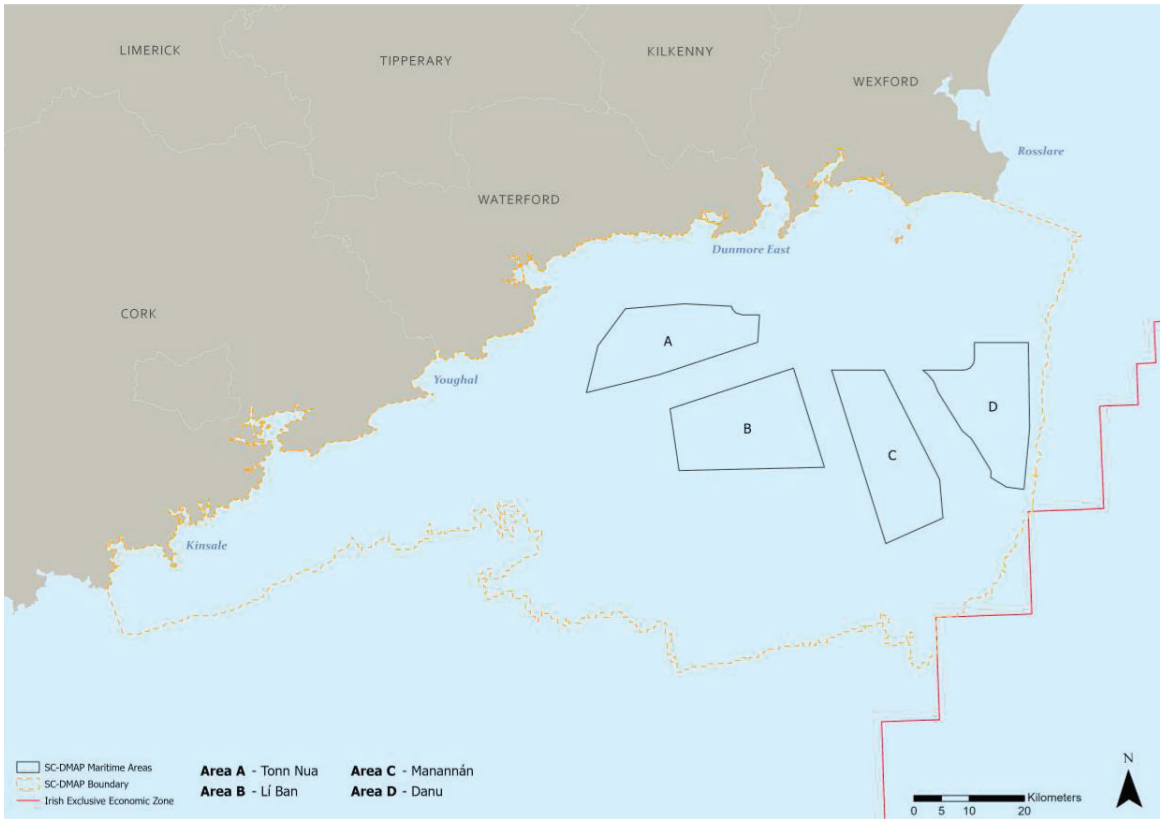

Figure 2-3 : South Coast Designated Maritime Plan (SC-DMAP)

2.1. Purpose of the Document

The purpose of this report is to summarise the work performed to date whilst also reflecting on the 10th of October 2024 approval of the SC-DMAP for Offshore Renewable Energy. This report considers options with respect to the following two features of the offshore electricity transmission system.

- Landfall Locations, and
- Grid Interface Points.

The report follows Steps 1 and 2 of EirGrid's six-step approach as defined in the EirGrid Have Sour Say document, see Section 4. The objective of following this process was to eliminate options through performing qualitative assessment thereby reducing the number of options which would be carried through to, the subsequent, Step 3 for analysis.

This report identifies the 'need' in Step 1 and consolidates Step 2 findings for landfall zones and grid interface points and will provide the input into the Step 3 scope.

2.2. Acronyms

Acronyms	Definition
AIL	Abnormal Indivisible Loads
AOI	Area of Interest
BSA	Biological Sensitive Area
BSF	Below Sea Floor

Acronyms	Definition
CAP	Climate Action Plan
CRU	The Commission for Regulation of Utilities
CAPEX	Capital Expenditure
DECC	Department of the Environment, Climate and Communications
DMAP	Designated Maritime Area Plan
FEED	Front End Engineering Design
ESBN	Electricity Supply Board Networks
FLA	Foreshore Licence Application
GIP	Grid Interface Point
GW	Gigawatts
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
HV	High Voltage
km	Kilometre
MAC	Maritime Area Consent
MARA	Maritime Area Regulatory Authority
MW	Megawatts
m	Metres
MUL	Maritime Usage Licence
OCC	Onshore Compensation Compound
OPEX	Operating Expenditure
ORESS	Offshore Renewable Electricity Supply Scheme
OSS	Offshore Substation
OWF	Offshore Windfarm
QI	Qualifying Interest
SC-DMAP	South Coast Designated Maritime Area Plan
SAC	Special Area of Conservation
TJB	Transition Joint Bay
T&I	Transport And Installation
TSO	Transmission System Operator

3. Project Summary

The Powering Up Offshore South Coast project will aim to deliver 900 Megawatts (MW) from offshore wind in the Celtic Sea off the south coast of Ireland. The development of the offshore electricity transmission system to deliver 900 MW includes:

- Offshore Substations,
- Submarine power cabling and terrestrial cabling systems,
- Transition Joint Bays,
- Landfall areas,
- Onshore Substations,
- High Voltage (HV) Compensation compound and its infrastructure,
- Connection to the grid,
- Communication interfaces and control system, and
- Other infrastructures to facilitate the requirements.

This new offshore electricity transmission system will bring electricity generated by offshore wind to the national electricity grid in Ireland. The offshore electricity transmission system will ultimately be owned and operated by EirGrid, as the TSO. Due to the onshore grid capacity constraints, it has been determined that one 450 MW connection will be connected in the Cork area and the other 450 MW connection will be connected in the Waterford/Wexford area.

For the development of the Powering Up Offshore South Coast project, EirGrid will manage all aspects including the design, planning, consenting, financing, engineering, procurement, construction, commissioning and operations and maintenance of this offshore electricity transmission system. The windfarm assets will be developed by third party Offshore Windfarm (OWF) developers. The successful developers will be determined through the ORESS 2.1 auction, which is expected to take place in early 2025.

Two Foreshore License Applications (FLA) were submitted to the Department of Housing, Local Government and Heritage in May 2023. The basis of these applications was the assumed Area of Interest (Figure 2-2) which was superseded by the SC-DMAP (Figure 2-3) and the establishment of Maritime Area Regulatory Authority (MARA). EirGrid consequently withdrew the FLAs in February 2024 following definition of the SC-DMAP and the updated MARA licensing system. This allows a new application for a Maritime Usage License (MUL) application to be submitted in accordance with the provisions of the SC-DMAP.

Further studies, new surveys and concept designs will be commenced since the approval by the Irish Government of the SC-DMAP and specifically to the Tonn Nua maritime area.

3.1. Technical Decisions

The development of the Powering Up Offshore South Coast project requires a number of technical decisions to be made with respect to the architecture of the offshore electricity transmission system. These have been identified through ongoing design development work and market engagement undertaken by the project. Key technical design decisions that will be subject to further assessment are identified below in Table 3-1, since they formed the basis of the work undertaken during Step 1 and Step 2 phases and documented in this report.

Table 3-1 : Key technical Decisions

No.	Technical Decisions	Current Assumptions
1	The number of offshore transmission cables	Minimum of 2 offshore transmission cables (minimum of 1 per OSS), with a cable corridor routed to a landfall in the Cork area and a cable corridor routed to a landfall in the Waterford/Wexford area, to be confirmed following concept design.
2	The number of transformers on the offshore substation	2 transformers per OSS
3	The number of offshore substations	2 x OSS
4	The capacity of the OSS	2 x 450 MW OSS
5	Grid Interface Points	Shortlisted options presented in Section 8.6 of this report
6	Landfall locations	Shortlisted options presented in Section 7.5 of this report
7	High Voltage Alternating Current (HVAC) or High Voltage Alternating Current (HVDC) transmission	HVAC

In the present Step 2 of the project, different options are being evaluated and compared, to enable selection of the offshore transmission system concept that best meets the project objectives and evaluation criteria. The output of these evaluations will form the basis for the Front-End Engineering Design (FEED) phase to be undertaken. The objective of FEED will be to optimise and de-risk the selected concept facilitating ease of constructability, installation and operations and maintenance. The FEED phase will ensure that the whole-life cycle of all assets that comprise the offshore electricity transmission system is considered in the design decision making.

