EirGrid

Winter Outlook 2024/25

October 2024

Introduction

EirGrid operates the electricity transmission system in Ireland.

We are responsible for the planning and operation of a safe, secure, reliable, economic and efficient electricity transmission system to ensure all reasonable demands for electricity are met. EirGrid is providing consumers with a high quality and increasingly clean energy supply, while also managing an increasingly complex supply and demand dynamic.

There are inherent challenges in all complex power systems. Electricity transmission system operators around the world face a wide range of demands and challenges, from geo-political pressures to the weather (including very cold spells and storms), to outages at power stations and on interconnectors. We utilise our deep technical expertise to deal with these, however, a confluence of these pressures at any one point can create an imbalance on the system which could, in rare cases, lead to localised loss of supply.

EirGrid does not generate electricity, deliver demand response or control market flows on interconnectors. As transmission system operator, we depend on others to have the power we need when we ask for it. These are the challenges that we manage every second of every day on behalf of communities and businesses across Ireland.

The All-Island Resource Adequacy Assessment, which replaces the All-Island Generation Capacity Statement, published by EirGrid and SONI will present information on generation adequacy studies that assess the balance between supply and demand over the next ten years. This Winter Outlook presents a more detailed view, focusing on the upcoming winter. This document helps inform the electricity industry and supports preparation for the coming months. We study the expected generation capacity and the forecast demand to determine if there is adequate generation capacity margin. We identify periods where the margin between generation capacity and forecast peak demand is low, and the security of supply of the electricity system may be at risk.

The winter outlook for 2024/25 covers the period from 4 November 2024 to 6 April 2025. The data-freeze date for the outlook was 13 September 2024.

Key technical terms

Here we explain some of the key technical terms used in the report. A full glossary of other terms can be found in the following section.

Loss of Load Expectation (LOLE) is a mathematical formula, based on studies, of the number of hours in a period (typically a year[1]) during which the available generation plant will be inadequate to meet the instantaneous demand. The higher this number is, the greater the risk that there will be insufficient generation available to meet the demand at all times.

Loss of Load Expectation (LOLE) Standard is set by the Department of the Environment, Climate and Communications (DECC). The LOLE Standard acts as a maximum level of risk that DECC has judged the system should be operated at. As of July 2024[2], the LOLE standard is 3 hours per year (previously 8 hours per year).

Expected Unserved Energy (EUE) is the expected amount of energy, based on the same LOLE studies, not supplied during a period (typically a year) due to insufficient generation being available.

Alert state is when a single event on the electricity power system would give rise to a reasonable possibility of one or more operational security limits being violated, e.g., failure to meet the demand.

Emergency state is when one or more operational security limits on the electricity power system are violated, e.g., failure to meet the demand.

De-rated generation capacity is the capacity of generation that can be expected to contribute to capacity adequacy. It is typically based on the historical performance of each generator on the system. A generator that has performed poorly in the past, by being unavailable for extended periods due to breakdowns, will have a lower de-rated capacity, as its contribution to capacity adequacy is deemed to be less.

De-rated margin is the sum of the de-rated generation capacity from all available generating units and interconnectors, less the forecast demand and reserve requirement.

1. For Winter Outlook 2024/25 LOLE is assessed over the period 4 November 2024 to 6 April 2025

2. https://www.semcommittee.com/files/semcommittee/2024-07/SEM%20-%2024%20-%20051%202027-28%20T-4%20Volumes%20Information%20Note.pdf

Glossary

All-Island Resource Adequacy Assessmen
The All-Island Resource Adequacy Assessment, which replaces the All-Island Generation Capacity Statement, published by EirGrid and SONI presents information on generation adequacy studies that assess the balance between supply and demand over the next ten years.

Capacity
The rated continuous power output of a generator.

Capacity/generation adequacy
When there is sufficient generation capacity to meet the demand and reserve requirements.

