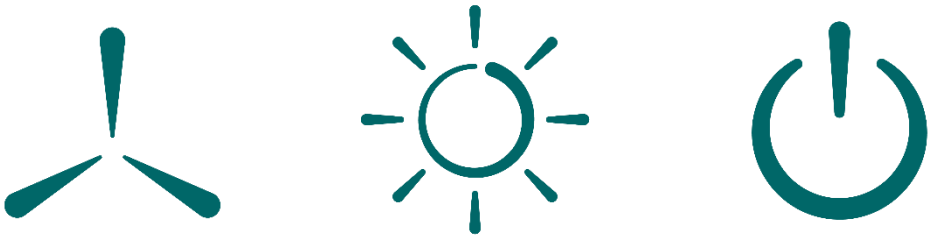
Annual Renewable Energy Constraint and Curtailment Report 2023

April 2024



EirGrid SONI

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Disclaimer

Please note that the historical data contained in this report is indicative and the best available data at the time of writing. While every effort has been made in the compilation of this report to ensure that the information herein is correct, the TSOs do not accept liability for any loss or damage arising from the use of this document or any reliance on the information it contains. Use of this document and the information it contains is at the user's sole risk.

Executive Summary

EirGrid and SONI have prepared this report for the regulatory authorities to outline the levels of dispatch-down of renewable energy in 2023, as required under European[1] and Member State[2] legislation.

Both Ireland and Northern Ireland have set renewable energy targets for 2030. The Climate Action Plan 2019 set a target of 70% RES-E in Ireland by 2030 and The Northern Ireland Energy Strategy set a target of at least 70% RES-E in Northern Ireland by 2030. Both of these targets were subsequently revised to 80% with the Climate Action Plan 2021 setting a target of 80% RES-E in Ireland by 2030 and the Climate Change (No. 2) Bill received Royal Assent on June 6th, 2022, and set a target of 80% RES-E in NI by 2030.

In Ireland and Northern Ireland, renewable energy is predominantly sourced from wind, although solar energy has grown in size and significance in recent years. Other sources include hydroelectricity, biomass, biogas and waste. The main focus of this report is the dispatch down of solar and wind as they are the main sources of renewable electricity on the island.

Dispatch-down of renewable energy refers to the amount of renewable energy that is available but cannot be used by the system. This is because of broad power system limitations, known as curtailments, or local network limitations, known as constraints.

In 2023, the total wind energy generated in Ireland and Northern Ireland was 13,757 GWh, while 1,663 GWh of wind energy was dispatched down. This represents 10.7% of the total available wind energy in 2023. The dispatch-down energy from solar resources was 50 GWh which represented 9.1% of the total available solar energy.

In Ireland, the dispatch-down energy from wind resources was 1,124 GWh. This is equivalent to 8.9% of the total available wind energy. The dispatch-down energy from solar resources was 39 GWh which represented 9.5% of the total available solar energy.

In Northern Ireland, the dispatch-down energy from wind resources was 539 GWh. This is equivalent to 18.6% of the total available wind energy. The dispatch-down energy from solar resources was 10 GWh which represented 7.9% of the total available solar energy.

[1] Article 16C of the 2009 Renewable Energy Directive (2009/28/EC) states: "If significant measures are taken to curtail the renewable energy sources in order to guarantee the security of the national electricity system and security of energy supply, Members States shall ensure that the responsible system operators report to the competent regulatory authority on those measures and indicate which corrective measures they intend to take in order to prevent inappropriate curtailments."

[2] Article 4.4 of Statutory Instrument 147 of 2011 states: "If significant measures are taken to curtail the renewable energy sources in order to guarantee the security of the electricity system and security of energy supply, the transmission system operator shall report to CRU on those measures and indicate which corrective measures it is intended to take in order to prevent inappropriate curtailments."

When all renewable sources of electricity are taken into account, the dispatch down level of all renewables on the island in 2023 was 9.5% (8.0% in Ireland and 16.0% in Northern Ireland). See table 6 in appendix A for the full breakdown of dispatch down percentages for all renewable energy sources.

Overall, the dispatch-down of energy from wind resources increased from 8.5% in 2022 to 10.7% in 2023. The level of dispatch-down is affected by a number of factors which vary from year to year, such as the amount of wind and solar installed on the system, system demand, interconnector flows and the capacity factor of the renewable generation. For 2023, N. Ireland dispatch-down has significantly increased from previous years. This has been driven by a combination of:

- Transmission outages across the summer period,
- Security of supply concerns that has resulted in a large generator being made "must-run",
- Interconnector imports have increased even at times of high renewables.