3.2. Feedback from the Industry

Ongoing market consultation will provide an enhanced understanding of the supply chain constraints and any potential opportunities, with EirGrid engaging with critical suppliers and attending conferences and seminars in the coming months. The main objectives of the market consultation are to;

- understand market capacity for the south coast,
- identify technical limits such as size, weight, equipment availability imposed by supply chain,
- increase attractiveness of Ireland Offshore Wind within the market,
- gain feed-back on options for Framework Agreements,
- collect market information, and
- inform the overarching procurement strategy.

Where supply chain engagement has identified that there are physical limits with respect to items such as size, weight and availability these limits have been accounted for in the qualitative assessment of options in S2.

The attractiveness of the Irish offshore wind market for the supply chain will be enhanced through the defined pipeline of projects.

4. Six-Step Approach

To deliver on the objective of this report, to assess and refine the list of landfalls and the grid interface points, Steps 1 and 2 of EirGrid's six-step approach have been followed to refine options for the best performing solution for the offshore electricity transmission system. A high-level summary of the six steps is presented in Figure 4-1. Each step has a distinct purpose with defined deliverables. The process is documented in full in EirGrid Have Your Say.

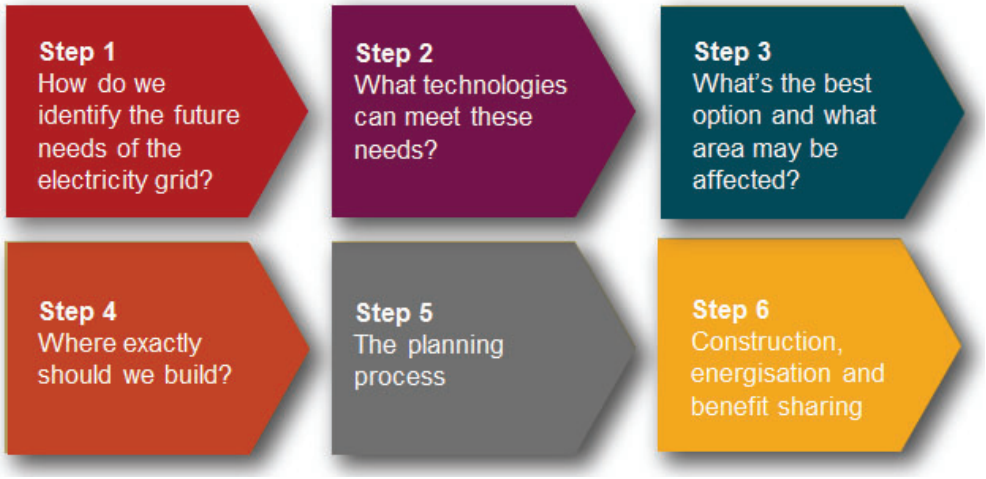

Figure 4-1 : High Level Project Development Process

This deliverable summarises the work undertaken to support Steps 1 and 2. The requirements for Steps 1 and 2 are described in further detail in Sections 4.1 and 4.2 respectively.

4.1. Step 1 – Identifying and Verifying Need

The objective of Step 1 is to identify the future needs of the electricity grid based on EirGrid's future energy scenarios and the current electricity grid capability. Individual 'needs' will then be verified to confirm the need for grid development and to outline the area and/or system nodes where that need occurs.

Where a 'need' is identified and verified during Step 1, candidate solutions will be presented, and their scale quantified. It is not, however, the intent during Step 1 to perform detailed analysis of specific solutions.

To align with Ireland's climate and energy targets the 'Need' is to develop an offshore electricity transmission system. EirGrid has conducted studies to assess possible connection methods for these offshore generation projects on the south coast of Ireland and the exact connection methods are subject to further optioneering. These studies have identified available onshore capacity for the integration of offshore renewable energy of 900 MW into the grid divided over two connection points. Additional offshore wind capacity is planned beyond this within the other areas of interest covered by the SC-DMAP.

4.2. Step 2 – Technology Options (Long List to Short List)

The objective of Step 2 is to identify a short list of technology solutions that will meet the identified need for grid development to the optimum extent.

Step 2 comprises a two-part approach, Part A and Part B, described in Sections 4.2.1 and 4.2.2. Part A is a first iteration which refines the long list. Part B will involve a second refinement of the options list.

The long list of technology options is identified for consideration. The long list is reduced to a refined list based on screening and refining which uses technical judgement and an analysis of costs and benefits. The

refined list is reduced to a short list of options based on technical judgement, a more detailed analysis of costs and benefits, and a high-level review of environmental, social and deliverability implications. A performance matrix is the tool used to assist this analysis.

This document summarises the Step 2 work performed to identify a short list of technology solutions to meet the identified need. The short list of options identified in Step 2 will then be taken into Step 3.

Multi criteria analysis was undertaken initially, to identify all the viable and technically acceptable options resulting in the 'the long list', referred to in Step 2 Part A. This list was refined with the aim to establish a shorter list of best performing solution options, referred to as Step 2 Part B, to bring forward for further investigation in Step 3.

4.2.1. Step 2 - Part A

The initial development of viable and technically acceptable options starts with the technology overview. This involves consideration of technical aspects which will form the basis of developing the solution options, such as technologies and potential connection points of the solutions. The reasoning and justification for any choices and decisions are outlined. The findings of the technology overview are then used to create a long list of viable and technically acceptable solution options.

The second task involves high level technical screening studies of the identified options to determine if they have a potential to solve the identified need. The options will also be assessed on their technical ability, relative to each other, to solve the identified problem.

The third task involves a multi-criteria comparison of the solution options in the long list using two criteria, technical performance and economic performance. This task may involve refining the list of options.

4.2.2. Step 2 - Part B

In Part B the option list is further refined, this time using a multi-criteria comparison against five criteria. The five criteria are technical performance, economic performance, environmental, deliverability and socio-economic aspects. Each remaining option is assessed against the five criteria. The outcome of Step 2 is a shorter list of solution options which will be taken to Step 3.

5. Assessment Process and Criteria

5.1. Criteria Used for Comparison of Options

Multi-criteria comparison is carried out twice in Step 2. Part A uses a performance matrix which compares only two criteria, technical performance and economic performance. In Part B the performance matrix compares five criteria, technical performance, economic performance, environmental performance, deliverability and socio-economic, a description of the objectives of these criteria is provided in the following sub-sections. The specific criteria for the landfalls and Grid Interface Points (GIP) are presented in Sections 7 and 8 respectively.

5.2. Performance criteria

5.2.1. Technical Performance

Technical performance is based on high level technical screening studies. Specific technical criteria are used to assess the landfalls and Grid Interface Points as presented in Section 7.2 and 8.4 respectively.

5.2.2. Economic Performance

Economic performance was evaluated based on comparative Capital Expenditure (CAPEX) and Operational Expenditure (OPEX) estimates. The assessment was based on desktop designs and costs for similar projects. The criteria used to assess the landfalls and Grid Interface Points are presented in Sections 7.2 and 8.4 respectively.

5.2.3. Environmental Performance

Environmental criteria have been applied in Step 2 Part B. These criteria have been applied to address the potential positive and negative aspects of temporary works (transportation, installation, construction) and permanent works (operation of the as-built project) for the options under consideration. Evaluations were based on information available at the time of this assessment, and so prior to the planned offshore and onshore surveys. As such these impacts should be re-assessed upon availability of collected survey data.

The Step 2 Part B environmental assessment was conducted with respect to identified Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). SACs are designated under the EU Habitats Directive 92/43/EEC10F and are intended to protect and manage identified Qualifying Interests (QI) with respect to natural habitats, and fauna. SPAs are designated under the EU Birds Directive 2009/147/EC11F and are intended to manage and protect bird species identified as QIs.

Candidate SACs (cSACs) and Candidate SPAs (cSPAs) also form part of the network and were considered as if fully designated for the purposes of assessment.

The environmental sub-criteria for the landfalls and Grid Interface Points are presented in Sections 7.2 and 8.4 respectively.

5.2.4. Deliverability

The analysis of deliverability considers technical risks which could extend delivery timescales and costs. A high-level assessment of the impacts of any planned onshore transmission equipment outages required has not been performed. The deliverability assessment sub-criteria for the Landfall and GIP are presented in Sections 7.2 and 8.4 respectively.

5.2.5. Socio-Economic Performance

A high-level desk-top study of potential socio-economic impacts has been undertaken against socio-economic criteria. Each element of project infrastructure was assessed with respect to the following Socio-Economic factors:

- Fisheries: Consideration for fisheries during the conception and design of offshore projects is essential. The Celtic Sea supports important nursery and spawning grounds and as such the area was established as a 'Biologically Sensitive Area (BSA)' in 2003,
- Aquaculture: Aquacultural activity in the area of interest is characterised by mussel, oyster, and clam production. These contribute to a sales value of over €65m (2022) across south coast aquacultural sites and therefore must be considered in any offshore development,
- Recreation and Tourism: There are many recreational activities and tourist attractions along the south coast requiring consideration including, for example, the Copper Coast UNESCO Global Geopark, blue flag beaches, recreational fishing, and sailing,
- Marine Traffic: The south coast experiences significant marine traffic activity with hotspots at Cork Harbour, Youghal and Waterford Harbour,
- Archaeology: Archaeological elements such as shipwrecks (offshore) and National Monuments (onshore) may pose restrictions/challenges if they are not considered at an early stage in project development,
- Settlement and Community: There are many local communities along the south coast making it a critical factor for consideration. Key elements to assess include employment, education, income, and housing, and
- Landscape and Visual: Landscape aesthetics can be impacted during multiple stages of a development's life span. Considering, at the outset, the potential scale and duration of these impacts is critical.