Capacity market auction
The Capacity Market is a mechanism designed to ensure that Ireland and Northern Ireland have enough electricity to power homes, businesses and industry. The market takes the form of an auction, held every year, for capacity for the future.

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

Conventional generating unit
The general term applied to generating units that produce electricity from coal, oil or natural gas.

Demand
The amount of electrical power consumed by the power system.

Demand Side Unit (DSU)
A unit consisting of one or more individual demand sites that can be dispatched by the TSO to reduce demand.

De-rating factor
The percentage of a generating unit's capacity that reliably contributes to capacity adequacy. It is typically based on forced outage rates.

Dispatchable generating unit/generation
Sources of electricity that can be used on demand and dispatched at the request of the TSOs. Does not include wind and solar generation which are non-dispatchable generation.

East West Interconnector (EWIC)
A 500 MW Interconnector that connects the electricity transmission systems of Ireland and Great Britain.

Forced outage
An event where a generator is unavailable for electricity production for a period of time due to unforeseen/ unplanned reasons.

Forced outage rate
The proportion of time that a generation unit is expected to be unavailable for electricity production due to unforeseen/ unplanned outages.

Forecast demand
The amount of electrical power that is expected to be consumed by the power system in a time period.

Forecast peak demand
The maximum amount of electricity that is forecast to be consumed by the power system on a daily, weekly or annual basis.

Generating unit
Any apparatus which produces electrical energy.

Generation Capacity Statement
Statement produced by EirGrid and SONI outlining the expected electricity demand and the level of generation capacity that will be required on the island of Ireland over the next ten years. It will be replaced by the All-Island Resource Adequacy Assessment.

Interconnector
An electrical link that connects two systems.

Megawatt (MW)
Unit of power; 1 Megawatt = 1,000,000 Watts.

North-South Tie Lines
The electrical link that connects the transmission system of Ireland to the transmission system of Northern Ireland.

Outage
A partial or total reduction in the availability of a generating unit such that the generating unit is unavailable to achieve its maximum capacity.

Peaker plant
A dispatchable generating unit that is typically used to meet evening peak demand.

Renewable
A natural resource or source of energy, such as wind, solar and hydro. Reserve requirement The additional generation capacity that is required to be available to meet demand in the event that the forecasted supply of power is disrupted.

Scheduled outage
Outage where a generator is unavailable for electricity production due to planned reasons, e.g., for maintenance.

Security of supply
The electricity system's capability to ensure uninterrupted availability of electricity at a reasonable cost.

System constraints
Congestion at one or more parts of the transmission network that prevent power being transmitted to the location of demand.

Security of Supply Programme
A programme of work published by CRU (https://www.cru.ie/publications/28016/) to increase generation capacity to provide additional stability and resilience to the Irish energy system. The programme of work was in response to EirGrid's identification of a potential capacity shortfall, if no action was taken, from 2021 to 2026.

Temporary emergency generation
Temporary generation procured and operated by EirGrid under the Risk Preparedness Plan for Ireland, published by CRU. In accordance with Regulation (EU) 2019/2019, this generation will only be dispatched when the system would otherwise be in Alert or Emergency State, and where it is evident that market-based measures alone are not sufficient to prevent a further deterioration of the electricity supply situation.

Thermal generating unit
Generating units that produce electricity from coal, oil or natural gas, using steam to power a turbine(s).

Executive Summary

The Loss of Load Expectation (LOLE) in Ireland for the five months of the winter period being studied is 3.6 hours. The LOLE has reduced from 21 hours last winter and 51 hours the previous winter; however, it remains just outside the 3 hours per year standard.

This means the system will operate at a higher level of risk than is set by the Department of the Environment, Climate and Communications. There is an expectation that the system could enter the Alert State at times, most likely at periods of low wind and low interconnector imports. There is a low probability of the system entering the Emergency State at times, due to insufficient generation being available to meet the demand.