Figure 1 below provides an all-island view of wind generation and dispatch down. It is important to note that despite the increase in dispatch-down percentages from 2021 to 2023, the volume of wind generation accommodated by the island system has also increased by 18%.

EirGrid and SONI publish renewable data monthly across the year and the reader can find the full data set[3] to answer any specific queries not directly covered in this report.

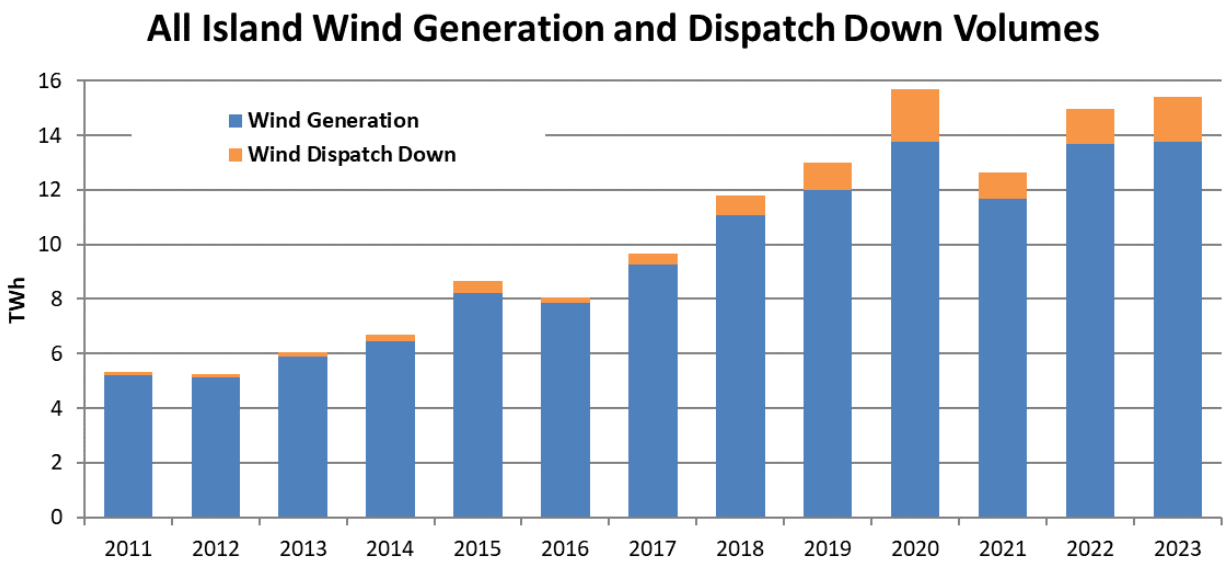


Figure 1: All Island Annual Wind Generation and Dispatch Down Volumes

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

http://www.soni.ltd.uk/how-the-grid-works/renewables/

1. Introduction

1.1 Context

The 2009 European Renewable Energy Directive (2009/28/EC) requires that the TSOs report to the regulatory authorities, Commission for Regulation of Utilities (CRU) in Ireland and the Utility Regulator (UR) in Northern Ireland on dispatch down of renewable energy. This report must detail why renewable energy was dispatched-down and what measures are being taken to prevent inappropriate curtailment.

This Directive was put into law in Ireland as S.I. No. 147 of 2011 and in Northern Ireland through the Electricity (Priority Dispatch) Regulations No. 385 of 2012. The Single Electricity Market (SEM) Committee, in its scheduling and dispatch decision paper SEM-11-062, requires that the TSOs report on this as appropriate to CRU and the UR, respectively. This report represents EirGrid and SONI's response to the obligations required through National Law and through the SEM Committee requirement.

1.2 Reasons for Dispatch-Down

Renewable generation receives priority within the scheduling and dispatch algorithms in the Control Centres. However, there will be times when it is not possible to accommodate all priority dispatch generation while maintaining the safe, secure operation of the power system. Security-based limits must be imposed due to both local network and system-wide security issues. It is necessary to reduce the output of renewable generators below their maximum available level when these security limits are reached. This reduction is referred to in this report as 'dispatch-down' of renewable generation and is consistent with the principle of priority dispatch as per SEM-11-062.