The environmental sub-criteria for the Landfall and GIP are presented in Sections 7.2 and 8.4 respectively.

5.3. Scale Used to Assess Each Criterion

The risk of each criterion parameter is presented along a range from "more significant"/" more difficult"/ "more risk" to "less significant"/" less difficult"/ "less risk". Table 5-1 provides the scale used to illustrate each criterion parameter.

Table 5-1 : Risk Scale

In the report this scale is quantified by text for example low (cream), low-moderate (green), mid-level (dark green), high-moderate (blue) or high (dark blue). Further information on how each of the sub-criteria is scored, in accordance with the risk scale, for the landfalls and the Grid Interface Points is provided in Appendices 1 and 2 respectively.

6. OSS Locations

OSS locations have not been considered in this report. Selection of sites for the OSSs is currently on hold until the extents and location of Area A, Tonn Nua, has been approved by the Irish Government. The OSSs are intended to be located within the Tonn Nua area. Future studies, offshore geotechnical and environmental surveys and engineering will also determine the OSS locations. Studies to identify the OSS locations within Area A are ongoing and will be a focus area of Step 4.

7. Landfall Locations

7.1. Overview

At the outset of the Step 2 assessment of landfall locations, the long list of offshore transmission cable landfall locations was determined based on a desk top study using publicly available data. Landfall locations were identified considering the following factors:

- Geological factors,
- Sea defences,
- Offshore logistics,
- Constructability,
- Onshore access,
- Existing infrastructure, and
- Distance to the preferred substation (assumed location).

Rivers, and inlets were considered. However, due to potential technical concerns of water depth and vessel manoeuvrability in restricted waters at this time no landfall locations in rivers and inlets were considered.

It was observed that rock outcrops dominate the area close to and up to 15 km from shore. Hence, cable routing in the vicinity of the landfall was considered to mitigate against cable installation issues such as the requirement for rock trenching and rock placement.

7.2. Performance Criteria

The performance criteria and their sub-criteria used for the evaluation of the landfall options are presented in Table 7-1, with further information on how they are scored provided in Appendix 1. The columns on the right-hand side of the table indicate which criteria will be applied to Step 2 Part A and Step 2 Part B.

Table 7-1: Landfall Performance Criteria

Performance Criteria	Sub-criteria	Part A	Part B
Technical	• Installation Methodology (Open Cut / HDD / Thrust Bore) • Beach Composition (Rock / Boulders / Gravel Sand) • Near shore seabed geotechnics (Rock / Boulders / Gravel Sand)	Yes	Yes
Economic	• Installation Costs Only - Non-standard Installation requiring additional vessels / equipment - Standard Installation with some specific equipment - Standard Installation • Distance from; - Great Island Power Station (Waterford / Wexford connection) where the transmission station may be located. - Aghada Power Station (Cork connection) where the transmission station may be located.	Yes	Yes

Performance Criteria	Sub-criteria	Part A	Part B
Deliverability	• Land access arrangements • Installation Methodology (Open Cut / HDD / Thrust Bore)	No	Yes
Environmental	• Proximity to European sites	No	Yes
Socio-Economic	• Tourism and Recreation • Marine Traffic • Archaeology (wrecks) • Aquaculture and Fishing • Settlement and Community • Landscape and Visual	No	Yes

7.3. Long List and Comparison of Options (Step 2 Part A)

An assessment was undertaken to identify anthropogenic hazards which may impact on cable corridor locations, such as existing infrastructure and sea defences. In the southern Celtic Sea, various infrastructure, existing and planned, were identified such as the Kinsale gas pipeline, existing telecoms cable, Celtic HVDC Interconnector and the GreenLink HVDC Interconnector.

Cable landing locations and routes were assessed to determine the potential effects to anthropogenic activities including tourism, fishing and shipping. Effects due to dropping of anchors on the cable from cargo vessels, snagging of cables during fishing activities, onshore site access or temporary closure of recreational facilities due to cable landing activities were assessed.

The long list of landfall options was established using a desktop study as well as a site visit to each location.

Table 7-2 lists the thirty-one landfall locations which were identified, during Step 2 Part A, at or within the proximity of Cork and Waterford/Wexford areas.

Location of the identified landfalls are shown for Cork area in Figure 7-1 and Figure 7-2.

Location of the identified landfalls are shown for Waterford / Wexford area in Figure 7-3.

Figure 7-1 : Landfall location options identified with green markers within the vicinity of Cork, long list, potential GIPs identified by red markers

Figure 7-2 : Landfall location options identified with green markers within the vicinity of Cork, long list.

Figure 7-3 : Landfall location options identified with green markers, within the vicinity of Waterford / Wexford, long list, potential GIPs identified by red markers

Table 7-2 : Long List of Landfall Locations

Long List			
Cork		**Waterford/Wexford**	
1	Rocky Bay	10	Clonea Beach
2	Corkbeg Beach	11	Kilfarrasy
3	White Bay Beach	12	Carnivan Beach
4	Inch Beach	13	The Long Gap
5	Ballycroneen Beach	14	Cullenstown Beach
6	Ballycrenane Beach	15	Blackhall Beach
7	Knockadoon Head	16	Bannow Bay Beach
8	Redbarn Beach	17	Bannow Island Beach
9	Claycastle Beach	18	Grange Beach Fethard
		19	Sandeel Beach
		20	Slade Harbour
		21	Dunmore East
		22	Rathmoylan Cove
		23	Tramore Beach
		24	Garrarus Beach
		25	Annestown Beach
		26	Bunmahon Beach
		27	Killelton Bay Beach
		28	Ballyvooney Cove
		29	Ballydowane Bay
		30	Stradbally Cove
		31	Fethard Beach

7.3.1. Long List Assessment and Conclusions

Table 7-3 provides a summary of the combined performance of each option against the two evaluation criteria (Technical Performance and Economic Performance). Calculation of the combined performance uses an equal weighting of technical and economic performance. Based on the assessment shortlisted landfall locations are highlighted in pink. Further details on scoring of the sub-criteria are provided in Appendix 1.

Table 7-3 : Long List Combined Performance

Options		Technical Performance	Economic Performance	Combined Performance
Cork				
1	Rocky Bay			
2	Corkbeg Beach			
3	White Bay Beach			
4	Inch Beach			
5	Ballycroneen Beach			
6	Ballycrenane Beach			
7	Knockadoon Head			
8	Redbarn Beach			
9	Claycastle Beach			
Waterford/Wexford				
10	Clonea Beach			
11	Kilfarrasy			
12	Carnivan Beach			
13	The Long Gap			
14	Cullenstown Beach			
15	Blackhall Beach			
16	Bannow Bay Beach			
17	Bannow Island Beach			
18	Grange Beach Fethard			
19	Sandeel Beach			
20	Slade Harbour			
21	Dunmore East			
22	Rathmoylan Cove			
23	Tramore Beach			
24	Garrarus Beach			
25	Annestown Beach			
26	Bunmahon Beach			
27	Killelton Bay Beach			
28	Ballyvooney Cove			
29	Ballydowane Bay			
30	Stradbally Cove			
31	Fethard Beach			

Note: Pink identifies emerging best performing options in the long list

7.4. Comparison of Solution Options (Step 2 Part B)

Table 7-4 provides a summary of the combined performance of each option against the five evaluation criteria of Step 2 Part B, outlined in Section 5. Based on the assessment shortlisted landfall locations are highlighted in pink. Further details on scoring of the sub-criteria are provided in Appendix 1.

Table 7-4 : Short List Combined Performance

Options		Technical Performance	Economic Performance	Deliverability Performance	Environmental Performance	Socio-Economic Performance	Combined Performance
Cork							
4	Inch Beach						
5	Ballycroneen Beach						
6	Ballycrenane Beach						
Waterford/Wexford							
12	Carnivan Beach						
13	The Long Gap						
15	Blackhall Beach						
25	Annestown Beach						
26	Bunmahon Beach						

7.5. Landfall Locations Shortlisted Options

Based on the analysis summarised in Table 7-4, the following landfall options for Cork are taken forward to Step 3.

- Inch Beach,
- Ballycroneen Beach, and
- Ballycrenane Beach.

For Waterford the highest risk option, Annestown Beach is removed from the list to be taken forward to Step 3. Therefore, the landfalls taken forward to Step 3 for further analysis are:

West of the Waterford/Suir Estuary

- Bunmahon Beach.

