Enduring Connection Policy 2.1 Constraints Report for Area K Solar and Wind

December 2021

Version 1.0

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Document History

Version	Date	Comment
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Document Structure

This document contains an Abbreviations and Terms section, an Executive Summary, five main sections, and three Appendices.

The structure of the document is as listed below.

Much of this document describes study assumptions and methodology. For customers wishing to see the estimated Total Dispatch Down, please proceed to both Section 6 and Appendix C.

Section 1: Introduction: presents the purpose of the report and the definitions of over-supply, curtailment and constraint.

Section 2: Study Overview: introduces the study areas, the study years and the generation scenarios. Together, these comprise the study scenarios.

Section 3: Study Input Assumptions: describes the study assumptions as they relate to network, demand, interconnection, generation and system operational limits.

Section 4: Study Methodology: provides an overview of the software used and how the model is put together. A description of how Total Dispatch Down results are apportioned is also provided.

Section 5: Results Summary for Ireland: provides an overview of the reduction in renewable generation forecasted by this study at system level for Ireland.

Section 6: Results for Area K: outlines the area covered by this report. The section provides a network diagram of Area K and an overview of the results for Area K.

Appendix A: Network Reinforcements: lists the reinforcements that are included in the study for each study scenario. These reinforcements have a material impact on the resulting constraints. This section also lists the representative transmission outage scheduled included within the analysis.

Appendix B: Generator Details: provides an overview of the generation. It also provides a comprehensive list of the individual generators included in the study.

Appendix C: Area K Node Results: provides a table of results for every node in the area. This table documents the installed capacity, available energy, over-supply, curtailment and constraint for every node in Area K.

The **Abbreviations and Terms** provide a list of the abbreviations and terms used in the document.

Important Note

This ECP 2.1 constraints report presents an estimate of the reduction in available solar and wind generation based on the study assumptions described. The reduction in available generation has been split into three categories for the purposes of this study: over-supply, curtailment and constraint.

The treatment of renewable generation under these three categories of generation reduction will be determined by the implementation of Articles 12 and 13 of the EU’s Clean Energy Package. A final decision from the Regulatory Authorities (RAs) in Ireland and Northern Ireland on the implementation of Articles 12 and 13 has yet to be published, and therefore an assumed interpretation has been included in this study, as detailed in this report.

This report uses the term “Total Dispatch Down” to refer to the total reduction in available solar and wind generation i.e. the sum of over-supply, curtailment and constraint. However, it is important to note that the term “dispatch down” is more correctly applicable only to TSO instructions to reduce generation output from a market position as is the case for curtailment and constraint, and is not necessarily applicable to a generator reducing its own output from its availability to a market position so that supply and demand are balanced, as is the case for over-supply.

The results presented in this report are based on the simulation and modelling assumptions described. The findings are indicative only and this report should in no way be read as a guarantee as to future levels of over-supply, curtailment and constraint.

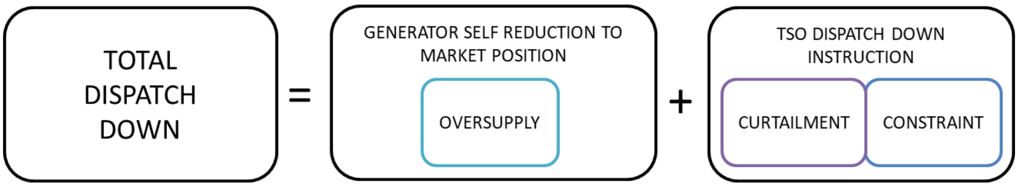
1 Introduction

1.1 Objective

It is a requirement of CRU's ECP 2 decision, CRU/20/060, that the Transmission System Operator (TSO) carry out system studies to inform applicants about possible generation constraint levels in Ireland. EirGrid will complete this requirement across twelve regional reports. The purpose of these reports is to provide generation developers with information on possible levels of generation output reduction for a range of scenarios.

The reports present results for a range of generation scenarios and indicate the levels of Total Dispatch Down that solar and wind generation might experience in the future, where Total Dispatch Down is defined as follows:

Total Dispatch Down[1] = Over-supply + Curtailment + Constraint



The over-supply, curtailment and constraint results for Area K are included in Section 6 and in Appendix C.

1.2 Background

The core study years for this analysis are 2024 and 2026. A further sensitivity study considers a "Future Grid" scenario that aligns with the network assumptions used in the Shaping Our Electricity Future (SOEF) Roadmap.

The evaluation of Total Dispatch Down is impacted by a range of assumptions; generation, demand, interconnection, network and operational limits. A brief summary of each of these is provided below. More details of the study assumptions are provided in Section 3.

<u>Generation</u>

Since Gate 3, EirGrid and ESB Networks have issued an additional 2 GW of wind and solar connection offers under the Non-GPA (Non-Group Processing Approach) rule set CER/09/099. In line with government policy and CRU direction, another 1.8 GW of wind and solar connection offers have been issued under Enduring Connection Policy – Stage 1 (ECP-1). The CRU decision on the Enduring Connection Policy – Stage 2 (ECP-2) mandates that the next stage of the connection policy will progress in three separate batches to be processed in 2021 (ECP-2.1), 2022 (ECP-2.2) and 2023 (ECP-2.3). This report deals with the 1.8 GW wind and solar generation processed under the first of these three batches – ECP-2.1.

It is not clear at this stage which generators will be successful in future renewable support auctions or other funding mechanisms and therefore, the timing and location of future generation connections is uncertain. For this reason, results for various renewable generation scenarios are presented in this report.

[1] For the purposes of this report, the term "Total Dispatch Down" includes over-supply. Note however that "dispatch down" more correctly refers to dispatch away from a market position and as such, includes curtailment and constraint but not necessarily over-supply.

Demand

Demand levels in Ireland have been increasing over a number of years, which has led to a reduction in renewable generation dispatch down levels and in particular, curtailment levels associated with the operational metric SNSP, which is impacted by the demand.

The system demand forecast used in the 2024 and 2026 ECP-2.1 constraints studies is the median demand forecast from the Generation Capacity Statement (GCS) 2021 - 2030. The "Future Grid" study uses the high demand forecast from the GCS 2021 – 2030, this aligns with the demand level used within the Shaping Our Electricity Future Roadmap.

Interconnection

As well as the existing Moyle and East-West (EWIC) HVDC interconnectors, the following future HVDC interconnectors have been assumed in some scenarios:

- 500 MW Greenlink HVDC interconnector to Great Britain;
- 700 MW Celtic HVDC interconnector to France.

In addition to the existing North-South HVAC interconnector between Louth and Tandragee, a second North-South HVAC interconnector between County Tyrone and County Meath has also been assumed in service for some scenarios.

Network

The network reinforcement assumptions used for the core 2024 and 2026 scenarios are aligned with the current estimated delivery dates for existing reinforcement projects.

The network assumed for the "Future Grid" study is aligned with the SOEF roadmap network assumptions.

Operational Limits

Under the SOEF Roadmap, the System Operation workstream sets out a plan for further developing our operation capability to facilitate increases in wind and solar generation levels. This includes evolution of the SNSP, RoCoF, inertia, minimum number of conventional units and system service provision from new, low carbon sources. The current System Operation roadmap assumptions are included in the assumptions for this report.

1.3 Definition of Over-Supply, Curtailment and Constraint

Over-Supply

The reduction of available renewable generation for over-supply reasons is necessary when the total available generation exceeds system demand plus interconnector export flows. In this study, generation reduction for over-supply is applied prior to curtailment and constraint.

Under the EU's Clean Energy Package, it has been mandated that priority dispatch of renewable generation will continue to apply only to generators which connected prior to July 4th 2019 (Article 12). This will create a new type of generator for consideration in the dispatch process – the non-priority dispatch renewable generator, connected post-July 4th 2019. A final decision in respect of the treatment of non-priority dispatch renewable generators is currently under consideration by the SEM Regulatory Authorities (RAs). An assumption on the implementation of Article 12 has been made for this ECP 2.1 constraints analysis and is summarised below. The final decision on the implementation of Article 12 will not be known until it is published by the RAs, and may differ from the assumption made for this study.

During generation reduction for over-supply reasons, a distinction is made between the treatment of priority and non-priority renewable generators, and non-priority generators are reduced ahead of priority generators. Within, these two categories of generation, over-supply is applied pro-rata across the all-island system for all generators in the category.

Curtailment

In order to operate a safe and secure electricity system, the TSO must operate the system within certain operational limits. These limits include:

- Maximum level of System Non-Synchronous Penetration (SNSP)
- Maximum rate of change of frequency (RoCoF)
- Minimum level of system inertia
- Minimum number of conventional units for stability
- Minimum levels of reserve
- Conventional generator "must run" rules to ensure adequate system voltage and power flow control

Curtailment is applied to reduce the output of renewable generators in order to ensure that operational limits are not breached, and the system can remain secure and stable. Curtailment is applied to all renewable generators across the island on a pro-rata basis with no distinction made between the treatment of priority and non-priority generators.

<u>Constraint</u>

Generators may also need to be dispatched down due to transmission network limitations and, in particular, to ensure that the thermal overload limits of transmission circuits and transformers are not breached. Transmission equipment may become overloaded in an intact network or for network contingencies, where a line may become overloaded if another line were to trip. In order to avoid this, renewable generation may be dispatched down.

Changes in generator output for this reason are referred to as a 'constraint'. The constraining of generation is location-specific and can be reduced, for example, by transmission network reinforcements. The model accounts for N-1 contingencies, this means that the system will be dispatched in such a way that any single contingency will not cause overloads.

Constraint is applied pro-rata across renewable generators which are effective in managing a particular network limitation, with no distinction made between the treatment of priority and non-priority generators.

2 Overview

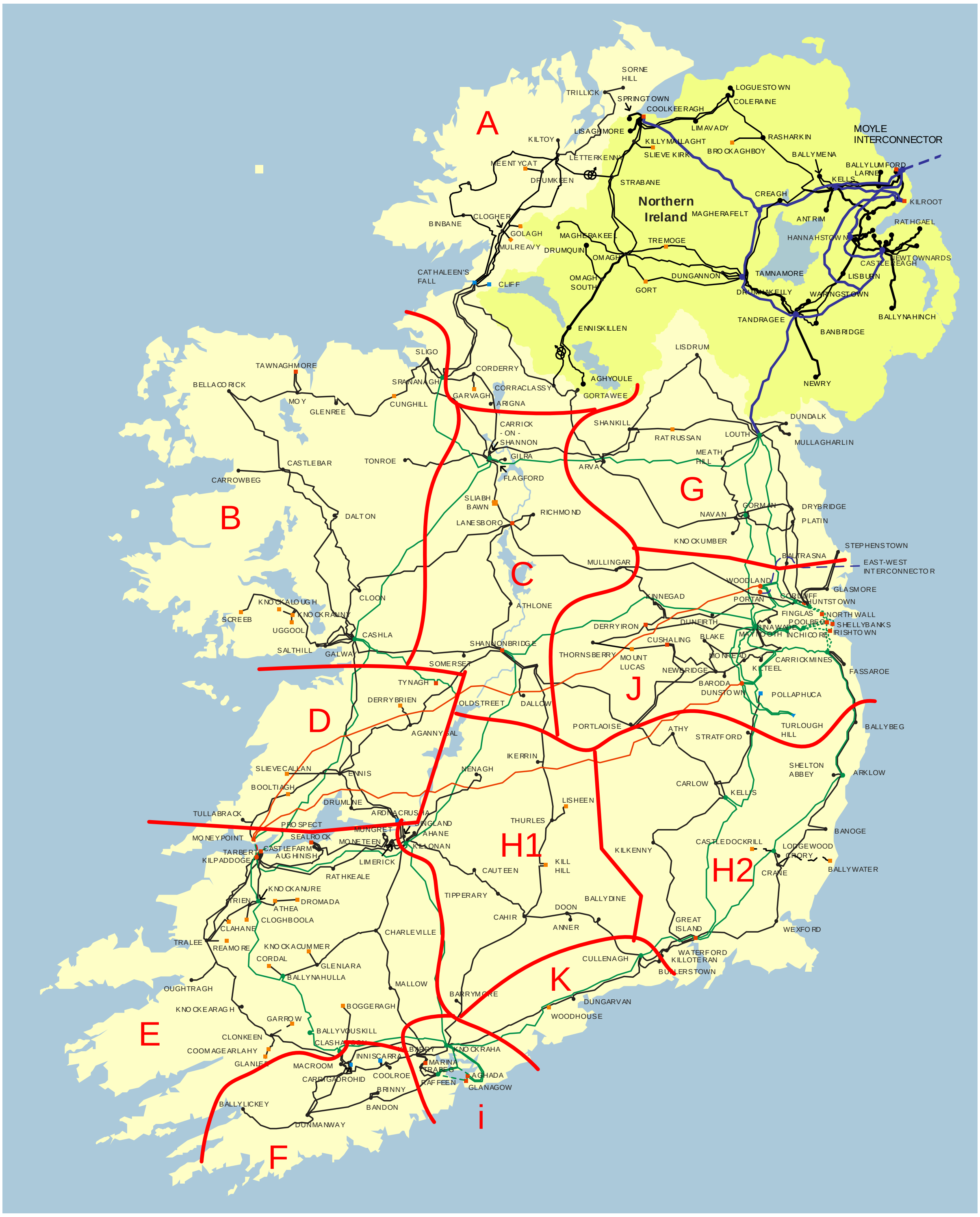


Figure 2-1 Areas Designated for Preparing Wind Energy Profiles, Generation Scenarios and Reporting Results

This section presents an overview of the over-supply, curtailment and constraints assessment. Descriptions of the study scenarios are provided which are a combination of generation scenarios and study years.

An overview of the study areas is also provided. These are fundamental to understanding the contents of the individual area reports. It also provides an overview of the demand, generation and network assumptions that are used in the study. Taken together this information provides an overview of this analysis.

2.1 Study Areas

The areas shown in Figure 2-1 are used for preparing wind energy profiles, for setting up generation scenarios and for reporting results. These areas are similar to those used for the Gate 3 and ECP 1 constraints analysis.

2.2 Study Scenarios

Studies were carried out for a number of study years with different network assumptions, and generation scenarios. An overview of the study scenarios can be seen in Figure 2-2 and Table 2-1.

The core ECP 2.1 study scenarios are highlighted in Figure 2-2 and cover the years 2024 and 2026. The core 2024 study does not include future interconnection (i.e. neither Greenlink nor Celtic interconnectors are included). The core 2026 study includes one future interconnector (Greenlink).

During consultations with industry in advance of this review, there were industry requests for a number of sensitivity studies to be carried out as part of the analysis in addition to the core study scenarios. As a result of this, a number of sensitivity scenarios were developed in consultation with industry. These include:

- Sensitivity studies considering various levels of future interconnection in 2026;
- Sensitivity studies considering the impact of the connection of offshore wind; and
- A sensitivity study for a Future Grid scenario which considers 2030 demand levels and the impact of the network reinforcements identified in the SOEF Roadmap.

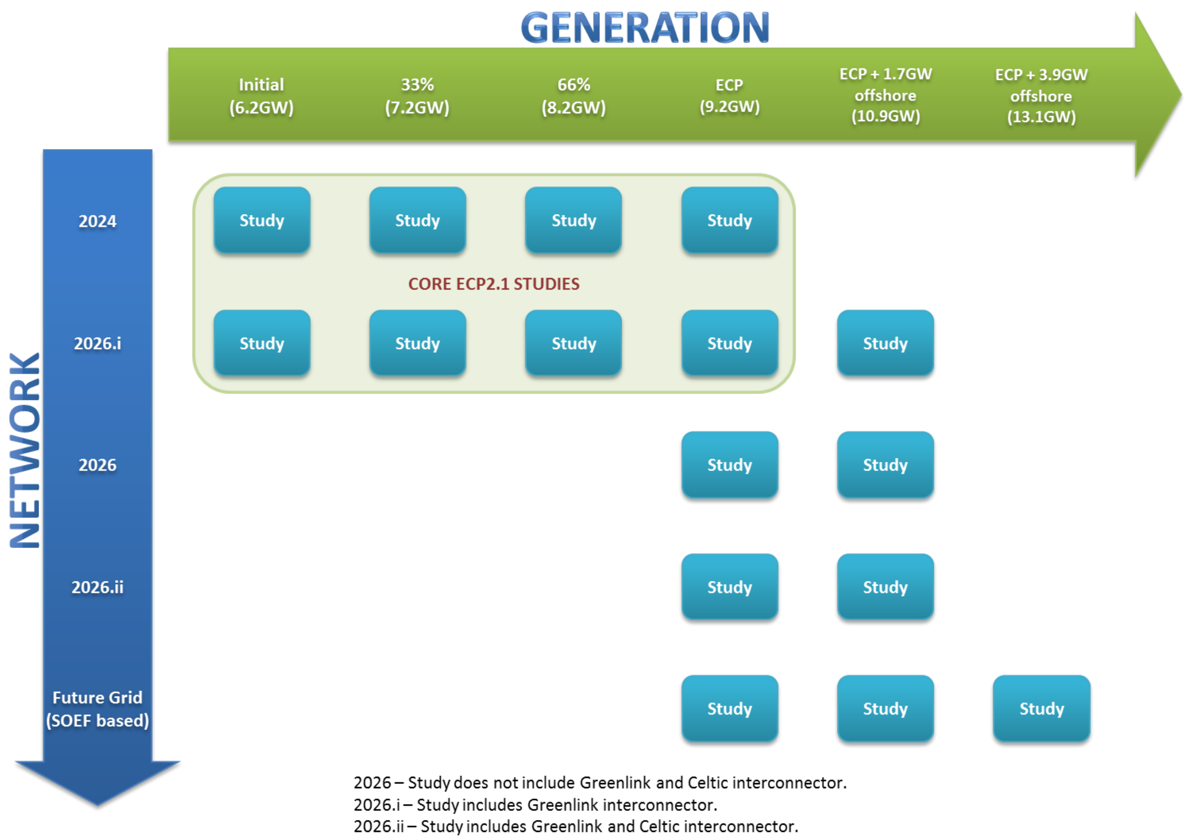


Figure 2-2 Study Scenarios: Matrix of Generation and Network Scenarios

Network	Generation					
	Initial	33%	66%	ECP	ECP + 1.7 GW offshore	ECP + 3.9 GW offshore
2024	X	X	X	X		
2026.i	X	X	X	X	X	
2026				X	X	
2026.ii				X	X	
Future Grid				X	X	X

Table 2-1 Overview of Study Scenarios – Core ECP 2.1 Study Scenarios Highlighted

A description of the generation scenarios and study year scenarios are provided below in Section 2.3 and Section 2.4 respectively.

2.3 Renewable Generation Scenarios

The generation study scenarios range from an "Initial" scenario which includes all renewable generation currently connected plus all Gate 3, non-GPA and ECP 1 renewable generation expected to connect by the end of 2023, to an "ECP" scenario which includes all renewable generation currently connected plus all Gate 3, non-GPA, ECP 1 and ECP 2.1 generation.

During consultations with industry in advance of this review, there was an industry request for further sensitivity studies considering the impact of offshore wind connections to be included in the study scope. As a result of this, two further sensitivity scenarios were developed in consultation with industry: the "ECP + 1.7 GW offshore" and "ECP + 3.9 GW offshore" scenarios.

There are four main generation scenarios summarised as follows:

- The "Initial" scenario includes currently connected renewable generation plus all renewable generation expected to be connected by end of 2023.
- The "33%" scenario includes the renewable generation in the initial scenario plus 33% of the difference in renewable generation between the Initial and ECP scenario.
- The "66%" scenario includes the renewable generation in the initial scenario plus 66% of the difference in renewable generation between the Initial and ECP scenario.
- The "ECP" scenario includes all renewable generation up to and including ECP 2.1.

There are two additional sensitivity scenarios summarised as follows:

- The "ECP + 1.7 GW offshore" scenario includes all renewable generation in the ECP scenario plus an additional 1.7 GW of offshore wind.
- The "ECP + 3.9 GW" offshore scenario includes all renewable generation in the ECP scenario plus an additional 3.9 GW of offshore wind.

A variety of renewable generation scenarios are included to take account of the possibility that not all generators will ultimately connect, and to give a view on the Total Dispatch Down seen under various renewable generation build out scenarios.

The results for each generation scenario are presented explicitly for each area in their respective area report. In this report the results for Area K are presented for each renewable generation scenario.

2.4 Study Year Scenarios

Network	TER (TWh)		
Year	**Ireland**	**Northern Ireland**	**All - Island**
2024	35.8	8.6	44.3
2026	37.5	8.6	46.1
Future Grid	46.5	9.5	56.0

Table 2-2 Total Electricity Requirement (TER) (TWh) from All-Island Generation Capacity Statement 2021-2030

The study years are chosen to capture expected progress over the short to medium term with regard to predicted operational limitation improvements, transmission reinforcements and forecast demand increase.

This is achieved by studying the years 2024 and 2026. For the years 2024 and 2026, the median demand forecast from EirGrid and SONI's All-Island Generation Capacity Statement 2021-2030 was used.

In consulting with industry in advance of this review, there was a request for an additional study showing the impact of the Shaping Our Electricity Future (SOEF) roadmap, recently published by EirGrid and SONI. Hence, a Future Grid scenario has also been studied, which has network and operational constraint assumptions that are aligned with the SOEF study. The demand level for the Future Grid study is based on the All-Island Generation Capacity Statement 2021-2030 high demand scenario for the year 2030.

3 Study Input Assumptions

This section provides an overview of the input assumptions for the over-supply, curtailment and constraint modelling.

3.1 Notable Study Assumptions

The following study assumptions are of note.

3.1.1 Valid for these Generation Assumptions

The estimated over-supply, curtailment and constraint levels in this report are valid for the generation assumptions used in these studies.

3.1.2 All Island Model

As ECP 2.1 is an Ireland connection process, this report provides estimates of over-supply, curtailment and constraint levels for Ireland and not for Northern Ireland. However, for this study, the all island system including Ireland and Northern Ireland has been modelled in Plexos. This is necessary in order to provide a more accurate estimate of generation reduction levels, given that both over-supply and curtailment are all island issues.

3.1.3 Data Freeze

The data freeze for the input assumptions for this analysis was July 2021 for 2024 and 2026 study scenarios and November 2021 for the Future Grid sensitivity study. As a result, there may be some recent developments within the electricity network that are not included.

3.1.4 Transmission Network Outage Programme

A basis of the previous ECP 1 constraints analysis was that the existing network was assumed to be available at all times. In reality, a transmission outage programme will be implemented each year, resulting in outages of transmission circuits and other equipment for periods of time. Outages may be due to scheduled maintenance, forced outages, to facilitate new connections or for reinforcement reasons (e.g. circuit/busbar uprates).

Transmission outages may increase generation constraints on the system and, as a result of industry feedback following ECP 1, a representative transmission outage schedule has been included for this ECP 2.1 analysis. The outages included in this schedule represent a geographical spread of circuits across the system and are each configured for a three-month period. This allows a representation of outage impact in each geographical area to be included in the studies. Longer duration outages which may be required for certain connections, reinforcement works or forced outages are not considered and may result in higher wind and solar constraints. The representative transmission outage schedule used in the studies is given in Appendix A Table A4.

3.1.5 Network Requirement for Batteries and Conventional generators

For this analysis, batteries are modelled with a two-hour storage capacity. The batteries are given a notional buy and sell price in the model. When the system price goes below €5 per MWh, batteries charge drawing megawatts from the system, up to their modelled maximum storage capacity. When the system price goes above €40 per MWh, the batteries provide megawatts to the system until they are fully discharged. This modelling approach means that batteries charge during times of high renewable generation, integrating more solar and wind generation on the system. Note that the batteries in the model are reacting to system wide prices and are not responding to local issues. In general, this approach means batteries do not export power to the system during times of high wind and solar generation.

The situation with conventional generation is similar. For conventional generation, the dispatch is primarily economic in nature. As such, the software only runs the relatively expensive conventional generators infrequently in the simulation.

Hence, the model generally does not dispatch batteries and peaking generators at times of high solar and wind generation output. For this analysis, these assumptions are reasonable. However, in the future, if there was a need for concurrent output from batteries at the same time as wind and solar and/or if a future operation of the system was to require prolonged running of peaker generators, or that some network capacity be explicitly reserved for peaker generators, then this analysis would need to be revised.

3.1.6 Priority Dispatch for Renewable Generation Connecting after July 2019

A recent regulation has been issued from the EU in relation to the treatment of priority dispatch for renewable generation which connected after the 4th July 2019.

The relevant clause (Article 12) is as follows:

> *REGULATION (EU) 2019/943 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 on the internal market for electricity*[2]
>
> *Article 12 (6)*
>
> *Without prejudice to contracts concluded before 4 July 2019, power-generating facilities that use renewable energy sources or high-efficiency cogeneration and were commissioned before 4 July 2019 and, when commissioned, were subject to priority dispatch under Article 15(5) of Directive 2012/27/EU or Article 16(2) of Directive 2009/28/EC of the European Parliament and of the Council (20) shall continue to benefit from priority dispatch. Priority dispatch shall no longer apply to such power-generating facilities from the date on which the power-generating facility becomes subject to significant modifications, which shall be deemed to be the case at least where a new connection agreement is required or where the generation capacity of the power-generating facility is increased.*

Under Article 12, renewable generation connected before the 4th July 2019 will still hold priority dispatch, while generation connected after this date will not. This will create a new type of generator for consideration in the dispatch process – the non-priority dispatch renewable generator, connected post July 4th 2019. A final decision in respect of the treatment of non-priority dispatch renewable generators is currently under consideration by the SEM Regulatory Authorities (RAs). The latest proposed decision by the RAs has been implemented in this ECP 2.1 constraints analysis and is summarised below.

During generation reduction for over-supply reasons, a distinction is made between the treatment of priority and non-priority renewable generators, with non-priority generators being dispatched down ahead of priority generators. Within, these two categories of generation, over-supply is applied pro-rata across the all-island system for all generators in the category.

During curtailment or constraint of renewable generation, no distinction is made between priority and non-priority generators, and dispatch down is applied pro-rata across either the all-island system (in the case of curtailment), or across the relevant transmission nodes (in the case of constraint).

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0943&from=EN

3.2 Network

3.2.1 Transmission Network

This section details the modelling assumptions used in this study for the transmission network.

The transmission system in Ireland is a meshed network with voltage levels at 400 kV, 275 kV, 220 kV and 110 kV. The network is necessary to allow bulk power flows to be transported over long distances from power stations and renewable generation sites to the towns and cities in Ireland. A diagram of the Irish transmission system can be seen in Figure 3-1. In addition to the current transmission network a number of network reinforcements are considered in each network scenario. A list of the network reinforcements used in the study are provided in Appendix A.

Figure 3-1 shows the Ireland transmission network in 2021. Figure 3-2 shows the Future Grid Ireland transmission network, this diagram shows the location of the large network projects that are included in the Future Grid scenario.