The Expected Unserved Energy (EUE) figure would suggest that, on average, electricity consumers could potentially be without supply for less than 10 minutes over the winter period. However, emergency protocols are in place with large energy users that would mitigate the impact on homes and businesses, where sufficient notice of an event can be provided (minimum of 1 hour). LOLE and EUE are metrics used to measure the risk or likelihood of such an event happening. This does not necessarily mean that electricity consumers will be without supply for any period. Based on information at the time of the data freeze, November and December is expected to be the most onerous period from a capacity margin perspective.

There is no risk of a system-wide “blackout” (a total loss of control of the electricity system) solely due to insufficient generation under any circumstances this winter. Other conditions would have to be present or multiple and significant failures occur to cause a system wide blackout. A key assumption underpinning the winter outlook analysis, based on best information available at the time of writing, is that there will be uninterrupted reserves of natural gas from both the Moffat terminal and the Corrib gas field, with no shortage issues.

Winter 2023/24 Review

Generation adequacy remained tight in Ireland across the winter period at times of low wind generation. Daily engagement and reciprocal support arrangements with transmission system operators in Great Britain and Continental Europe were key to minimising the number of System Alerts during these periods. As a result, there was only one System Alert due to reduced generation capacity margins[3] in Ireland during Winter 2023/24.

Winter 2023/24 was a relatively mild winter. There was a period of cold weather in early- to mid-January, when a system demand record of 5,577 MW was set. On average, temperatures at the time of daily peak demand over the winter period were 0.8°C higher than the 15-year average. The minimum temperature over the same period was approximately 0.5°C lower than the 15-year average. The peak demand of 5,577 MW when temperature-corrected was approximately 75 MW below our median forecast from last year's Winter Outlook.

The forced outage rate of dispatchable generation (excluding DSUs) over the winter period was 14.1%. This was more than our assumption of 13.8%.

Wind generation output over the winter period was consistent with recent winters, supplying 42% of the electricity demand. However, wind generation output varied from 15 MW to 3,866 MW over the period.

During the ten periods with the tightest generation margin, the average import from Northern Ireland was 180 MW on the North-South Tie Lines and 521 MW from Great Britain on the East West Interconnector.

3. There were two System Alerts during Winter 2023/24; from 17:22 to 18:35 on 15/11/2023 due to reduced generation capacity margins and from 21:18 on 21/01/2024 to 01:02 on 22/01/2024 due to transmission line trippings during storm Isha.

Winter Outlook

Demand

As can be seen in Figure 1, the transmission peak electricity demand in Ireland has been on an upward trend over the last number of years. Last winter a record peak demand (not temperature corrected) of 5,577 MW was recorded on 18 January 2024 at 17:50.

The analysis of Ireland's peak demand over winter indicates that a 1°C decrease in outside temperature results in a 40 MW increase in peak demand (50 MW when wind-chill is taken into account), and vice-versa, meaning electricity demand in the winter is heavily influenced by weather conditions.

For Winter Outlook 2024/25, our median forecast peak demand is 5,834 MW. Figure 2 compares the weekly peak demand, including temperature-corrected weekly peak demand, for the 2022/2023 and 2023/2024 winter periods to the median forecast weekly peak demand for the 2024/2025 winter period.