East of the Waterford/Suir Estuary

- Carnivan Beach,
- The Long Gap, and
- Blackhall Beach.

The landfalls taken in to Step 3 are largely independent of the first maritime area in the SC-DMAP, given the requirement to connect into two individual GIPs.

8. Grid Interface Points

8.1. Overview

According to EirGrid's Policy 18 Statement [9] "Options for Connecting Customers to the Transmission Network", there are four possible methods to establish a connection with the transmission system operator (TSO). This policy is not applicable to this project's GIP, as the customer connects to the transmission system offshore.

The onshore connection is between EirGrid and Electricity Supply Board Networks (ESBN), not ESBN and a Customer which is the subject of Policy 18.

The offshore transmission cable connects to new future EirGrid owned Onshore Compensation Compound (OCC). This OCC contains a combination of static and dynamic compensation devices for harmonic performance, reactive power capability and fault ride through capability to be able to regulate and control the transmission system voltages at the GIP from the offshore wind farm. The optional connection methods are presented in 8.2.

8.2. Connection Methods

8.2.1. Tail feed to Meshed Transmission System

If the connection method is a tail from an OCC to a meshed ESBN transmission station, then the preferred connection method is the ESBN owned cable will connect to the EirGrid owned switchgear (as shown in Figure 8-1).

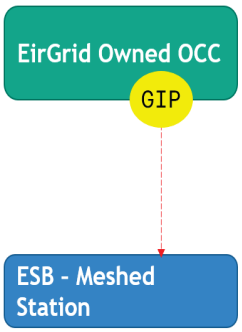

Figure 8-1 : Tail feed to meshed transmission system

8.2.2. Loop Into an Overhead Line (OHL)

If the connection method is a loop into an existing overhead line, then the preferred connection method is that the cable from the OCC terminates into a new substation build to ESBN standards to accommodate the looped connection (as shown in Figure 8-2).

[9] EirGrid, Policy Statement on Options for Connecting Customers to the Transmission Network

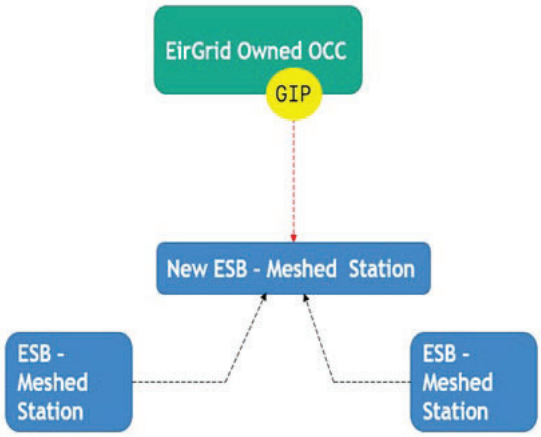

Figure 8-2 : New substation tail fed from a new transmission substation, which is looping into an existing transmission circuit

The justification for this is that the OCC substation is constructed to different standard than a transmission station. The OCC has a single busbar, and each OCC is bespoke designed for each offshore connection.

8.2.3. EirGrid Requirement for a New ESB Meshed Station

In certain circumstances EirGrid will require a new meshed station in the location of a tail feeding station, this could be due to load growth in the area. That station will be subject to a contribution from EirGrid.

8.3. Long List and Comparison of Options

Eleven (11) options for grid interface points were identified by EirGrid internal analysis. To assess the eleven (11) connection options, an analysis was performed which considered load flow, future developments, TSO connection costs and complexity as criteria in an EirGrid internal analysis. An extract of this analysis is shown in Figure 8-1 which consists of eight options in Cork region and three options in Waterford/Wexford region.

Table 8-1 : Options analysed by EirGrid internal analysis

Options	Technical Performance			Economic Performance	Overall Performance
	Load-flow	Future Developments	Complexity	TSO Connection Costs	
In Cork Region					
Option 1: Tail into Knockraha 220 kV station					
Option 2: Tail into Aghada 220 kV station					
Option 3: Tail into Raffeen 220 kV station					
Option 4: New station looped into Aghada - Knockraha 1&2 220 kV					
Option 5: New station looped into Cullenagh – Knockraha 220 kV and/or Knockraha – Raffeen 220 kV circuits					
Option 6: New station looped into Clashavoon – Knockraha 220 kV and/or Killonan – Knockraha 220 kV circuits					
Option 7: New station looped into Aghada – Knockraha 220 kV 1&2 and/or Knockraha – Raffeen 220 kV circuits					
Option 8: New station looped into Aghada – Knockraha 220 kV 1&2, and/or (Celtic) Ballyadam 400 kV circuit					
In Waterford/Wexford Region					
Option 9: Tail into Great Island 220 kV station					
Option 10: Tail into Cullenagh 220 kV station					
Option 11: New station loop into Great Island – Kellis 220 kV circuit					

The eleven (11) options presented in the EirGrid analysis of the south coast region were further analysed during the Step 2 assessment

The options analysis criteria, introduced in Section 5, are further explained in detail in the following sub-sections. The analysis includes the load-flow, future developments, complexity, and TSO costs shown in Table 8-1 and the availability of space to make the connection.

In all options analysed, a new 220 kV onshore compensation compound would be required. As described in the earlier sections of this report, the OCC will accommodate the incoming feeder(s) from the landfall point and hold equipment related to the connection of the OSS (e.g. control and protection equipment), associated switchgear, LV interface, reactive compensation devices, harmonic filter(s), earthing/auxiliary transformer, and transformer for reactive compensation device (as required).

For loop in connections, the new substation would ideally be located closer to the overhead lines or the circuits, to minimise CAPEX. In the majority of loop in options considered above, a two-circuit loop in connection is preferred, and this is mainly to minimise constraint of wind farm export power when considering a single circuit (N-1) outage.

8.4. Performance Criteria

The performance criteria and their sub-criteria used for the evaluation of the GIP options are presented in Table 8-2, with further information on how they are scored provided in Appendix 2. The columns on the right-hand side of the table indicate which criteria will be applied to Step 2 Part A and Step 2 Part B.

Table 8-2 : Performance Criteria

Performance Criteria	Sub criteria	Part A	Part B

Technical	• Load Flow (Note 1)
	• Direct connection
	  - Switchgear bay availability
	  - Gas Insulated Switchgear (GIS) / Air Insulated Switchgear (AIS) space availability
	• Loop-in connection
	  - Loss of power due to network circuit outage
	  - Capacity available in relevant circuit
	• Network constraints
	• Electrical Connection Complexity
	• Technical Performance
		Yes	Yes

Economic	• Comparative CAPEX estimates for establishing a connection (Note 2)	Yes	Yes

Performance Criteria	Sub criteria	Part A	Part B

Deliverability	• New substation;
	  - Land availability
	  - Access availability
	• Direct connection;
	  - Bays available + possibility to add new AIS/GIS
	  - Access to the existing substation
	  - Space within and land availability around substation
	  - Cable access to existing substation
	• Loop in
	  - Need for upgrading circuits
	• Direct connection and loop in
	  - Planned outages
	  - Network constraints
	  - Complexity of connection including interface with 3rd parties
		No	Yes

Environmental	• Proximity to European sites	No	Yes
Socio-Economic	• Tourism • Archaeology • Settlement and Community • Landscape and Visual	No	Yes

Note 1 - The results from the EirGrid load flow analysis were used to analyse the eleven (11) solution options.

Note 2 - Economic performance was based on comparative CAPEX estimates for establishing a connection, detailed costing was not performed. The following assumptions were made to compare CAPEX.

- a direct substation connection is lower CAPEX than a single-circuit loop in
- a single circuit loop in is lower CAPEX than a double-circuit loop in

8.5. Long List Assessment and Conclusions (Step 2 Part A)

During the Step 2 Part A assessment the solution options were assessed based on two criteria: technical performance and economic performance. The aim of this assessment is to compare the options and eliminate options that are not technically feasible. The following sections of this report describe the outcome.

Table 8-3 provides a summary of the combined performance of each option against the two evaluation criteria (Technical Performance and Economic Performance). Full details of the sub-criteria used for this assessment can be found in Appendix 2. Based on the analysis, it was determined that only one option, Option 10, was technically unfeasible, and the remaining ten were technically feasible. Below is a refined list of solution options to be evaluated in Step 2 Part B, Section 8.6:

- Option 1: Connection at Knockraha Substation (Method 2),
- Option 2: Connection at Aghada Substation (Method 2),
- Option 3: Connection at Raffeen Substation (Method 2),
- Option 4: Aghada – Knockraha 220 kV 1&2 circuits (Method 1),

- Option 5: Cullenagh - Knockraha 220 kV & Knockraha - Raffeen 220 kV Circuits (Method 1),
- Option 6: Clashavoon - Knockraha 220 kV and Killonan - Knockraha 220 kV Circuits (Method 1),
- Option 7: Aghada - Knockraha 220 kV 1 & 2, and Knockraha – Raffeen 220 kV Circuits (Method 1),
- Option 8: Aghada - Knockraha 220 kV 1&2 circuits and Celtic (Ballyadam - Knockraha) 400 kV circuit (Method 1),
- Option 9: Connection at Great Island 220 kV Substation (Method 2), and
- Option 11: Great Island – Kellis 220 kV looped in, within 5 km of Great Island (Method 1).