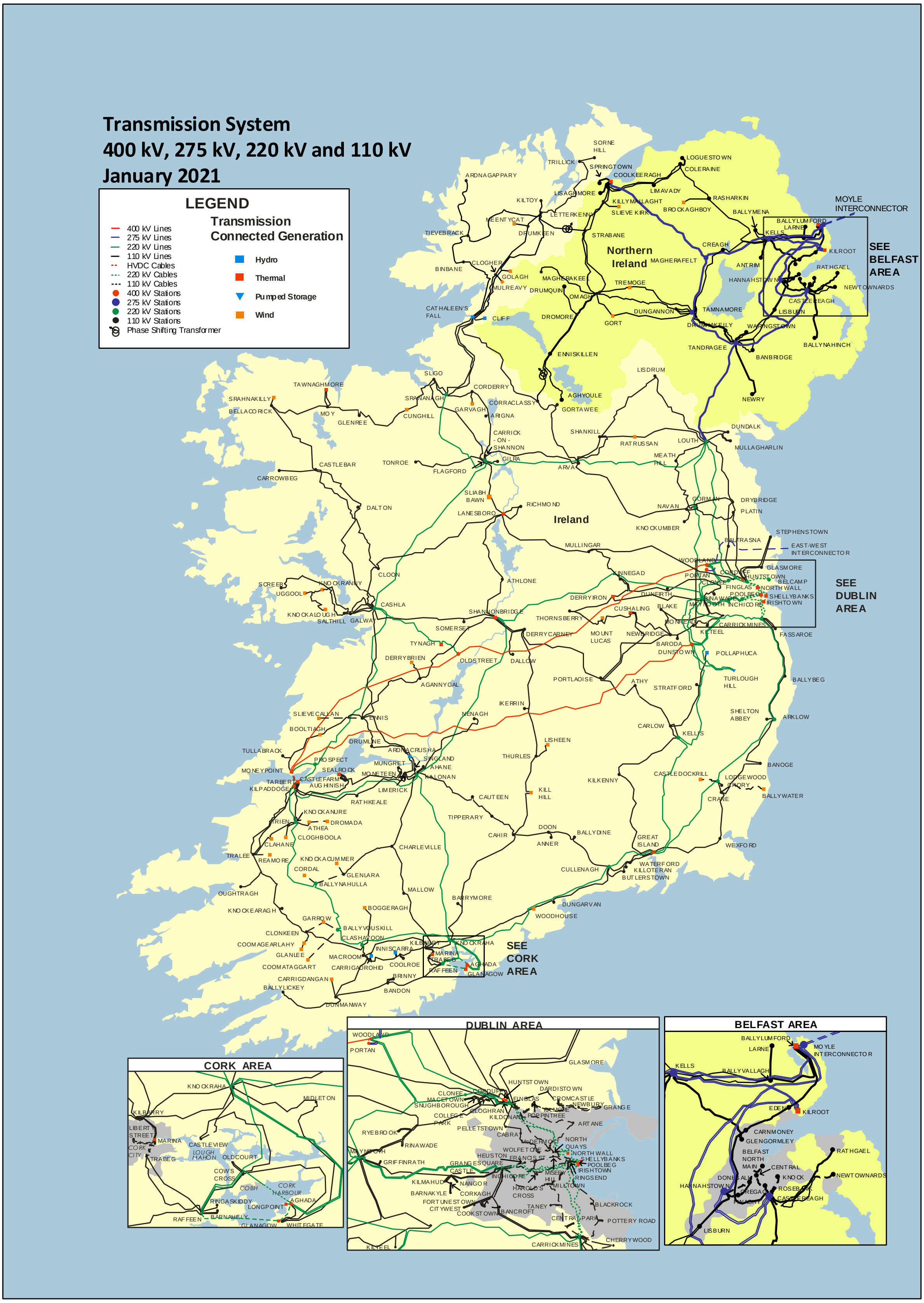


Figure 3-1 Ireland Transmission Network 2021

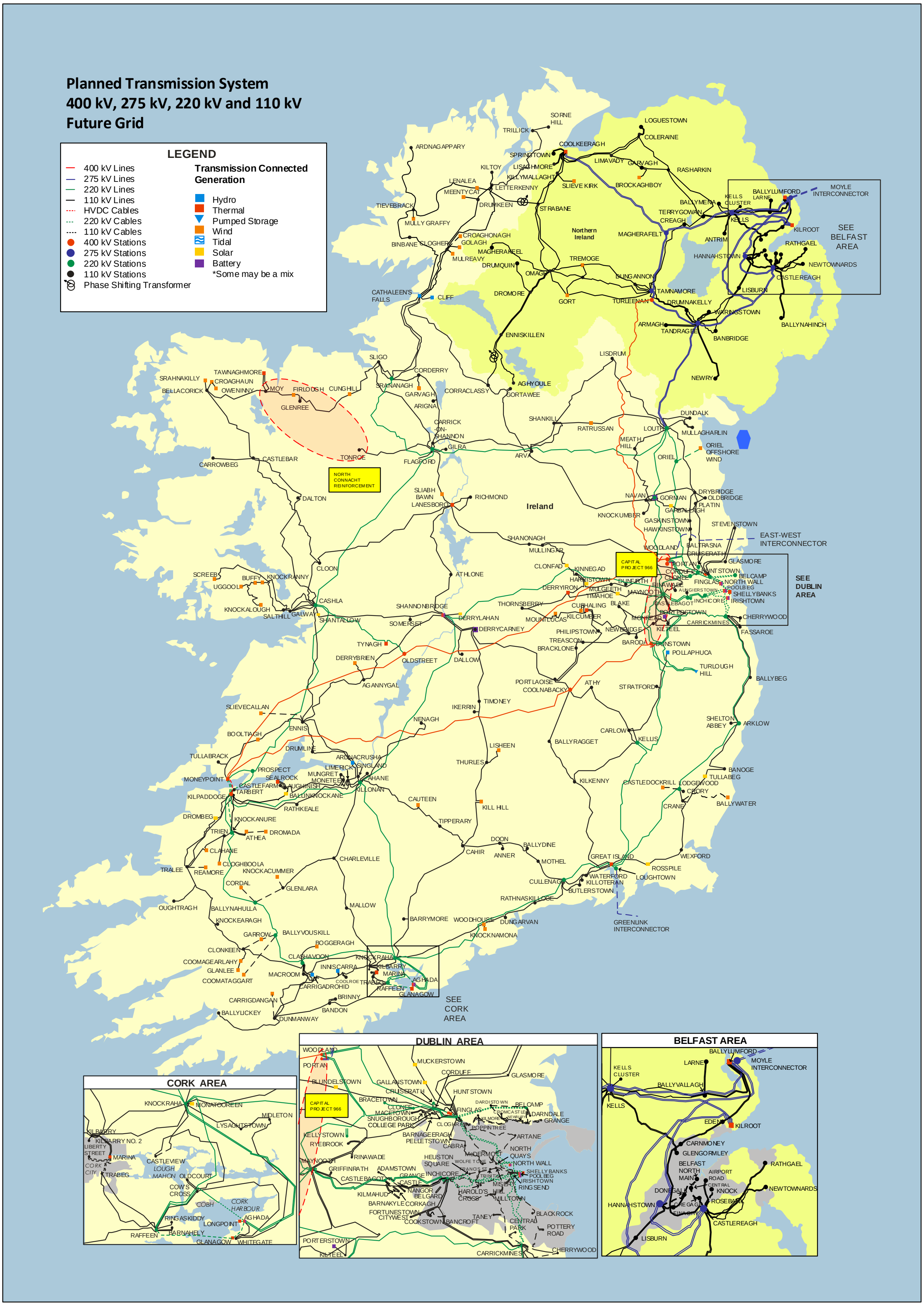


Figure 3-2 Ireland Transmission Network Showing Assumed Future Network Reinforcements

3.2.2 Distribution System

For the purposes of the constraints modelling, a simplified representation of the distribution system is used whereby all load and generation is assumed to be aggregated to the nearest transmission node.

Hence, this report does not account for the impact of constraints (if any) on the distribution network.

3.2.3 Ratings and Overload Ratings

The Ireland transmission system is operated to safely accommodate a single transmission asset loss (N-1 contingency). While formulating an optimum dispatch, system operation takes account of potential overloads that could be caused as a result of certain N-1 contingencies on the transmission system. When determining if the post-contingency flows are within limits, the system operator uses the overload rating of the apparatus or plant (for N-1) as well as the normal rating (for N flows). Where available, the overload rating is typically higher than the normal rating, but is only allowed in emergency conditions and for short periods of time. The overload rating is plant specific. The study is modelled to include the N-1 contingency monitoring.

This rating and overload rating are handled in Plexos.

3.2.4 Transmission Reinforcements

For each study year (2024, 2026 and Future Grid) a number of transmission reinforcements are added to the model. These additional transmission reinforcements include overhead line (OHL) and cable uprating as well as new build OHLs, cables and transformers.

A full list of the transmission reinforcements (new build and uprates) assumed in the constraints modelling is included in Appendix A.1 – A.3.

Customers should recognise that the reinforcements listed will be subject to a full analysis and optimisation process under EirGrid's Framework for Grid Development before a decision is made to proceed with them. Inclusion of transmission reinforcement projects in this report is not confirmation that they will proceed, and other projects may be selected in their place. For the avoidance of doubt, any party making a decision based on this list should recognise that these are modelling assumptions only and should not be considered as a basis in fact. Additional information about reinforcements is available on the EirGrid website.

3.3 Demand

An introduction to the demand used in this report is provided in Section 2.

The demand profile shapes for Ireland and Northern Ireland are based on their 2018 historical demand profiles. The historical profiles are adjusted to reflect a future winter peak and annual energy value based on the All Island Generation Capacity Statement 2021 – 2030 median demand (for 2024 and 2026) and 2030 high demand (for Future Grid). The values used are shown in Table 3-1.

	TER (TWh)			Transmission Winter Peak (GW)		
Year	**Ireland**	**Northern Ireland**	**All - Island**	**Ireland**	**Northern Ireland**	**All-Island**
2024	35.8	8.6	44.3	5.96	1.67	7.57
2026	37.5	8.6	46.1	6.14	1.69	7.77
Future Grid	46.5	9.5	56.0	7.04	1.80	8.75

Table 3-1 Forecast Demand and Peak for Study Years 2024, 2026 and Future Grid

The nodal distribution of the load used in the constraints modelling is consistent with the "All Island Ten Year Transmission Forecast Statement 2019".

3.4 Interconnection

Existing Interconnection on the island consists of a tie line between Ireland and Northern Ireland plus two High Voltage Direct Current (HVDC) interconnectors to Great Britain (GB), referred to as the Moyle Interconnector and the East-West Interconnector (EWIC). This section describes the assumptions and modelling methodology used for interconnection in these studies.

3.4.1 North–South Tie Line

The connection of Ireland's power system to Northern Ireland is achieved via a double circuit 275 kV line running from Louth to Tandragee. In addition to the main 275 kV double circuit, there are two 110 kV connections, one between Letterkenny in Co. Donegal and Strabane in Co. Tyrone, and the other between Corraclassy in Co. Cavan and Enniskillen in Co. Fermanagh.

The purpose of these 110 kV circuits is to provide support to either transmission system for certain conditions or in the event of an unexpected circuit outage. Phase shifting transformers in Strabane and Enniskillen are used to control the power flow under normal conditions.

It is assumed that the Letterkenny-Strabane and Corraclassy-Enniskillen 110 kV connections are not used to transfer power between the two control areas for the purposes of this modelling exercise.

EirGrid and SONI are also currently developing a 400 kV North-South Interconnector between Woodland in Ireland and Turleenan in Northern Ireland. The new North-South Interconnector is assumed to be in place for the 2026 and Future Grid scenarios.

Prior to the 400 kV North-South Interconnector being built, the existing Louth-Tandragee Interconnector is assumed to be limited. The assumption in this study is that flows are limited to 300 MW from South to North and 300 MW from North to South. When the 400 kV North-South Interconnector is in place, this limitation will be effectively removed.

3.4.2 Moyle Interconnector

The Moyle Interconnector, which went into commercial operation in 2002, connects the electricity grids of Northern Ireland and Great Britain between Ballycronan More (Islandmagee) and Auchencrosh (Ayrshire). It technically has a transfer capacity of 500 MW, however due to constraints on the transmission networks at either end this capacity can be reduced.

For the purposes of this study the Moyle Interconnector is assumed to have a 400 MW capacity for the 2024 and 2026 study horizons, this assumption is increased to 500 MW for the Future Grid scenario. An overview of the interconnector capacities can be seen in Table 3-2.

3.4.3 East–West Interconnector (EWIC)

The East-West Interconnector links the electricity grids of Ireland and Great Britain, from convertor stations at Portan in Ireland to Shotton in Wales. It began commercial operation in December 2012.

The EWIC Interconnector is modelled for all study years with a maximum capacity of 500 MW.

3.4.4 Additional Interconnection

For 2026 studies, three separate scenarios for additional interconnection were studied. The core 2026 scenario includes a Greenlink interconnector with a capacity of 500 MW connecting Ireland to Great Britain. Two 2026 sensitivity studies were also included: one with no additional interconnectors; and one with the Greenlink interconnector as well as a Celtic interconnector with a capacity of 700 MW connecting Ireland to France.

For the Future Grid scenario, the Celtic interconnector with a capacity of 700 MW and the Greenlink interconnector with a capacity of 500 MW are both modelled.

3.4.5 Interconnector Capacities

The interconnector capacities used in the model are shown in Table 3-2.

Interconnector Export/Import Capacity (MW)	2024	2026	2026.i	2026.ii	Future Grid
Moyle	400/450	400/450	400/450	400/450	500/500
EWIC	500/500	500/500	500/500	500/500	500/500
Greenlink			500/500	500/500	500/500
Celtic				700/700	700/700

Table 3-2 Interconnection Capacities

It is a study assumption that interconnectors can be used to export renewable energy, with the provision that, when calculating an annual average behaviour, it would be optimistic to assume that maximum interconnector export will always be available when required.

Based on historical flow analysis, the interconnectors to GB are modelled to have a full export capacity for 65% of the time. As a result of this the Moyle, EWIC and Greenlink interconnectors are modelled with an ability to export at full capacity for 65% of the time.

However, the Celtic interconnector's export capacity is de-rated by 20%, i.e. Celtic has an export rating of 560 MW in the model. This has been assumed as there will be times when the international market schedule will sometimes provide less export than could theoretically be possible. For example, the receiving country may not be in a position to accept large trades, the position of renewable energy in the day ahead market may be impacted by forecast error, etc.

3.5 Priority Dispatch

3.5.1 Priority Dispatch for Wind and Solar Generation

The priority dispatch of renewable generation is only applicable for generators connected before the 4th July 2019.

For this study, when applying generation reduction for over-supply reasons, priority generators are given a negative offer price in the model to ensure their priority in the dispatch. During generation re-dispatch for curtailment and constraint reasons, the renewable generators are all given a zero-offer price without a distinction being made between priority and non-priority generators[3]. As Plexos seeks to provide the most economical solution while satisfying all system constraints it consequently will run as much wind and solar generation as is possible.

3.6 Generation

An introduction and overview of the generation in this study is provided in Section 2. Additional detail is now provided in this section.

3.6.1 Conventional Generation

The model includes a portfolio of the thermal conventional generation in both Ireland and Northern Ireland.

[3] These generator price assumptions have been applied for the purposes of modelling in this study. The final SEMC decision on the implementation of Articles 12 and 13 of the Clean Energy Package has yet to be published and may differ from the implementation used in this study.

The operating characteristics of the existing conventional generation employed in the modelling are principally based on the SEM Generator Dataset. In some instances, minor changes to the dataset are made due to additional information becoming available to the TSOs.

The technical dataset includes the following information:

1. Fuel type (e.g. gas, wind, coal etc.) including emissions rates;
2. Maximum and minimum operating output (MW);
3. Capacity state and heat rates (used to determine how much fuel is burnt to produce 1 MW of output power);
4. Ramp rates (important to determine how quickly a machine can change its power output);
5. Minimum up-time and downtime.

This technical data allows the Plexos software to calculate the cost of generating a megawatt of electrical energy for each generator in the model. Note that each generator has a different cost.

Other factors that influence the generation dispatch over an extended study horizon are:

- Generation commissioning and decommissioning;
- Generation outages;
- Generation emissions restrictions.

3.6.2 Conventional Generation Outages

Scheduled and forced conventional generator outages are modelled in Plexos using Scheduled Outage Durations (SODs) and Forced Outage Probabilities (FOPs).

For this study, the Forced Outage Probabilities are used. The FOPs employed are those used for the Dispatch Balancing Costs (DBC) 2020 – 2021 Forecast. Plexos generates forced outage patterns from the FOP and mean time to repair data, which provides a deterministic outage pattern against which the model dispatches generation against demand.

3.6.3 Renewable Generation

The amount of electrical energy output from renewable generation is generally described in terms of capacity factor. The capacity factor relates to the amount of energy that may be achieved from a renewable technology over the period of one calendar year. One factor in the energy yield difference is that solar PV does not produce electrical energy at night, but the wind can blow at any time of the day or night.

The values used in this study for solar and wind are listed in the following sections.

3.6.3.1 Solar

On average, solar profiles tend to have a fairly predictable shape. Figure 3-3 shows the average hourly energy output from solar PV over a one year period. The capacity factor for solar PV is largely dependent on latitude - the closer to the equator the higher the annual capacity factor. The solar capacity factor for a country like Spain will have a value of around 20%, i.e. double the output of Ireland.

The surface plot of Figure 3-3 highlights the typical Ireland solar profile characteristic. The lowest intensity of solar electrical output is in the four winter months November through to February with hourly values on average not exceeding 20%. As expected the solar electrical energy output is highest in the summer months with average hourly solar electrical output peaking in the 50-60% range.

The main point is that the solar electrical available energy is fairly predictable and is typically there during times of increasing electrical demand i.e. the morning load rise. However, the winter peak demand will not be met by solar.

Solar energy output may be reduced if it is located on a part of the network that has constraint issues.

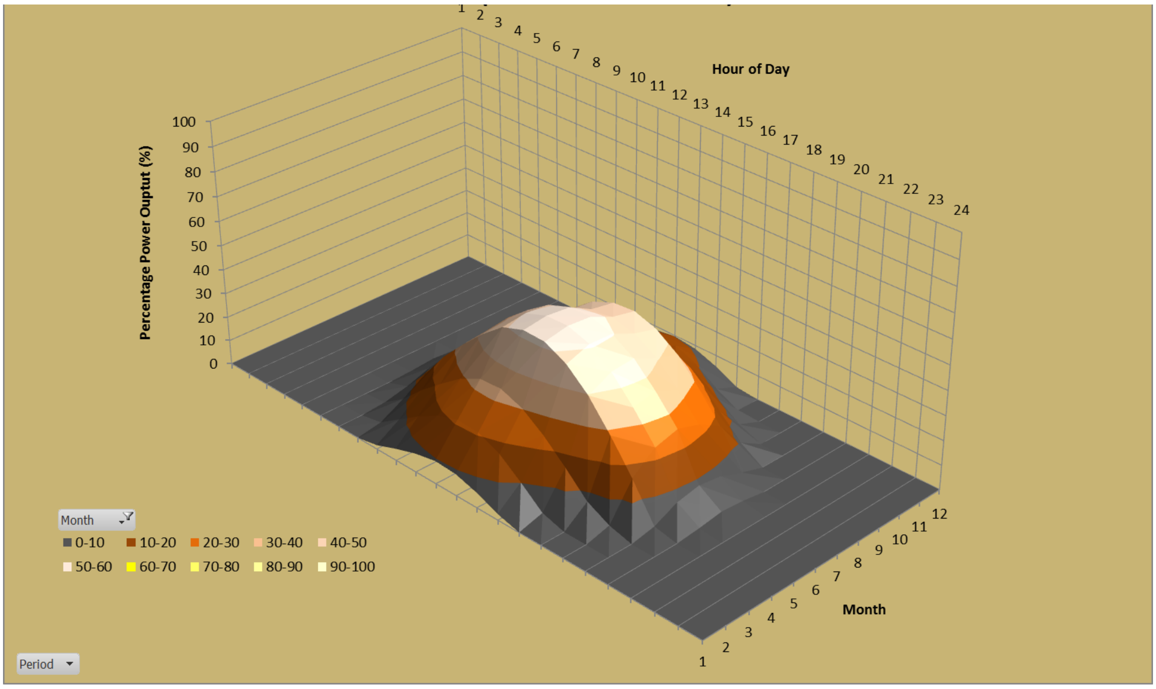


Figure 3-3 Solar Energy Profile (Monthly Average – Hour of Day)

3.6.3.1.1 Solar Profiles

Solar generation is modelled in the analysis using an hourly solar power series at every transmission node where solar generation is connected.

To provide a representative solar series for Ireland, three solar profiles are used. The groupings used are shown in Figure 3-4. The capacity factors of the different profiles are shown in Table 3-3.

This approach captures the variation in solar energy when comparing solar farms in the south and solar farms in the north. Clearly, this approach does not consider hourly variations in solar power within each group, due to local cloud cover in that individual hour, etc. Since this study is focused on the over-supply, curtailment and constraint on the transmission system, it is reasonable to assume that these solar profiles capture the average behaviour of solar on the island.

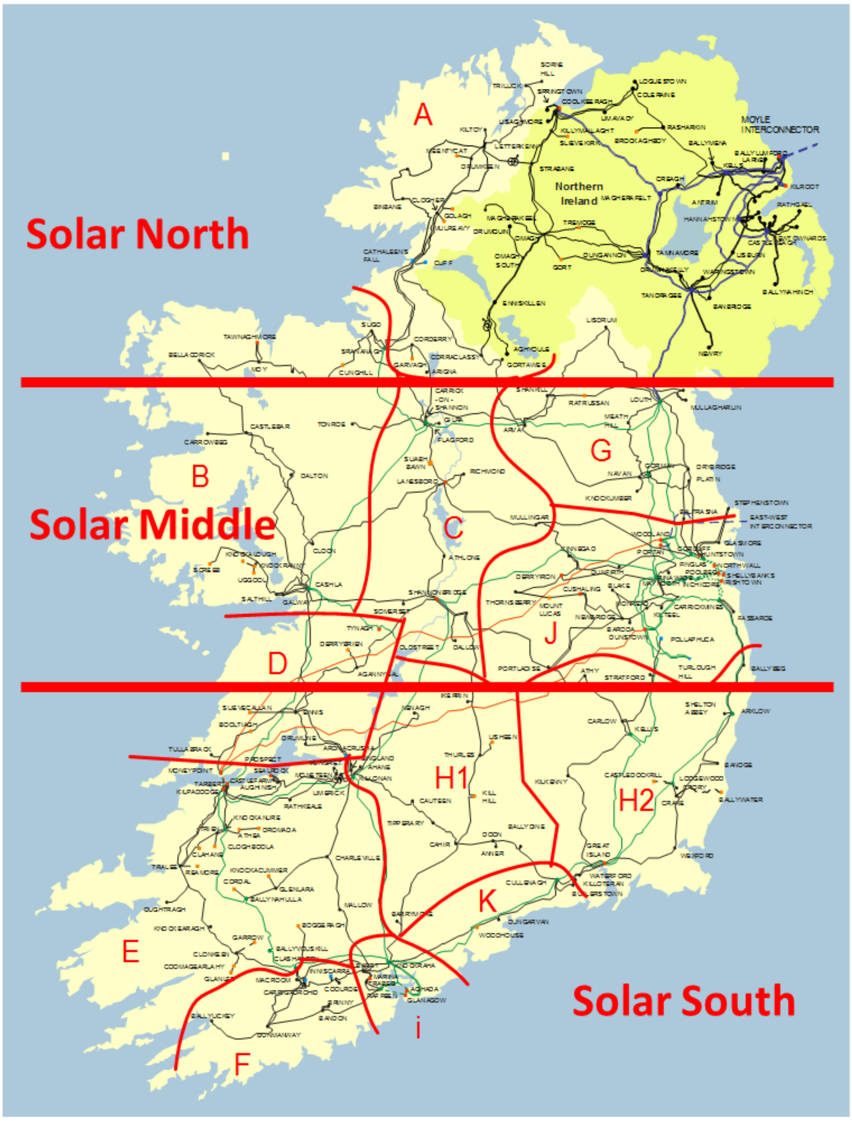


Figure 3-4 Groupings Used for Solar Profiles in Model

Solar	Capacity Factor
Solar North	10%
Solar Middle	11%
Solar South	12%

Table 3-3 Capacity Factor of Solar Profiles

It should be noted that given that the profiles are averaged, the expected reduction in generation levels may be underestimated in this study.

3.6.3.2 Wind

This section details how wind generation on the island of Ireland is modelled in Plexos.

Wind generation is modelled using an hourly wind power series at every transmission node where wind generation is connected. To provide a representative wind series, wind profiles are used. In this study, wind profiles are used for all wind farms in an area, i.e. the same wind profiles are used for wind generators in a single area.

By using historical wind profiles, it is possible to account for the geographical variation of wind power across the island. The wind profiles for the study year for both Ireland and Northern Ireland are created using 2015 wind data (2015 was a comparatively high wind year). The capacity factors of these profiles are shown in Figure 3-5 and in Table 3-4.

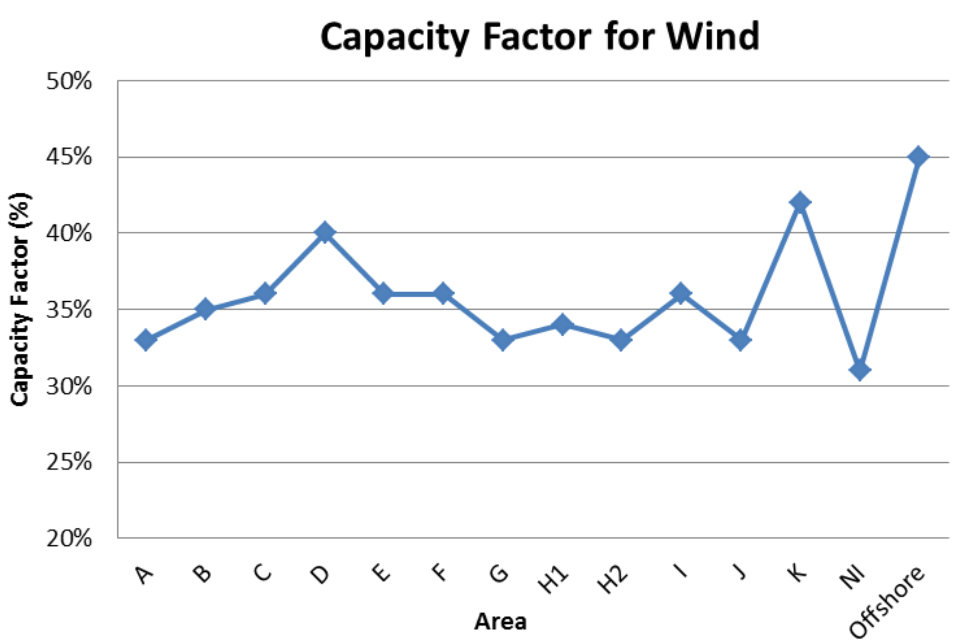


Figure 3-5 Capacity Factor by Area for Wind

Wind Regions	2015 Capacity Factors for Future Windfarms
Ireland	
A	33%
B	35%
C	36%
D	40%
E	36%
F	36%
G	33%
H1	34%
H2	33%
I	36%
J	33%
K	42%
Offshore	45%
Northern Ireland	
NI	31%

Table 3-4 Capacity Factors for Future Wind

Capacity Factor

The average wind generation capacity factor for Ireland using the historical 2015 wind profiles is 36%. This gives a capacity factor that is higher as a system average than has been achieved in recent years. This value is representative of a wind fleet that will include new onshore and offshore wind farms incorporating the latest available technology. Consultation with industry selected 2015 as a suitable wind year to use in this study.

3.6.3.3 Renewable Generation – Installed Capacity

Section 2 describes the renewable generation scenarios that are considered as part of this analysis. Some further detail is provided here.

A variety of renewable generation scenarios are included to take account of the possibility that not all generators will ultimately connect, and to give a view on the Total Dispatch Down seen under various renewable generation build out rates. The levels of installed solar and wind generation included in each scenario are shown in Table 3-5.

The Initial scenario includes currently connected renewable generation plus all renewable generation expected to be connected by end of 2023. The "ECP" scenario includes all renewable generation up to and including ECP 2.1. The 33% and 66% scenarios were created by scaling the outputs of generators assumed to connect post-2023 by 33% and 66% respectively.

Gen Type (MW)	Initial	33%	66%	ECP	ECP + 1.7 GW offshore	ECP + 3.9 GW offshore
Solar	1,245	1,804	2,380	2,939	2,939	2,939
Wind	4,957	5,388	5,833	6,264	6,264	6,264
Wind Offshore	0	0	0	0	1,720	3,932
Totals	**6,202**	**7,192**	**8,212**	**9,202**	**10,922**	**13,134**

Table 3-5 Connected and Contracted Solar and Wind Quantities in Ireland for Our Study Scenarios

3.6.3.4 Generation Controllability

Historically smaller (and some older) wind farms and solar generators are not controllable. The study methodology takes into account all uncontrollable wind and solar generation and does not include these generators in any output reduction calculations.

Generally, apart from some older windfarms, it is assumed that all wind farms are controllable if their MEC is greater than or equal to 5 MW (for generators which received a connection offer before 2015) or if their MEC is greater than or equal to 1 MW (after 2015). All solar farms with an MEC greater than or equal to 1 MW are assumed to be controllable.

3.6.3.5 Perfect Foresight – Wind Forecast

Building an economic power market model will always require input assumptions. One such assumption is that the climatic year will be from historical data. The use of historical data means that the power market model will create generation commitment and dispatch decisions based on the perfect foresight of wind and solar output. In real-time operation of the power system, this is not the case and there will be forecast errors associated with variable renewables and demand. Perfect foresight may mean that power market models show lower levels of curtailment since it may choose to de-commit units based on what it knows will happen. In reality, wind or demand forecast errors may mean that a different schedule of generators may be required than that modelled with perfect foresight.

3.7 System Operation

3.7.1 Safe Operation (Security Constrained N-1)

The basic principle of N-1 security in network planning states that if a component – e.g. a transformer or circuit – should fail in a network, then the network security must still be guaranteed and the remaining network resources must not be overloaded or must not exceed the short-term overload capability of the equipment. System voltage must also remain within permitted limits although Plexos, as a DC load flow analysis tool, does not monitor system voltage as part of this study.

EirGrid operates the Ireland transmission network to be N-1 secure. This Plexos study also monitors N-1 contingencies to ensure the results are valid for an N-1 secure network.

3.7.2 Operational Constraint Rules

This section presents the all-island operational constraints, which feed into the Plexos economic dispatch tool. The operational constraints cover System Non-Synchronous Penetration (SNSP), inertia, operating reserve requirements and minimum number of synchronous units required.

The purpose of this section is to define the set of operational constraints, and how these constraints may evolve over the proposed study horizons. Operational constraints are important as they define system limits that may require reductions in renewable generation, resulting in curtailment. In general, it is expected that certain operational constraints may be relaxed over time, as the system evolves.

3.7.2.1 System-Wide Operational Constraints

There are a number of system-wide operational constraints which ensure that the system operators can operate the system securely and within stability limits.

This study uses the operational constraints listed in Table 3-6 and Table 3-8. The RoCoF limit was not monitored in the Plexos study but is included in Table 3-6 for information.