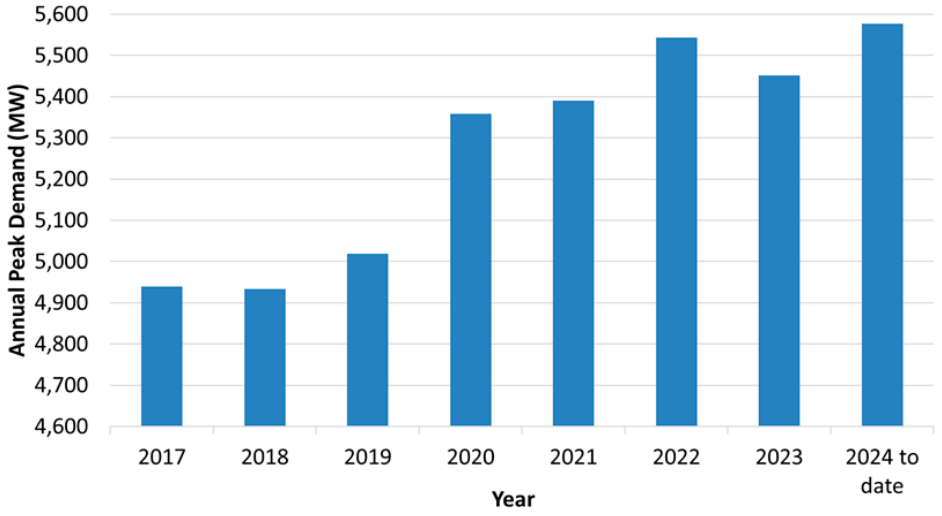

Figure 1: Ireland historical annual peak demand

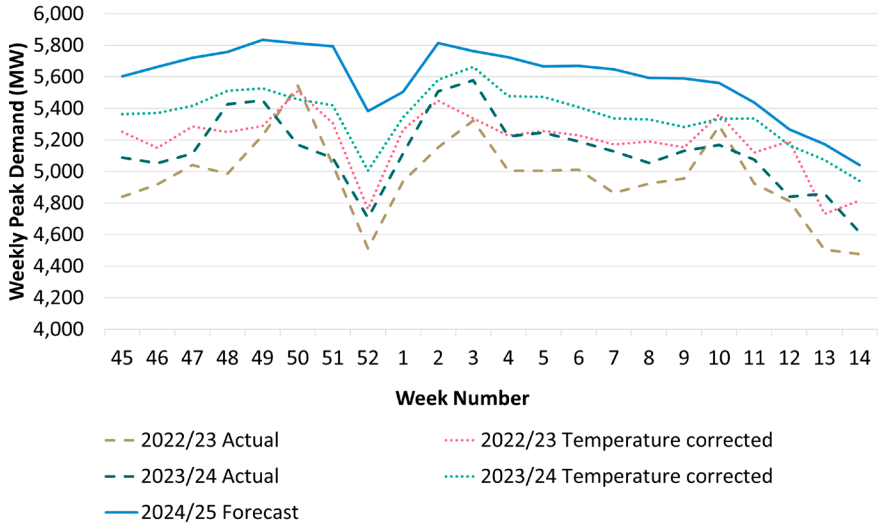

Figure 2: Ireland weekly peak demand for 2022/2023 and 2023/2024 winter periods versus forecast median weekly peak demand for 2024/2025 winter period

Generation capacity versus forecast demand

The total generation capacity in Ireland is made up of a variety of different types of generating units; combined cycle gas turbines (CCGTs) (gas), thermal generation plant (coal, heavy fuel oil, biomass), peaker plant (gas and distillate), renewables (mostly wind, solar and hydro), demand side units (DSUs), storage (pumped hydro and batteries), and a small volume of other technologies.

505 MW of Temporary Emergency Generation (TEG), secured as a result of measures taken under the Security of Supply Programme, are included in our analysis, as are 190 MW of new gas fired peaker plant and 270 MW of new batteries, delivered through the Capacity Market. In addition, an extra 425 MW of wind and solar generation is included.

Two interconnectors are considered for this Winter Outlook, the 500 MW East West Interconnector (EWIC) which connects Ireland and Great Britain, and the North-South Tie Lines connecting Ireland and Northern Ireland. Greenlink, a new 500 MW interconnector between Ireland and Great Britain, is expected to be commissioning over the study period with the project expected to be completed by the end of the year. However, consistent with National Grid Electricity System Operator, the TSO in Great Britain, it is not included in our analysis for the study period.

We apply derating factors to the generation capacity to reflect the contribution of each generator to capacity adequacy, to calculate a de-rated generation capacity. For conventional dispatchable generating units, the de-rating factor is typically based on forced outage rates in a rolling three-year period.