There are two reasons for the dispatch-down of wind and solar energy: constraint and curtailment. **Constraint** refers to the dispatch-down of wind and solar generation for localised network reasons (where only a subset of wind/solar generators can contribute to alleviating the problem). **Curtailment** refers to the dispatch-down of wind/solar for system-wide reasons (where the reduction of any or all wind/solar generators would alleviate the problem). The SEM Committee approved the difference between constraint and curtailment in their SEM-13-011 paper.

1.3 Reporting Methodology

All controllable wind and solar farms are issued with detailed constraint and curtailment reports each month.

The reports include clear categorisation between constraint and curtailment and clear reasons for why a curtailment or constraint was applied called a 'reason code'. All wind and solar farms also have access to dispatch instructions and wind and solar farm data with each dispatch instruction time-stamped with the instruction time.

A detailed wind and solar aggregate constraint and curtailment report is also published online every month to coincide with the individual wind and solar farm reports. This report is accompanied by a separate user guide, which contains a detailed description of the methodology, worked examples and a Frequently Asked Questions (FAQs) section. Both the aggregate report and the user guide can be found at:

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

http://www.soni.ltd.uk/how-the-grid-works/renewables/

Note: Any reduction in the output of renewable generators whilst responding to system frequency is not assessed in these reports. When operating in frequency response mode the wind/solar farm output varies in real time based on the current system conditions and not in response to a dispatch instruction from the wind dispatch tool. In Ireland, frequency response mode is at time turned on. In N. Ireland, frequency response is currently not utilised.

2. Level of Dispatch-Down Energy in 2023

The following provides a summary of the dispatch-down of wind and solar energy in 2023 for Ireland and Northern Ireland. (**Note:** The values are based on the best available data at the time of writing.) More details and figures are provided in Appendix A.

2.1 All-Island

In 2023, the share of electricity demand from renewable sources in Ireland and Northern Ireland was 40.5% (Figure 2). This is broken down as follows:

- 34.1% provided by wind.
- 1.3% provided by solar.
- 2.3% provided by hydro.
- 2.8% provided by other renewable energy sources.

The total wind energy generated was 13,757 GWh in Ireland and Northern Ireland. There was an estimated total of 1,663 GWh of dispatch-down energy from wind farms.

This level of dispatch-down of wind represents 10.7% of total available energy from wind resources in Ireland and Northern Ireland.