Active System Wide Operational Constraints (SNSP, Inertia & Minimum Sets)		
Limit	**Operational Constraint Rule**	**Limit Across the Study Years**
System Non-Synchronous Penetration (SNSP)	There is a requirement to limit the instantaneous penetration of asynchronous generation connected to the all island system.	80% - 2024 85% - 2026 95% - Future Grid
Operational Limit for Inertia	There is a requirement to have a minimum level of inertia on the all-island system.	20,000 MWs - 2024 17,500 MWs - 2026 15,000 MWs - Future Grid
RoCoF	Maximum acceptable Rate of Change of Frequency on the system for the loss of a large infeed (e.g. trip of an interconnector or generator)	1 Hz/s - 2024, 2026 & Future Grid
Minimum sets	Minimum number of synchronous machines required to be on load in each jurisdiction.	4 IE & 3 NI - 2024 4 IE & 2 NI - 2026 2 IE & 2 NI - Future Grid

Table 3-6 Active System Wide Operational Constraints (SNSP, Inertia & Minimum Sets)

3.7.2.2 System Non-Synchronous Penetration (SNSP)

There is a system need to limit the amount of 'non-synchronous' generation at any point in time. The limit ensures that the power system operates within a stable zone.

A mathematical expression describing the SNSP rule is as follows:

$$\frac{All\ Island\ Asynchronous\ Generation + Interconnector\ Imports}{All\ Island\ Demand + Interconnector\ Exports} \leq SNSP\ Limit$$

An increase in the SNSP limit will allow more 'non-synchronous' generation to be accepted onto the system.

3.7.2.3 Minimum Number of Synchronous Generators

There is a requirement to have a minimum number of conventional generators synchronised at all times to provide inertia to the power system, ensure voltage stability, dynamic stability and to ensure that network limitations (line loading and system voltages) are respected. The minimum number of units in each study horizon is given in Table 3-6.

Changes to the rules are guided by operational and/or planning assumptions. Table 3-7 provides the current requirements for minimum number of conventional units required on the system.

Minimum Conventional Generation Assumptions
Ireland
A minimum of 2 large units in the Dublin region must be synchronised at all times. A minimum of 5 large units in Ireland must be synchronised at all times.
Northern Ireland
A minimum of 3 large units in Northern Ireland must be synchronised at all times.

Table 3-7 Summary of Current Conventional Minimum Generation Assumptions

3.7.2.4 Operating Reserve

Operating reserve is surplus operating capacity that can instantly respond to a sudden increase in load or decrease in generation output. Operating reserve provides a safety margin that helps ensure reliable electricity supply despite variability in the load and generation. To provide reserve, some generators are part-loaded i.e. are operated below their maximum output capacity to provide a fast-acting source of reserve. Reserve can also be provided by non-conventional sources such as batteries, storage, interconnectors and demand response, and the future, it is expected that a greater share of reserve may be maintained by such non-conventional sources.

The system wide operating reserve requirements that are used in these studies are shown in Table 3-8.

Operating Reserve Requirements	
Limit	**Operational Constraint rule**
Primary Reserve	All Island primary reserve must be at least 75% of the largest in-feed with jurisdictional limits of: Ireland: 155 MW (daytime) and 150 MW (night time) Northern Ireland: 50 MW

Table 3-8 Active System Wide Operating Reserve Constraints

4 Study Methodology

4.1 Introduction

This section provides an overview of the modelling methodology employed to determine the likely over-supply, curtailment and constraint levels for renewable generation in this study.

The methodology of production cost modelling is utilised to conduct the studies for this report. This section includes a detailed description of production cost modelling, and an overview of Plexos (the modelling tool employed) is also provided. In addition, there is a description of the over-supply, curtailment and constraint modelling methodology.

4.2 Production Cost Modelling

In general terms, production cost models utilise optimisation algorithms with the objective of minimising the cost of generating power to meet demand in a region while satisfying operational, security and environmental constraints. A production cost model minimises the combined fuel cost, CO_2 cost, and variable operation, maintenance and start-up cost. In the model, wind and solar generation are variable sources with zero production cost. Hydro generation also has zero production cost but is energy limited. Chronological production cost models optimise generator commitment and dispatch scheduling for every hour of a study period (typically one-year duration).

Production cost models require:

- Specification of individual generator capabilities including capacity, start-up energy, annual forced outage rate, annual scheduled outage duration, reserve provision capabilities, emission rates and heat rates (fuel input requirement per unit output generation).
- Specification of the hourly demand profile for the region.
- Specification of the fuel price for each type of fuel.
- Specification of the transmission network (required for studies where transmission constraint information is the desired output).
- Specification of contingencies.
- System security constraints such as the requirement for reserve.
- Generator operational constraints such as maximum and minimum operational levels, ramp rates, minimum runtimes and downtimes etc.
- Environmental considerations such as the cost of CO_2.

The commercially available production cost modelling tool employed in this study is Plexos.

4.3 The Software: Plexos Integrated Energy Model

Plexos is a detailed generation and transmission analysis program that has been widely used in the electricity industry for many years. EirGrid has extensive experience in using this simulation tool to model the Irish power system. It is a production cost modelling simulation program, used to determine power system performance and cost. It is a complex and powerful tool for power system analysis, with separate commitment and dispatch algorithms.

Commitment and Dispatch

The commitment process refers to the selection of a number of generators, from the total generation portfolio, that are available to meet customer demand. The decision as to when these generators should come on or off-line is also part of the commitment process. So, for example, additional generation is committed on Monday mornings in order to meet higher weekday (than weekend) demand.

The dispatch process refers to the decisions taken on the loading of individual generation units. Thus, the contribution from each online, or committed, unit towards meeting customer demand is determined by the dispatch decision.

Generator, Demand and Network

Full technical performance characteristics and operational cost details of each generation unit on the system are specified. An hourly system demand profile is also required. In this study, the transmission system is also modelled.

The program output provides complete details of the operation of each generation unit. These are aggregated into system totals. Flows on transmission lines can be monitored and potential constraints on the system can be identified. A wide range of output reports are available, from system summaries to hour-by-hour information on individual generators.

DC Loadflow

Plexos is a DC loadflow simulation tool. Therefore, it only models real power flows and does not consider voltage. Transmission plant and line ratings are MVA rated and ratings vary with voltage. For the purposes of modelling the DC load flow MW ratings for the circuits, the model assumes a conversion factor of 0.9.

The conversion factor allows the necessary spare capacity for reactive power on the circuits and it allows for post-contingency low voltage. This 0.9 conversion factor gives a good performance for a wide range of pre-contingency and post-contingency conditions.

The Plexos model, as constructed, does not account for losses. However, losses are accounted for within the Total Electricity Requirement (TER) demand figures.

4.4 System Model

For this study, the system is modelled at generator level i.e. each conventional generator is modelled in detail. Characteristics such as heat rates, ramp rates, minimum runtime and downtime, start-up energy, reserve provision capabilities, annual forced outage rate, annual scheduled outage duration and emission rates of each individual generator are specified.

Solar and wind powered generators are modelled at 110 kV node level. In other words, if several windfarms are fed from a 110 kV node, the model represents them as a single windfarm at that node. The same is true for solar farms. These generators use hourly generation profiles series. More detail on the modelling of solar and wind powered generation is provided in Section 3.6.3.

Ireland and Northern Ireland are treated as a single dispatch system in the production cost model for the purposes of producing an optimal minimum cost commitment and dispatch. Generators are dispatched based on their short-run marginal costs (which include the costs of fuel and CO_2 emissions) and in accordance with the dispatch assumptions outlined below.

4.5 Software Determination of Over-Supply, Curtailment and Constraint

For this report, wind and solar generators are assumed to be Grid Code compliant and it is assumed that controllable wind and solar generators can be instructed to reduce their output if required. It is worth noting that there are a small number of older wind turbine sites that are uncontrollable, as mentioned in Section 3.6.3.4.

The Plexos model is used to calculate over-supply, curtailment and constraint. A number of supplementary studies are also needed to properly apportion each of these three types of reduction in generator output.

In the simulation, generators are committed and dispatched in the most economical manner while satisfying operational and security constraints such as limitations on the instantaneous wind/solar penetration, operating reserve requirements, requirement for a minimum number of synchronised conventional generators, system inertia limits, as well as the limitations of the transmission network.

The simulation is a security constrained N-1 study. This means that the network flows are constantly monitored to be safe against the possible loss of any item of transmission equipment.

The total reduction in energy for each renewable generator is calculated by comparing the renewable energy output from the simulation with the available renewable energy.

4.6 Apportioning of Over-Supply, Curtailment and Constraint

Over-supply

Per Article 12 of the EU's Clean Energy Package, priority dispatch of renewable generation will continue to apply only to generators which connected prior to July 4th 2019.

For this study, during generation reduction for over-supply reasons, a distinction is made between the treatment of priority and non-priority renewable generators, and non-priority generators are dispatched down ahead of priority generators. Within, these two categories of generation, over-supply is applied pro-rata across the all-island system for all generators in the category.

Curtailment

For hours when it is necessary to curtail wind and solar generation output, a decision has to be made as to which generators should have their output reduced. It is assumed in this study that, where possible, all controllable wind and solar generators share the reduction in output energy arising from curtailment in proportion to their available energy in that hour i.e. on a pro-rata basis.

Constraint

When a transmission constraint occurs, Plexos will attempt to alleviate the constraint in the most cost-effective manner.

If a transmission constraint causes wind or solar generation to be constrained down, Plexos' internal dispatch logic may choose one generator to constrain down out of several that have the same flow impact on the constraint (due to the fact that, in the constraints model, all wind and solar generators are modelled with zero cost of production).

This report studies the connection of very large amounts of generation to the transmission network. As such, there are some areas where the levels of transmission constraints are both large and frequent. There are also areas where there are, at times, several overlapping operational and transmission constraints. This makes it more difficult to apportion curtailment and constraints to individual nodes.

Post-processing of the results is required to ensure study results are more representative of the application of a constraint instruction. The process involves sharing the constraint volume proportionally between generators that have a similar impact on a constraint issue.

5 Results Summary for Ireland

This section provides a summary of the Total Dispatch Down levels estimated by this study at a system level for Ireland.

Results are shown for the core study scenarios consisting of:

- Study year scenarios 2024 (with no future interconnection) and 2026i (with one future interconnector – Greenlink);
- Renewable generation scenarios Initial, 33%, 66% and ECP.

Results are also shown for the sensitivity study scenarios that were developed in consultation with industry, and in response to industry feedback, consisting of:

- Two 2026 sensitivity studies considering the impact of varying levels of future interconnection: 2026 (with no future interconnection) and 2026ii (with two future interconnectors – Greenlink and Celtic);
- A Future Grid study based on 2030 demand levels and aligned with the network from the SOEF Roadmap.
- Two offshore wind scenarios: ECP + 1.7 GW offshore (2026 and 2030) and ECP + 3.9 GW offshore (2030);

Figure 5-1, Figure 5-2 and Figure 5-3 provide an overview of:

- System Total Dispatch Down percentage levels; broken down by over-supply, curtailment and constraint.
- System Total Dispatch Down and wind and solar generated energy levels in TWh; broken down by over-supply, curtailment and constraint.
- Total Dispatch Down percentage levels per area; broken down by over-supply, curtailment and constraint.

In general, a reduction in Total Dispatch Down levels is seen in later study years due to the benefits of network reinforcements, future interconnection, relaxation of operational constraints and increased demand levels.

An increase in Total Dispatch Down levels is seen for the offshore sensitivity studies, which is largely driven by over-supply.

More detailed results for Area K can be seen in Section 6.

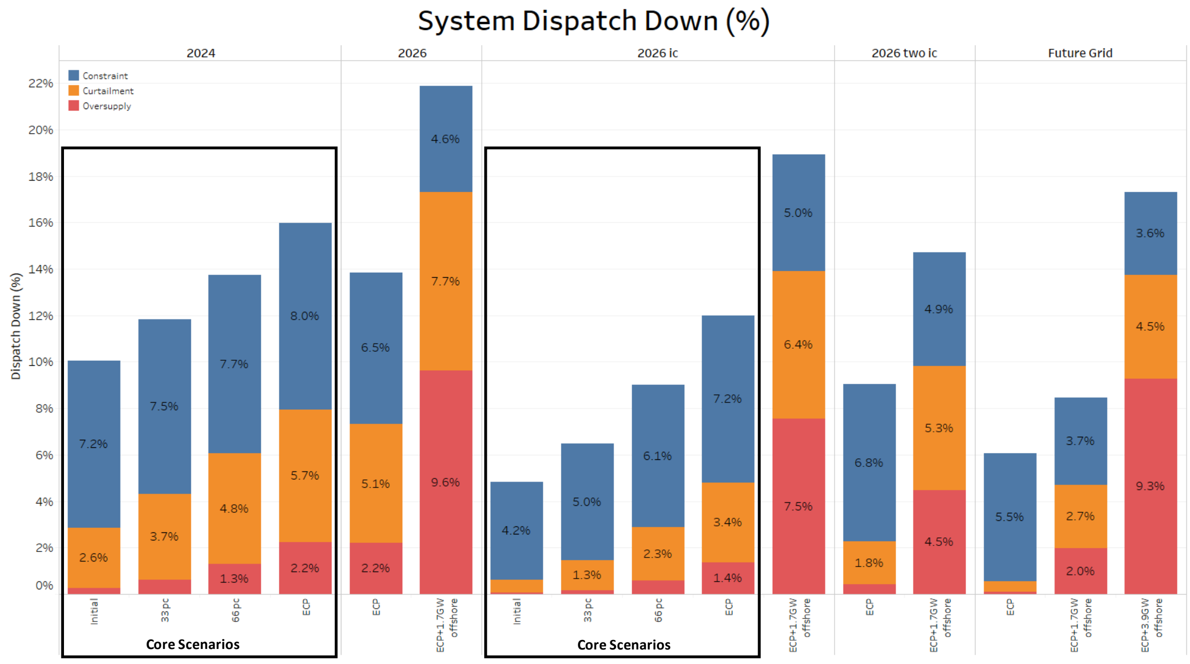


Figure 5-1 System Total Dispatch Down %

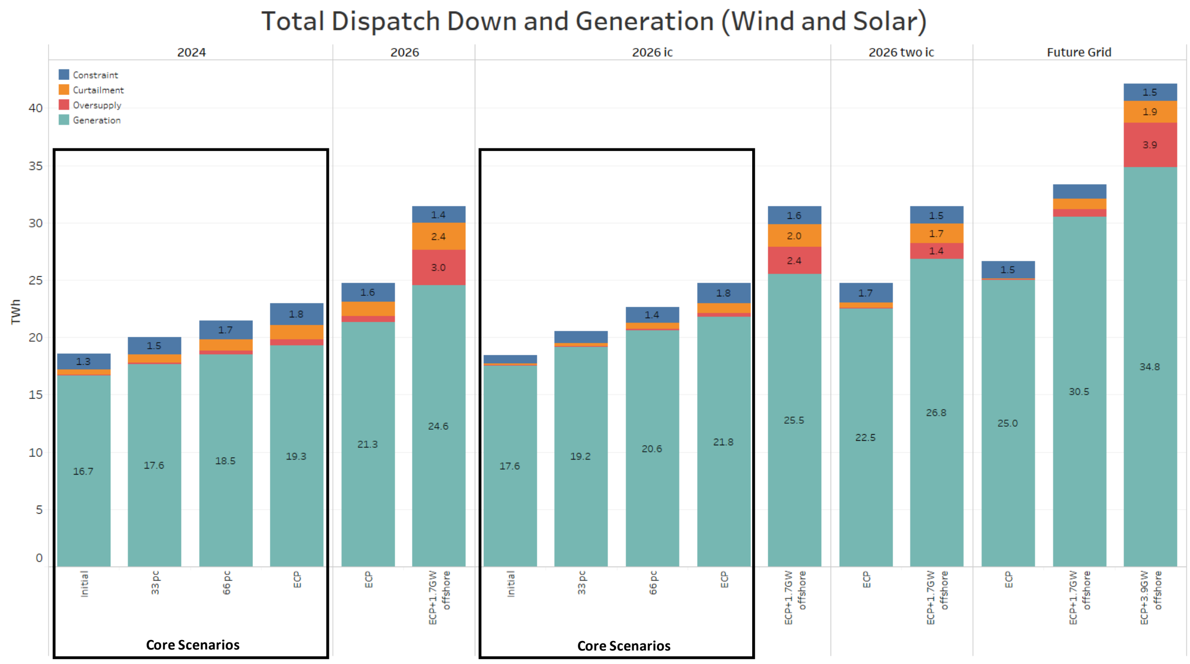


Figure 5-2 Total Dispatch Down and Generation (Wind and Solar)

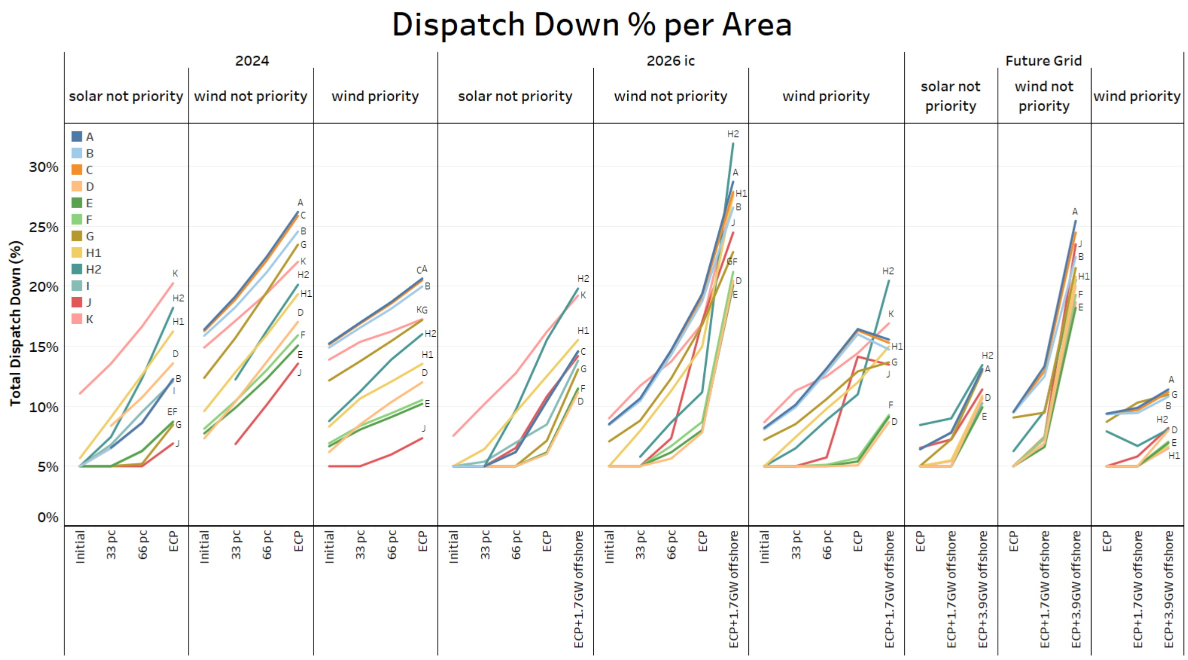


Figure 5-3 Total Dispatch Down % per Area

6 Results for Area K

6.1 Introduction

This section provides the over-supply, curtailment and constraint results for Area K that are estimated by this analysis. There is a total of eight core ECP 2-1 studies and eight sensitivity studies presented in this report. The study scenarios and the associated assumptions can be found in Section 2 and Section 3. An overview and discussion of the results is provided in this Section. The over-supply, curtailment and constraint results for each node are provided in Appendix C.

6.2 Study Notes

A list of the major study assumptions is provided in Section 3. For Area K, it is worth mentioning the following again.

6.2.1 Network Outages

The scenarios in this report are intended to give a view of average long-term levels of over-supply, curtailment and constraint, subject to installed generation, demand, interconnection, operational constraints and reinforcement delivery.

A basis of the previous ECP 1 constraints analysis assumed that the existing network was available at all times. In reality, a transmission outage programme will be implemented each year resulting in outages of transmission circuits and other equipment for periods of time. Outages may be due to scheduled maintenance, forced outages, to facilitate new connections or for reinforcement reasons (e.g. circuit/busbar uprates).

Transmission outages may increase generation constraints on the system and as a result of industry feedback following ECP 1, a representative transmission outage schedule has been included for this ECP 2.1 analysis. The outages included in this schedule represent a geographical spread of circuits across the system and are each configured for a three-month period. This allows a representation of outage impact in each geographical area to be included in the studies. Longer duration outages which may be required for certain connections, reinforcement works or forced outages are not considered and may result in higher wind and solar constraints. This representative transmission outage schedule is given in Appendix A – Table A-4.

6.2.2 Benefit of Capacity Factor

In practice a specific windfarm may be located at a site with higher wind speeds or may have a better performing type of wind turbine; the result is a higher capacity factor than neighbouring windfarms. This report doesn't reflect this localised diversity between windfarm sites, however, a windfarm with a higher capacity factor may see lower percentage over-supply, curtailment or constraint levels than an adjacent windfarm with a lower capacity factor. This is because at times of medium or low wind speed, the high capacity factor windfarm can generate power when the low capacity factor windfarm can not.

6.2.3 Notes on Over–supply, Curtailment and Constraint Modelling

Over-supply

During generation reduction for over-supply, a distinction is made between the treatment of priority and non-priority renewable generators, with non-priority generators being dispatched down ahead of priority generators. Within these two categories of generation, over-supply is applied pro-rata across the all-island system for all renewable generators in the category.

For any hour of the study the over-supply level will depend on system demand and interconnector flows. In general, over-supply is expected to increase with increasing installed renewable capacity.

Curtailment

In this report, for each hour of the study, the curtailment is shared pro-rata on a system wide basis with no distinction made between priority and non-priority generators. This means that both curtailment reductions and curtailment increases are shared system wide.

Solar generation has different reported levels of curtailment compared to wind due to different capacity factors and annual profile shapes.

The applied curtailment is broadly constant across the system. However, due to differences in wind and solar profiles and capacity factors between areas, the percentage average curtailment differs between areas.

Constraints

During the constraint of renewable generation, no distinction is made between priority and non-priority generators, the dispatch down is applied across the relevant transmission nodes.

In general, there is a tendency for renewable bulk power to flow towards the demand in Dublin and the interconnectors. These flow patterns are relevant when seeking to understand constraint apportionment in the simulation.

When presented as percentage values, the constraint results look different for solar and wind, as they have a low correlation due to different profile shapes driven by weather patterns.

6.3 Generation Overview

A detailed system level overview of the renewable generation scenarios used in these studies is given in Section 2. The distribution of generation in each scenario based on technology, area and node is given in Appendix B. The node level installed wind and solar generation for Area K in the "ECP" scenario is given in Table 6-1.

Node	SO	Status	Solar	Wind
Butlerstown	DSO	connected		2
Butlerstown	DSO	due to connect	27	
Dungarvan	DSO	connected		5
Dungarvan	DSO	due to connect	74	
Rathnaskilloge	TSO	due to connect	95	
Woodhouse	TSO	connected		20
Woodhouse	TSO	due to connect		34
Total			**196**	**61**

Table 6-1 Wind and Solar Generation Summary in Area K for Generation Scenario "ECP"

Installed generation for each generation scenario (Ireland and Area K)

Table 6-2 and Table 6-3 show installed solar and wind generation for Ireland and Area K, and the available solar and wind generation for Area K for each generation scenario.

Solar	Generation Scenario					
	Initial	33%	66%	ECP	ECP + 1.7GW offshore	ECP + 3.9GW offshore
Installed Ireland (MW)	1,245	1,804	2,380	2,939	2,939	2,939
Installed Area K (MW)	122	146	171	196	196	196
Installed Controllable Area K (MW)	122	146	171	196	196	196
Available Controllable Area K (GWh)	132	158	185	212	212	212

Table 6-2 Installed MW and Available GWh for Area K – Solar

Wind	Generation Scenario					
	Initial	33%	66%	ECP	ECP + 1.7GW offshore	ECP + 3.9GW offshore
Installed Ireland (MW)	4,957	5,388	5,833	6,264	7,984	10,196
Installed Area K (MW)	61	61	61	61	61	61
Installed Controllable Area K (MW)	54	54	54	54	54	54
Available Controllable Area K (GWh)	197	197	197	197	197	197

Table 6-3 Installed MW and Available GWh for Area K – Wind

6.3.1 Connection Works and Generators

In the ECP generation scenario, 818 MW of contracted generation is identified as having Site Related Connection Equipment (SRCE). This means that those generators will not be permitted to connect until certain system works are complete. These works will not be complete by 2024 and are not included in the 2024 study. Consequently, the generators that are associated with these SRCE works are also not included in the 2024 study. In the connection contract, these are included in the Site Related Connection Equipment.

A per-area distribution of generation associated with SRCE per technology is given in Table 6-4.

AREA	Solar (MW)	Wind (MW)	Total (MW)
B	-	180.1	180.1
F	-	13.8	13.8
G	20.0	-	20.0
H1	-	28.8	28.8
H2	87.9	60.0	147.9
J	156.8	270.2	427.0
Total	**264.7**	**552.9**	**817.6**

Table 6-4 SRCE Generation not included in 2024 Study

6.4 Network Overview

Area K, in the south of the country, includes a mix of priority wind and non-priority solar and wind generators. A summary of generators is given in Table 6-1.

The transmission network in Area K and the surrounding areas is shown in Figure 6-1. The 400 kV circuits are shown in red, the 220 kV circuits in green and the 110 kV circuits in black. Possible future transmission stations and lines for the connection of new generation are also shown on the map below.

Figure 6-1 Network Map for Area K

For Area K, the dominant power flows tend to be towards the load centres on the east coast and the interconnectors. These flow patterns are relevant when seeking to understand constraint apportionment in the simulation.

Constraints in Area K can be caused both by local and wider system issues. Constraints in the model are optimised on a system-wide basis so, in theory, an increase in the installed generation in another area may increase constraints in Area K.

In addition to the power flows out of Area K, there are also power flows across or through Area K. Renewable power from the south west will flow across the transmission network and at least some of this power will flow through Area K.

The power flowing out of Area K meets and joins with power flows from other areas, as the power flows towards the demand centres and interconnectors. A transmission bottleneck between Area K and the east is shared with power flows coming from other areas.

6.5 Future Grid Sensitivity Scenario

In response to feedback from industry, a Future Grid scenario has been modelled as part of this analysis. All reasonable efforts have been made to align the network assumptions in the Future Grid scenario to the Shaping Our Electricity Future (SOEF) roadmap. The network projects included in the study are given in Appendix A – Table A-4. Note however that the wind and solar generation portfolio in the ECP 2.1 Future Grid scenario necessarily differs from the wind and solar portfolio considered in SOEF, in order to maintain compliance with the ECP 2.1 process. The ECP study includes all wind and solar projects which have applied through connection processes, whereas the SOEF study does not include the full set of wind and solar applicants.

The Future Grid study includes a base renewable generation scenario (ECP), along with two sensitivity generation scenarios (ECP + 1.7 GW offshore and ECP + 3.9 GW offshore). The latter two scenarios with additional offshore wind have been included to show the potential impact of increasing offshore wind on Total Dispatch Down levels.

The demand modelled for the Future Grid scenario is based on the high demand scenario for 2030 as published in the All-Island Generation Capacity Statement 2021-2030.

This study is not intended as an assurance to individual generators that their Total Dispatch Down will change to the estimated levels. Rather, it is a consideration of the potential impact of the SOEF reinforcement portfolio on the dispatch down of wind and solar generators. This study is not intended to be exhaustive and it is not intended to remove all transmission constraints.

6.6 Area K – Average Results

The Total Dispatch Down results for Area K are provided below in Table 6-5 to Table 6-7 and Figure 6-2 to Figure 6-4. These include the breakdown between over-supply, curtailment and constraint. The Total Dispatch Down percentages are based on the total available energy. The Total Dispatch Down is the sum of over-supply, curtailment and constraint. The node level breakdown of over-supply, curtailment and constraint are given in Appendix C.

For each generation type in Area K (solar not priority, wind not priority and wind priority), the total installed capacity in MW and total available generation in GWh are given in Table 6-5, Table 6-6 and Table 6-7. The total generation in GWh, after dispatch down and corresponding percentage Total Dispatch Down are also included in the tables for each scenario. Details on the generation and network scenarios are given in Section 2.

6.6.1 Interconnector and Offshore Wind Sensitivity Studies

Results for the interconnector and offshore wind-based sensitivity studies are also included, along with results for the core scenarios. The general trend with increases in interconnector capacity is a reduction in the Total Dispatch Down, largely due to decreases in over-supply. Increasing levels of offshore wind on the other hand, result in increases in the Total Dispatch Down due to significant increases in the available wind energy, resulting in increased levels of over-supply.

6.6.2 Impact of Article 12

Higher Total Dispatch Down is observed for non-priority generators due to the impact of the implementation of Article 12 in the studies, which results in non-priority generators being reduced ahead of priority generators for over-supply reasons.

6.6.3 Future Grid Sensitivity Study

The results of the Future Grid scenario show a notable reduction in Total Dispatch Down over the core study years (2024 and 2026) due to the impact of the SOEF network reinforcements, increased demand levels in 2030 and the relaxation of operational constraints in 2030. However, increases in installed wind and solar generation, as seen in the offshore wind scenarios, result in rising over-supply levels, resulting in an increase in Total Dispatch Down. A detailed impact on Area K in the Future Grid and associated sensitivity case is given in Table 6-5, Table 6-6 and Table 6-7. Further node level details can be viewed in Appendix C.