Table 8-3 : Combined Overall Performance (Long List)

Connection Method Option (CMO)	Technical Performance	Economic Performance	Combined Performance
In Cork Region			
Option 1: Tail into Knockraha 220 kV station			
Option 2: Tail into Aghada 220 kV station			
Option 3: Tail into Raffeen 220 kV station			
Option 4: New station looped into Aghada - Knockraha 1&2 220 kV			
Option 5: New station looped into Cullenagh – Knockraha 220 kV and/or Knockraha – Raffeen 220 kV circuits			
Option 6: New station looped into Clashavoon – Knockraha 220 kV and/or Killonan – Knockraha 220 kV circuits			
Option 7: New station looped into Aghada – Knockraha 220 kV 1&2 and/or Knockraha – Raffeen 220 kV circuits			
Option 8: New station looped into Aghada – Knockraha 220 kV 1&2, and/or (Celtic) Ballyadam 400 kV circuit			
In Waterford/Wexford Region			
Option 9: Tail into Great Island 220 kV station			
Option 10: Tail into Cullenagh 220 kV station			
Option 11: New station loop into Great Island – Kellis 220 kV circuit			

8.6. Comparison of Solution Options (Step 2 Part B)

Table 8-4 shows a summary of the combined performance of each option against the five evaluation criteria, as presented in Section 5, applied at Step 2 Part B. Full details of the sub-criteria scoring is provided in Appendix 2.

Table 8-4 : Combined Overall Performance (Short List)

Options	Technical Performance	Economic Performance	Environmental Performance	Deliverability Performance	Socio-Economic Performance	Combined Performance
Option 1: Tail into Knockraha 220 kV station						
Option 2: Tail into Aghada 220 kV station						
Option 3: Tail into Raffeen 220 kV station						
Option 4: New station looped into Aghada - Knockraha 1&2 220 kV						
Option 5: New station looped into Cullenagh – Knockraha 220 kV and/or Knockraha – Raffeen 220 kV circuits						
Option 6: New station looped into Clashavoon – Knockraha 220 kV and/or Killonan – Knockraha 220 kV circuits						
Option 7: New station looped into Aghada – Knockraha 220 kV 1&2 and/or Knockraha – Raffeen 220 kV circuits						
Option 8: New station looped into Aghada – Knockraha 220 kV 1&2, and/or (Celtic) Ballyadam 400 kV circuit						
Option 9: Tail into Great Island 220 kV station						
Option 11: New station loop into Great Island – Kellis 220 kV circuit						

8.7. Grid Interface Points Shortlisted Options

Based on the analysis summarised in the table above, the refined list of solution options to be brought forward for more detailed evaluation in Step 3 is presented below:

- Option 4: Connection in Cork region – Loop-in connection between Aghada - Knockraha 1&2 circuits,
- Option 9: Connection in Waterford/Wexford region – At Great Island substation, and
- Option 11: Connection in Waterford/Wexford region – Loop-in connection between Great Island and Kellis circuit.
- Option 3: Connection in Cork region – Raffeen substation, has currently been excluded from the short list based on the conclusions of desktop study analysis that there was no suitable landfall, in addition there is a nearby anchorage which the offshore transmission cable would be required to cross.

9. Public Consultation

In June 2023, information was presented to the public about the project and six public events were held across the counties of Waterford, Wexford and Cork. The purpose of the engagement was to provide introductory information about the project outline the offshore zones under consideration at that time. Briefings were also provided to all the county councils at that time.

As part of the engagement in 2023, EirGrid met with the local fishing community and has continued to engage via our dedicated Fisheries Liaison Officer.

EirGrid are also members of the Seafood ORE Working Group established by the Irish Government to facilitate discussion on matters arising from the interaction of the seafood and offshore renewable energy industries. The aims of this group are to promote best practice and encouraging liaison with other sectors in the marine environment.

10. Ongoing and future work

10.1. Ongoing Work

The outcome of Step 2 was a list of the emerging best performing options for landfall points and grid interface options which will be taken forward to Step 3 for further investigation and evaluation. Further concept select design work has been recommenced after approval was given by the Irish Government of the SC-DMAP. However, irrespective of the SC-DMAP approval, it is expected that the shortlist of landfalls and grid interface points will be unaffected.

The current ongoing work to support the decision-making process on the issues highlighted in Section 3.1 include;

- Further refine the short list of landfall locations,
- Produce all supporting technical notes and reports to enable progression to Step 3.
- Finalise scope and timeframe for the Marine Geophysical, Geotechnical and Environmental Surveys needed to identify a single best performing option for offshore substation and landfall locations,
- Progress the cable route optioneering based on the short listed best performing options,
- Further refine the short list of grid interface points,
- Review onshore cable routes to determine between emerging best preforming landfalls and GIPs, and
- Prepare the Maritime Usage License application.

EirGrid is currently assessing design-risk and costing options for Marine Nature Inclusive Design features, such as carbon-neutral, plastic-free, reef-forming eco-concrete mattresses, and fish cages on substation platforms.

10.2. Future Work

Future work will include commencing Step 3 activities to identify best performing technology solutions and associated offshore transmission cable corridor study area to meet the identified need for grid development from the short list of options identified in Section 11. Step 3 will include stakeholder engagement

The short-listed options and ultimately the best performing solution will be evaluated from a spatial, environmental, social as well as technical and economic perspective. Therefore, each will have an identified corresponding offshore transmission cable corridor study area, including identified environmental and other constraints within that corridor study area.

It is assumed that the results of the marine survey geophysical campaign, which was completed in September 2024 by the Marine Institute on behalf of DECC, will be available to support the concept design optioneering and EirGrid's own future marine survey works. It should be noted that the data gathered by this survey will not cover the entire area of interest.

The factual survey data gathered will allow a greater understanding of the bathymetry and offshore soil conditions which will help to identify potential OSS locations. In addition, if the Marine Institute can survey any preliminary cable routes this will help in determining a more viable route to survey prior to EirGrid's own marine survey campaign.

It is intended to commence EirGrid's geophysical and geotechnical marine survey campaigns when a Marine Usage Licence has been approved. Several marine survey campaigns will take place, and it is anticipated that these will start in the spring / summer of 2025. The survey data when available will determine the emerging best performing option for the offshore substation and landfall location. In addition, the survey data will contribute to the finalisation of the offshore cable route between the selected offshore substation location and landfall point.

The best performing technology solution(s) identified by Step 3, will be further assessed in Step 4 with the objective to identify the specific OSS locations, landfall locations, cable routing and grid interface points, which will form the basis of the subsequent planning process. With detailed environmental and social analysis and appropriate consultation, that explores feasible and best performing local siting and routing options for that technology solution. This step is therefore predicated upon project-specific local and landowner stakeholder engagement. Within the six-step approach, at Step 5 the proposal will be brought forward for statutory consenting in accordance with the legislation applying at the time.

Once design-risk assessed and costed, EirGrid will integrate marine nature inclusive design (e.g. eco-concrete mattresses and fish cages) into offshore design documents.

11. Conclusion of Step 2

This document has presented the results of Step 2 of EirGrid's six-step approach to develop and implement the best performing option for an identified transmission network problem for Powering Up Offshore South Coast project. For Phase 2 the 'need' identified in Section 4.1 is to develop an offshore electricity transmission system.

Step 2 was carried out in two parts. Part A covered the aspects that were considered when the high-level long list of options was created, and solution options identified in the long list were assessed based on technical performance and economic performance.

After completing a high-level desktop technology overview and economic comparative performance as part of Part A assessment, the long list was further refined in Part B. The remaining landfalls, and grid interface points for each region around Cork and Waterford/Wexford areas were assessed under five criteria:

- technical performance,
- economic performance,
- deliverability,
- environmental performance, and
- socio-economic performance.

The outcome of Step 2 was a short list of options for the landfalls, and GIP that will be taken forward into Step 3. A summary of the resulting landfalls and GIPs are provided in Section 11.1 and 11.2 respectively.

11.1. Landfalls

The combined Step 2B results for the landfall are presented in Table 11-1.

Table 11-1 : Landfall combined performance

Option No	Grid Interface Point Region	Landfall	Combined Performance
4	Cork	Inch Beach	
5		Ballycroneen Beach	
6		Ballycrenane Beach	
12	Waterford / Wexford	Carnivan Beach	
13		The Long Gap	
15		Blackhall Beach	
25		Annestown Beach	
26		Bunmahon Beach	

Based on the analysis presented this report recommends the following landfalls for further analysis and consideration into Step 3:

Cork Area

- Inch Beach,
- Ballycroneen Beach, and
- Ballycrenane Beach.