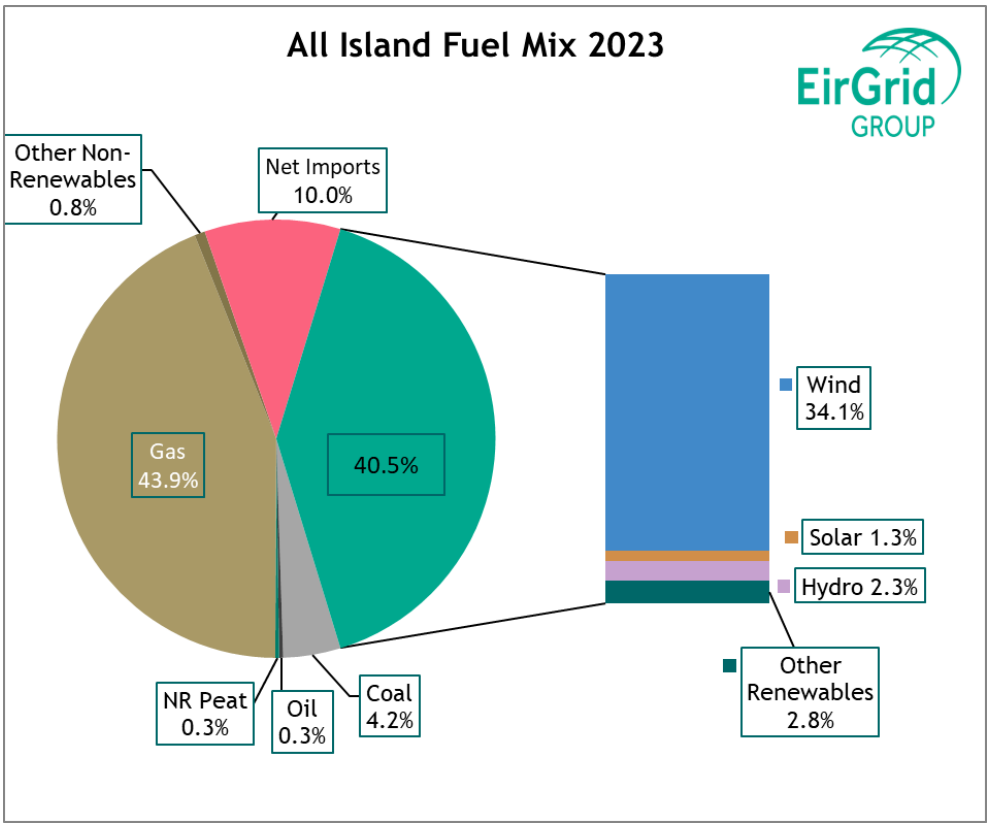


Figure 2: All-Island Fuel Mix for 2023 as Percentage of Demand

2.2 Northern Ireland

In 2023, the total dispatch-down energy from wind generation in Northern Ireland was 539 GWh. This is equivalent to 18.6% of total available wind energy in that jurisdiction.

In 2023, the total dispatch-down energy from solar generation in Northern Ireland was 10 GWh. This is equivalent to 7.9% of total available solar energy in that jurisdiction.

2.3 Ireland

In 2023, the total dispatch-down energy from wind generation in Ireland was 1,124 GWh. This is equivalent to 8.9% of total available wind energy in Ireland.

In 2023, the total dispatch-down energy from solar generation in Ireland was 39 GWh. This is equivalent to 9.5% of total available solar energy in that jurisdiction.

3. Contributory Factors for Dispatch-Down of Wind and Solar

3.1 Installed Wind and Capacity Factor

As explained in section 1.2, it is sometimes necessary to limit the maximum level of wind generation on the system for security or safety reasons. The impact of these limits on the level of dispatch-down will depend on two factors: the amount of wind generation installed on the system; and the capacity factor of the wind generation.

In 2023, 217 MW was added to the wind installed capacity on the island. The breakdown of wind installed capacities between Ireland and Northern Ireland[4] is shown below in Table 1.

Wind Installed Capacities (MW)									
	Ireland			Northern Ireland			All Island		
Year End	TSO	DSO	Total	TSO	DSO	Total	TSO	DSO	Total
2010	727.8	662.6	**1,390.4**	0.0	392.2	**392.2**	727.8	1,054.8	**1,782.6**
2011	769.2	815.4	**1,584.6**	73.6	438.8	**512.4**	842.8	1,254.2	**2,097.0**
2012	769.2	934.3	**1,703.5**	73.6	526.0	**599.6**	842.8	1,460.3	**2,303.1**
2013	845.2	1,078.1	**1,923.3**	73.6	566.4	**640.0**	918.8	1,644.5	**2,563.3**
2014	1,046.6	1,219.9	**2,266.4**	73.6	655.5	**729.1**	1,120.2	1,875.4	**2,995.5**
2015	1,152.6	1,294.7	**2,447.3**	73.6	677.4	**751.0**	1,226.2	1,972.1	**3,198.3**
2016	1,371.3	1,423.5	**2,794.8**	73.6	869.0	**942.6**	1,444.9	2,292.5	**3,737.4**
2017	1,591.5	1,710.8	**3,302.3**	121.1	1,032.6	**1,153.7**	1,712.6	2,743.4	**4,456.0**
2018	1,774.5	1,892.6	**3,667.0**	121.1	1,155.2	**1,276.3**	1,895.6	3,047.8	**4,943.3**
2019	1,932.5	2,180.3	**4,112.8**	121.1	1,155.2	**1,276.3**	2,053.6	3,335.5	**5,389.1**
2020	2,064.8	2,258.1	**4,322.9**	121.1	1,155.2	**1,276.3**	2,185.9	3,413.3	**5,599.2**
2021	2,074.1	2,258.1	**4,332.2**	121.1	1,229.5	**1,350.6**	2,195.2	3,487.6	**5,682.8**
2022	2,234.7	2,292.6	**4,527.3**	121.1	1,229.5	**1,350.6**	2,355.8	3,522.1	**5,877.9**
2023	2,416.8	2,313.7	**4,730.4**	121.1	1,243.2	**1,364.3**	2,537.9	3,556.9	**6,094.7**

Table 1: Installed wind capacities on the island from 2010 to 2023

Over the year, the capacity factor[5] of wind farms was 26% which was slightly lower than in 2022. For comparison, it was 29%, 24% and 27% in 2020, 2021 and 2022 respectively.