6.6.4 Area Subgroups

There is often a post-processing step between the Plexos simulation and this report. This is necessary if a subgroup of nodes within the area has noticeably different constraint levels from another subgroup as a result of the network topology. This step is not required for Area K. Within Area K, all the nodes have similar levels of constraints and there is no need to prepare subgroups.

SOLAR NOT PRIORITY							
AREA K	Year	Initial	33%	66%	ECP	ECP + 1.7GW Offshore	ECP + 3.9GW Offshore
Installed (MW)	2024	122	146	171	196		
Installed (MW)	2026				196	196	
Installed (MW)	2026 with GL	122	146	171	196	196	
Installed (MW)	2026 with GL and Celtic				196	196	
Installed (MW)	Future Grid				196	196	196
Available Energy (GWh)	2024	131.8	158.1	185.3	211.7		
Available Energy (GWh)	2026				211.5	211.5	
Available Energy (GWh)	2026 with GL	131.7	158.0	185.1	211.5	211.5	
Available Energy (GWh)	2026 with GL and Celtic				211.5	211.5	
Available Energy (GWh)	Future Grid				211.5	211.5	211.5
Generation (GWh)	2024	117.2	136.7	154.5	168.8		
Generation (GWh)	2026				180.6	171.7	
Generation (GWh)	2026 with GL	121.7	141.9	161.6	177.2	170.9	
Generation (GWh)	2026 with GL and Celtic				199.8	191.9	
Generation (GWh)	Future Grid				200.9	200.0	189.0
Over-supply (%)	2024	0%	1%	2%	3%		
Over-supply (%)	2026				3%	9%	
Over-supply (%)	2026 with GL	0%	0%	1%	2%	7%	
Over-supply (%)	2026 with GL and Celtic				1%	4%	
Over-supply (%)	Future Grid				0%	2%	7%
Curtailment (%)	2024	1%	2%	2%	3%		
Curtailment (%)	2026				2%	4%	
Curtailment (%)	2026 with GL	0%	1%	1%	2%	3%	
Curtailment (%)	2026 with GL and Celtic				1%	3%	
Curtailment (%)	Future Grid				0%	1%	2%
Constraint (%)	2024	10%	11%	13%	14%		
Constraint (%)	2026				9%	6%	
Constraint (%)	2026 with GL	7%	10%	11%	12%	9%	
Constraint (%)	2026 with GL and Celtic				4%	2%	
Constraint (%)	Future Grid				4%	2%	1%
Total Dispatch Down (%)	2024	11%	14%	17%	20%		
Total Dispatch Down (%)	2026				15%	19%	
Total Dispatch Down (%)	2026 with GL	8%	10%	13%	16%	19%	
Total Dispatch Down (%)	2026 with GL and Celtic				6%	9%	
Total Dispatch Down (%)	Future Grid				5%	5%	11%

Table 6-5 Over-supply, Curtailment and Constraint for Solar Not Priority in Area K

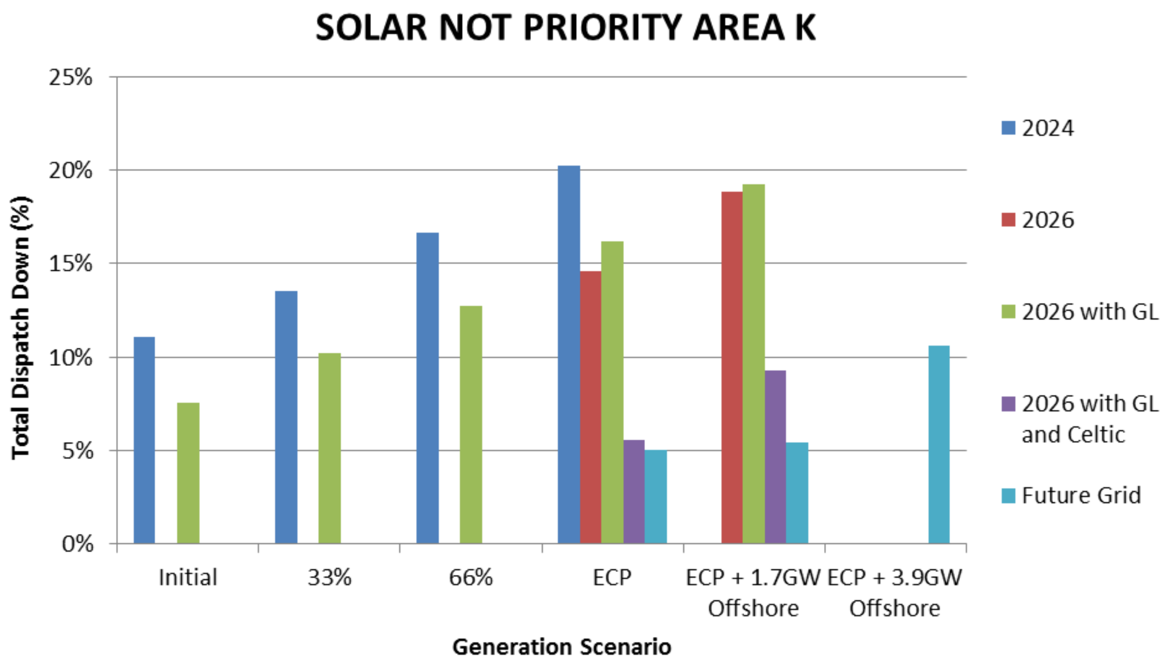


Figure 6-2 Results Solar Not Priority Area K

WIND NOT PRIORITY							
AREA K	**Year**	**Initial**	**33%**	**66%**	**ECP**	**ECP + 1.7GW Offshore**	**ECP + 3.9GW Offshore**
Installed (MW)	2024	34.0	34.0	34.0	34.0		
Installed (MW)	2026				34.0	34.0	
Installed (MW)	2026 with GL	34.0	34.0	34.0	34.0	34.0	
Installed (MW)	2026 with GL and Celtic				34.0	34.0	
Installed (MW)	Future Grid				34.0	34.0	34.0
Available Energy (GWh)	2024	124.5	124.5	124.5	124.5		
Available Energy (GWh)	2026				124.0	124.0	
Available Energy (GWh)	2026 with GL	124.0	124.0	124.0	124.0	124.0	
Available Energy (GWh)	2026 with GL and Celtic				124.0	124.0	
Available Energy (GWh)	Future Grid				124.0	124.0	124.0
Generation (GWh)	2024	106.0	103.2	100.4	97.1		
Generation (GWh)	2026				101.7	88.2	
Generation (GWh)	2026 with GL	112.8	109.5	107.0	103.1	89.8	
Generation (GWh)	2026 with GL and Celtic				117.3	105.4	
Generation (GWh)	Future Grid				117.8	114.9	100.8
Over-supply (%)	2024	1%	3%	5%	7%		
Over-supply (%)	2026				6%	18%	
Over-supply (%)	2026 with GL	0%	1%	2%	3%	14%	
Over-supply (%)	2026 with GL and Celtic				1%	8%	
Over-supply (%)	Future Grid				0%	3%	14%
Curtailment (%)	2024	2%	3%	4%	5%		
Curtailment (%)	2026				4%	6%	
Curtailment (%)	2026 with GL	1%	1%	2%	3%	5%	
Curtailment (%)	2026 with GL and Celtic				2%	5%	
Curtailment (%)	Future Grid				0%	2%	4%

Constraint (%)	2024	11%	11%	11%	11%		
Constraint (%)	2026				8%	5%	
Constraint (%)	2026 with GL	8%	10%	10%	10%	8%	
Constraint (%)	2026 with GL and Celtic				3%	2%	
Constraint (%)	Future Grid				4%	1%	1%
Total Dispatch Down (%)	2024	15%	17%	19%	22%		
Total Dispatch Down (%)	2026				18%	29%	
Total Dispatch Down (%)	2026 with GL	9%	12%	14%	17%	28%	
Total Dispatch Down (%)	2026 with GL and Celtic				5%	15%	
Total Dispatch Down (%)	Future Grid				5%	7%	19%

Table 6-6 Over-supply, Curtailment and Constraint for Wind Not Priority in Area K

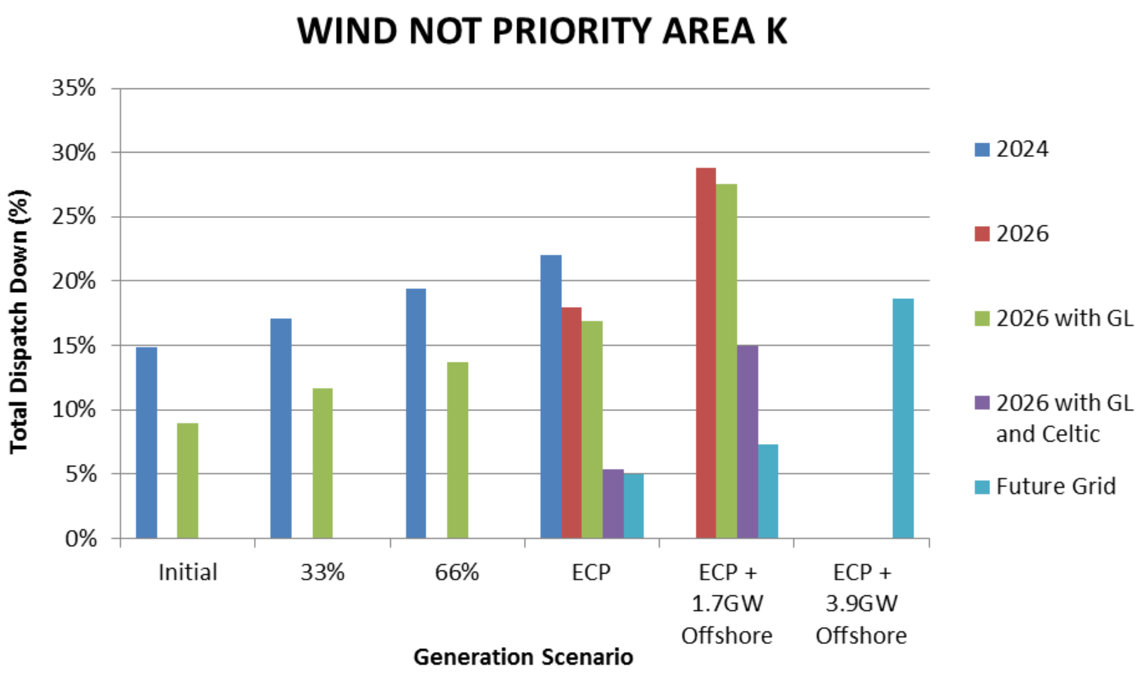


Figure 6-3 Results Wind Not Priority Area K

WIND PRIORITY							
AREA K	Year	Initial	33%	66%	ECP	ECP + 1.7GW Offshore	ECP + 3.9GW Offshore
Installed (MW)	2024	20	20	20	20		
Installed (MW)	2026				20	20	
Installed (MW)	2026 with GL	20	20	20	20	20	
Installed (MW)	2026 with GL and Celtic				20	20	
Installed (MW)	Future Grid				20	20	20
Available Energy (GWh)	2024	73.2	73.2	73.2	73.2		
Available Energy (GWh)	2026				72.9	72.9	
Available Energy (GWh)	2026 with GL	72.9	72.9	72.9	72.9	72.9	
Available Energy (GWh)	2026 with GL and Celtic				72.9	72.9	
Available Energy (GWh)	Future Grid				72.9	72.9	72.9
Generation (GWh)	2024	63.1	62.0	61.4	60.6		
Generation (GWh)	2026				62.7	61.9	

Generation (GWh)	2026 with GL	66.6	64.7	63.8	62.4	60.6	
Generation (GWh)	2026 with GL and Celtic				69.3	67.1	
Generation (GWh)	Future Grid				69.3	69.3	68.2
Over-supply (%)	2024						
Over-supply (%)	2026						
Over-supply (%)	2026 with GL						
Over-supply (%)	2026 with GL and Celtic						
Over-supply (%)	Future Grid						
Curtailment (%)	2024	3%	4%	5%	6%		
Curtailment (%)	2026				6%	9%	
Curtailment (%)	2026 with GL	1%	1%	2%	4%	7%	
Curtailment (%)	2026 with GL and Celtic				2%	6%	
Curtailment (%)	Future Grid				0%	3%	5%
Constraint (%)	2024	11%	12%	11%	11%		
Constraint (%)	2026				8%	6%	
Constraint (%)	2026 with GL	8%	10%	10%	11%	10%	
Constraint (%)	2026 with GL and Celtic				3%	2%	
Constraint (%)	Future Grid				5%	2%	1%
Total Dispatch Down (%)	2024	14%	15%	16%	17%		
Total Dispatch Down (%)	2026				14%	15%	
Total Dispatch Down (%)	2026 with GL	9%	11%	12%	14%	17%	
Total Dispatch Down (%)	2026 with GL and Celtic				5%	8%	
Total Dispatch Down (%)	Future Grid				5%	5%	7%

Table 6-7 Over-supply, Curtailment and Constraint for Wind Priority in Area K

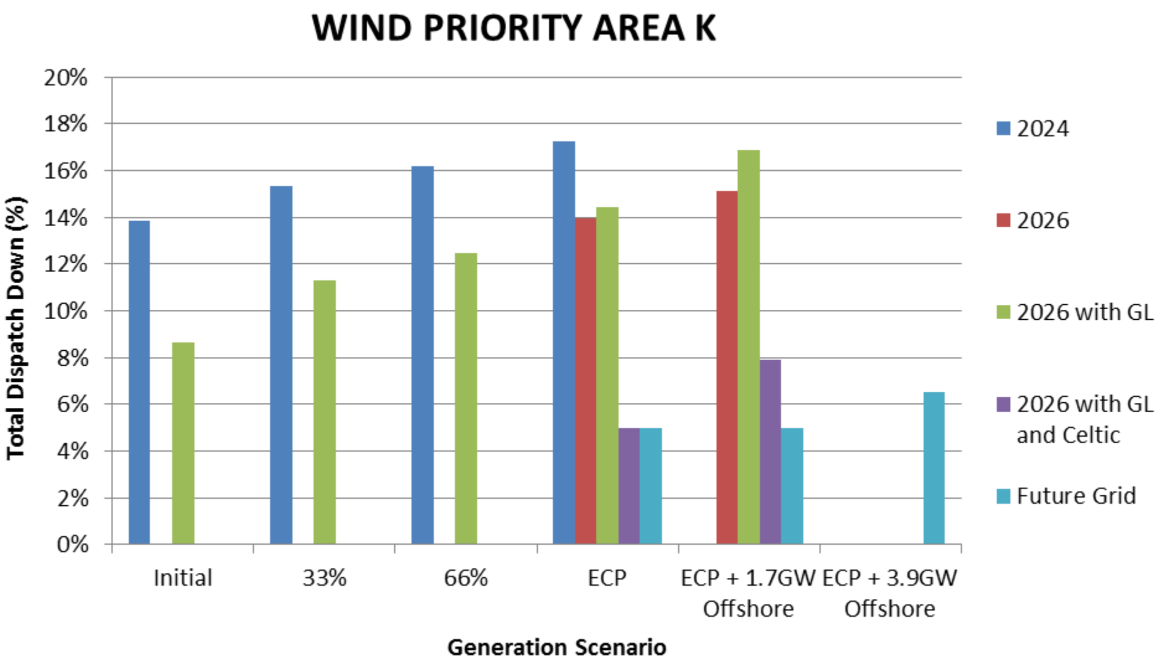


Figure 6-4 Results Wind Priority Area K

6.7 Conclusion – Results for Area K

This section provides an overview of the estimated over-supply, curtailment and constraint values for Area K for a range of scenarios based on a number of installed generation assumptions (generation scenarios) and the study year (network and demand assumptions). The results highly depend on the study assumptions, which are described in this report.

Appendix C contains the detailed results consisting of energy (GWh), percentage over-supply, curtailment and constraint values for each node for both solar and wind in Area K.

Appendix A – Network Reinforcement & Maintenance

A.1 Reinforcements in 2024

The table below lists the reinforcements, additional to the current network, that are included in the 2024 study scenario.

Project Type	Project	Year
Station	Aghada 220 kV Station busbar reconfiguration	2024
Station	Agivey 110/33 kV cluster substation	2024
Uprate	Arva - Carrick on Shannon 110 kV uprate (circuit 1)	2024
Uprate	Ballylumford - Eden 110 kV uprate	2024
Uprate	Ballynahulla - Ballyvouskil 220 kV uprate	2024
Uprate	Ballynahulla - Knockanure 220 kV uprate	2024
Static Compensator	Ballynahulla station - statcom	2024
New Build	Ballyragget - Kilkenny 110 kV line	2024
Reactive Support	Ballyvouskil Temporary 50 Mvar reactor	2024
Static Compensator	Ballyvouskill station - statcom	2024
New Build	Belcamp Shellybanks 220 kV Cable	2024
SPS	Bellacorick Special Protection Scheme	2024
Uprate	Binbane - Cathaleen's Fall 110 kV uprate (circuit 1)	2024
Uprate	Cashla - Salthill 110 kV uprate (circuit 1)	2024
Uprate	Castlebar - Cloon 110 kV uprate (circuit 1)	2024
Station	Clashavoon 250 MVA transformer and couple 110 kV	2024
Uprate	Coolkeeragh - Magherafelt 275 kV uprate (OHL part to Redwood)	2024
Uprate	Coolnabacky - Portlaoise 110 kV uprate (circuit 1)	2024
Uprate	Corduff - Ryebrook 110 kV uprate	2024
New Build	Corduff T2103 - 220 kV Station Deep Reinforcement Works	2024
Uprate	Drybridge - Oldbridge - Platin 110 kV uprate (Oldbridge Amazon)	2024
Uprate	Flagford - Louth 220 kV solve derate - restore rating to this circuit	2024
Uprate	Flagford - Sliabh Bawn 110 kV uprate (circuit 1)	2024
Uprate	Galway - Knockranny 110 kV uprate (when Galway station redevelops)	2024
Station	Galway 110 kV station redevelopment project	2024
Uprate	Gorman - Platin 110 kV uprate	2024
Uprate	Great Island - Kilkenny 110 kV uprate (circuit 1)	2024
Station	Kells 110/33 kV cluster substation	2024
New Build	Kellystown new 220 kV station	2024
Station	Kilbarry 110 kV GIS Station	2024
New build	Kilpaddoge - Knockanure 220 kV cable	2024
New build	Kilpaddoge - Moneypoint 400 kV Project (Cross Shannon)	2024
Station	Kinnegad 110 kV Station, Derryiron 110 kV Bay Conductor Uprate	2024
Reactive Support	Knockanure reactor	2024
Uprate	Knockraha - Raffeen 220 kV line refurbishment and fix derate	2024
Station	Knockraha 220 kV busbar station & installation of additional couplers	2024
Uprate	Lanesboro - Mullingar 110 kV uprate (circuit 1)	2024
Uprate	Lanesboro - Sliabh Bawn 110 kV uprate (circuit 1)	2024
Station	Lanesboro 110 kV station redevelopment project	2024
Uprate	Maynooth - Woodland 220 kV uprate	2024
Transformer	Moneypoint T4202 fix derate	2024
New Build	North Connacht 110 kV Project & Flagford - Tonroe 110 kV uprate	2024

Uprate	Omagh Main - Dromore 110 kV uprate	2024
SNSP	SNSP 80% (70% at present - please note that the TSOs on 22nd April 2021 commenced a 75% SNSP trial)	2024

Table A-1 Reinforcements included in the 2024 study

A.2 Reinforcements in 2026

The table below lists the network reinforcements included in the 2026 study scenario, additional to the network in the 2024 study scenario.

Project Type	Project	Year
Uprate	Bandon - Dunmanway 110 kV uprate (circuit 1)	2026
Uprate	Cahir - Barrymore 110 kV uprate	2026
New Build	Celtic Interconnector	2026
Station	Coolnabacky Station 400 kV - new station and associated lines and station works	2026
Uprate	Dalton busbar uprate	2026
Series Capacitor	Dunstown 400 kV Series Capacitor	2026
New Build	Greenlink Interconnector	2026
Uprate	Louth - Ratrussan 110 kV uprate	2026
New Build	Mid Antrim project	2026
Series Capacitor	Moneypoint 400 kV Series Capacitor	2026
Uprate	Moy - Glenree 110 kV uprate (circuit 1)	2026
New Build	North South 400 kV Interconnector	2026
Series Capacitor	Oldstreet 400 kV Series Capacitor	2026

Table A-2 Reinforcements included in the 2026 study scenario, additional to 2024 study reinforcements

A.3 Reinforcements in Future Grid

The table below lists the reinforcements, additional to the current network, that are included in the Future Grid study scenario.

Project Type	Project	Year
Station	Aghada Station Busbar Reconfiguration	Future Grid
Upvoltage	Arklow - Ballybeg - Carrickmines 220 kV (circuit 1)	Future Grid
Uprate	Arva - Carrick On Shannon 110 kV uprate (circuit 1)	Future Grid
Uprate	Athlone - Lanesboro 110 kV uprate (circuit 1)	Future Grid
Uprate	Athy - Carlow 110 kV uprate (circuit 1)	Future Grid
Uprate	Ballylumford - Eden 110 kV uprate	Future Grid
Static Compensator	Ballynahulla Station - Statcom	Future Grid
Uprate	Ballyvouskill - Ballynahula - Knockanure 220 kV uprate	Future Grid
Static Compensator	Ballyvouskill 220/110 kV Station - Statcom	Future Grid
Uprate	Bandon - Dunmanway 110 kV uprate (circuit 1)	Future Grid
Uprate	Baroda - Monread 110 kV uprate (circuit 1)	Future Grid
DLR	Baroda - Newbridge 110 kV (circuit 1)	Future Grid
DLR	Bellacorrick - Castlebar 110 kV (circuit 1)	Future Grid
Uprate	Binbane - Cathaleen's Fall 110 kV uprate (circuit 1)	Future Grid
New Build	Binbane - Clogher - Cathaleen's Fall - 110 kV Clogher tie in	Future Grid
DLR	Cashla - Dalton 110 kV (circuit 1)	Future Grid
Uprate	Cashla - Salthill 110 kV uprate (circuit 1)	Future Grid
Uprate	Castlebar - Cloon 110 kV uprate (circuit 1)	Future Grid
Station	Castlebar 110 kV station busbar	Future Grid
DLR	Cathaleen's Fall - Coraclassy 110 kV (circuit 1)	Future Grid
New Build	Clashavoon - Macroom No. 1 & associated station works & 250 MVA transformer	Future Grid
Uprate	Clashavoon - Tarbert 220 kV uprate (circuit 1)	Future Grid
New Build	Clogher - Srananagh 220 kV (circuit 1)	Future Grid
Uprate	Coleraine - Coolkeeragh 110 kV uprate (circuit 1)	Future Grid
Uprate	Coolkeeragh - Killymallaght 110 kV uprate (circuit 1)	Future Grid
Uprate	Coolkeeragh - Limavady 110 kV uprate (circuit 1)	Future Grid
Uprate	Coolkeeragh - Magherafelt 275 kV Circuits Refurbishment	Future Grid
Uprate	Coolkeeragh - Strabane 110 kV uprate (circuit 1)	Future Grid
Uprate	Coolnabacky - Portlaoise 110 kV uprate (circuit 1)	Future Grid
Station	Coolnabacky Station 400 kV - new station and associated lines and station works	Future Grid
Uprate	Corderry - Srananagh 110 kV uprate (circuit 1)	Future Grid
Uprate	Crane - Wexford 110 kV uprate (circuit 1)	Future Grid
DLR	Cushaling - Newbridge 110 kV (circuit 1)	Future Grid
Station	Dalton busbar	Future Grid
Uprate	Derryiron - Kinnegad 110 kV uprate (circuit 1)	Future Grid
Reactive Support	Distributed Series Reactors Project (Nationwide)	Future Grid
Uprate	Drumkeen - Clogher 110 kV uprate (circuit 1)	Future Grid
Uprate	Drumnakelly - Tamnamore 110 kV uprate (circuit 1)	Future Grid
Uprate	Drumnakelly - Tamnamore 110 kV uprate (circuit 2)	Future Grid
Uprate	Drybridge - Louth 110 kV uprate (circuit 1)	Future Grid
Series Capacitor	Dunstown Series Capacitor	Future Grid
Uprate	Finglas - North Wall 220 kV uprate (circuit 1)	Future Grid
Uprate	Flagford - Sliabh Bawn 110 kV uprate (circuit 1)	Future Grid
Upvoltage	Flagford - Srananagh 110 kV (circuit 1)	Future Grid
Uprate	Galway - Salthill 110 kV uprate (circuit 1)	Future Grid
Station	Galway Station Redevelopment Project	Future Grid
Transformer	Gort second transformer	Future Grid
Uprate	Great Island - Kellis 220 kV uprate (circuit 1)	Future Grid
Uprate	Great Island - Kilkenny 110 kV uprate (circuit 1)	Future Grid

Transformer	Great Island 220/110 kV transformer No.3	Future Grid
New Build	Inchicore - Carrickmines 220 kV (circuit 1)	Future Grid
Station	Kilbarry GIS Station	Future Grid
New Build	Kildare - Meath 400 kV Grid Upgrade Project (Capital Project 966)	Future Grid
Uprate	Killoteran - Waterford 110 kV uprate (circuit 1)	Future Grid
New Build	Kilpaddoge - Knockanure 220 kV cable	Future Grid
New Build	Kilpaddoge - Moneypoint 400 kV Project (Cross Shannon)	Future Grid
Uprate	Kilteel - Maynooth 110 kV uprate (circuit 1)	Future Grid
Reactive Support	Knockanure Reactor	Future Grid
Uprate	Knockraha - Cahir 110 kV uprate (circuit 1)	Future Grid
Station	Knockraha Short Circuit Rating Mitigation	Future Grid
Station	Knockraha station installation of additional couplers	Future Grid
Uprate	Lanesboro - Mullingar 110 kV uprate (circuit 1)	Future Grid
Uprate	Lanesboro - Sliabh Bawn 110 kV uprate (circuit 1)	Future Grid
Station	Lanesboro Station Redevelopment Project	Future Grid
Station	Letterkenny busbar	Future Grid
Uprate	Louth - Oriel 220 kV uprate (circuit 1)	Future Grid
DLR	Magherakeel - Omagh (circuit 1)	Future Grid
Uprate	Maynooth - Rinawade 110 kV uprate (circuit 1)	Future Grid
Uprate	Maynooth - Timahoe 110 kV uprate (circuit 1)	Future Grid
Uprate	Derryiron - Timahoe 110 kV uprate (circuit 1)	Future Grid
New Build	Mid Antrim Upgrade	Future Grid
New Build	Mid-Tyrone Project	Future Grid
Series Capacitor	Moneypoint Series Capacitor	Future Grid
Uprate	Moy - Glenree 110 kV uprate (circuit 1)	Future Grid
Station	Moy 110 kV Station reconfiguration and busbar uprate	Future Grid
New Build	North Connacht 110 kV Reinforcement Project	Future Grid
New Build	North South 400 kV Interconnector - NI	Future Grid
New Build	North South 400 kV Interconnector - IE	Future Grid
Uprate	North Wall - Poolbeg 220 kV uprate (circuit 1)	Future Grid
New Build	North West of NI 110 kV reinforcement	Future Grid
Series Capacitor	Oldstreet Series Capacitor	Future Grid
Uprate	Omagh - Strabane 110 kV uprate (circuit 2)	Future Grid
Uprate	Omagh Main - Dromore Uprate	Future Grid
Uprate	Poolbeg - Carrickmines 220 kV uprate (circuit 1)	Future Grid
Uprate	Poolbeg South - Inchicore 220 kV uprate (circuit 1)	Future Grid
Uprate	Poolbeg South - Inchicore 220 kV uprate (circuit 2)	Future Grid
Uprate	Rinawade - Dunfirth Tee 110 kV uprate (circuit 1)	Future Grid
Uprate	Sligo - Srananagh 110 kV uprate (circuit 3)	Future Grid
Static Compensator	Thurles Station - Statcom	Future Grid
New Build	Woodland - Finglas 400 kV cable cct	Future Grid
Uprate	Woodland - Oriel 220 kV uprate (circuit 1)	Future Grid

Table A-3 Reinforcements included in the Future Grid study

A.4 Maintenance within the Plexos Modelling

The table below outlines the representative transmission outage schedule applied within the Plexos model for this study.