Waterford/Wexford

- West of Waterford/Suir Estuary
  - Bunmahon Beach.
- East of Waterford/Suir Estuary
  - Carnivan Beach,
  - The Long Gap, and
  - Blackhall Beach.

11.2. Grid Connection Solutions

The combined Step 2B results for the landfall are presented in

Option No	Grid Interface Point Region	Options	Combined Performance
1	Cork	Tail into Knockraha 220 kV station	
2		Tail into Aghada 220 kV station	
3		Tail into Raffeen 220 kV station	
4		New station looped into Aghada - Knockraha 1&2 220 kV	
5		New station looped into Cullenagh – Knockraha 220 kV and/or Knockraha – Raffeen 220 kV circuits	
6		New station looped into Clashavoon – Knockraha 220 kV and/or Killonan – Knockraha 220 kV circuits	
7		New station looped into Aghada – Knockraha 220 kV 1&2 and/or Knockraha – Raffeen 220 kV circuits	
8		New station looped into Aghada – Knockraha 220 kV 1&2, and/or (Celtic) Ballyadam 400 kV circuit	
9	Waterford / Wexford	Tail into Great Island 220 kV station	
11		New station loop into Great Island – Kellis 220 kV circuit	

Based on the analysis presented this report recommends the following grid connection solutions for further analysis:

- Option 4: Connection in Cork region – Loop-in connection between Aghada - Knockraha 1&2 circuits
- Option 9: Connection in Waterford/Wexford region – At Great Island substation, and
- Option 11: Connection in Waterford/Wexford region – Loop-in connection between Great Island and Kellis circuit,

Appendix 1 - Landfall Selection

Scoring criteria

		SCORING CRITERIA				
CRITERIA	**SUB-CRITERIA**					
TECHNICAL	Installation Methodology (Open Cut/HDD/Thrust Bore)	Majority rock trenching / HDD / placement	HDD / boulder removal / rock trenching	HDD	HDD and Open Cut	Open cut
	Beach Composition	Rugged seabed with exposed rock in area	Significant rock outcrops	Mix sand / many boulders / rock outcrops	Sand/ boulders / some rock outcrops	Gravel / Sand
	Near shore seabed geotechnical	Rugged seabed with exposed Rock in area	Significant rock outcrops	Mix sand / many boulders / rock outcrops	Sand / boulders / some rock outcrops	Gravel / Sand
ECONOMIC	Offshore supply and Installation Costs Only	Non-standard installation requiring additional vessels / equipment		Standard installation with some specific equipment		Standard installation
	Distance from Great Island (Waterford / Wexford) Distance from Aghada (Cork)	> 40 km	< 40 km	< 30km	< 20km	< 10km
ENVIRONMENTAL	Distance from Natura 2000 Sites	0 km	0-0.9 km	1-1.9 km	2-2.9 km	> 3 km

		SCORING CRITERIA				
CRITERIA	**SUB-CRITERIA**					
SOCIO-ECONOMIC	Tourism and Recreation	Major lasting impact to tourist and/or recreation facilities without mitigation	Lasting impact to tourist and/or recreation facilities with mitigation	Major temporary impact to tourist and/or recreation facilities during construction / installation	Minor temporary impact to tourist and/or recreation facilities during construction / installation	No impact to tourism and/or recreation facilities
	Marine Traffic	>100 Vessel hours per sq. km per month	<100 Vessel hours per sq. km per month	<40 Vessel hours per sq. km per month	<20 Vessel hours per sq. km per month	<10 Vessel hours per sq. km per month
	Archaeology (wrecks)	>100 wrecks within 200 m of proposed offshore transmission cable route	<100 wrecks within 200 m of proposed offshore transmission cable route	<50 wrecks within 200 m of proposed offshore transmission cable route	<25 wrecks within 200 m of proposed offshore transmission cable route	<10 wrecks within 200 m of proposed offshore transmission cable route
	Aquaculture and Fishing	>30 Vessel hours per sq. km per month	<30 Vessel hours per sq. km per month	<20 Vessel hours per sq. km per month	<10 Vessel hours per sq. km per month	<5 Vessel hours per sq. km per month
	Settlement and Community	Direct impact on existing development	Landfall proximity to nearest settlement < 0.5 km	Landfall proximity to nearest settlement < 1 km	Landfall proximity to nearest settlement < 2 km	Landfall proximity to nearest settlement > 2 km

		SCORING CRITERIA				
CRITERIA	**SUB-CRITERIA**					
SOCIO-ECONOMIC	Landscape and Visual	Major lasting impact to landscape without mitigation	Lasting impact to landscape with mitigation	Major temporary impact to landscape during construction / installation	Minor temporary impact to landscape during construction / installation	No impact to landscape
DELIVERABILITY	Ease of Access	New access required with significant challenges	New access required/ difficult access due to infrastructure	Single track/ road needs upgrading	Single track/ road for construction traffic	Good access
	Installation Methodology (Open Cut/HDD/Thrust Bore)	Highly complex and may necessitate requiring additional vessels/ equipment, rock placement/ rock cutting/ plough	Highly complex/ difficult - with both rock placement and rock cutting required	Minimum ploughing and major rock cutting	Mix plough and rock cutting	Standard installation - open cut plough from beach

Cork Landfall Zone Results

Description

No	Location	Landfall Description
1	**Rocky Bay**	Rocky Bay is a broad beach that leads up to a steep cliff face. No seabed channels have been observed to be present but infills in between the exposed rock are observed consisting of sands, gravels, fine-grained sandy clay or clayey sand sediments. Main Anchorage for Dublin port which would have to be circumnavigated, and high level of marine traffic related to Dublin port. Assume HDD would be the only solution.
2	**Corkbeg Beach**	Small narrow sand / pebble beach, limited space available on shoreline and access from land limited. Offshore restricted vessel manoeuvrability due to Dublin port traffic. Boulders and rock outcrops offshore. Potential open cut installation.
3	**White Bay Beach**	Small sand / pebble beach, steep cliffs face behind, access from land limited and offshore restricted vessel manoeuvrability due to Dublin port traffic. Boulders and rocks outcrops offshore. Potential open cut installation.
4	**Inch Beach**	Broad sand / pebble beach with fields behind and surrounding area appearing accessible for construction traffic, with sufficient area for construction works to be carried out. An assumed open cut methodology for installing the cable with minimal disturbance to surrounding area. The seabed is dominated by shallow outcropping bedrock and muddy sand. Potential open cut installation. A desk study review indicates there is a decommissioned pipeline running parallel to the beach.
5	**Ballycroneen Beach**	Wide narrow sand / pebble beach with low lying fields behind. The seabed consists of sand overlying rock after which is dominated by shallow outcropping bedrock. The bedrock is composed of sandstone. No seabed channels are observed to be present but infills in between the exposed rock are observed consisting of sands, gravels, fine-grained sandy clay or clayey sand sediments. There is a high possibility of surface and subsurface boulders will be present. Potential HDD / open cut installation.
6	**Ballycrenane Beach**	Wide narrow sand / pebble beach with low lying fields behind. The seabed consists of sand overlying rock after which it is dominated by shallow outcropping bedrock. The bedrock is composed of sandstone. No seabed channels are observed to be present but infills in between the exposed rock is observed consisting of sands, gravels, fine-grained sandy clay or clayey sand sediments. There is a high possibility of surface and subsurface boulders likely to be present. Potential HDD / Open cut installation.
7	**Knockadoon Head**	High steep cliffs, no beach, rock outcrops. Assume HDD only installation solution.

No	Location	Landfall Description
8	**Redbarn Beach**	Broad sand/gravel gently sloping beach with low level sand dunes / fields behind beach with no major inclines. Beach and surrounding area appear accessible for construction traffic, with sufficient area for construction works to be carried out, assuming lease / purchase of land and new haul road etc constructed. An assumed open cut methodology for installing the cable with minimal disturbance to surrounding area.
9	**Claycastle Beach**	Beach and surrounding area appear accessible for construction traffic, with restricted area for construction works to be carried out and routing for onshore cable. Sand/gravel beach consistency overlying rock. An assumed open cut methodology for installing the cable (like Celtic Interconnector) with minimal disturbance to surrounding area. Limited beach access along the promenade will be required during installation.