[4] Some of Northern Ireland's DSO wind connection dates are currently unavailable. Best estimates for the annual installed capacities are used instead.

[5] The capacity factor is the amount of energy produced (MW output) relative to the theoretical maximum that could have been produced if the wind generation operated at full capacity.. This capacity factor is indicative and based on real-time SCADA data.

3.2 Generation and Transmission System Outages in 2023

Across the year, generators and interconnectors will take planned outages at various times. There will also be transmission system outages. These outages may affect dispatch down figures. In N. Ireland across the summer period, there were periods where significantly transmission outages were taken for reinforcement works to increase network capacity. These outages included periods where double/both circuits outages were required to be taken.

3.3 Demand Level

The level of demand is another important factor which may affect the dispatch-down of renewable generation. Increased demand generally enables greater levels of wind and solar to be accommodated on the system.

3.4 Changes to Operational Policy

Since the introduction of SEM-11-062, there is a requirement to dispatch-down wind and solar generators based on their controllability category. This is defined under the Grid Codes and is verified through performance monitoring and testing.

The key operational policies in 2023 that impacted on curtailment levels were as follows:

- **System Non-Synchronous Penetration (SNSP)**: 75% limit applied for the full year. The 75% SNSP trial which started on 15 April 2021 continued to 31 March 2022 at which point the 75% SNSP limit became formal operational policy.
- **Minimum Number of Units**: A minimum requirement of 8 units (3 in N. Ireland and 5 in Ireland) applied for the full year. On 30th May 2023, a 7 set trial commenced (3 in N. Ireland and 4 in Ireland)
- **Inertia**: 23,000 MWs floor applied for the full year.
- **Reserve**: No significant change. The requirement for 50 MW of negative reserve to be held on conventional generators in NI continued through 2023.

In N. Ireland the closure of the coal units in September 2023 and the delay in commissioning of new units resulted in a large CCGT being made “must run”. This generator is located in a high wind region and hence will have impacted dispatch-down of renewables.

4. Breakdown of Wind Dispatch-Down Constraints vs Curtailments

Table 2 shows the aggregate breakdown[6] of wind dispatch-down on the island over the last eleven years.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total Dispatch Down Levels	3.2%	4.1%	5.1%	2.9%	4.0%	6.0%	7.7%	12.1%	7.4%	8.5%	10.7%
Constraints	0.9%	1.4%	1.8%	1.4%	1.2%	2.2%	4.0%	6.2%	4.4%	5.0%	6.1%
Curtailments	2.3%	2.6%	3.3%	1.5%	2.7%	3.8%	3.7%	5.9%	3.0%	3.5%	4.7%

Table 2: All-Island Yearly Breakdown of Wind Dispatch-Down Levels into Constraints and Curtailments

Individual breakdowns for Ireland and Northern Ireland can be found in the Appendix.

4.1 Curtailment

Curtailment refers to the dispatch-down of wind / solar for system-wide reasons. There are different types of system security limits that necessitate curtailment:

1. System stability requirements (synchronous inertia, dynamic and transient stability),
2. Operating reserve requirements, including negative reserve,
3. Voltage control requirements,
4. System Non-Synchronous Penetration (SNSP[7]) limit.

In order to securely operate the system these limits result in minimum generation requirements on the conventional (synchronous) generation portfolio. The implementation of these security limits is described in detail in the Operational Constraints Update paper. This document is published[8] on the EirGrid Group website.

SNSP is a system security metric that has been established from the results of the DS3 programme.

SNSP (System Non-Synchronous Penetration) is the sum of non-synchronous generation (such as wind, solar and HVDC imports) as a percentage of total demand and exports. When the SNSP limit is raised, a trial period takes place before it becomes permanent. During the trial period, the system is operated at this increased SNSP limit except during adverse system events or during system testing.

[6] A more accurate methodology for calculating wind dispatch down was implemented from 2016. Figures from previous years are best estimates.

[7] SNSP is the ratio of non-synchronous generation (wind and HVDC imports) to demand plus HVDC exports.
[8] http://www.eirgridgroup.com/library/index.xml

The power system is now permanently operated to an SNSP Limit of 75%. The SNSP limit can reduce the ability to accommodate wind and solar generation, particularly during lower demand periods.

The impact of curtailment can be seen in Figure 5, which shows the total annual all-island dispatch-down of energy by hour of day. There are more curtailments in the night hours (11pm to 7am) when compared to constraints because the demand is lower (Figure 5 is essentially the mirror image of the demand curve).