Object	Duration in Months (M[4])	Category
Ballylumford - Kells 275 kV	M6-8	NI
Coleraine - Coolkeeragh 110 kV	M6-8	NI
Kells 110 kV - 275 kV	M9-11	Transformer
Tandragee 110 kV - 275kV	M6-8	Transformer
Arva - Navan 110 kV (circuit 1)	M3-5	IE
Carrigadrohid - Kilbarry 110 kV (circuit 1)	M9-11	IE
Castlebar - Cloon 110 kV (circuit 1)	M6-8	IE
Corduff - Woodland 220 kV (circuit 1)	M6-8	IE
Cullenagh - Great Island 220 kV (circuit 1)	M3-5	IE
Cushaling - Portlaoise 110 kV (circuit 1)	M3-5	IE
Dunstown - Kellis 220 kV (circuit 1)	M6-8	IE
Dunstown - Maynooth 220 kV (circuit 2)	M9-11	IE
Flagford - Louth 220 kV (circuit 1)	M9-11	IE
Flagford - Sligo 110 kV (circuit 1)	M3-5	IE
Gorman - Maynooth 220 kV (circuit 1)	M6-8	IE
Great Island - Lodgewood 220 kV (circuit 1)	M9-11	IE
Kilpaddoge - Moneypoint 380 kV (circuit 1 new)	M9-11	IE
Kilpaddoge - Tralee 110 kV (circuit 1)	M6-8	IE
Maynooth - Blake-T 110 kV (circuit 1)	M9-11	IE
Maynooth - Shannonbridge 220 kV (circuit 1)	M3-5	IE
Oldstreet - Woodland 380 kV (circuit 1)	M6-8	IE
Thurles - Ikerrin-T 110 kV (circuit 1)	M6-8	IE
Arklow T2102	M6-8	Transformer
Cashla T2101	M3-5	Transformer
Cashla T2104	M6-8	Transformer
Clashavoon T2102	M3-5	Transformer
Dunstown T4202	M9-11	Transformer
Killonan T2104	M9-11	Transformer
Knockraha T2101	M9-11	Transformer
Moneypoint T4202	M3-5	Transformer

Table A-4 Representative Transmission Outage Schedule

[4] M1-12 is January to December

Appendix B – Generator

The following generator information is included in this Appendix:

- Generator Type for each Generation Scenario
- Generator Type by Area for each Generation Scenario
- Generator Type by Node for all Generators
- Generation List by Name

Note: the tables in the following section include both Ireland and Northern Ireland generation.

B.1 Generation Type for each Generator Scenario

The table below shows existing and expected wind, wind offshore, solar, wave, battery and other technologies (other technologies include: biomass, biogas, CHP, LFG and Anaerobic Digester (AD) plants) in both Ireland and Northern Ireland, which were included in this analysis.

	Initial (MW)	33% (MW)	66% (MW)	ECP (MW)	ECP + 1.7 GW offshore (MW)	ECP + 3.9 GW offshore (MW)
Battery	1,072	1,171	1,272	1,371	1,371	1,371
Wave	-	3	7	10	10	10
Solar	1,431	1,990	2,566	3,125	3,125	3,125
Other Technologies	25	53	82	114	114	114
Wind	6,320	7,056	7,815	8,552	8,552	8,552
Wind Offshore	-	-	-	-	1,720	3,932
Totals	**8,848**	**10,274**	**11,743**	**13,172**	**14,892**	**17,104**

Table B-1 Total Generation per Generation Type

B.2 Generation Type by Area for each Generator Scenario

The table below shows existing and expected wind, wind offshore, solar, wave, battery and other technologies (other technologies include: biomass, biogas, CHP, LFG and AD plants) in both Ireland and Northern Ireland, which were included in this analysis.

	Initial (MW)	33% (MW)	66% (MW)	ECP (MW)	ECP + 1.7 GW offshore (MW)	ECP + 3.9 GW offshore (MW)
Battery	**1,072**	**1,171**	**1,272**	**1,371**	**1,371**	**1,371**
B	11	15	19	23	23	23
C	263	268	274	279	279	279
E	31	43	56	69	69	69
G	50	70	90	110	110	110
H2	25	45	65	85	85	85
I	178	178	178	178	178	178
J	304	336	369	401	401	401
NI	210	215	221	226	226	226
Other Technologies	**25**	**53**	**82**	**114**	**114**	**114**
A	-	0	0	0	0	0
B	2	18	35	51	51	51
C	-	0	1	1	1	1
D	0	0	0	0	0	0
E	0	1	1	2	2	2
F	2	2	2	2	2	2
G	13	13	14	14	14	14
I	1	2	3	5	5	5
J	6	9	13	16	16	16
K	0	0	0	0	0	0
NI	-	6	12	22	22	22
Solar	**1,431**	**1,990**	**2,566**	**3,125**	**3,125**	**3,125**
A	-	13	27	40	40	40
B	43	51	59	67	67	67
C	77	131	187	241	241	241
D	-	8	17	26	26	26
E	148	177	207	236	236	236
F	9	17	25	32	32	32
G	212	257	303	347	347	347
H1	26	84	144	202	202	202

H2	211	322	437	548	548	548
I	35	94	156	215	215	215
J	362	502	647	788	788	788
K	122	146	171	196	196	196
NI	187	187	187	187	187	187
Wave	**-**	**3**	**7**	**10**	**10**	**10**
B	-	3	7	10	10	10
Wind	**6,320**	**7,056**	**7,815**	**8,552**	**8,552**	**8,552**
A	814	840	866	891	891	891
B	782	872	964	1,055	1,055	1,055
C	131	193	256	317	317	317
D	310	315	320	324	324	324
E	1,461	1,494	1,528	1,561	1,561	1,561
F	208	216	224	232	232	232
G	230	246	263	279	279	279
H1	541	551	561	571	571	571
H2	332	372	413	453	453	453
I	7	7	8	8	8	8
J	80	222	369	511	511	511
K	61	61	61	61	61	61
NI	1,363	1,668	1,983	2,288	2,288	2,288
Wind Offshore	**-**	**-**	**-**	**-**	**1,720**	**3,932**
B	-	-	-	-	-	392
G	-	-	-	-	350	370
H2	-	-	-	-	520	520
J	-	-	-	-	850	2,650
Grand Total	**8,848**	**10,274**	**11,743**	**13,172**	**14,892**	**17,104**

Table B-2 Generation Type by Area for each Generator Scenario

B.3 Generation Type by Node

The table below shows expected wind, wind offshore, solar, wave, battery and other technologies (other technologies include: biomass, biogas, CHP, LFG and AD plants) in both Ireland and Northern Ireland, which were included in this analysis.

Area and Node	Battery	Wave	Solar	Other Technologies	Wind	Wind Offshore
A	**0**	**0**	**40**	**0**	**286**	**0**
Binbane	0	0	0	0	30	0
Corderry	0	0	40	0	16	0
Croaghonagh	0	0	0	0	138	0
Gortawee	0	0	0	0	10	0
Lenalea	0	0	0	0	31	0
Letterkenny	0	0	0	0	31	0
Tievebrack	0	0	0	0	30	0
B	**23**	**10**	**67**	**49**	**447**	**392**
Bellacorick	0	10	0	0	204	0
Cashla	0	0	0	0	0	392
Cloon	0	0	24	0	5	0
Dalton	12	0	8	0	0	0
Firlough	0	0	0	0	76	0
Knockranny	0	0	0	0	159	0
Shantallow	0	0	35	0	0	0
Sligo	0	0	0	0	4	0
Tawnaghmore	11	0	0	49	0	0
C	**179**	**0**	**241**	**1**	**226**	**0**
Athlone	0	0	8	0	1	0
Carrick on Shannon	0	0	4	0	0	0
Derrycarney	0	0	0	0	34	0
Lanesboro	16	0	61	0	98	0
Mullingar	0	0	29	1	93	0
Richmond	0	0	12	0	0	0
Shannonbridge	0	0	65	0	0	0
Shannonbridge 220	163	0	0	0	0	0
Somerset	0	0	4	0	0	0
Shanonagh	0	0	59	0	0	0
D	**0**	**0**	**26**	**0**	**29**	**0**
Ardnacrusha	0	0	14	0	0	0
Booltiagh	0	0	0	0	29	0
Drumline	0	0	12	0	0	0
E	**38**	**0**	**236**	**2**	**101**	**0**
Aughinish	0	0	50	0	0	0
Boggeragh	0	0	0	0	3	0
Charleville	0	0	30	2	0	0
Clahane	0	0	34	0	0	0
Coomagearlahy	0	0	7	0	0	0
Drombeg	0	0	50	0	0	0
Glenlara	0	0	10	0	0	0
Kilpaddoge	30	0	0	0	25	0
Knockearagh	0	0	9	0	0	0
Limerick	0	0	9	0	5	0
Mallow	0	0	5	0	0	0
Moneypoint	8	0	0	0	0	0
Oughtragh	0	0	4	0	0	0
Reamore	0	0	0	0	25	0
Tralee	0	0	7	0	0	0

Trien	0	0	9	0	0	0
Ballyvouskil 220	0	0	13	0	42	0
F	**0**	**0**	**32**	**0**	**31**	**0**
Ballylickey	0	0	0	0	6	0
Bandon	0	0	21	0	0	0
Dunmanway	0	0	5	0	25	0
Macroom	0	0	6	0	0	0
G	**110**	**0**	**347**	**13**	**105**	**370**
Baltrasna	0	0	75	0	0	0
Drybridge	0	0	17	0	0	0
Dundalk	0	0	5	0	0	0
Gaskinstown	0	0	85	0	0	0
Gillinstown	0	0	95	0	0	0
Gorman	50	0	0	0	0	0
Hawkinstown	0	0	50	0	0	0
Lisdrum	60	0	0	0	82	0
Meath Hill	0	0	0	0	23	0
Navan	0	0	16	13	0	0
Oriel	0	0	0	0	0	370
Shankill	0	0	4	0	0	0
H1	**0**	**0**	**202**	**0**	**123**	**0**
Ahane	0	0	8	0	0	0
Ballydine	0	0	6	0	0	0
Barrymore	0	0	15	0	0	0
Cahir	0	0	31	0	0	0
Doon	0	0	8	0	0	0
Killonan	0	0	0	0	94	0
Lisheen	0	0	0	0	29	0
Mothel	0	0	60	0	0	0
Nenagh	0	0	4	0	0	0
Tipperary	0	0	4	0	0	0
Timoney	0	0	67	0	0	0
H2	**85**	**0**	**548**	**0**	**121**	**520**
Arklow	30	0	63	0	40	520
Ballybeg	0	0	8	0	0	0
Ballyragget	0	0	40	0	60	0
Banoge	9	0	9	0	0	0
Carlow	0	0	9	0	21	0
Crane	16	0	14	0	0	0
Crory	0	0	20	0	0	0
Great Island	30	0	17	0	0	0
Kilkenny	0	0	18	0	0	0
Rosspile	0	0	95	0	0	0
Tullabeg	0	0	50	0	0	0
Waterford	0	0	4	0	0	0
Wexford	0	0	201	0	0	0
I	**178**	**0**	**215**	**4**	**1**	**0**
Aghada	178	0	0	0	0	0
Barnahely	0	0	5	0	1	0
Castleview	0	0	0	4	0	0
Coolroe	0	0	10	0	0	0
Cow Cross	0	0	5	0	0	0
Kilbarry	0	0	10	0	0	0
Knockraha	0	0	26	0	0	0
Midleton	0	0	8	0	0	0
Trabeg	0	0	10	0	0	0
Raffeen	0	0	55	0	0	0

Lysaghtstown	0	0	87	0	0	0
J	**393**	**0**	**788**	**10**	**430**	**2,650**
Athy	0	0	9	0	0	0
Belcamp	0	0	0	0	0	500
Blake T	0	0	5	0	0	0
Blundelstown	0	0	60	0	0	0
Carrickmines	0	0	0	0	0	700
Clonfad	0	0	100	0	0	0
Coolnabacky	0	0	55	0	0	0
Cushaling	0	0	0	0	100	0
Derryiron	38	0	47	0	110	0
Dunfirth	0	0	38	0	0	0
Finglas	0	0	8	0	0	0
Glasmore	0	0	45	0	0	0
Griffinrath	0	0	41	0	0	0
Harristown	0	0	42	0	0	0
Huntstown 220	10	0	0	0	0	0
Inchicore	30	0	0	0	0	0
Irishtown	30	0	0	0	0	0
Kilteel	90	0	15	0	0	0
Monread	0	0	8	0	0	0
Mount Lucas	0	0	0	0	60	0
Newbridge	0	0	16	0	0	0
North Wall	120	0	0	0	0	0
Poolbeg north	75	0	0	0	0	450
Poolbeg south	0	0	0	0	0	1,000
Portlaoise	0	0	4	0	45	0
Stephenstown	0	0	5	0	0	0
Thornsberry	0	0	10	10	5	0
Treascon	0	0	40	0	0	0
Gallanstown	0	0	170	0	0	0
Philipstown	0	0	0	0	50	0
Mulgeeth	0	0	0	0	60	0
Timahoe North	0	0	70	0	0	0
K	**0**	**0**	**196**	**0**	**34**	**0**
Butlerstown	0	0	27	0	0	0
Dungarvan	0	0	74	0	0	0
Rathnaskilloge	0	0	95	0	0	0
Woodhouse	0	0	0	0	34	0
NI	**116**	**0**	**21**	**22**	**1,055**	**0**
Aghyoule	0	0	0	0	24	0
Agivey	0	0	0	0	86	0
Antrim	0	0	0	0	5	0
Ballymena	0	0	0	0	38	0
Ballynahinch	0	0	0	0	13	0
Banbridge	0	0	0	0	7	0
Belfast North	0	0	0	0	2	0
Brockaghboy	0	0	0	0	5	0
Carnmoney	0	0	0	0	5	0
Castlereagh	50	0	0	0	9	0
Coleraine	0	0	0	0	49	0
Coolkeeragh	0	0	0	0	38	0
Creagh	0	0	0	0	5	0
Cregagh	0	0	0	0	1	0
Curraghamulkin	0	0	0	0	131	0
Drumnakelly	0	0	0	0	7	0
Dungannon	0	0	0	0	24	0

Eden	0	0	0	0	5	0
Enniskillen	0	0	0	0	20	0
Glengormley	0	0	0	18	17	0
Gort	0	0	0	0	23	0
Kells	50	0	21	0	48	0
Killymallaght	0	0	0	0	50	0
Larne	0	0	0	0	50	0
Limavady	0	0	0	0	36	0
Lisaghmore	0	0	0	0	8	0
Lisburn	0	0	0	0	7	0
Magherafelt	0	0	0	0	121	0
Magherakeel	0	0	0	0	19	0
Newry	16	0	0	4	8	0
Omagh	0	0	0	0	91	0
Strabane	0	0	0	0	35	0
Tremoge	0	0	0	0	63	0
Waringstown	0	0	0	0	7	0
Grand Total	**1,121**	**10**	**2,959**	**100**	**2,989**	**3,932**

Table B-3 Generation Type by Node

B.4 Generator List by Name

The table below shows existing and expected wind, wind offshore, solar, wave, battery and other technologies (other technologies include: biomass, biogas, CHP, LFG and AD plants) sorted A to Z by name in both Ireland and Northern Ireland, which were included in this analysis.

Area	Node	Type	Name	SO	Status	MEC
E	Knockearagh	other technologies	Adambridge Manufacturers Ltd	DSO	connected	3
I	Aghada	battery	Aghada BESS 01	TSO	offer	19
I	Aghada	battery	Aghada BESS 02	TSO	offer	159
NI	Aghyoule	wind	Aghyoule Main Total Wind	DSO	connected	3
A	Corderry	wind	Altagowlan (1)	DSO	connected	8
NI	Limavady	wind	Altahullion - replant extra for 70pc	DSO	offer	24
NI	Limavady	wind	Altahullion 1	DSO	connected	26
NI	Limavady	wind	Altahullion 2	DSO	connected	12
NI	Gort	wind	Altamuskin	DSO	connected	14
NI	Rasharkin	wind	Altaveedan	DSO	connected	18
K	Butlerstown	solar	Amberhill Solar Farm	DSO	offer	4
B	Bellacorick	wave	AMETS Belmullet (1)	DSO	offer	10
H1	Thurles	wind	An Cnoc	DSO	connected	12
A	Cathaleen's Fall	wind	Anarget (1)	DSO	connected	2
NI	Antrim	solar	Antrim Main Total PV	DSO	connected	4
NI	Antrim	wind	Antrim Main Total Wind	DSO	connected	1
NI	Antrim	wind	Antrim small scale - extra for 70pc	DSO	offer	5
B	Knockranny	wind	Ardderoo 2 (Formerly Buffy)	TSO	offer	64
B	Knockranny	wind	Ardderoo wind extension	TSO	offer	18
B	Knockranny	wind	Ardderoo Wind Farm	TSO	offer	27
H2	Arklow	wind offshore	Arklow 220 offshore new A	TSO	offer	260
H2	Arklow	wind offshore	Arklow 220 offshore new B	TSO	offer	260
H2	Arklow	wind	Arklow Bank (1)	DSO	connected	25
E	Trien	solar	Asdee solar	DSO	offer	5
E	Athea	wind	Athea (1)a	TSO	connected	34
H2	Arklow	other technologies	Aughrim Energy (1)	DSO	connected	1
NI	Coolkeeragh	wind	Aught Wind Farm	TSO	offer	38
H2	Crane	battery	Avonbeg ESS	DSO	offer	16
G	Meath Hill	other technologies	Bailie Foods CHP (1)	DSO	connected	1
G	Meath Hill	other technologies	Bailieboro CHP II	DSO	connected	4
E	Trien	wind	Ballagh (1)	DSO	connected	5
H2	Crory	wind	Ballaman formerly (Kennystown) (1)	DSO	connected	4
H1	Thurles	wind	Ballinacurry WF	DSO	connected	5
H1	Tipperary	solar	Ballinalard Solar Farm	DSO	offer	4
E	Tralee	wind	Ballincollig Hill (1)	DSO	connected	15
E	Aughinish	solar	Ballinknockane Solar Farm	TSO	offer	50
H1	Nenagh	wind	Ballinlough (1)	DSO	connected	3
I	Raffeen	solar	Ballinrea Solar Park	TSO	offer	55
H1	Nenagh	wind	Ballinveny (1)	DSO	connected	3
F	Ballylickey	wind	Ballybane (Glanta Commons) Wind Farm	DSO	connected	20
F	Ballylickey	wind	Ballybane 2 (Glanta Commons) Wind Farm	DSO	connected	8
F	Ballylickey	wind	Ballybane 2A	DSO	connected	12
F	Ballylickey	wind	Ballybane 2A (Glanta Commons) Wind Farm Extension	DSO	connected	2
F	Ballylickey	wind	Ballybane 3 (Glanta Commons) Wind Farm	DSO	connected	4
H1	Thurles	wind	Ballybay Wind Farm (Tullaroan)	DSO	connected	14
NI	Newtownards	solar	Ballyboley (Solar Farm)	DSO	connected	5
H2	Crory	wind	Ballycadden (1)	DSO	connected	14
H2	Crory	wind	Ballycadden (2)	DSO	connected	10

C	Somerset	solar	Ballycrissane Solar Farm	DSO	offer	4
H2	Great Island	solar	Ballycullane Solar Park	DSO	offer	5
H2	Arklow	wind	Ballycumber (1)	DSO	connected	18
K	Dungarvan	wind	Ballycurreen (1)	DSO	connected	5
H2	Crory	wind	Ballyduff (1)	DSO	connected	4
NI	Ballymena	solar	Ballygarvey Road	DSO	connected	7
H2	Great Island	solar	Ballygowny Solar Farm	DSO	offer	12
J	Glasmore	solar	Ballykea Solar Farm	DSO	offer	1
NI	Larne	wind	Ballykeel Wind Farm	DSO	offer	16
E	Kilpaddoge	wind	Ballylongford Windfarm	DSO	offer	25
K	Dungarvan	solar	Ballymac PV	DSO	offer	5
H1	Cahir	solar	Ballymacadam (Monraha) Solar PV Farm	DSO	offer	19
H2	Arklow	wind	Ballymanus WindFarm	DSO	offer	40
H2	Waterford	wind	Ballymartin (1)	DSO	connected	6
H2	Waterford	wind	Ballymartin (2)	DSO	connected	8
NI	Ballymena	solar	Ballymena Main Total PV	DSO	connected	4
NI	Ballymena	wind	Ballymena Main Total Wind	DSO	offer	4
NI	Ballymena	wind	Ballymena Main Total Wind	DSO	connected	1
NI	Ballymena	wind	Ballymena small scale - extra for 70pc	DSO	offer	10
I	Cow Cross	solar	Ballynacrusha	DSO	offer	5
NI	Ballynahinch	wind	Ballynahinch Main Total Wind	DSO	offer	5
NI	Ballynahinch	wind	Ballynahinch Main Total Wind	DSO	connected	2
NI	Ballynahinch	wind	Ballynahinch small scale - extra for 70pc	DSO	offer	8
H2	Crory	wind	Ballynancoran (1)	DSO	connected	4
H2	Kilkenny	solar	Ballytobin Solar PV	DSO	offer	4
NI	Glengormley	wind	Ballyutoagh Wind Farm	DSO	offer	12
H2	Ballywater	wind	Ballywater (1)	TSO	connected	32
H2	Ballywater	wind	Ballywater (2)	TSO	connected	11
NI	Banbridge	wind	Banbridge Main Total Wind	DSO	connected	4
NI	Banbridge	wind	Banbridge small scale - extra for 70pc	DSO	offer	7
E	Clahane	solar	Banemore Solar Farm	TSO	offer	34
NI	Rasharkin	solar	Bann Road PV	DSO	connected	36
B	Cloon	solar	Barnderg Solar Farm	DSO	offer	4
H2	Banoge	solar	Barnland Solar	DSO	offer	1
H1	Barrymore	wind	Barranafaddock (1)	DSO	connected	32
F	Macroom	wind	Bawnmore (1) formerly Burren (Cork)	DSO	connected	24
E	Trien	wind	Beale Hill (1)	DSO	connected	2
E	Trien	wind	Beale Hill (2)	DSO	connected	3
E	Trien	wind	Beale Hill (3)	DSO	connected	1
K	Butlerstown	wind	Beallough (1)	DSO	connected	2
A	Trillick	wind	Beam Hill (1)	DSO	connected	14
F	Dunmanway	solar	Beanhill South	DSO	offer	5
G	Drybridge	solar	Beaulieu PV	DSO	offer	4
E	Tralee	wind	Beenageeha (1)	DSO	connected	4
E	Athea	battery	Beenanaspock and Tobertooreen Wind Farm	TSO	connected	11
E	Athea	wind	Beenanaspock and Tobertooreen Wind Farm	TSO	connected	23
NI	Belfast Central	solar	Belfast Central Main Total PV	DSO	connected	3
NI	Belfast North	wind	Belfast North small scale - extra for 70pc	DSO	offer	2
B	Bellacorick	wind	Bellacorick (1)	DSO	connected	6
NI	Omagh	wind	Bessy Bell	DSO	connected	5
NI	Omagh	wind	Bessy Bell - replant extra for 70pc	DSO	offer	24
NI	Omagh	wind	Bessy Bell 2	DSO	connected	9
H2	Carlow	wind	Bilboa (1)	DSO	offer	15
H2	Carlow	wind	Bilboa (2)	DSO	offer	6
NI	Strabane	wind	Bin Mountain	DSO	connected	9
B	Tonroe	other technologies	Biocore Enviromental AD	DSO	connected	2

C	Mullingar	other technologies	Bioenergy Facility	DSO	offer	1
A	Corderry	wind	Black Banks (1)	DSO	connected	3
A	Corderry	wind	Black Banks (2)	DSO	connected	7
B	Glenree	wind	Black Lough (1)	DSO	connected	13
C	Shannonbridge	solar	Blackwater Bog Solar 1	TSO	offer	65
J	Blundelstown	solar	Blundlestown	TSO	offer	60
H2	Wexford	solar	Blusheens Solar (1)	DSO	offer	8
H2	Wexford	solar	Blusheens Solar (2)	DSO	offer	4
J	Monread	solar	Bodenstown Solar Farm	DSO	offer	4
E	Boggeragh	wind	Boggeragh (1)	TSO	connected	57
E	Boggeragh	wind	Boggeragh 2	TSO	connected	66
E	Boggeragh	wind	Boggeragh 2 (Killavoy (1))	TSO	connected	18
E	Charleville	wind	Boolard Wind Farm (Charlevile)	DSO	connected	4
D	Slievecallan	wind	Boolinrudda (formerly Loughaun North)	TSO	connected	45
D	Booltiagh	wind	Booltiagh (1)	TSO	connected	19
D	Booltiagh	wind	Booltiagh (2)	TSO	connected	3
D	Booltiagh	wind	Booltiagh (3)	TSO	connected	9
D	Booltiagh	wind	Boolynagleragh (1)	DSO	connected	37
NI	Ballymena	wind	Brackagh Quarry	DSO	connected	5
NI	Brockaghboy	wind	Brockaghboy	TSO	connected	48
NI	Brockaghboy	wind	Brockaghboy extension - extra for 70pc	DSO	offer	5
H1	Lisheen	wind	Bruckana (1)	DSO	connected	40
J	Finglas	solar	Bullstown Solar Farm	DSO	offer	8
B	Bellacorick	wind	Bunnahowen (1)	DSO	connected	3
B	Glenree	wind	Bunnyconnellan (1)	DSO	connected	28
E	Garrow	wind	Caherdowney (1)	DSO	connected	10
D	Booltiagh	wind	Cahermurphy (1)	DSO	connected	6
NI	Enniskillen	wind	Callagheen	DSO	connected	17
F	Bandon	solar	Callatrim South Solar Farm (prev. Kilcawha)	DSO	offer	6
H1	Cauteen	wind	Cappagh White (1)	DSO	connected	13
H1	Cauteen	wind	Cappawhite A	DSO	connected	57
F	Dunmanway	other technologies	Carbery Milk Products CHP (1)	DSO	connected	6
A	Letterkenny	wind	Cark (1)	DSO	connected	15
NI	Carnmoney	wind	Carn Hill	DSO	connected	14
NI	Kells	wind	Carnalbanagh	TSO	offer	25
NI	Carnmoney	wind	Carnmoney small scale - extra for 70pc	DSO	offer	5
H2	Wexford	wind	Carnsore (1)	DSO	connected	12
A	Corderry	wind	Carrane Hill (1)	DSO	connected	3
A	Corderry	wind	Carrane Hill (2)	DSO	connected	2
H1	Ballydine	solar	Carrick Solar	DSO	offer	6
A	Letterkenny	wind	Carrick Wind Farm (Garrymore)	DSO	offer	4
G	Shankill	solar	Carrickabane Solar Farm	DSO	offer	4
G	Shankill	wind	Carrickallen Wind Farm	DSO	connected	22
NI	Killymallaght	wind	Carrickatane	DSO	connected	21
B	Sligo	wind	Carrickeeney (1)	DSO	connected	8
J	Carrickmines	wind offshore	Carrickmines 220 offshore new A	TSO	offer	350
J	Carrickmines	wind offshore	Carrickmines 220 offshore new B	TSO	offer	350
C	Dallow	wind	Carrig (1)	DSO	connected	3
E	Boggeragh	wind	Carrigcannon (1)	DSO	connected	20
E	Boggeragh	wind	Carrigcannon (2)	DSO	offer	3
F	Dunmanway	wind	Carrigdangan (formerly Barnadivine)	TSO	connected	60
F	Dunmanway	wind	Carrigdangan Wind Farm Ext.	TSO	offer	8
E	Rathkeale	wind	Carrons (1)	DSO	connected	5
B	Dalton	battery	Carrowbeg Battery Storage (Prev MCB)	DSO	offer	12
B	Glenree	wind	Carrowleagh (1)	DSO	connected	34
B	Glenree	wind	Carrowleagh (2)	DSO	connected	3
D	Tullabrack	wind	Carrownawelaun (1)	DSO	connected	5

B	Cashla	wind offshore	Cashla 220 offshore new	TSO	offer	392
NI	Curraghamulkin	wind	Castlecraig	DSO	connected	25
H2	Castledockrell	wind	Castledockrell (1)	TSO	connected	20
H2	Castledockrell	wind	Castledockrell (2)	TSO	connected	2
H2	Castledockrell	wind	Castledockrell (3)	TSO	connected	3
H2	Castledockrell	wind	Castledockrell (4)	TSO	connected	16
NI	Kells	wind	Castlegore	DSO	offer	23
H2	Kilkenny	solar	Castlekelly Solar PV Farm	DSO	offer	4
E	Charleville	wind	Castlepook (1)	DSO	connected	33
NI	Castlereagh	battery	Castlereagh battery	TSO	offer	50
NI	Magherakeel	wind	Church Hill	DSO	connected	18
E	Clahane	wind	Clahane (1)	TSO	connected	38
E	Clahane	wind	Clahane (2)	TSO	connected	14
B	Dalton	solar	Claremorris 2 Solar Farm	DSO	offer	4
K	Butlerstown	solar	Clashganny South Solar Farm	DSO	offer	10
K	Dungarvan	solar	Clashnagoneen Solar Farm	DSO	offer	4
E	Coomataggart	wind	Cleanrath (1)	DSO	connected	43
C	Richmond	solar	Cleggill Solar Park	DSO	offer	8
C	Derrycarney	wind	Cloghan Wind Farm	TSO	offer	34
E	Cloghboola	wind	Cloghanaleskirt (1)	DSO	connected	13
A	Binbane	wind	Clogheravaddy Wind Farm (Phase 1)	DSO	connected	9
A	Binbane	wind	Clogheravaddy Wind Farm (Phase 2)	DSO	offer	11
A	Binbane	wind	Clogheravaddy Wind Farm (Phase 3)	DSO	offer	4
NI	Tremoge	wind	Cloghfin	DSO	offer	5
J	Cushaling	wind	Cloncreen Wind farm	TSO	offer	100
C	Shanonagh	solar	Clondardis Solar	TSO	offer	59
J	Clonfad	solar	Clonfad Solar	TSO	offer	100
J	Derryiron	solar	Clonin North solar	TSO	offer	47
D	Drumline	solar	Clonloghan 2 Solar Park	DSO	offer	8
H1	Cahir	solar	Clonmel Road Solar	DSO	offer	4
J	Thornsberry	wind	Clonminch Community Wind Turbine	DSO	offer	5
B	Cloon	solar	Cloonascragh Solar	DSO	offer	20
C	Athlone	wind	Clooncon East Single WTG	DSO	offer	1
B	Cloon	wind	Clooninagh Wind Farm	DSO	offer	5
B	Cloon	wind	Cloonlusk (1)	DSO	connected	4
NI	Loguestown	wind	Cloonty	DSO	connected	9
G	Drybridge	solar	Cluide Solar	DSO	offer	4
E	Garrow	wind	Clydaghroe (1)	DSO	connected	5
H1	Ahane	solar	Clyduff Solar Park	DSO	offer	4
NI	Coleraine	wind	Coleraine Main Total Wind	DSO	connected	10
NI	Coleraine	wind	Coleraine small scale - extra for 70pc	DSO	offer	25
G	Drybridge	wind	Collon Wind Power	DSO	connected	2
J	Griffinrath	solar	Confey Solar Park	DSO	offer	10
G	Lisdrum	wind	Coolberrin Wind Farm (formerly Bragan Wind Farm)	DSO	offer	33
C	Mullingar	wind	Coole wind	TSO	offer	88
E	Cordal	wind	Coollegrean (1)	DSO	connected	19
H2	Arklow	solar	Coolnagloose Community Solar	DSO	offer	1
K	Dungarvan	solar	Cooltubbrid West Solar	DSO	offer	4
A	Trillick	wind	Cooly (1)	DSO	connected	4
I	Kilbarry	solar	Coolyduff	DSO	offer	5
E	Garrow	wind	Coomacheo (1)	TSO	connected	41
E	Garrow	wind	Coomacheo (2)	TSO	connected	18
E	Coomagearlahy	wind	Coomagearlahy (1)	TSO	connected	43
E	Coomagearlahy	wind	Coomagearlahy (2)	TSO	connected	9
E	Coomagearlahy	wind	Coomagearlahy (3)	TSO	connected	30
F	Dunmanway	wind	Coomatallin (1)	DSO	connected	6
F	Dunmanway	wind	Coomatallin (2)	DSO	offer	3