The de-rated margin is the sum of the de-rated generation capacity from all available generating units and interconnectors, less the forecast demand and the reserve requirement. The more positive the de-rated margin is, the greater the likelihood that we will have sufficient capacity to meet demand, while a negative de-rated margin indicates there may be a shortage of generation capacity.

Figure 3 shows the total generation capacity on the system, the de-rated generation capacity, and the forecast demand plus reserve for the day with the highest peak demand across the upcoming winter period.

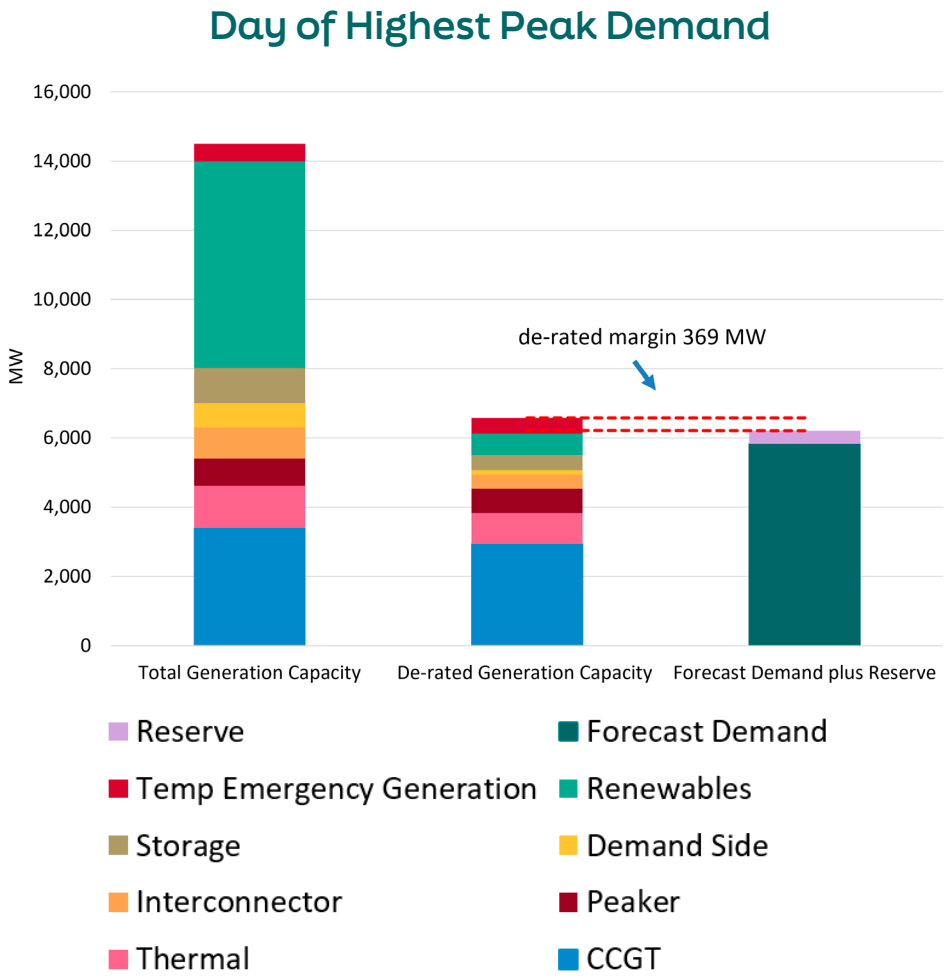

Figure 3: Ireland generation capacity versus forecast demand for the day of highest peak demand/lowest capacity margin