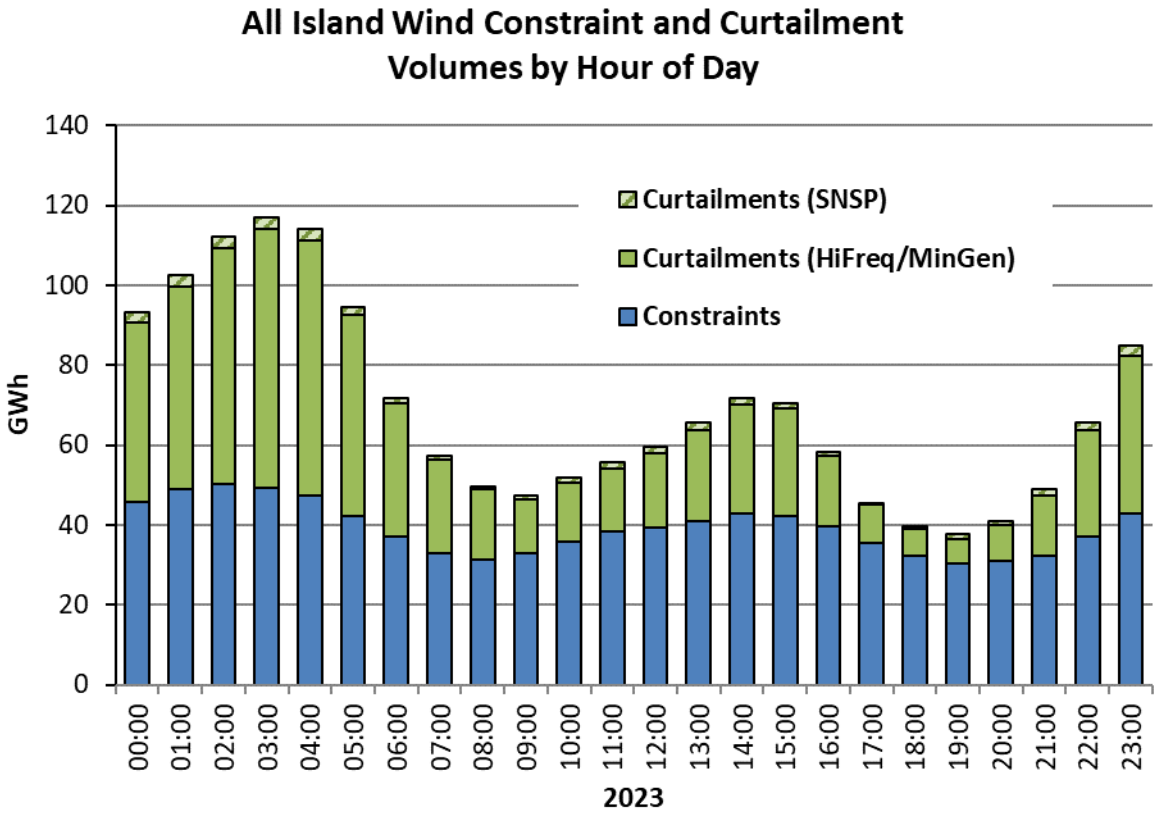


Figure 5: All-Island breakdown of wind constraints and curtailments in 2023 by hour of day

Due to the nature of solar, constraints and curtailments are experienced during daylight hours with the highest level of dispatch down between 10am and 4pm as shown in Figure 22 in the Appendix.

4.2 Constraints

The dispatch-down of wind for network reasons is referred to as a constraint.

Constraint of wind and solar can occur for two main reasons:

- more wind generation than the localised carrying capacity of the network; or
- during outages for maintenance, upgrade works or faults.

In order to reinforce the network to facilitate more wind and solar generation, a number of major capital works projects are scheduled during the transmission outage season each year. These outages may reduce the renewable generation capacity of the network for the duration of any works. In the short term, this

leads to a rise in the levels of constraint in these areas. However, in the long term, this reinforcement of the network increases its capacity. This enables the accommodation of more generation in that area.

The level of all-island dispatch-down attributable to constraints (rather than curtailment) was 6.1% in 2023, which was higher than the 5.0% constraint levels experienced in 2022.

However, it is possible to experience constraints on the transmission system during intact conditions when there is more renewable generation available than the localised carrying capacity of the network.