H2	Carlow	solar	Coppenagh solar	DSO	offer	5
E	Cordal	wind	Cordal (1)	TSO	connected	36
E	Cordal	wind	Cordal (2)	TSO	connected	54
A	Gortawee	wind	Coreen (1)	DSO	connected	3
F	Macroom	other technologies	Cork Green Energy Biomass CHP Plant	DSO	connected	1
I	Kilbarry	other technologies	Cork University Hospital CHP (1)	DSO	connected	1
A	Binbane	wind	Corkermore (1)	DSO	connected	10
A	Binbane	wind	Corkermore (2)	DSO	offer	9
NI	Ballymena	wind	Corkey	DSO	connected	5
NI	Ballymena	wind	Corkey - replant extra for 70pc	DSO	offer	24
NI	Curraghamulkin	wind	Cornavarrow	DSO	connected	36
A	Arigna	wind	Corrie Mountain (1)	DSO	connected	5
A	Sorne Hill	wind	Corvin Wind Turbine	DSO	connected	2
B	Bellacorick	wind	Corvoderry (was Gortnahurra (1))	DSO	offer	34
E	Coomagearlahy	solar	Coumaclovane Solar Extension	TSO	offer	7
H2	Banoge	solar	Courtown Solar Farm (previously Coolnastudd)	DSO	offer	4
NI	Agivey	wind	Craiggore	DSO	offer	24
NI	Creagh	wind	Creagh Main Total Wind	DSO	connected	8
NI	Creagh	wind	Creagh small scale - extra for 70pc	DSO	offer	5
C	Lanesboro	solar	Creevy Solar	DSO	offer	4
NI	Cregagh	wind	Cregagh small scale - extra for 70pc	DSO	offer	1
NI	Tremoge	wind	Cregganconroe	DSO	connected	14
NI	Magherakeel	wind	Crigshane	DSO	connected	32
A	Croaghonagh	wind	Croaghonagh 1 Windfarm (Merged withCarrickalangan)	TSO	offer	138
I	Midleton	wind	Crocane (1)	DSO	connected	2
NI	Dungannon	wind	Crockagarran	DSO	connected	18
A	Trillick	wind	Crockahenny (1)	DSO	connected	5
NI	Tremoge	wind	Crockandun	DSO	connected	15
NI	Gort	wind	Crockbaravally	DSO	connected	8
NI	Tremoge	wind	Crockdun	DSO	connected	13
A	Ardnagappary	wind	Cronalaght (1)	DSO	connected	5
A	Ardnagappary	wind	Cronalaght (2)	DSO	connected	18
H2	Carlow	wind	Cronelea (1)	DSO	connected	5
H2	Carlow	wind	Cronelea (2)	DSO	connected	5
H2	Carlow	wind	Cronelea Upper (1)	DSO	connected	3
H2	Carlow	wind	Cronelea Upper (2)	DSO	connected	2
E	Mallow	solar	Crossfield	DSO	offer	5
D	Booltiagh	wind	Crossmore (1)	DSO	offer	15
D	Booltiagh	wind	Crossmore (2)	DSO	offer	10
B	Castlebar	wind	Cuillalea (1)	DSO	connected	3
B	Castlebar	wind	Cuillalea (2)	DSO	connected	2
A	Letterkenny	wind	Culliagh (1)	DSO	connected	12
F	Bandon	solar	Currabeha	DSO	offer	5
F	Dunmanway	wind	Currabwee (1)	DSO	connected	5
E	Glenlara	solar	Curraduff (previously Southwest Solar)	DSO	offer	5
NI	Curraghamulkin	wind	Curraghamulkin - extra for 70pc	DSO	offer	37
E	Trien	wind	Curraghderrig (1)	DSO	connected	5
H1	Nenagh	wind	Curraghgraigue (1)	DSO	connected	3
H1	Nenagh	wind	Curraghgraigue (2)	DSO	connected	2
H2	Waterford	solar	Curraghmartin Solar Park	DSO	offer	4
NI	Lisaghmore	wind	Curryfree	DSO	connected	15
J	Philipstown	wind	Cushaling wind (loop into Cushaling - Newbridge)	TSO	offer	50
E	Mallow	other technologies	Dairygold Mallow (2)	DSO	connected	4
H1	Barrymore	other technologies	Dairygold, Mitchelstown, zero	DSO	connected	9
G	Baltrasna	solar	Darthogue Solar	DSO	offer	20

J	College Park	inertia	Data Electronics Services Ltd	DSO	connected	4
H2	Wexford	solar	Davidstown Solar	DSO	offer	5
H2	Wexford	solar	Dennistown Extension Solar Park	DSO	offer	24
I	Barnahely	wind	DePuy	DSO	connected	3
I	Barnahely	wind	DePuy Synthes Turbine2	DSO	offer	1
F	Ballylickey	wind	Derreenacrinnig West (prev Kilvinane 2 WF)	DSO	offer	6
C	Lanesboro	battery	Derryadd battery	TSO	offer	16
C	Lanesboro	wind	Derryadd wind	TSO	offer	90
D	Derrybrien	wind	Derrybrien (1)	TSO	connected	60
J	Thornsberry	other technologies	Derryclure (1)	DSO	offer	10
B	Castlebar	wind	Derrynadivva Wind Farm (prev. Raheen Bar 2)	DSO	connected	9
A	Garvagh	wind	Derrysallagh Wind Farm (Formerly Kilronan 2)	DSO	connected	34
F	Dunmanway	wind	Derryvacorneen (1)	DSO	connected	17
NI	Curraghamulkin	wind	Dooish	DSO	offer	42
B	Bellacorick	wind	Dooleeg More (1)	DSO	offer	3
B	Bellacorick	wind	Dooleeg More Ext.	DSO	offer	1
J	Portlaoise	wind	Dooray WF	DSO	offer	45
NI	Magherafelt	wind	Doraville - extra for 70pc	TSO	offer	118
J	Mulgeeth	wind	Drehid wind	TSO	offer	60
E	Dromada	wind	Dromada (1)	TSO	connected	29
E	Glenlara	solar	Dromalour	DSO	offer	5
E	Drombeg	solar	Drombeg Solar Park	TSO	offer	50
E	Glenlara 220 kV side	wind	Dromdeeveen (1)	DSO	connected	11
E	Glenlara 220 kV side	wind	Dromdeeveen (2)	DSO	connected	17
E	Tralee	solar	Dromroe Solar	DSO	offer	4
E	Tralee	solar	Dromroe Solar 2	DSO	offer	3
D	Ardnacrusha	solar	Dromsallagh Solar	DSO	offer	4
I	Kilbarry	solar	Drumgarriff South	DSO	offer	5
G	Lisdrum	wind	Drumlins Park wind	TSO	offer	49
A	Trillick	wind	Drumlough Hill (1)	DSO	connected	5
A	Trillick	wind	Drumlough Hill (2)	DSO	connected	10
NI	Drumnakelly	solar	Drumnakelly Main Total PV	DSO	connected	2
NI	Drumnakelly	wind	Drumnakelly Main Total Wind	DSO	connected	8
NI	Drumnakelly	wind	Drumnakelly small scale - extra for 70pc	DSO	offer	7
K	Dungarvan	solar	Drumroe East Solar 2 Cluster	DSO	offer	37
K	Dungarvan	solar	Drumroe East Solar Farm	DSO	offer	15
J	Ringsend	other technologies	Dublin Civic Offices CHP (1)	DSO	connected	1
NI	Coleraine	wind	Dunbeg	DSO	connected	42
NI	Dungannon	solar	Dungannon Main Total PV	DSO	connected	5
NI	Dungannon	wind	Dungannon Main Total Wind	DSO	connected	9
NI	Dungannon	wind	Dungannon small scale - extra for 70pc	DSO	offer	24
NI	Coleraine	wind	Dunmore	DSO	connected	21
G	Drybridge	wind	Dunmore (1)	DSO	connected	2
G	Drybridge	wind	Dunmore (2)	DSO	connected	2
J	Newbridge	solar	Dunmurry Springs PV	DSO	offer	12
NI	Antrim	solar	Dunore Point solar PV Farm	DSO	connected	5
J	Dunfirth	solar	Dysart PV	DSO	offer	20
NI	Eden	wind	Eden Main Total Wind	DSO	connected	4
NI	Eden	wind	Eden small scale - extra for 70pc	DSO	offer	5
NI	Killymallaght	wind	Eglish	DSO	connected	15
NI	Ballymena	wind	Elginny Hill	DSO	connected	23
NI	Larne	wind	Elliots Hill	DSO	connected	5
NI	Larne	wind	Elliot's Hill - replant extra for 70pc	DSO	offer	24

NI	Enniskillen	wind	Enniskillen Main Total Wind	DSO	connected	11
NI	Enniskillen	wind	Enniskillen small scale - extra for 70pc	DSO	offer	20
K	Dungarvan	other technologies	Eras Eco AD (prev Knocknagappagh WF)	DSO	connected	2
H1	Timoney	solar	Erkina solar	TSO	offer	67
NI	Tremoge	wind	Eshmore	DSO	connected	7
E	Boggeragh	wind	Esk (1)	DSO	connected	6
E	Boggeragh	wind	Esk Wind Farm (sub metered Gneeves 2 Merge)	DSO	connected	5
E	Boggeragh	wind	ESK Wind Farm Phase 2	DSO	connected	12
E	Charleville	other technologies	Evaporator Upgrade	DSO	offer	2
NI	Agivey	wind	Evishagarran	DSO	offer	40
NI	Agivey	wind	Evishagarran Inc MEC	DSO	offer	7
H1	Barrymore	solar	Farran South	DSO	offer	15
F	Bandon	solar	Farrangalway Solar PV Farm	DSO	offer	5
B	Sligo	wind	Faughary (1)	DSO	connected	6
J	Glasmore	solar	Featherbed Lane Solar	DSO	offer	4
E	Charleville	solar	Fiddane Solar	DSO	offer	30
NI	Rasharkin	solar	Finvoy Road	DSO	connected	5
D	Drumline	solar	Firgrove Solar Park	DSO	offer	4
B	Firlough	wind	Firlough TG371 was Carrowleagh-Kilbride DG741	TSO	offer	48
B	Firlough	wind	Firlough Wind Farm	TSO	offer	27
A	Sorne Hill	wind	Flughland (1)	DSO	connected	9
I	Castleview	other technologies	FMC Gas Turbine	DSO	connected	2
K	Dungarvan	solar	Foxhall PV	DSO	offer	4
H1	Thurles	wind	Foyle Windfarm	DSO	connected	10
G	Navan	solar	Friarspark (was Glebe Golf Course)	DSO	offer	4
G	Navan	solar	Friarspark Solar 2	DSO	offer	2
B	Knockranny	wind	Fuinneamh Oileáin Árann	DSO	offer	2
J	Gallanstown	solar	Gallanstown Solar	TSO	offer	119
J	Stephenstown	battery	Gardnershill FGS	DSO	connected	9
H1	Cauteen	wind	Garracummer (1)	DSO	connected	37
H1	Cauteen	wind	Garracummer (2)	DSO	connected	1
F	Bandon	wind	Garranereagh (1)	DSO	connected	9
I	Coolroe	solar	Garravagh 1 Solar Park	DSO	offer	10
A	Letterkenny	wind	Garrymore WF	DSO	offer	4
D	Ardnacrusha	solar	Garrynacurra Solar Farm (Cratloe Community Solar)	DSO	offer	5
F	Bandon	solar	Garryndruig	DSO	offer	5
G	Meath Hill	wind	Gartnaneane (1)	DSO	connected	11
G	Meath Hill	wind	Gartnaneane (2)	DSO	connected	5
A	Garvagh	wind	Garvagh - Glebe (1a)	TSO	connected	26
A	Garvagh	wind	Garvagh - Tullynahaw (1c)	TSO	connected	22
NI	Coleraine	wind	Garves	DSO	connected	15
G	Gaskinstown	solar	Gaskinstown Solar Farm	TSO	offer	85
A	Corderry	wind	Geevagh (1)	DSO	connected	5
H2	Crory	wind	Gibbet Hill (1)	DSO	connected	15
G	Gillinstown	solar	Gillinstown Solar	TSO	offer	95
A	Sorne Hill	wind	Glackmore Hill (2)	DSO	connected	1
E	Cloghboola	wind	Glanaruddery 1 (formerly Dromadda More Wind Farm)	DSO	connected	20
E	Cloghboola	wind	Glanaruddery 2 (formerly Dromadda More 2)	DSO	connected	12
J	Portlaoise	other technologies	Glanbia Ballyraggett CHP (1)	DSO	connected	8
E	Glanlee	wind	Glanlee (1)	TSO	connected	30
E	Cloghboola	wind	Glantaunyalkeen Windfarm (Cloghboola (2) Ext)	DSO	connected	10
A	Corderry	solar	Glen Solar	TSO	offer	40

A	Letterkenny	wind	Glenalla (Garrymore)	DSO	offer	2
NI	Rasharkin	wind	Glenbuck	DSO	connected	9
H1	Cauteen	wind	Glencarbry (1)	DSO	connected	33
E	Kilpaddoge	battery	Glencloosagh Phase 3	TSO	offer	30
NI	Glengormley	wind	Glengormley Main Total Wind	DSO	connected	1
NI	Glengormley	wind	Glengormley small scale - extra for 70pc	DSO	offer	5
H2	Arklow	solar	Glenoge Community Solar	DSO	offer	5
H1	Cauteen	wind	Glenough (1)	DSO	connected	33
E	Knockearagh	wind	Gneeves (1)	DSO	connected	9
A	Golagh	wind	Golagh (1)	TSO	connected	15
E	Charleville	other technologies	Golden Vale CHP (1)	DSO	connected	4
H2	Banoge	battery	Gorey Battery Energy Storage	DSO	offer	9
H2	Banoge	solar	Gorey Solar	DSO	offer	4
G	Gorman	battery	Gorman (Graigs) Energy Storage Station	TSO	offer	30
G	Gorman	battery	Gorman Energy Storage Station - Extension	TSO	offer	20
D	Booltiagh	wind	Gortaheera CM2 Windfarm	DSO	offer	4
H2	Carlow	wind	Gortahile (1)	DSO	connected	21
J	Athy	other technologies	Gorteen Lower	DSO	connected	1
NI	Tremoge	wind	Gortfinbar	DSO	connected	15
E	Trien	wind	Gortnacloghy Wind Farm	DSO	connected	4
B	Tonroe	wind	Grady Joinery	DSO	connected	3
H2	Wexford	solar	Grahormick solar	TSO	offer	60
H2	Crane	solar	Graigue Beg Community Solar Farm	DSO	offer	5
F	Bandon	other technologies	Graingers Sawmills CHP (1)	DSO	connected	3
G	Drybridge	solar	Grangegeeth Solar	DSO	offer	4
H2	Crane	wind	Greenoge (1)	DSO	connected	5
NI	Magherakeel	wind	Gronan Wind Farm	DSO	offer	12
E	Rathkeale	wind	Grouse Lodge (1)	DSO	connected	15
E	Coomataggart	wind	Grousemount WF	TSO	connected	114
G	Dundalk	wind	Grove Hill (1) formerly Tullynageer	DSO	connected	16
NI	Coleraine	wind	Gruig	DSO	connected	25
J	Inchicore	other technologies	Guinness CHP (1)	DSO	connected	8
H1	Thurles	wind	Gurteen (1)	DSO	connected	2
J	Gallanstown	solar	Harlockstown Solar (Gallanstown Solar Extension)	TSO	offer	51
J	Harristown	solar	Harristown Solar PV	TSO	offer	42
G	Hawkinstown	solar	Hawkinstown Solar Park re-submission	TSO	offer	50
NI	Glengormley	other technologies	Hightown Quarry, Boghill Rd, Mallusk	DSO	offer	18
G	Baltrasna	solar	Hilltown PV	DSO	offer	10
I	Castleview	other technologies	Hoffman Renewable Bioenery Plant	DSO	offer	4
H1	Cauteen	wind	Holyford (1)	DSO	connected	9
H1	Doon	solar	Horsepasture Solar Farm (Grian PV)	DSO	offer	8
J	Dunfirth	solar	Hortland PV (from merge Knockanally and Hortland)	DSO	offer	14
NI	Omagh	wind	Hunters Hill	DSO	connected	20
J	Huntstown 220	battery	Huntstown 10 MW battery	TSO	offer	10
J	Finglas	other technologies	Huntstown Renewable Bioenergy Plant	DSO	connected	4
J	Inchicore	battery	Inchicore BESS	DSO	offer	30
NI	Tremoge	wind	Inishative	DSO	connected	14
B	Knockranny	wind	Inverin (Knock South) (1)	DSO	connected	3
F	Ballylickey	wind	Kealkil (Curraglass) (1)	DSO	connected	9
H2	Kilkenny	solar	Keatingstown Solar Farm	DSO	offer	6
J	Glasmore	other technologies	Keelings CHP	DSO	connected	2
K	Butlerstown	solar	Keiloge Solar	DSO	offer	4
NI	Kells	battery	Kells battery	TSO	offer	50
E	Kilpaddoge	wind	Kelwin Power Plant	TSO	connected	42
E	Kilpaddoge	battery	Kelwin Power Plant - Phase 2	TSO	connected	20

J	Monread	solar	Kerdiffstown PV	DSO	offer	4
E	Limerick	wind	Kilballyowen Windfarm	DSO	offer	5
E	Charleville	wind	Kilberehert (1)	DSO	connected	5
H2	Crane	wind	Kilbranish (1)	DSO	connected	3
G	Baltrasna	solar	Kilbrew Solar Farm	TSO	offer	35
J	Glasmore	other technologies	Kilbush Nurseries CHP	DSO	connected	2
K	Dungarvan	solar	Kilcannon	DSO	offer	5
H2	Carlow	solar	Kilcarrig Solar PV Farm	DSO	offer	4
C	Lanesboro	wind	Kilcash Community Wind Turbine	DSO	offer	3
E	Limerick	solar	Kilcolman Solar Farm	DSO	offer	4
G	Navan	solar	Kilkeelan Phase 2 Solar Farm	DSO	offer	1
G	Navan	solar	Kilkeelan Solar Farm	DSO	offer	4
H1	Kill Hill	wind	Kill Hill (1) - phase 1	TSO	connected	36
B	Tawnaghmore	battery	Killala (phase 2)	DSO	offer	11
B	Tawnaghmore	wind	Killala Wind Farm (Phase 1)	DSO	connected	19
F	Dunmanway	wind	Killaveenoge (formerly Barrboy (1))	DSO	connected	8
A	Gortawee	wind	Killegar Community Wind Turbine	DSO	offer	5
A	Binbane	wind	Killin Hill (1)	DSO	connected	6
A	Binbane	wind	Killybegs (1)	DSO	connected	3
A	Binbane	wind	Killybegs Community Wind Turbine	DSO	offer	4
NI	Killymallaght	wind	Killymallaght - extra for 70pc	DSO	offer	50
H2	Great Island	battery	Kilmannock Battery Storage Facility	DSO	offer	30
E	Charleville	wind	Kilmeedy (1)	DSO	connected	5
A	Arigna	wind	Kilronan (1)	DSO	connected	5
NI	Kilroot	battery	Kilroot battery	TSO	connected	10
D	Booltiagh	wind	Kiltumper	DSO	connected	5
F	Bandon	wind	Kilvinane (1)	DSO	connected	5
B	Cunghill	wind	Kingsmountain (1)	TSO	connected	24
B	Cunghill	wind	Kingsmountain (2)	TSO	connected	11
J	Blake T	solar	Kishavanna Solar Farm	DSO	offer	5
NI	Castlereagh	wind	Knock small scale - extra for 70pc	DSO	offer	1
E	Knockacummer	wind	Knockacummer (1)	TSO	connected	100
H2	Arklow	solar	Knockadosan Solar (formerly Springfarm Wind Farm)	DSO	offer	6
D	Slievecallan	wind	Knockalassa (formerly Keelderry)	TSO	connected	27
B	Knockranny	wind	Knockalough (1)	TSO	connected	35
E	Oughtragh	wind	Knockaneden (1)	DSO	connected	9
D	Ardnacrusha	wind	Knockastanna (1)	DSO	connected	8
E	Trien 220 kV side	wind	Knockawarriga (1)	DSO	connected	23
E	Trien 220 kV side	wind	Knockawarriga Extension (Glenduff & Caherlevoy) Wi	DSO	connected	7
F	Dunmanway	wind	Knockeenbui Wind Farm	DSO	offer	14
F	Macroom	solar	Knockglass Solar extension	DSO	offer	2
F	Macroom	solar	Knockglass Solar Farm	DSO	offer	4
E	Cloghboola	wind	Knocknagashel Wind (Cloghboola (1))	TSO	connected	46
E	Reamore	wind	Knocknagoum (1)	DSO	connected	43
E	Reamore	wind	Knocknagoum (2) formerly Muingnatee (3)	DSO	connected	2
H2	Crory	wind	Knocknalour (1)	DSO	connected	5
H2	Crory	wind	Knocknalour (2)	DSO	connected	4
K	Woodhouse	wind	Knocknamona Wind Farm (Prev. Crohaun)	TSO	offer	34
E	Ballyvouskil 220	solar	Knocknamork solar	TSO	offer	13
E	Ballyvouskil 220	wind	Knocknamork wind	TSO	offer	42
E	Charleville	wind	Knocknatallig	DSO	connected	18

B	Knockranny	wind	Knockranny wind	TSO	offer	47
H2	Kilkenny	solar	Knocktopher Solar	DSO	offer	4
B	Moy	wind	Lackan (1)	DSO	connected	6
H1	Ahane	solar	Laghtane Solar Farm	DSO	offer	4
F	Dunmanway	wind	Lahanaght Hill (1)	DSO	connected	4
B	Tonroe	wind	Largan Hill (1)	DSO	connected	6
NI	Larne	wind	Larne Main Total Wind	DSO	connected	10
NI	Larne	wind	Larne small scale - extra for 70pc	DSO	offer	10
NI	Waringstown	solar	Laurel Hill Road + Overinstall	DSO	connected	10
C	Dallow	wind	Leabeg (1)	DSO	connected	4
I	Barnahely	solar	Leacht Cross Solar	DSO	offer	5
E	Kilpaddoge	wind	Leanamore (1) (formerly Tarbert (1))	DSO	connected	18
J	Thornsberry	solar	Lehinch Solar Farm	DSO	offer	4
B	Salthill	wind	Leitir Guingaid & Doire Chrith1 & 2 Merge	DSO	connected	41
A	Lenalea	wind	Lenalea Wind Farm	TSO	offer	31
B	Castlebar	wind	Lenanavea (Burren) Wind Farm	DSO	connected	5
NI	Omagh	wind	Lendrum's Bridge	DSO	connected	13
NI	Omagh	wind	Lendrum's Bridge - replant extra for 70pc	DSO	offer	26
A	Letterkenny	wind	Lettergull (1)	DSO	offer	20
G	Shankill	wind	Liffey Autoproduction Project	DSO	connected	2
G	Shankill	wind	Liffey Autoproduction Project (extension)	DSO	connected	1
NI	Limavady	wind	Limavady Main Total Wind	DSO	connected	3
NI	Limavady	wind	Limavady small scale - extra for 70pc	DSO	offer	12
NI	Lisaghmore	wind	Lisaghmore Main Total Wind	DSO	connected	4
NI	Lisaghmore	wind	Lisaghmore small scale - extra for 70pc	DSO	offer	4
H1	Nenagh	solar	Lisbrien Solar Farm	DSO	offer	4
NI	Lisburn	solar	Lisburn Main Total PV	DSO	connected	1
NI	Lisburn	wind	Lisburn Main Total Wind	DSO	connected	4
NI	Lisburn	solar	Lisburn PV Park (aka Balinderry Road and Moneybroo	DSO	connected	17
NI	Lisburn	wind	Lisburn small scale - extra for 70pc	DSO	offer	7
H2	Ballyragget	wind	Lisdowney (1)	DSO	connected	9
J	Portlaoise	wind	Lisdowney (1)	DSO	connected	9
G	Lisdrum	battery	Lisdrumdoagh Energy Storage Facility	TSO	offer	60
B	Dalton	solar	Lisduff Solar Park (Claremorris)	DSO	offer	4
NI	Eden	wind	Lisglass	DSO	connected	2
H1	Lisheen	wind	Lisheen (1)	TSO	connected	36
H1	Lisheen	wind	Lisheen (1a)	TSO	connected	23
H1	Lisheen	wind	Lisheen 3	TSO	offer	29
C	Richmond	solar	Lisnageeragh Solar Farm	DSO	offer	4
C	Mullingar	solar	Liss Solar Farm (prev Lands at Liss)	DSO	offer	4
D	Booltiagh	wind	Lissycasey (1)	DSO	connected	13
H2	Ballyragget	solar	Loan PV	DSO	offer	5
NI	Loguestown	wind	Loguestown Main Total Wind	DSO	connected	6
NI	Rasharkin	wind	Long Mountain	DSO	connected	28
NI	Strabane	wind	Lough Hill	DSO	connected	8
NI	Lisburn	solar	Lough Road Solar	DSO	connected	25
K	Butlerstown	solar	Loughdenee Solar	DSO	offer	9
A	Binbane	wind	Loughderryduff (1)	DSO	connected	8
J	Coolnabacky	solar	Loughteague	TSO	offer	55
C	Derrycarney	battery	Lumcloon ESS (Derrycarney)	TSO	connected	100
A	Letterkenny	wind	Lurganboy (1)	DSO	connected	5
I	Midleton	solar	Lurrig Solar Farm	DSO	offer	4
I	Lysaghtstown	solar	Lysaghtstown Solar	TSO	offer	87
H2	Crane	solar	Macallian Solar	DSO	offer	9
B	Dalton	wind	Mace Upper (1)	DSO	connected	3