LOLE and de-rated margin

The Loss of Load Expectation (LOLE) in Ireland for the five months of the winter period being studied is 3.6 hours. This is just outside the 3 hours per year standard meaning the system will operate at a higher level of risk than is set by the Department of the Environment, Climate and Communications. The minimum de-rated margin over the winter period is expected to be in the range of 233 MW to 551 MW. There is an expectation that the system could enter the Alert State at times, most likely at periods of low wind and low interconnector imports. There is a low probability of the system entering the Emergency State at times due to insufficient generation being available to meet the demand. The Expected Unserved Energy (EUE) figure would suggest that, on average, electricity consumers could potentially be without supply for less than 10 minutes over the winter period. However, emergency protocols are in place with large energy users that would mitigate the impact on homes and businesses, where sufficient notice of an event can be provided (minimum of 1 hour). LOLE and EUE are metrics used to measure the risk or likelihood of such an event happening. This does not necessarily mean that electricity consumers will be without supply for any period.

Figure 4 shows the de-rated margin as a percentage of demand plus reserve for the day with the highest peak demand across the winter period for three demand scenarios. An approximate figure for the de-rated margin associated with an LOLE of 3 hours per year is also shown.

Table 1: Ireland key metrics for median demand level

	2024/25 base case
Loss of Load Expectation (LOLE)	3.6 hours
Expected Unserved Energy (EUE)	580 MWh
Minimum de-rated margin (MW) over winter period	369 MW
Minimum de-rated margin (%) over winter period	5.9%

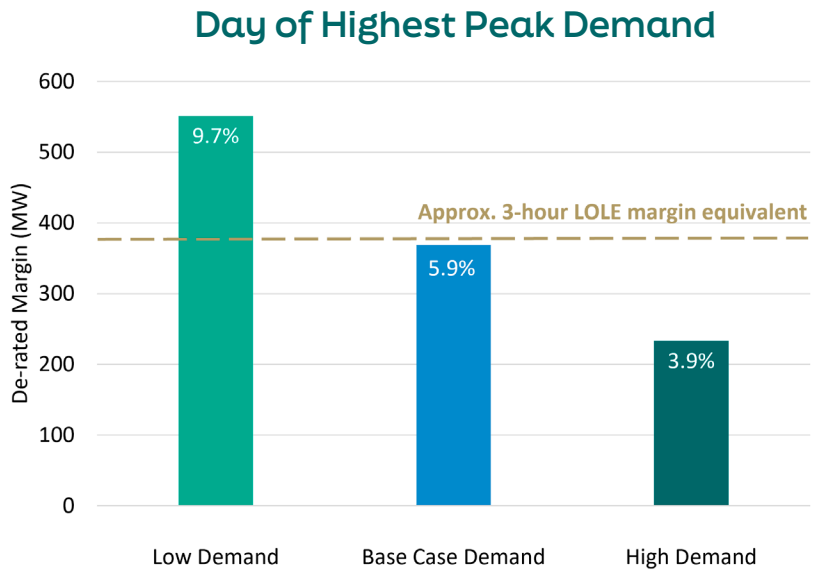

Figure 4: Ireland de-rated margin for low, median and high demand scenarios on day of highest peak demand

Weekly analysis

We study the expected de-rated generation capacity and the forecast demand for each week across the winter period. This allows us to identify weeks when the de-rated margin is low and when the system is at risk of entering the Alert and Emergency states. We look at three interconnector (East West Interconnector and North-South Tie Lines) import scenarios; low (0 MW), medium (400 MW) and high (900 MW) imports. It should be noted that our studies also include probabilistic analysis of forced outages, which can have a more significant impact than outlined below.

Figure 5 shows the expected weekly de-rated generation capacity in the medium import scenario. The de-rated generation capacity remains broadly static throughout the winter period, as there are relatively few scheduled outages of generating units.

Figure 6 shows the expected weekly de-rated generation capacity for each import scenario versus the forecast demand plus reserve. In the medium import scenario, the de-rated capacity is greater than the demand plus reserve requirement in all weeks. There are seven weeks in the low import scenario where the demand plus reserve requirement exceeds the de-rated capacity. The risk of the system entering the Alert and Emergency states is higher in November and December.