4.3 Wind Dispatch-Down by Region

The areas with the highest levels of wind dispatch-down (constraints and curtailment) in 2023 were the West and North West of Ireland (Figure 6). The following are the main factors for high wind dispatch-down in these regions:

Northern Ireland:

In general, wind constraints are trending upwards in Northern Ireland due to the amount of wind on the Northern Ireland system relative to its size. At times there is no option but to constrain wind (and solar) if all the online conventional units are at minimum generation, while also managing the potential loss of the tie-line. The loss of the tie-line is flagged as a Northern Ireland constraint as opposed to curtailment, as it does not affect wind in Ireland, i.e. it's a local Northern Ireland issue.

From a Northern Ireland perspective, there will always be occasions throughout the year when outages required to maintain the network can increase constraints. In 2023 there were a number of significant outages that impacted dispatch-down. These outages which included double circuit outages were needed to upgrade the network.

Following the closure of the coal units in N. Ireland and the delay in replacement units a "must run" constraint was implemented on a large CCGT that is located in a high wind region. This was implemented to maintain Security of Supply.

In addition, interconnector imports from GB into N. Ireland have increased and TSOs have observed imports even at time of high wind on the island.

Ireland:

In recent years significant capital works have been undertaken to upgrade the transmission system to allow more wind generation to be exported from wind farms on the system particularly in the North West and South West regions of Ireland. These areas have previously experienced the greatest level of restrictions for the export of wind. Every year a range of planned transmission outages are undertaken which at times will increase constraints.

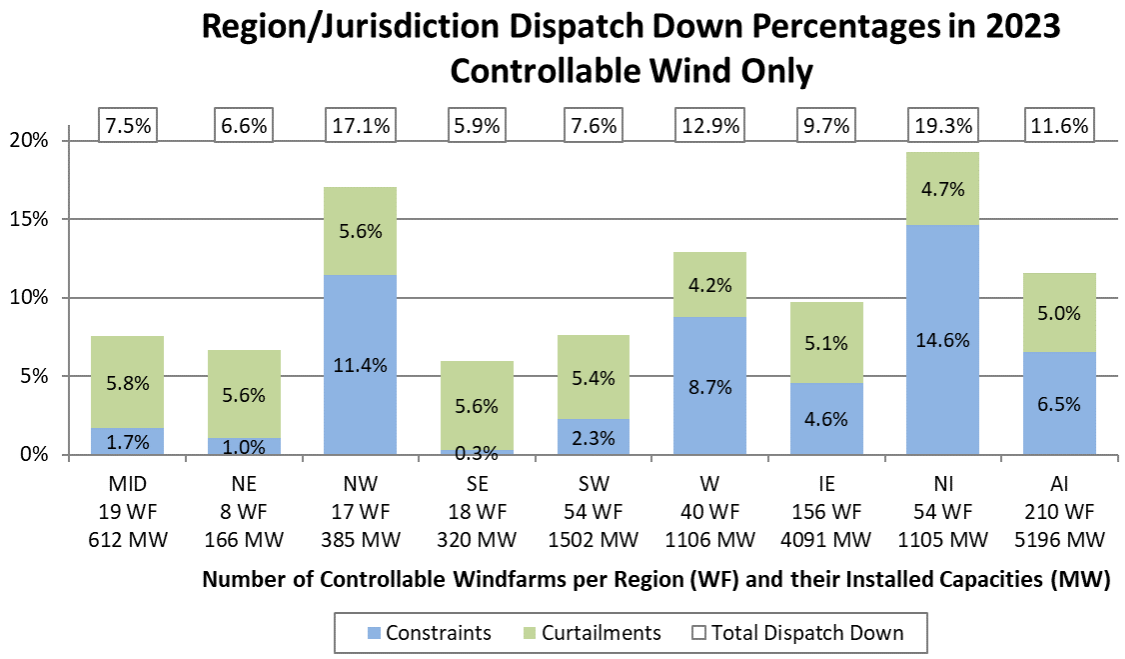


Figure 6: Regional/Jurisdictional Controllable Wind Dispatch-Down Percentages in 2023

Notes:

- Installed capacities are indicative end of year figures and do not reflect capacity changes throughout the year.
- This chart reflects the dispatch down levels and breakdowns for controllable windfarms only which are different from the levels for all windfarms quoted elsewhere in this report.
- IE = Ireland, NI = Northern Ireland, AI = All Island.