Assessment

		Rocky Bay	Corkbeg Beach	White Bay Beach	Inch Beach	Ballycroneen Beach	Ballycrenane Beach	Knockadoon Head	Redbarn Beach	Claycastle Beach
TECHNICAL	Installation Methodology (Open Cut / HDD / Thrust Bore)									
	Beach Composition									
	Near shore seabed geotechnical									
	TECHNICAL SUMMARY									
ECONOMIC	Offshore supply and Installation Costs Only									
	Distance from Aghada (East side landings only of Cork Harbour)									
	Distance from Raffeen (West Side landings only of Cork Harbour)									
	ECONOMIC SUMMARY									
Technical & Economic Combined (Step 2A Score)										

		Inch Beach	Ballycroneen Beach	Ballycrenane Beach
ENVIRONMENTAL	Distance from Natura 2000 Sites			
	ENVIRONMENTAL SUMMARY			
SOCIO-ECONOMIC	Tourism and Recreation			
	Marine Traffic			
	Archaeology (wrecks)			
	Aquaculture and Fishing			
	Settlement and Community			
	Landscape and Visual			
	SOCIO-ECONOMIC SUMMARY			
DELIVERABILITY	Ease of Access			
	Installation Methodology (Open Cut / HDD / Thrust Bore)			
	DELIVERABILITY SUMMARY			
Technical, Economic, Environmental, Socio-Economic and Deliverability Combined (Step 2B Score)				

Waterford Landfall Zone Results

Description

No	Location	Landfall Description
10	**Clonea Beach**	Wide open beach, with some rock outcrops. Either HDD or open cut
11	**Kilfarrasy Beach**	Narrow access, Exposed rocks, rugged coastline offshore and sheer cliffs, requiring HDD or open cut
12	**Carnivan Beach**	High cliffs, good sandy beach, some rock exposure, HDD required
13	**The Long Gap**	Open sandy beach with some rock exposure. Either HDD or open cut
14	**Cullenstown Beach**	Wide open sandy beach with some rock exposure. Either HDD or open cut. Marine routing will have to consider the Keeragh Islands SPA/NHA and the Saltee Islands SAC and SPA- May cause major concern over installation works
15	**Blackhall Strand Beach**	Open sandy beach with some rock exposure. Either HDD or open cut
16	**Bannow Bay Beach**	Long and shallow water depth, either HDD or open cut with use of shallow water vessel and inline splice. Rock outcrops and high cliffs
17	**Bannow Bay Island Beach**	Long and shallow water depth, either HDD or open cut with use of shallow water vessel and inline splice. Rock outcrops and high cliffs
18	**Grange Beach Fethard**	High cliffs, requiring HDD, rock outcrops
19	**Sandeel Beach**	Access, rock outcrops, HDD or open cut
20	**Slade Harbour Beach**	Next to harbour. high cliffs, road access for routing difficult
21	**Dunmore East**	Restricted area for construction works due to settlements in location, High cliffs requiring HDD or potential small sandy beach could be an open cut solution
22	**Rathmoylan Cove Beach**	Small track very narrow access, no area for construction works. Narrow access from offshore could hamper cable installation
23	**Tramore Beach**	Wide open beach and bay area. Installation difficulties with numerous wrecks within the bay
24	**Garrarus Beach**	Small track very narrow access, no area for construction works. Good beach before high cliffs
25	**Annestown Beach**	Good access. Rocks offshore and beach, requiring HDD or open cut

No	Location	Landfall Description
26	**Bunmahon Beach**	Wide sandy beach, some minor rock exposure
27	**Killelton Bay Beach**	Rugged coastline, high cliffs, no access
28	**Ballyvooney Cove**	Small shale beach, stream inland, steep drop to cove, HDD or open cut
29	**Ballydowane Bay**	Rugged coastline, exposed rocks, high cliffs, small beach, limited tight access
30	**Stradbally Cove Beach**	Offshore narrow cove inlet, with some exposed rock, narrow access with stream down one side, sandy beach with some exposed rock
31	**Fethard Beach**	Near harbour, sandy beach with exposed rocks limited access. HDD or open cut

Assessment

		Clonea Beach	Kilfarrasy	Carnivan Beach	The Long Gap	Cullenstown Beach	Blackhall Beach	Bannow Bay Beach	Bannow Island Beach	Grange Beach Fethard	Sandeel Beach	Slade Harbour	Dunmore East	Rathmoylan Cove	Tramore Beach	Garrarus Beach	Annestown Beach	Bunmahon Beach	Killelton Bay Beach	Ballyvooney Cove	Ballydowane Bay	Stradbally Cove	Fethard Beach
TECHNICAL	Installation Methodology (Open Cut / HDD / Thrust Bore)																						
	Beach Composition																						
	Near shore seabed geotechnical																						
	TECHNICAL SUMMARY																						
ECONOMIC	Offshore supply and Installation Costs Only																						
	Distance from Great Island																						
	ECONOMIC SUMMARY																						
	Technical & Economic Combined (Step 2A Score)																						

		Carnivan Beach	The Long Gap	Blackhall Beach	Annestown Beach	Bunmahon Beach
ENVIRONMENTAL	Distance from Natura 2000 Sites					
	ENVIRONMENTAL SUMMARY					
SOCIO-ECONOMIC	Tourism and Recreation					
	Marine Traffic					
	Archaeology (wrecks)					
	Aquaculture and Fishing					
	Settlement and Community					
	Landscape and Visual					
	SOCIO-ECONOMIC SUMMARY					
DELIVERABILITY	Ease of Access					
	Installation Methodology (Open Cut / HDD / Thrust Bore)					
	DELIVERABILITY SUMMARY					
Technical, Economic, Environmental, Socio-Economic and Deliverability Combined (Step 2B Score)						

Appendix 2 - Grid Connection Point Selection

Scoring criteria

		SCORING CRITERIA				
CRITERIA	**SUB-CRITERIA**					
TECHNICAL	Load Flow	Scoring provided based on previous analysis				
	Direct connection at EirGrid Substation: Are switchgear bays available?	No spare breaker/ bays available	Less chances of bays availability	Medium chances of breaker/ bays available	Spare breaker/ bay available; may need some work	Spare breaker/ bay available; needs no work
	Direct connection at EirGrid Substation: Is space for a new GIS/AIS available?	No space available for AIS/GIS	Limited space available for AIS/GIS	Space available requiring work and potentially causing disruption	Space for a GIS is available may need work and outages	Space available; needs least work and disruption
	Loop-in connection: Loss of power due to network circuit outage (N-1)	1-circuit outage; power export to 0 MW; certain	1-circuit outage; power export to 0 MW; high probability	1-circuit outage; power export to 1/2; moderate probability	1-circuit outage; power export to 2/3; moderate – low probability	1-circuit outage; power export to <2/3; low probability
	Loop-in connection: Capacity available in the relevant circuit	Very low likelihood of capacity available	Low likelihood of having capacity in circuit(s)	Moderate likelihood of capacity in the circuit(s) is available	High likelihood of having capacity in circuit(s)	Capacity available from high-level analysis

		SCORING CRITERIA				
CRITERIA	**SUB-CRITERIA**					
TECHNICAL	Network constraints: Constraints (and potential curtailments) e.g. at 220kV or 110kV	Very high likelihood of curtailment due to constraints	Relatively high likelihood of curtailment/ constraint	Medium likelihood of curtailment/ constraint	Low likelihood of curtailment/ constraint	No likelihood of curtailment/ constraint
	Electrical Connection Complexity	3-circuit loop-in of 400kV connection; very high complexity	3-circuit loop-in of 220 kV; high complexity	2-circuit loop-in of 220 kV; moderate complexity	1-circuit loop-in or direct connection of 220 kV; moderate – low complexity	No new substation. Least complex; straight connection to existing substation
ECONOMIC	Costs comparison (Direct vs Loop-in)	3-circuit loop-in of 400kV connection; very high complexity	3-circuit loop-in of 220 kV; high complexity	2-circuit loop-in of 220 kV; moderate complexity	1-circuit loop-in or direct conn of 220 kV; moderate – low complexity	No new substation. Least complex; straight connection to existing substation
ENVIRONMENTAL	Distance from Natura 2000 Sites	0 km	0-0.9 km	1-1.9 km	2-2.9 km	3 km +
SOCIO-ECONOMIC	Tourism and Recreation	Major lasting impact to tourist and/or recreation facilities without mitigation	Lasting impact to tourist and/or recreation facilities with mitigation	Major temporary impact to tourist and/or recreation facilities during construction / installation	Minor temporary impact to tourist and/or recreation facilities during construction / installation	No impact to tourism and/or recreation facilities

		SCORING CRITERIA				
CRITERIA	**SUB-CRITERIA**					
SOCIO-ECONOMIC	Archaeology (distance to monuments and archaeological sites)	0 km	0-0.9km	1-1.9km	2-2.9km	3km +
	Settlement and Community	Direct impact on existing settlement	Nearest settlement < 0.5 km	Nearest settlement < 1 km	Nearest settlement < 2 km	Nearest settlement > 2 km
	Landscape and Visual	Major lasting impact to landscape without mitigation	Lasting impact to landscape with mitigation	Major temporary impact to landscape during construction / installation	Minor temporary impact to landscape during construction / installation	No impact to landscape
	Natural Heritage Sites (Distance to NHAs and proposed NHAs)	0 km	0-0.9km	1-1.9km	2-2.9km	➢ 3km
DELIVERABILITY	New Substation: Land Availability	Inadequate land available for construction	Limited availability of agricultural land with settlements within 1 km	Significant availability of agricultural land with settlements within 1.5 km	Significant availability of agricultural land with settlements within 2 km	Significant availability of agricultural land with no settlements within 2 km