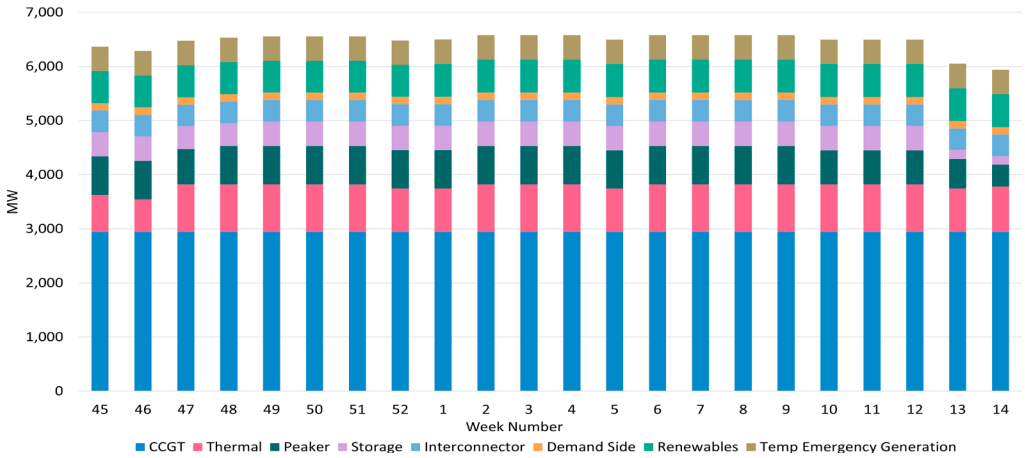

Figure 5: Ireland expected weekly de-rated generation capacity per type of generating unit

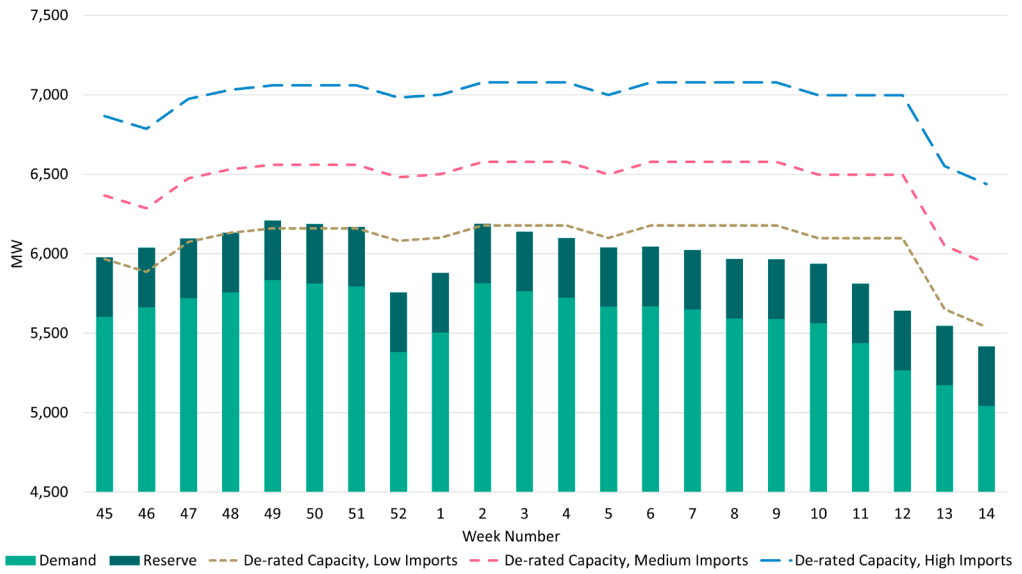

Figure 6: Ireland weekly de-rated generation capacity (dashed lines) for each import scenario versus the forecast demand plus reserve (bars)

Ireland forced outage rates

The dispatchable generation (excluding DSUs) forced outage rate in Ireland has increased significantly over the last number of years. For January to July 2024, it stands at 21%. This has led to tight margins at times in 2024 and has impacted the system's ability to accommodate generator and transmission planned outages.