H2	Wexford	solar	Mackmine Solar	DSO	offer	19
E	Knockearagh	solar	Madam's Hill Solar Park	DSO	offer	9
NI	Lisburn	solar	Maghaberry Road	DSO	connected	27
B	Dalton	wind	Magheramore and Cloontooa (1)	DSO	connected	41
E	Oughtragh	solar	Maine Solar	DSO	offer	4
J	Glasmore	solar	Mainscourt	DSO	offer	40
C	Mullingar	solar	Marlinstown Solar Farm (prev Russellstown)	DSO	offer	4
G	Navan	solar	Martinstown Solar formerly Crowinstown Great wind	DSO	offer	5
J	Finglas	other technologies	Mater Hospital CHP (1)	DSO	connected	2
J	Stephenstown	solar	Matt Solar Farm	DSO	offer	5
E	Glenlara 220 kV side	wind	Mauricetown (Glenduff) Wind Farm	DSO	connected	14
B	Tawnaghmore	other technologies	Mayo Renewable Power Biomass CHP	DSO	offer	49
G	Drybridge	other technologies	Meath Waste-to-Energy (2)	DSO	connected	4
A	Binbane	wind	Meenachullalan (1)	DSO	connected	12
A	Binbane	wind	Meenachullalan (2)	DSO	offer	2
A	Cathaleen's Fall	wind	Meenadreen (1)	DSO	connected	3
A	Letterkenny	wind	Meenanilta (1)	DSO	connected	3
A	Letterkenny	wind	Meenanilta (2)	DSO	connected	2
A	Letterkenny	wind	Meenanilta (3)	DSO	connected	3
A	Trillick	wind	Meenaward	DSO	connected	7
A	Sorne Hill	wind	Meenkeeragh (1)	DSO	connected	4
A	Meentycat	wind	Meentycat (1)	TSO	connected	71
A	Meentycat	wind	Meentycat (2)	TSO	connected	14
C	Dallow	wind	Meenwaun WF	DSO	connected	10
NI	Ballymena	wind	Michelin	DSO	connected	5
C	Lanesboro	solar	Middleton solar (Longford)	TSO	offer	57
F	Dunmanway	wind	Milane Hill (1)	DSO	connected	6
NI	Antrim	solar	Millar Farm	DSO	connected	8
I	Midleton	other technologies	Millipore	DSO	connected	1
H2	Ballybeg	solar	Millvale PV	DSO	offer	8
D	Tullabrack	wind	Moanmore (1)	DSO	connected	13
J	Mount Lucas	wind	Moanvane wind	TSO	offer	60
J	Athy	solar	Moatstown Solar	DSO	offer	4
NI	Aghyoule	wind	Molly Mountain	DSO	connected	15
H1	Ikerrin	wind	Monaincha Bog (1)	DSO	connected	36
I	Knockraha	solar	Monatooreen Solar	TSO	offer	26
A	Corderry	wind	Moneenatieve (1)	DSO	connected	4
E	Moneypoint	battery	Moneypoint Battery Storage	TSO	offer	8
E	Moneypoint	wind	Moneypoint WF	TSO	connected	17
NI	Coolkeeragh	wind	Monnaboy	DSO	connected	12
H1	Cahir	solar	Monroe East solar from merge Ballyfowloo Lawclon	DSO	offer	8
H1	Mothel	solar	Mothel PV	TSO	offer	60
E	Tralee	wind	Mount Eagle (1)	DSO	connected	5
E	Tralee	wind	Mount Eagle (2)	DSO	connected	2
J	Mount Lucas	wind	Mount Lucas (1)	TSO	connected	79
G	Ratrussan	wind	Mountain Lodge (1)	TSO	connected	25
G	Shankill	wind	Mountain Lodge (2)	DSO	connected	3
G	Ratrussan	wind	Mountain Lodge (3)	TSO	connected	6
J	Thornsberry	solar	Muinagh Solar Farm	DSO	offer	4
J	Thornsberry	solar	Muinagh Solar Phase 2	DSO	offer	2
E	Reamore	wind	Muingnaminnane (1)	DSO	connected	15
G	Meath Hill	wind	Mullananalt (1)	DSO	connected	8
A	Tievebrack	wind	Mully Graffy Windfarm (Kilgorman)	TSO	offer	30
A	Mulreavy	wind	Mulreavy (Mulreavy (1))	TSO	connected	82

A	Mulreavy	wind	Mulreavy Ext (Croaghnameal (1))	TSO	connected	4
A	Mulreavy	wind	Mulreavy Ext (Meenadreen South (1))	TSO	connected	4
A	Mulreavy	wind	Mulreavy Ext (Meenadreen South (2))	TSO	connected	5
E	Limerick	solar	Mungret Solar	DSO	offer	5
NI	Gort	wind	Murley Mountain	DSO	offer	23
NI	Newry	battery	Newry battery	TSO	offer	16
NI	Newry	other technologies	Newry Biomass	DSO	offer	4
NI	Newry	solar	Newry Main Total PV	DSO	connected	2
NI	Newry	wind	Newry Main Total Wind	DSO	connected	3
NI	Newry	wind	Newry small scale - extra for 70pc	DSO	offer	8
NI	Newtownards	wind	Newtownards Main Total Wind	DSO	connected	5
NI	Castlereagh	wind	Newtownards small scale - extra for 70pc	DSO	offer	4
H2	Arklow	battery	North Arklow battery	TSO	offer	30
H2	Arklow	solar	North Arklow Solar	TSO	offer	47
J	Belcamp	wind offshore	North Irish Sea Array	TSO	offer	250
J	Belcamp	wind offshore	North Irish Sea Array (1) B	TSO	offer	250
J	North Wall	battery	North Wall 5	TSO	offer	120
NI	Omagh	wind	Omagh Main Total Wind	DSO	connected	13
NI	Omagh	wind	Omagh small scale - extra for 70pc	DSO	offer	41
NI	Enniskillen	wind	Ora More	DSO	connected	15
G	Oriel	wind offshore	Oriel (1)	TSO	offer	210
G	Oriel	wind offshore	Oriel offshore new A	TSO	offer	160
K	Butlerstown	other technologies	Ormonde Organics AD	DSO	connected	1
J	Dunfirth	solar	Ovidstown Solar	DSO	offer	4
B	Bellacorick	wind	Oweninny 3 (Previously Oweninny 5)	TSO	offer	50
B	Bellacorick	wind	Oweninny Power (1)	TSO	connected	93
B	Bellacorick	wind	Oweninny Power (2)	TSO	offer	83
NI	Strabane	wind	Owenreagh - replant extra for 70pc	DSO	offer	23
NI	Strabane	wind	Owenreagh 1	DSO	connected	6
NI	Strabane	wind	Owenreagh 2	DSO	connected	5
G	Baltrasna	solar	Painestown Hill Solar Farm	DSO	offer	10
H2	Ballyragget	solar	Parksgrove solar	DSO	offer	35
I	Trabeg	solar	Piercestown (formerly Jackeens) SPV	DSO	offer	5
NI	Curraghamulkin	wind	Pigeon Top	DSO	offer	52
H2	Ballyragget	wind	Pinewoods wind	TSO	offer	60
I	Kilbarry	wind	Pluckanes (1)	DSO	connected	1
J	Newbridge	solar	Pollardstown PV	DSO	offer	4
J	Poolbeg north	wind offshore	Poolbeg 220 north offshore new A	TSO	offer	450
J	Poolbeg south	wind offshore	Poolbeg 220 south offshore new B	TSO	offer	500
J	Poolbeg south	wind offshore	Poolbeg 220 south offshore new C	TSO	offer	500
J	Poolbeg north	battery	Poolbeg BESS	TSO	offer	75
J	Kilteel	battery	Porterstown battery	TSO	offer	60
J	Kilteel	battery	Porterstown Battery Storage Facility	TSO	offer	30
B	Castlebar	wind	Raheen Barr (1)	DSO	connected	19
B	Castlebar	wind	Raheen Barr extension (was Derrynadivva extension)	DSO	connected	7
H2	Arklow	wind	Raheenleagh (1)	DSO	connected	35
H2	Waterford	wind	Rahora (1)	DSO	connected	4
G	Meath Hill	wind	Raragh (2)	DSO	connected	12
E	Rathkeale	wind	Rathcahill (1)	DSO	connected	13
NI	Rathgael	wind	Rathgael Main Total Wind	DSO	connected	1
NI	Castlereagh	wind	Rathgael small scale - extra for 70pc	DSO	offer	4
C	Carrick on Shannon	solar	Rathleg Solar Farm	DSO	offer	4
E	Charleville	wind	Rathnacally (1)	DSO	connected	4
K	Rathnaskilloge	solar	Rathnaskilloge	TSO	offer	95
NI	Ballymena	wind	Rathsherry	DSO	connected	21

G	Ratrussan	wind	Ratrussan (1a)	TSO	connected	48
F	Dunmanway	wind	Reenascreena (1)	DSO	connected	5
J	Derryiron	battery	Rhode 37.5 MW ESS	DSO	offer	38
H2	Wexford	wind	Richfield (1)	DSO	connected	20
H2	Wexford	wind	Richfield (2)	DSO	connected	7
NI	Coleraine	wind	Rigged Hill	DSO	connected	5
NI	Coleraine	wind	Rigged Hill - replant extra for 70pc	DSO	offer	24
C	Athlone	solar	Rooaun Solar	DSO	offer	4
B	Tonroe	wind	Roosky (1)	DSO	connected	4
NI	Rosebank	wind	Rosebank Main Total Wind	DSO	connected	3
B	Knockranny	wind	Rossaveel Wind	DSO	connected	3
H2	Rosspile	solar	Rosspile Solar Farm	TSO	offer	95
C	Lanesboro	wind	Roxborough	DSO	offer	5
E	Cordal	wind	Scartaglen (1)	DSO	connected	35
E	Cordal	wind	Scartaglen (2)	DSO	connected	4
NI	Omagh	wind	Screggagh	DSO	connected	20
B	Uggool	wind	Seecon (1)	TSO	connected	105
NI	Magherakeel	wind	Seegronan	DSO	connected	14
NI	Magherakeel	wind	Seegronan Extension Wind farm	DSO	offer	7
A	Arigna	wind	Seltanaveeny (1)	DSO	connected	5
G	Navan	other technologies	Shamrock Renewable Fuels formerly Farelly Brothers	DSO	offer	13
E	Trien	solar	Shanacool (Trienearagh) Solar Park	DSO	offer	4
I	Trabeg	solar	Shanagraigue	DSO	offer	5
J	Portlaoise	solar	Shanderry Solar Farm	DSO	offer	4
A	Binbane	wind	Shannagh (1) previously Kilcar	DSO	connected	3
C	Athlone	solar	Shannagh Beg Solar Farm	DSO	offer	4
C	Shannonbridge 220	battery	Shannonbridge B ESS	TSO	offer	63
C	Shannonbridge 220	battery	Shannonbridge ESS	TSO	offer	100
B	Shantallow	solar	Shantallow Solar	TSO	offer	35
NI	Gort	wind	Shantavny Scotch	DSO	connected	16
B	Bellacorick	wind	Sheskin (1)	DSO	offer	17
B	Bellacorick	wind	Sheskin (2)	DSO	offer	16
C	Mullingar	solar	Sianmore PV	DSO	offer	17
C	Dallow	wind	Skehanagh (1)	DSO	connected	4
C	Lanesboro	wind	Skrine (1)	DSO	connected	5
C	Sliabh Bawn	wind	Sliabh Bawn (1)	TSO	connected	58
NI	Omagh	wind	Slieve Divena 1	DSO	connected	30
NI	Gort	wind	Slieve Divena 2	DSO	connected	20
NI	Killymallaght	wind	Slieve Kirk	TSO	connected	74
NI	Aghyoule	wind	Slieve Rushen (Mantlin)	DSO	connected	54
NI	Curraghamulkin	wind	Slieveglass	DSO	connected	7
NI	Ballymena	wind	Slievehanaghan	DSO	connected	1
H1	Tipperary	wind	Slievereagh (1)	DSO	connected	3
H1	Tipperary	wind	Slievereagh (1)	DSO	connected	2
NI	Agivey	wind	Smulgedon	DSO	offer	16
NI	Aghyoule	wind	Snugborough	DSO	connected	14
NI	Aghyoule	wind	Snugborough - replant extra for 70pc	DSO	offer	24
C	Somerset	wind	Sonnagh Old (1)	DSO	connected	8
A	Sorne Hill	wind	Sorne Hill (1)	DSO	connected	32
A	Sorne Hill	wind	Sorne Hill (2)	DSO	connected	7
A	Sorne Hill	wind	Sorne Hill Single Turbine (Enros)	DSO	connected	2
D	Booltiagh	wind	Sorrell Island (Glenmore) WF Ext	DSO	connected	8
D	Booltiagh	wind	Sorrell Island (prev Glenmore) (1)	DSO	connected	24
J	Irishtown	battery	South Wall BESS	TSO	offer	30
A	Cathaleen's Fall	wind	Spaddan (1)	DSO	connected	18

A	Arigna	wind	Spion Kop (1)	DSO	connected	1
NI	Lisaghmore	wind	Springtown small scale - extra for 70pc	DSO	offer	4
E	Reamore	wind	Stack's Mountain	DSO	offer	25
G	Drybridge	solar	Stamullen 2	DSO	offer	1
G	Drybridge	solar	Stamullen Solar Park	DSO	offer	4
NI	Kells	solar	Steeple Road	DSO	offer	21
NI	Strabane	wind	Strabane Main Total Wind	DSO	connected	12
NI	Strabane	wind	Strabane small scale - extra for 70pc	DSO	offer	12
NI	Magherafelt	wind	Straw Mountain Wind Farm	DSO	offer	3
J	Griffinrath	solar	Taghadoe Solar Farm	DSO	offer	25
G	Meath Hill	wind	Taghart (1)	DSO	offer	23
NI	Tamnamore	battery	Tamnamore battery	TSO	connected	50
NI	Tandragee	battery	Tandragee battery	TSO	connected	50
NI	Omagh	wind	Tappaghan	DSO	connected	29
E	Glenlara	wind	Taurbeg (1)	DSO	connected	26
I	Midleton	solar	Tead More Solar (Meelshane)	DSO	offer	4
G	Meath Hill	wind	Teevurcher	DSO	connected	9
NI	Gort	wind	Teiges	DSO	connected	11
H1	Nenagh	wind	Templederry (1)	DSO	connected	4
B	Sligo	wind	Templehouse Community Wind Turbine	DSO	offer	4
H2	Arklow	solar	Templerainey East Solar Farm (Ballycooleen)	DSO	offer	4
H2	Crory	solar	The Dell Solar	DSO	offer	20
NI	Magherakeel	wind	Thornog	DSO	connected	20
A	Sorne Hill	wind	Three Trees (1)	DSO	connected	4
J	Kilteel	solar	Threecastles Solar Farm	DSO	offer	15
NI	Magherakeel	wind	Tievenameenta	DSO	connected	35
J	Timahoe North	solar	Timahoe North solar	TSO	offer	70
F	Bandon	other technologies	Timoleague Agri Gen	DSO	connected	1
E	Trien	wind	Tournafulla (1)	DSO	connected	8
E	Trien 220 kV side	wind	Tournafulla (2)	DSO	connected	17
J	Griffinrath	solar	Tower Hill Solar Farm	DSO	offer	6
H2	Wexford	solar	Tracystown Solar	TSO	offer	81
J	Treascon	solar	Treascon Solar	TSO	offer	40
NI	Tremoge	wind	Tremoge - extra for 70pc	DSO	offer	58
C	Mullingar	wind	Tromra Community WT	DSO	offer	5
H2	Tullabeg	solar	Tullabeg Solar Park	TSO	offer	50
D	Tullabrack	wind	Tullabrack (1)	DSO	connected	14
A	Gortawee	wind	Tullyhaw Community Wind Turbine	DSO	offer	5
C	Mullingar	solar	Tullynally Estate	DSO	offer	4
G	Meath Hill	wind	Tullynamalra (1)	DSO	connected	3
A	Corderry	wind	Tullynamoyle (1)	DSO	connected	9
A	Corderry	wind	Tullynamoyle 2 Wind Farm	DSO	connected	10
A	Corderry	wind	Tullynamoyle 3	DSO	connected	12
A	Corderry	wind	Tullynamoyle Wind Farm 5	DSO	offer	16
D	Ardnacrusha	solar	Tuogh Solar Park	DSO	offer	5
E	Tralee	wind	Tursillagh (1)	DSO	connected	15
E	Tralee	wind	Tursillagh (2)	DSO	connected	7
B	Uggool	wind	Uggool (1)	TSO	connected	64
J	Blackrock	other technologies	University College Dublin	DSO	connected	1
H1	Killonan	wind	Upperchurch (1)	DSO	offer	94
NI	Waringstown	wind	Waringstown small scale - extra for 70pc	DSO	offer	7
E	Knockearagh	wind	WEDcross (1)	DSO	connected	5
G	Dundalk	solar	Willville Solar Park	DSO	offer	4
G	Dundalk	solar	Willville Solar Park extension	DSO	offer	1
I	Barnahely	wind	Wind Energy Project (Janssen)	DSO	connected	2
NI	Larne	wind	Wolf Bog	DSO	connected	10

K	Woodhouse	wind	Woodhouse (1)	TSO	connected	20
J	Athy	solar	Woodstock North Solar Farm	DSO	offer	5
E	Rathkeale	other technologies	Wyeth Askeaton	DSO	connected	7
J	Derryiron	wind	Yellow River Wind Farm	TSO	offer	110

Table B-4 Generator List by Name

Note that the year of connection is rounded from the build-out rate date or target connection date.

These are in addition to the large generators which are listed in EirGrid and SONI's All Island Generation Capacity Statement 2021 - 2030.

Appendix C Area K Node Results

This appendix presents the results of the modelling analysis for Area K. The levels of over-supply, curtailment and constraint that controllable solar and wind generators in Area K might expect to experience are reported on a nodal basis for the study scenarios. Details on the generation capacity at each node are also provided along with the assumed amount of controllable generation.

This appendix also presents a list for each node of those generators that are included in the study.

Figure C-1 Area K

C.1 Butlerstown

The location of this node is shown in the figure below.

Figure C-2 Location of Node

The generators, which are modelled at this node, are listed as follows.

Generator	SO	Type	Status	Capacity (MW)
Amberhill Solar Farm	DSO	solar not priority	ECP 2.1	4.0
Beallough (1)	DSO	wind uncontrolled	Pre-Gate	1.7
Clashganny South Solar Farm	DSO	solar not priority	ECP 2.1	10.0
Keiloge Solar	DSO	solar not priority	ECP 1	4.0
Loughdenee Solar	DSO	solar not priority	ECP 2.1	9.0
Ormonde Organics AD	DSO	priority	Non GPA	1.0

Table C-1 Generation Included in Study for Node

The solar not priority data is given in the below table.

BUTLERSTOWN							
SOLAR NOT PRIORITY	Year	Initial	33%	66%	ECP	ECP + 1.7GW Offshore	ECP + 3.9GW Offshore
Installed (MW)	2024	4	12	19	27		
Installed (MW)	2026				27	27	
Installed (MW)	2026 with GL	4	12	19	27	27	
Installed (MW)	2026 with GL and Celtic				27	27	
Installed (MW)	Future Grid				27	27	27
Available Energy (GWh)	2024	4.3	12.5	20.9	29.1		
Available Energy (GWh)	2026				29.1	29.1	
Available Energy (GWh)	2026 with GL	4.3	12.5	20.9	29.1	29.1	
Available Energy (GWh)	2026 with GL and Celtic				29.1	29.1	
Available Energy (GWh)	Future Grid				29.1	29.1	29.1

Generation (GWh)	2024	3.8	10.8	17.4	23.2		
Generation (GWh)	2026				24.8	23.6	
Generation (GWh)	2026 with GL	3.9	11.2	18.2	24.4	23.5	
Generation (GWh)	2026 with GL and Celtic				27.5	26.4	
Generation (GWh)	Future Grid				27.6	27.5	26.0
Over-supply (%)	2024	0%	1%	2%	3%		
Over-supply (%)	2026				3%	9%	
Over-supply (%)	2026 with GL		0%	1%	2%	7%	
Over-supply (%)	2026 with GL and Celtic				1%	4%	
Over-supply (%)	Future Grid				0%	2%	7%
Curtailment (%)	2024	1%	2%	2%	3%		
Curtailment (%)	2026				2%	4%	
Curtailment (%)	2026 with GL		1%	1%	2%	3%	
Curtailment (%)	2026 with GL and Celtic				1%	3%	
Curtailment (%)	Future Grid				0%	1%	2%
Constraint (%)	2024	10%	11%	13%	14%		
Constraint (%)	2026				9%	6%	
Constraint (%)	2026 with GL	7%	10%	11%	12%	9%	
Constraint (%)	2026 with GL and Celtic				4%	2%	
Constraint (%)	Future Grid				4%	2%	1%
Total Dispatch Down (%)	2024	11%	14%	17%	20%		
Total Dispatch Down (%)	2026				15%	19%	
Total Dispatch Down (%)	2026 with GL	7%	10%	13%	16%	19%	
Total Dispatch Down (%)	2026 with GL and Celtic				6%	9%	
Total Dispatch Down (%)	Future Grid				5%	5%	11%

Table C-2 Results for Solar Not Priority

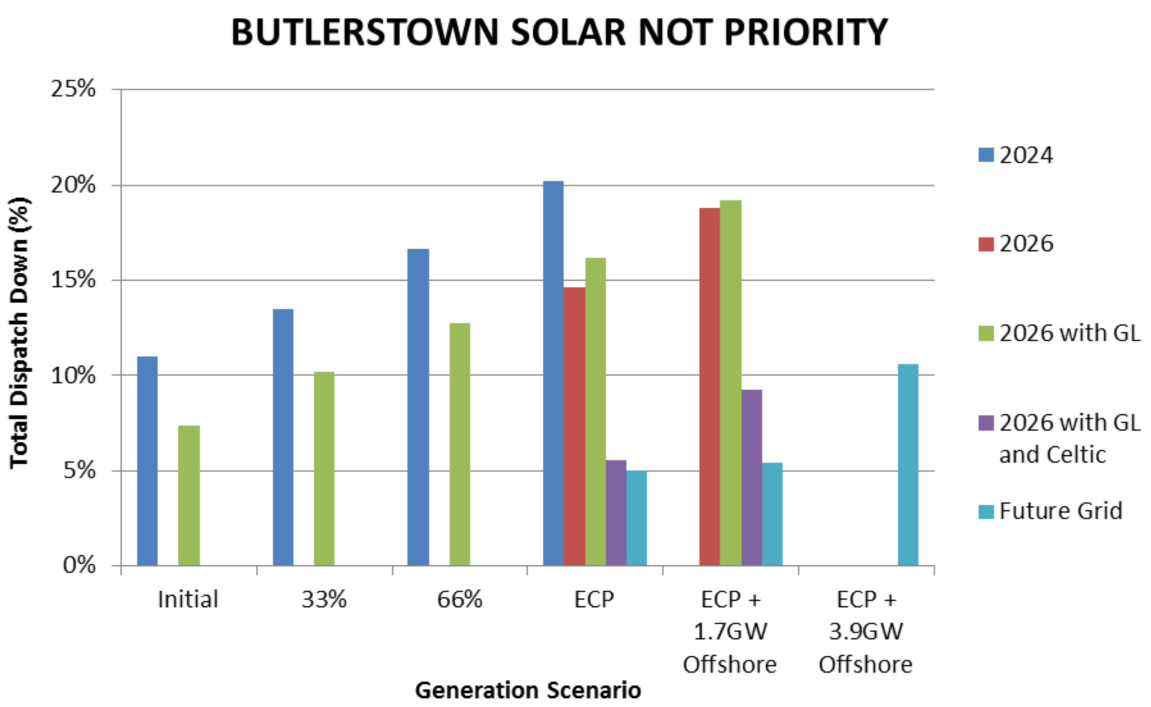


Figure C-3 Total Dispatch Down for Solar Not Priority

C.2 Dungarvan

The location of this node is shown in the figure below.

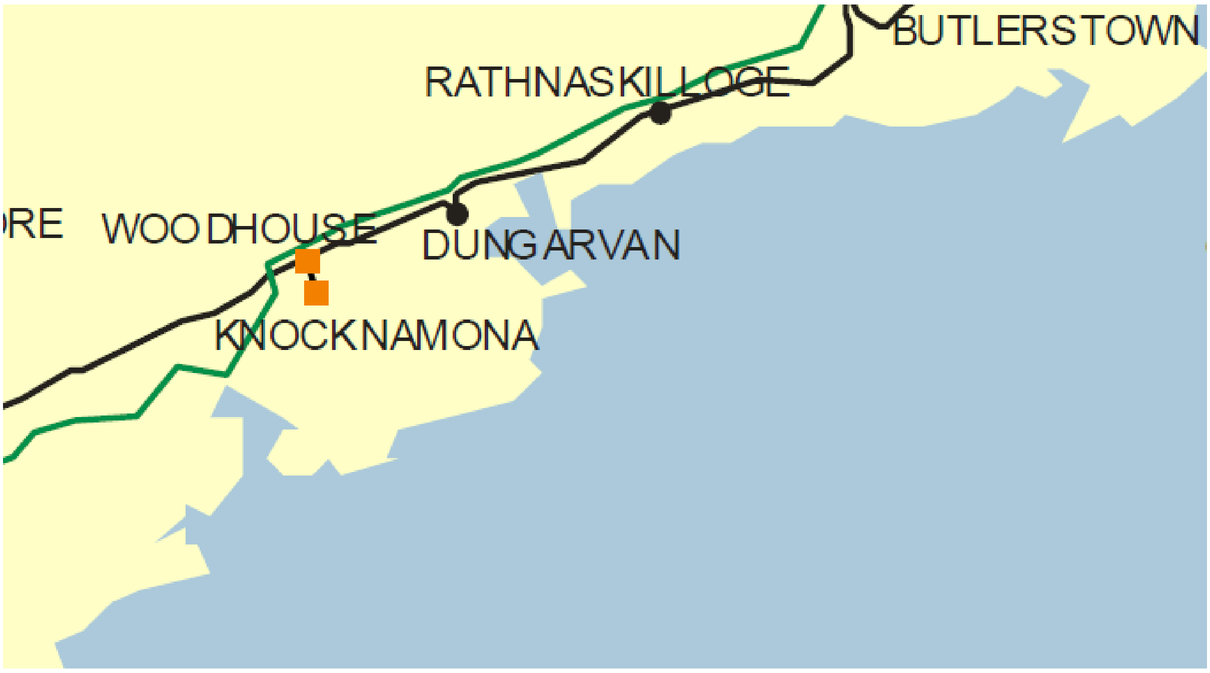


Figure C-4 Location of Node

The generators, which are modelled at this node, are listed as follows.

Generator	SO	Type	Status	Capacity (MW)
Ballycurreen (1)	DSO	wind uncontrolled	Gate 3	5.0
Ballymac PV	DSO	solar not priority	ECP 2.1	5.0
Clashnagoneen Solar Farm	DSO	solar not priority	ECP 1	4.0
Cooltubbrid West Solar	DSO	solar not priority	ECP 2.1	4.0
Drumroe East Solar 2 Cluster	DSO	solar not priority	ECP 2.1	37.0
Drumroe East Solar Farm	DSO	solar not priority	ECP 1	15.0
Eras Eco AD (prev Knocknagappagh WF)	DSO	priority	Gate 2	1.7
Foxhall PV	DSO	solar not priority	ECP 1	4.0
Kilcannon	DSO	solar not priority	ECP 2.1	5.0

Table C-3 Generation Included in Study for Node

The solar not priority data is given in the below table.

DUNGARVAN							
SOLAR NOT PRIORITY	Year	Initial	33%	66%	ECP	ECP + 1.7GW Offshore	ECP + 3.9GW Offshore
Installed (MW)	2024	23	40	57	74		
Installed (MW)	2026				74	74	
Installed (MW)	2026 with GL	23	40	57	74	74	
Installed (MW)	2026 with GL and Celtic				74	74	
Installed (MW)	Future Grid				74	74	74

Available Energy (GWh)	2024	24.8	43.0	61.7	79.9		
Available Energy (GWh)	2026				79.8	79.8	
Available Energy (GWh)	2026 with GL	24.8	43.0	61.7	79.8	79.8	
Available Energy (GWh)	2026 with GL and Celtic				79.8	79.8	
Available Energy (GWh)	Future Grid				79.8	79.8	79.8
Generation (GWh)	2024	22.1	37.2	51.5	63.7		
Generation (GWh)	2026				68.2	64.8	
Generation (GWh)	2026 with GL	22.9	38.6	53.8	66.9	64.5	
Generation (GWh)	2026 with GL and Celtic				75.4	72.4	
Generation (GWh)	Future Grid				75.8	75.5	71.3
Over-supply (%)	2024	0%	1%	2%	3%		
Over-supply (%)	2026				3%	9%	
Over-supply (%)	2026 with GL	0%	0%	1%	2%	7%	
Over-supply (%)	2026 with GL and Celtic				1%	4%	
Over-supply (%)	Future Grid				0%	2%	7%
Curtailment (%)	2024	1%	2%	2%	3%		
Curtailment (%)	2026				2%	4%	
Curtailment (%)	2026 with GL	0%	1%	1%	2%	3%	
Curtailment (%)	2026 with GL and Celtic				1%	3%	
Curtailment (%)	Future Grid				0%	1%	2%
Constraint (%)	2024	10%	11%	13%	14%		
Constraint (%)	2026				9%	6%	
Constraint (%)	2026 with GL	7%	10%	11%	12%	9%	
Constraint (%)	2026 with GL and Celtic				4%	2%	
Constraint (%)	Future Grid				4%	2%	1%
Total Dispatch Down (%)	2024	11%	14%	17%	20%		
Total Dispatch Down (%)	2026				15%	19%	
Total Dispatch Down (%)	2026 with GL	8%	10%	13%	16%	19%	
Total Dispatch Down (%)	2026 with GL and Celtic				6%	9%	
Total Dispatch Down (%)	Future Grid				5%	5%	11%

Table C-4 Results for Solar Not Priority

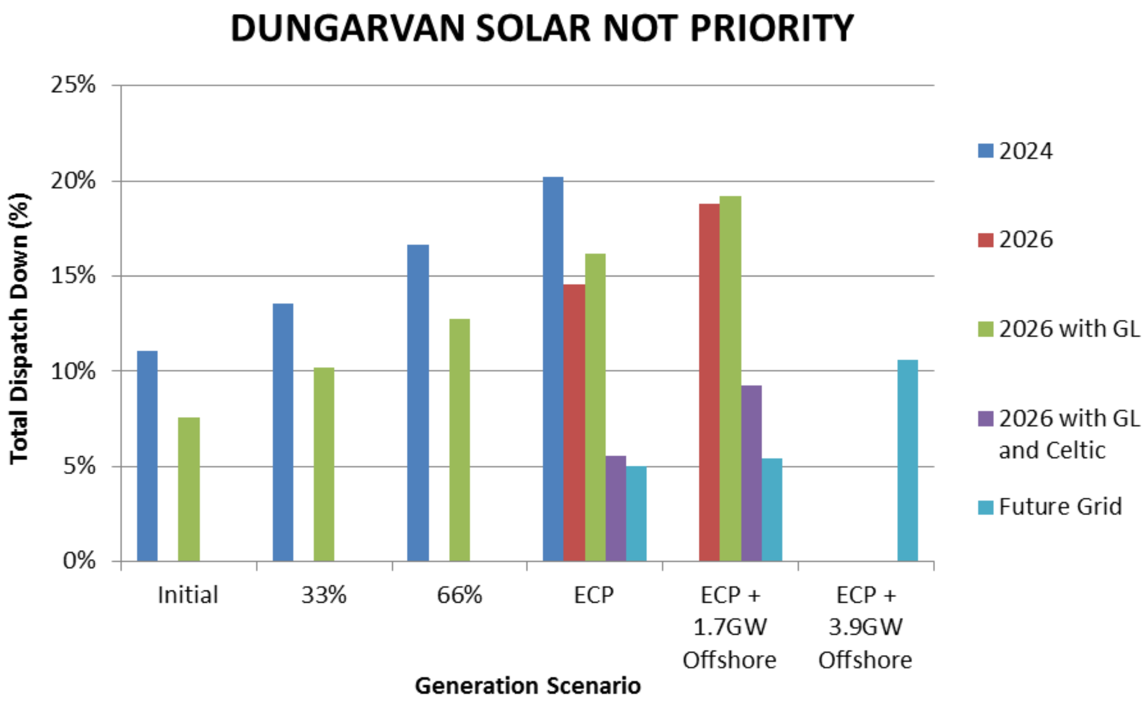


Figure C-5 Total Dispatch Down for Solar Not Priority

C.3 Rathnaskilloge

The location of this node is shown in the figure below.