		SCORING CRITERIA				
CRITERIA	**SUB-CRITERIA**					
DELIVERABILITY	New Substation: Access availability	No access currently available to nearest road >2 km	No access currently available nearest road <2 km	Limited access available unsuitable for Abnormal Indivisible Loads (AIL) and Heavy Goods Vehicle (HGV)	Restricted access available for AIL and HGV	Main road access to site with no requirement for modification
	Direct Connection: Bays available + possibility to add new AIS/GIS	No spare breaker/bays available No space available for AIS/GIS	Less probability of bays availability Limited space available for AIS/GIS	Moderate probability of breaker/bays to be available Space available requiring work and potentially cause disruption	Spare breaker/bay available; may need some work Space for a GIS is available may need work and outages	Spare breaker/bay available; needs no work Space available for GIS; needs least work and disruption
	Direct Connection: Access to the existing subs	Limited access to existing substation requires adaption for accepting AIL		Good access to substation but requires transiting settlements		Good access to existing substation with minimal disruption
	Direct Connection: Space within subs and land around the subs for expansion	No space available for further expansion	Limited space for expansion will require further analysis to validate adequacy	Good space availability but will require moderate layout modifications to existing substation	Good space availability but will require minor layout modifications to existing substation	Good space availability with no modifications required to existing substation

		SCORING CRITERIA				
CRITERIA	**SUB-CRITERIA**					
DELIVERABILITY	Direct Connection: Bringing in cables to the existing subs	Existing substation surrounded by extensive development requiring complex cable installation solution and disruption		Limited development surrounding the substation requires limited complex cable installation solution		Clear cable route to the existing substation enabling low complexity cable installation solution
	Loop in: Need for upgrading circuits (towers are likely to get a cable sealing end in all cases)	No capacity available on existing transmission circuits	High likelihood of circuit upgrade required to accommodate wind farm capacity	Moderate likelihood of circuit upgrade required to accommodate wind farm capacity	Limited likelihood of circuit upgrade required to accommodate wind farm capacity	No circuit upgrade required
	Direct and Loop in: Planned outages (criticality of outages)	Connection to > 5 substations	Connection to < 5 substations	Connections to < 3 substations	Connection to 1 substation	No planned outages during installation
	Direct and Loop in: Network constraints - Constraints (and potential curtailments) e.g. at 220kV or 110kV	Very high probability of curtailment / constraints	High probability of curtailment / constraint	Moderate probability of curtailment / constraint	Low probability of curtailment / constraint	No probability of curtailment / constraint

		SCORING CRITERIA				
CRITERIA	**SUB-CRITERIA**					
DELIVERABILITY	Direct and Loop in: Complexity of connection including dealing with 3rd party	3-circuit loop-in of 400kV connection; very high complexity	3-circuit loop-in of 220 kV; high complexity	2-circuit loop-in of 220 kV; moderate complexity	1-circuit loop-in or direct conn of 220 kV; moderate – low complexity	No new substation. Least complex; straight connection to existing substation

Description

Option	Identifier Code	Description	Region
1	Phase 2.1 CMO-1 (KRA)	Tail into Knockraha 220 kV station	Cork
2	Phase 2.1 CMO-2 (AD~)	Tail into Aghada 220 kV station	Cork
3	Phase 2.1 CMO-3 (RAF)	Tail into Raffeen 220 kV station	Cork
4	Phase 2.1 CMO-4 (AD~1&2 - KRA)	New station looped into Aghada - Knockraha 1&2 220 kV	Cork
5	Phase 2.1 CMO-5 (CUL-RAF-KRA)	New station looped into Cullenagh – Knockraha 220 kV and/or Knockraha – Raffeen 220 kV circuits	Cork
6	Phase 2.1 CMO-6 (CLA-KLN-KRA)	New station looped into Clashavoon – Knockraha 220 kV and/or Killonan – Knockraha 220 kV circuits	Cork
7	Phase 2.1 CMO-7 (AD~1&2-RAF-KRA)	New station looped into Aghada – Knockraha 220 kV 1&2 and/or Knockraha – Raffeen 220 kV circuits	Cork
8	Phase 2.1 CMO-8 (AD~1&2-BDM-KRA)	New station looped into Aghada – Knockraha 220 kV 1&2, and/or (Celtic) Ballyadam 400 kV circuit	Cork
9	Phase 2.2 CMO-1 (GI~)	Tail into Great Island 220 kV station	Waterford / Wexford
10	Phase 2.2 CMO-2 (CUL)	Tail into Cullenagh 220 kV station	Waterford / Wexford
11	Phase 2.2 CMO-3 (GI~-KLS)	New station loop into Great Island – Kellis 220 kV circuit	Waterford / Wexford

Assessment

		Cork								Waterford / Wexford		
		1	2	3	4	5	6	7	8	9	10	11
		Phase 2.1 CMO-1 (KRA)	Phase 2.1 CMO-2 (AD~)	Phase 2.1 CMO-3 (RAF)	Phase 2.1 CMO-4 (AD~ 1&2 - KRA)	Phase 2.1 CMO-5 (CUL-RAF-KRA)	Phase 2.1 CMO-6 (CLA-KLN-KRA)	Phase 2.1 CMO-7 (AD~ 1&2-RAF-KRA)	Phase 2.1 CMO-8 (AD~1 &2-BDM-KRA)	Phase 2.2 CMO-1 (GI~)	Phase 2.2 CMO-2 (CUL)	Phase 2.2 CMO-3 (GI~-KLS)
TECHNICAL	Load Flow											
	Direct connection at EirGrid Substation: Are switchgear bays available											
	Direct connection at EirGrid Substation: Has space for a new GIS/AIS											
	Loop-in connection: Loss of power due to network circuit outage (N-1)											
	Loop-in connection: Capacity available in the relevant circuit											
	Network constraints: Constraints (and potential curtailments) e.g. at 220kV or 110kV											
	Electrical Connection Complexity											
	TECHNICAL SUMMARY											
ECONOMIC	Costs comparison (Direct vs Loop-in)											
	ECONOMIC SUMMARY											
	Technical & Economic Combined (Step 2A Score)											

		Cork								Waterford / Wexford		
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
		Phase 2.1 CMO-1 (KRA)	*Phase 2.1 CMO-2 (AD~)*	*Phase 2.1 CMO-3 (RAF)*	*Phase 2.1 CMO-4 (AD~ 1&2 - KRA)*	*Phase 2.1 CMO-5 (CUL-RAF-KRA)*	*Phase 2.1 CMO-6 (CLA-KLN-KRA)*	*Phase 2.1 CMO-7 (AD~ 1&2-RAF-KRA)*	*Phase 2.1 CMO-8 (AD~1 &2-BDM-KRA)*	*Phase 2.2 CMO-1 (GI~)*	*Phase 2.2 CMO-2 (CUL)*	*Phase 2.2 CMO-3 (GI~-KLS)*
SOCIO-ECONOMIC	Tourism and Recreation											
	Archaeology (distance to monuments and archaeological sites)											
	Settlement and Community											
	Landscape and Visual											
	Natural Heritage Sites (Distance to NHAs and proposed NHAs)											
	SOCIO-ECONOMIC SUMMARY											
DELIVERABILITY	New Substation: Land Availability											
	New Substation: Access availability											
	Direct Connection: Bays available + possibility to add new AIS/GIS											
	Direct Connection: Access to the existing subs											
	Direct Connection: Space within subs and land around the subs for expansion											
	Direct Connection: Bringing in cables to the existing subs											
	Loop in loop out: Need for upgrading circuits (towers are likely to get a cable sealing end in all cases)											

		Cork								Waterford / Wexford		
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
		Phase 2.1 CMO-1 (KRA)	*Phase 2.1 CMO-2 (AD~)*	*Phase 2.1 CMO-3 (RAF)*	*Phase 2.1 CMO-4 (AD~ 1&2 - KRA)*	*Phase 2.1 CMO-5 (CUL-RAF-KRA)*	*Phase 2.1 CMO-6 (CLA-KLN-KRA)*	*Phase 2.1 CMO-7 (AD~ 1&2-RAF-KRA)*	*Phase 2.1 CMO-8 (AD~1 &2-BDM-KRA)*	*Phase 2.2 CMO-1 (GI~)*	*Phase 2.2 CMO-2 (CUL)*	*Phase 2.2 CMO-3 (GI~-KLS)*
DELIVERABILITY	Direct and Loop in loop out: Planned outages (criticality of outages)											
	Direct and Loop in loop out: Network constraints - Constraints (and potential curtailments) e.g. at 220kV or 110kV											
	Direct and Loop in loop out: Complexity of connection including dealing with 3rd party											
	DELIVERABILITY SUMMARY											
Technical, Economic, Environmental, Socio-Economic and Deliverability Combined (Step 2B Score)												