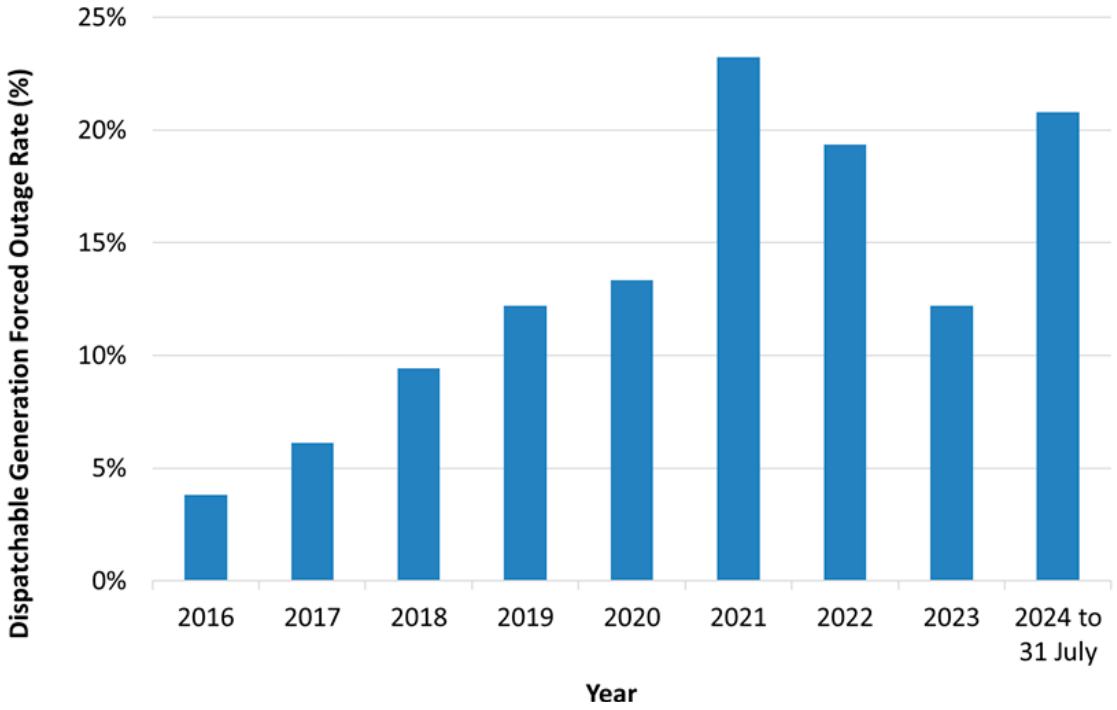

Figure 7: Ireland historical dispatchable generation annual forced outage rates

Assumptions

- There will be uninterrupted reserves of natural gas from both the Moffat terminal and the Corrib gas field, with no shortage issues.
- The All-Island Resource Adequacy Assessment methodology was used as a basis for studies with the following inputs and assumptions.
- De-rating factors/capacity credits:
  - CCGT, large thermal and hydro units (high- and mid-merit units) de-rating factors based on forced outage rates between July 2021 and June 2024 inclusive,
  - Peaker and new unit de-rating factor: 0.9,
  - DSU de-rating factors based on availability rates between July 2023 and June 2024 inclusive,
  - Battery, wind, solar de-rating factors as per 2024/25 Capacity Market auctions.
- 505 MW of Temporary Emergency Generation (TEG) operational.
- A fully intact network will be available.
- Demand scenarios: low, median (base case) and high as per the All-Island Resource Adequacy Assessment (for diagrams only). Studies use median demand.
- Ireland interconnector scenarios (for diagrams only. Studies include model of Great Britain and France systems):

Table 2: Import scenario breakdown

	Low Import (MW)	Medium Import (MW)	High Import (MW)
East West Interconnector	0	300	500
North-South Tie Lines	0	100	400
Total	**0**	**400**	**900**


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