Figure C-6 Location of Node

The generators, which are modelled at this node, are listed as follows.

Generator	SO	Type	Status	Capacity (MW)
Rathnaskilloge	TSO	solar not priority	ECP 1	95.0

Table C-5 Generation Included in Study for Node

The solar not priority data is given in the below table.

RATHNASKILLOGE							
SOLAR NOT PRIORITY	Year	Initial	33%	66%	ECP	ECP + 1.7GW Offshore	ECP + 3.9GW Offshore
Installed (MW)	2024	95	95	95	95		
Installed (MW)	2026				95	95	
Installed (MW)	2026 with GL	95	95	95	95	95	
Installed (MW)	2026 with GL and Celtic				95	95	
Installed (MW)	Future Grid				95	95	95
Available Energy (GWh)	2024	102.7	102.7	102.7	102.7		
Available Energy (GWh)	2026				102.6	102.6	
Available Energy (GWh)	2026 with GL	102.6	102.6	102.6	102.6	102.6	
Available Energy (GWh)	2026 with GL and Celtic				102.6	102.6	
Available Energy (GWh)	Future Grid				102.6	102.6	102.6
Generation (GWh)	2024	91.3	88.7	85.6	81.9		
Generation (GWh)	2026				87.6	83.3	
Generation (GWh)	2026 with GL	94.8	92.1	89.5	86.0	82.9	
Generation (GWh)	2026 with GL and Celtic				96.9	93.1	
Generation (GWh)	Future Grid				97.4	97.0	91.7
Over-supply (%)	2024	0%	1%	2%	3%		
Over-supply (%)	2026				3%	9%	

Over-supply (%)	2026 with GL	0%	0%	1%	2%	7%	
Over-supply (%)	2026 with GL and Celtic				1%	4%	
Over-supply (%)	Future Grid				0%	2%	7%
Curtailment (%)	2024	1%	2%	2%	3%		
Curtailment (%)	2026				2%	4%	
Curtailment (%)	2026 with GL	0%	1%	1%	2%	3%	
Curtailment (%)	2026 with GL and Celtic				1%	3%	
Curtailment (%)	Future Grid				0%	1%	2%
Constraint (%)	2024	10%	11%	13%	14%		
Constraint (%)	2026				9%	6%	
Constraint (%)	2026 with GL	7%	10%	11%	12%	9%	
Constraint (%)	2026 with GL and Celtic				4%	2%	
Constraint (%)	Future Grid				4%	2%	1%
Total Dispatch Down (%)	2024	11%	14%	17%	20%		
Total Dispatch Down (%)	2026				15%	19%	
Total Dispatch Down (%)	2026 with GL	8%	10%	13%	16%	19%	
Total Dispatch Down (%)	2026 with GL and Celtic				6%	9%	
Total Dispatch Down (%)	Future Grid				5%	5%	11%

Table C-6 Results for Solar Not Priority

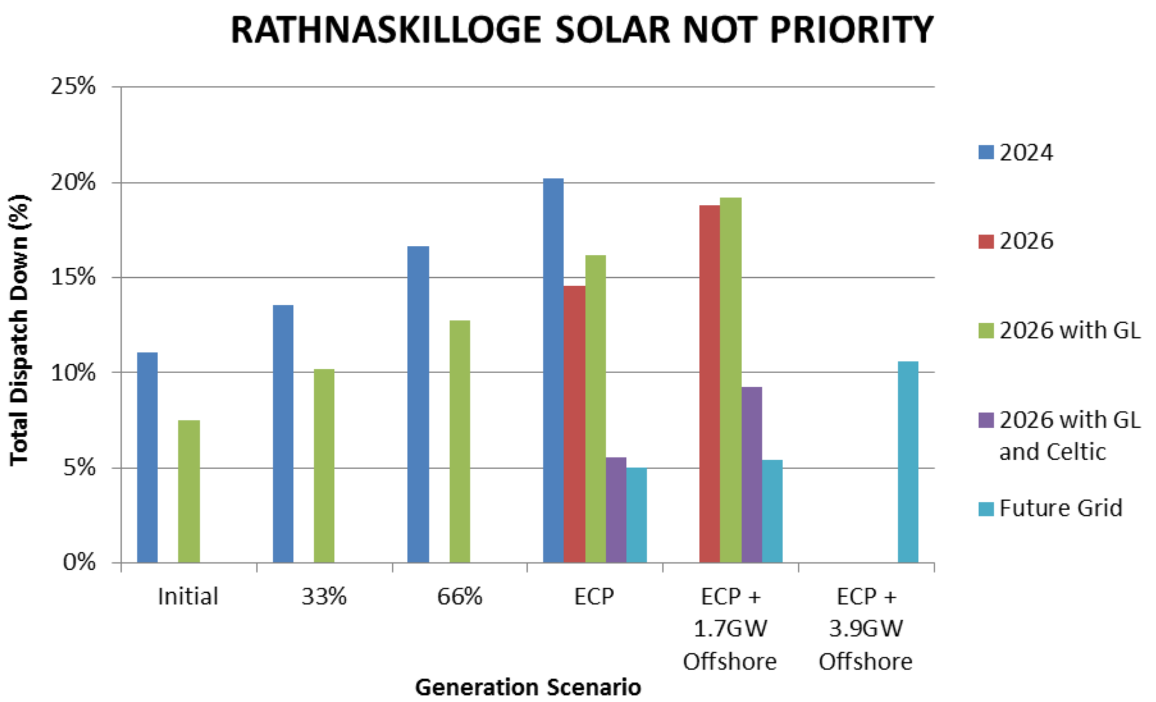


Figure C-7 Total Dispatch Down for Solar Not Priority

C.4 Woodhouse

The location of this node is shown in the figure below.

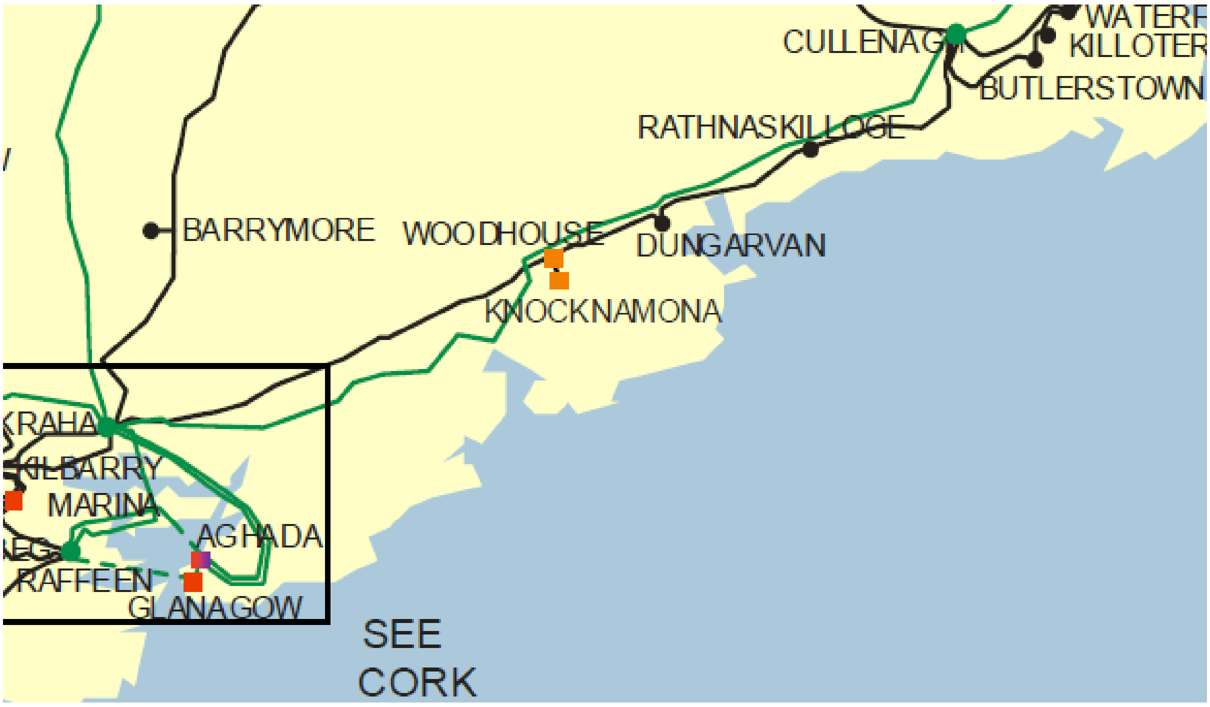


Figure C-8 Location of Node

The generators, which are modelled at this node, are listed as follows.

Generator	SO	Type	Status	Capacity (MW)
Knocknamona Wind Farm (Prev. Crohaun)	TSO	wind not priority	Gate 3	34.0
Woodhouse (1)	TSO	wind priority	Gate 3	20.0

Table C-7 Generation Included in Study for Node

The wind not priority data is given in the below table.

WOODHOUSE							
WIND NOT PRIORITY	Year	Initial	33%	66%	ECP	ECP + 1.7GW Offshore	ECP + 3.9GW Offshore
Installed (MW)	2024	34	34	34	34		
Installed (MW)	2026				34	34	
Installed (MW)	2026 with GL	34	34	34	34	34	
Installed (MW)	2026 with GL and Celtic				34	34	
Installed (MW)	Future Grid				34	34	34
Available Energy (GWh)	2024	124.5	124.5	124.5	124.5		
Available Energy (GWh)	2026				124.0	124.0	
Available Energy (GWh)	2026 with GL	124.0	124.0	124.0	124.0	124.0	
Available Energy (GWh)	2026 with GL and Celtic				124.0	124.0	
Available Energy (GWh)	Future Grid				124.0	124.0	124.0
Generation (GWh)	2024	106.0	103.2	100.4	97.1		
Generation (GWh)	2026				101.7	88.2	

Generation (GWh)	2026 with GL	112.8	109.5	107.0	103.1	89.8	
Generation (GWh)	2026 with GL and Celtic				117.3	105.4	
Generation (GWh)	Future Grid				117.8	114.9	100.8
Over-supply (%)	2024	1%	3%	5%	7%		
Over-supply (%)	2026				6%	18%	
Over-supply (%)	2026 with GL	0%	1%	2%	3%	14%	
Over-supply (%)	2026 with GL and Celtic				1%	8%	
Over-supply (%)	Future Grid				0%	3%	14%
Curtailment (%)	2024	2%	3%	4%	5%		
Curtailment (%)	2026				4%	6%	
Curtailment (%)	2026 with GL	1%	1%	2%	3%	5%	
Curtailment (%)	2026 with GL and Celtic				2%	5%	
Curtailment (%)	Future Grid				0%	2%	4%
Constraint (%)	2024	11%	11%	11%	11%		
Constraint (%)	2026				8%	5%	
Constraint (%)	2026 with GL	8%	10%	10%	10%	8%	
Constraint (%)	2026 with GL and Celtic				3%	2%	
Constraint (%)	Future Grid				4%	1%	1%
Total Dispatch Down (%)	2024	15%	17%	19%	22%		
Total Dispatch Down (%)	2026				18%	29%	
Total Dispatch Down (%)	2026 with GL	9%	12%	14%	17%	28%	
Total Dispatch Down (%)	2026 with GL and Celtic				5%	15%	
Total Dispatch Down (%)	Future Grid				5%	7%	19%

Table C-8 Results for Wind Not Priority

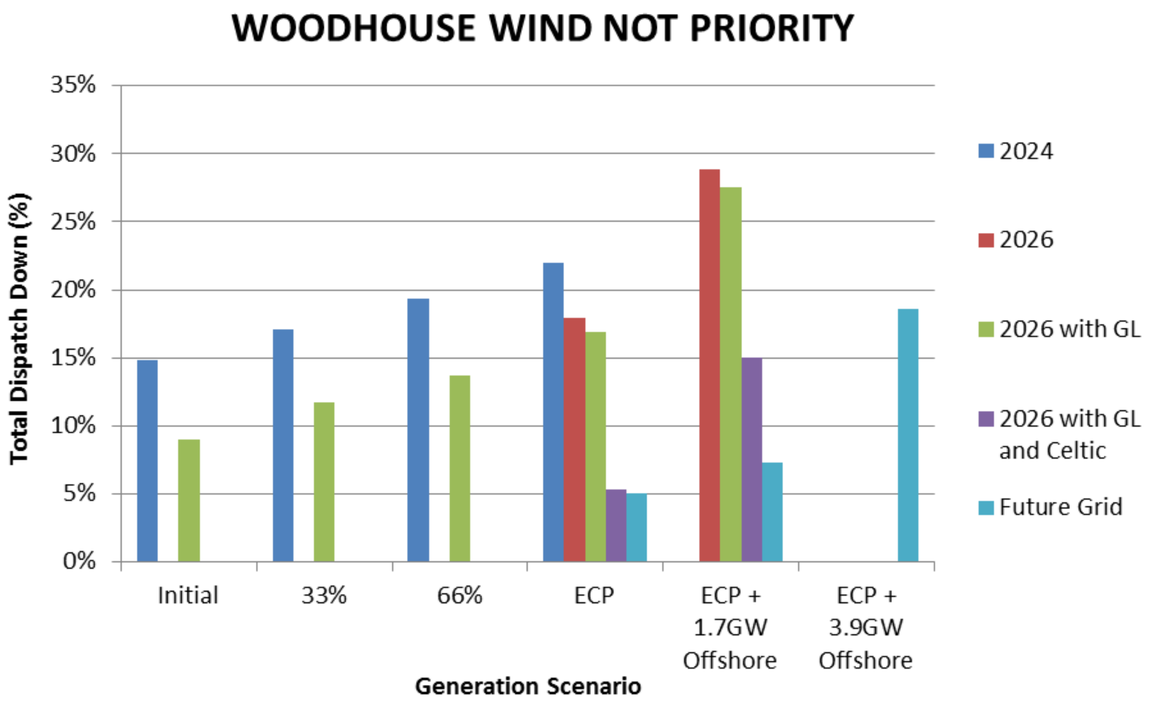


Figure C-9 Total Dispatch Down for Wind Not Priority

The wind priority data is given in the below table.

WOODHOUSE							
WIND PRIORITY	**Year**	**Initial**	**33%**	**66%**	**ECP**	**ECP + 1.7GW Offshore**	**ECP + 3.9GW Offshore**
Installed (MW)	2024	20	20	20	20		
Installed (MW)	2026				20	20	
Installed (MW)	2026 with GL	20	20	20	20	20	
Installed (MW)	2026 with GL and Celtic				20	20	
Installed (MW)	Future Grid				20	20	20
Available Energy (GWh)	2024	73.2	73.2	73.2	73.2		
Available Energy (GWh)	2026				72.9	72.9	
Available Energy (GWh)	2026 with GL	72.9	72.9	72.9	72.9	72.9	
Available Energy (GWh)	2026 with GL and Celtic				72.9	72.9	
Available Energy (GWh)	Future Grid				72.9	72.9	72.9
Generation (GWh)	2024	63.1	62.0	61.4	60.6		
Generation (GWh)	2026				62.7	61.9	
Generation (GWh)	2026 with GL	66.6	64.7	63.8	62.4	60.6	
Generation (GWh)	2026 with GL and Celtic				69.3	67.1	
Generation (GWh)	Future Grid				69.3	69.3	68.2
Over-supply (%)	2024						
Over-supply (%)	2026						
Over-supply (%)	2026 with GL						
Over-supply (%)	2026 with GL and Celtic						
Over-supply (%)	Future Grid						
Curtailment (%)	2024	3%	4%	5%	6%		
Curtailment (%)	2026				6%	9%	
Curtailment (%)	2026 with GL	1%	1%	2%	4%	7%	
Curtailment (%)	2026 with GL and Celtic				2%	6%	
Curtailment (%)	Future Grid				0%	3%	5%
Constraint (%)	2024	11%	12%	11%	11%		
Constraint (%)	2026				8%	6%	
Constraint (%)	2026 with GL	8%	10%	10%	11%	10%	
Constraint (%)	2026 with GL and Celtic				3%	2%	
Constraint (%)	Future Grid				5%	2%	1%
Total Dispatch Down (%)	2024	14%	15%	16%	17%		
Total Dispatch Down (%)	2026				14%	15%	
Total Dispatch Down (%)	2026 with GL	9%	11%	12%	14%	17%	
Total Dispatch Down (%)	2026 with GL and Celtic				5%	8%	
Total Dispatch Down (%)	Future Grid				5%	5%	7%

Table C-9 Results for Wind Priority

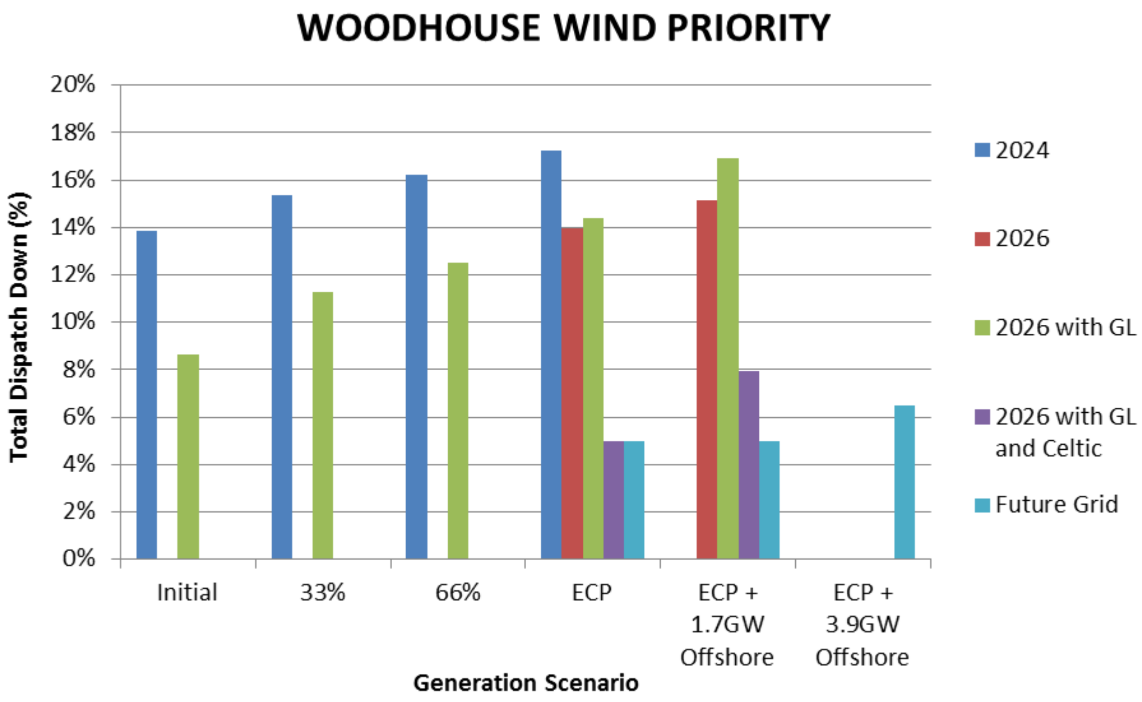


Figure C-10 Total Dispatch Down for Wind Priority

Abbreviation and Terms

Active Power

The product of voltage and the in-phase component of alternating current measured in Megawatts (MW). When compounded with the flow of 'reactive power', measured in Megavolt-Amperes Reactive (Mvar), the resultant is measured in Megavolt-Amperes (MVA).

Busbar

The common connection point of two or more circuits.

Capacity Factor

The capacity factor of a generator is the ratio of the actual electrical energy output over a given period of time to the maximum possible electrical energy output over that period.

$$Capacity\ Factor = \frac{Energy\ Output}{Hours\ per\ year * Installed\ Capacity}$$

Combined Cycle Gas Turbine (CCGT)

This is a type of thermal generator that typically uses natural gas as a fuel source. It is a collection of gas turbines and steam units; where waste heat from the gas turbines(s) is passed through a heat recovery boiler to generate steam for the steam turbines.

Commission for Regulation of Utilities (CRU)

The CRU is the regulator for the electricity, natural gas and public water sectors in Ireland.

Constraint

The reduction in output of a generator due to network limits. Usually, constraints are local to a transmission bottleneck.

Contingency

The unexpected failure or outage of a system component, such as a generation unit, transmission line, transformer or other electrical element. The transmission network is operated safe against the possible failure or outage of any system component. Hence, contingency usually refers to the possible loss of any system component. A contingency may also include multiple components, when these are subject to common cause outages.

Curtailment

Curtailment is when the transmission system operators EirGrid and SONI ask generation to reduce their output to ensure system security is maintained. Usually, curtailment is shared across the whole system.

Demand

The amount of electrical power that customers consume and which is measured in Megawatts (MW). In a general sense, the amount of power that must be transported from transmission network connected generation stations to meet all customers' electricity requirements.

Dispatch Balancing Costs (DBC)

Dispatch Balancing Costs refers to a number of payments related to how generators are instructed. They include Constraint Payments, Uninstructed Imbalance Payments and Generator Testing Charges. The Transmission System Operators (TSOs) are responsible for forecasting and managing Dispatch Balancing Costs.

Enduring Connection Policy (ECP)

The Commission for Regulation of Utilities (CRU) has put in place a revised approach to issuing connection offers to generators. This approach is called the Enduring Connection Policy (ECP). With ECP, it is envisaged that batches of generator connection offers will issue on a periodic basis.

Enduring Connection Policy - 2 (ECP-2)
ECP-2 is the second stage of the CRU's development of enduring connection policy in Ireland. In June 2020 the CRU published their decision on ECP-2, this decision set policy for at least three batches of connection offers (ECP-2.1, ECP-2.2 and ECP-2.3).

Forced Outage Probability (FOP)
This is the statistical probability that a generation unit will be unable to produce electricity for non-scheduled reasons due to the failure of either the generation plant or supporting systems. Periods, when the unit is on scheduled outage, are not included in the determination of forced outage probability.

Generation Dispatch
This is the configuration of outputs from the connected generation units.

Interconnector
The electrical link, facilities and equipment that connect the transmission network of one power market to another.

Loadflow
Study carried out to simulate the flow of power on the transmission system given a generation dispatch and system load.

A DC loadflow is a study, which uses simplifying assumptions in relation to voltage and reactive power. DC loadflow studies are used as part of an overarching study. For example, Plexos uses DC loadflow because it is performing studies for every hour of every study year and is performing a large optimisation calculation for each of these.

Maximum Export Capacity (MEC)
The maximum export value (MW) provided in accordance with a generator's connection agreement. The MEC is a contract value that the generator chooses as its maximum output.

Megawatt (MW) and Gigawatt (GW)
Unit of power: 1 megawatt = 1,000 kilowatts = 106 joules / second
1 gigawatt = 1,000 megawatts

Megawatt Hour (MWh), Gigawatt Hour (GWh) and Terawatt Hour (TWh)
Unit of energy: 1 megawatt hour = 1,000 kilowatt hours = 3.6 x 10^9 joules
1 gigawatt hour = 1,000 megawatt hours
1 terawatt hour = 1,000 gigawatt hours

Operational Constraints/Limits
In order to operate a safe, secure and stable electricity system, the TSO must operate the system within certain operational constraints/limits which include; maximum SNSP, maximum RoCoF, minimum level of system inertia, minimum number of conventional units, minimum levels of reserve.

Conventional generator "must run" rules to ensure adequate system voltage and power flow control

Over-supply
Reduction of renewable generation to a level below its availability for over-supply reasons is necessary when the total available generation exceeds system demand plus interconnector export flows. Over-supply is applied through market processes prior to dispatch or balancing actions taken by the transmission system operator such as curtailment and constraint.

Plexos
Plexos is a commercially available power system simulation tool used in this study to evaluate over supply, curtailment and constraint. Plexos is a detailed generation and transmission analysis program that has been widely used in the electricity industry for many years.

Rate of Change of Frequency (RoCoF)
As low inertia non-synchronous generators displace high inertia synchronous generators in system dispatch, then the system gets lighter. Then, for the loss of a large infeed (e.g. trip of an interconnector or generator), the system frequency will change more quickly.

RoCoF is the agreed limit to which the system is agreed to be operated and which generators, demand and system protection schemes are expected to manage. In Ireland, the TSOs are proposing to increase the RoCoF value. This will allow more renewable generation and may require confirmation by participants that they can meet the proposed RoCoF.

Short Run Marginal Cost (SRMC)
The instantaneous variable cost for a power plant to provide an additional unit of electricity, i.e. the cost of each extra MW it could produce excluding its fixed costs. The SRMC reflects the opportunity cost of the electricity produced, which is the economic activity that the generator forgoes to produce electricity. For example, in the case of a generator fuelled by gas, the opportunity cost includes the price of gas on the day that it is bidding in because if the generator is not producing electricity it could sell its gas in the open market.

System Non-Synchronous Penetration (SNSP)
The introduction of large quantities of non-synchronous generators such as solar and wind poses challenges to a synchronous power system. For Ireland, a system non-synchronous penetration (SNSP) ratio is defined to help identify the system operational limits. The present allowable ratio is 75% but future system services arrangements and proposed amendments to system operation are expected to allow SNSP to increase in future years.

Total Dispatch Down
For the purpose of this report Total Dispatch Down is equivalent to the sum of oversupply (generation self reduction due to market position), plus curtailment (re-dispatch due to system operational constraints), plus constraint (re-dispatch due to network limitations).

Total Electricity Requirement (TER)
TER is the total amount of electricity required by a country. It includes all electricity exported by generating units, as well as that consumed on-site by self-consuming electricity producers, e.g. CHP.

Transmission Peak
The peak demand that is transported on the transmission network. The transmission peak includes an estimate of transmission losses.

Transmission System
The transmission system is a meshed network of high-voltage lines and cables (400 kV, 275 kV, 220 kV and 110 kV) for the transmission of bulk electricity supply around Ireland and Northern Ireland.

Transmission System Operator (TSO)
In the electrical power business, a transmission system operator is the licensed entity that is responsible for transmitting electrical power from generation plants to regional or local electricity distribution operators and Large Energy Users connected at the transmission level.

Uprating
A network reinforcement solution whereby an existing circuit's rating can be increased. This is achieved by increasing ground clearances and/or replacing conductor, together with any changes to terminal equipment, support structures and foundations.

Winter Peak
This is the maximum annual system demand. Historically this occurs in the winter period October to February, inclusive in Ireland and in the period November to February in Northern Ireland.

References

Enduring Connection Policy

http://www.eirgridgroup.com/customer-and-industry/becoming-a-customer/generator-connections/enduring-connection-polic/

Generation Capacity Statement

http://www.eirgridgroup.com/site-files/library/EirGrid/208281-All-Island-Generation-Capacity-Statement-LR13A.pdf

Reinforcement Projects

http://www.eirgridgroup.com/the-grid/projects/

http://www.soni.ltd.uk/the-grid/projects/

All Island Ten Year Transmission Forecast Statement 2020

https://www.eirgridgroup.com/site-files/library/EirGrid/All-Island-Ten-Year-Transmission-Forecast-Statement-2020.pdf

Tomorrows Energy Scenarios

http://www.eirgridgroup.com/site-files/library/EirGrid/EirGrid-TES-2019-Report.pdf

Generator Information

http://www.eirgridgroup.com/how-the-grid-works/renewables/

https://www.esbnetworks.ie/new-connections/generator-connections/generator-connection-statistics

Shaping Our Electricity Future

https://www.eirgridgroup.com/site-files/library/EirGrid/Full-Technical-Report-on-Shaping-Our-Electricity-Future.pdf