5. Mitigation Measures

5.1 Operational Policy and the SOEF Programme

EirGrid and SONI TSO launched the Shaping Our Electricity Future (SOEF) programme in October 2021[9]. It identifies the network, engagement, market and operational programmes of work required to enable achievement of our 2030 renewable generation targets. As part of the Operations workstream of SOEF, EirGrid and SONI have developed an Operational Policy Roadmap[10] that sets out our plans to evolve operational policy in order to facilitate more renewable generation on the system. The SOEF is updated regularly and SOEF version 1.1[11] has been published.

The roadmap includes the TSOs plans to increase the SNSP limit and reduce the Minimum Number of Units constraint. Commencement of a trial on the reduction of the Minimum Number of Units constraint from 8 to 7 started in May 2023.

These changes in operational policy (or at least trialling of them) will contribute to reductions in curtailment levels and deliver important next steps in the evolution of operational policy to enable our renewable integration targets.

5.2 Operational Policy – Interconnector Countertrading[12]

Trades are carried out by the TSOs to minimise the dispatch down of priority generation. The approach to countertrading in the SEM is carried out on the principle of trades being coordinated (i.e. 'agreed') with the other TSO (i.e. National Grid Electricity System Operator (NGESO)).

Given that all co-ordinated third-party countertrades must be agreed by NGESO, on the majority of occasions it is not always possible to countertrade due to similar congestion issues arising in GB.

5.3 Controllability of Wind and Solar Generators

Wind and solar farm controllability is the ability of the TSO control centres to dispatch a wind/solar farm's output to a specific level. Uncontrollable wind farms (legacy wind farms connected before April 2005) are dispatched directly by opening circuit breakers. This results in full disconnection rather than a gradual

[9] https://www.eirgridgroup.com/site-files/library/EirGrid/Shaping_Our_Electricity_Future_Roadmap.pdf

[10] https://www.eirgridgroup.com/site-files/library/EirGrid/Operational-Policy-Roadmap-2023-to-2030.pdf

[11] https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwia29KMyI-FAxXUWkEAHQ2GCCAQFnoECAYQAQ&url=https%3A%2F%2Fwww.eirgrid.ie%2Fsite-files%2Flibrary%2FEirGrid%2FShaping-Our-Electricity-Future-Roadmap_Version-1.1_07.23.pdf&usg=AOvVaw3W37uPjdETJqdJqEnEx4oz&opi=89978449

[12] http://www.eirgridgroup.com/site-files/library/EirGrid/InformationNoteExtensionofTSOcounter-tradingfacilitiesforDBCmanagement.pdf

dispatch-down. Controllability enables fairness of dispatch-down between wind farms on a pro-rata basis. To ensure increasing and appropriate levels of controllability, EirGrid and SONI have sought, where possible, to standardise testing procedures and rigorously enforce controllability requirements on all wind farms.

6. Appendix A – Detailed Results

The following charts provide a breakdown of the wind and solar dispatch-down categories both in volumes and in percentage of available energy.

More detailed monthly and regional figures are available in our final monthly wind and solar dispatch-down reports for 2023. Our user guide provides a detailed description of the dispatch-down categories and the methodology used. Both the monthly report and the user guide are available on our website:

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

http://www.soni.ltd.uk/how-the-grid-works/renewables/

6.1 Reason Codes

This is a list of all the reason codes used when constraining and curtailing wind and solar:

- Transmission (TSO) Constraints: Used to resolve a local network issue,
- Testing (TSO): Used when wind/solar farm testing is carried out by the TSO, e.g. for commissioning and monitoring,
- Curtailments:
    - High Frequency/Minimum generation: Used when attempting to alleviate an emergency high frequency event or in order to facilitate the minimum level of conventional generation on the system to satisfy reserve requirements, priority dispatch or to provide ramping capabilities,
    - SNSP Issue: Used to reduce the System Non-Synchronous Penetration,
    - ROCOF/Inertia: Used when the Rate of Change of Frequency (ROCOF) value for the loss of the largest single infeed is unacceptably high and wind/solar must be dispatched down as a result or when the system inertia is too low.
- Other Reductions:
    - DSO/DNO Constraints: Used when a dispatch is carried out as a result of a request from the Distribution System Operator or the Distribution Network Operator,
    - Developer Outage: Used when a wind/solar farm must reduce output mainly to carry out software upgrades,
    - Developer Testing: Used when testing is carried out by a wind/solar farm developer.

6.2 All-Island Wind

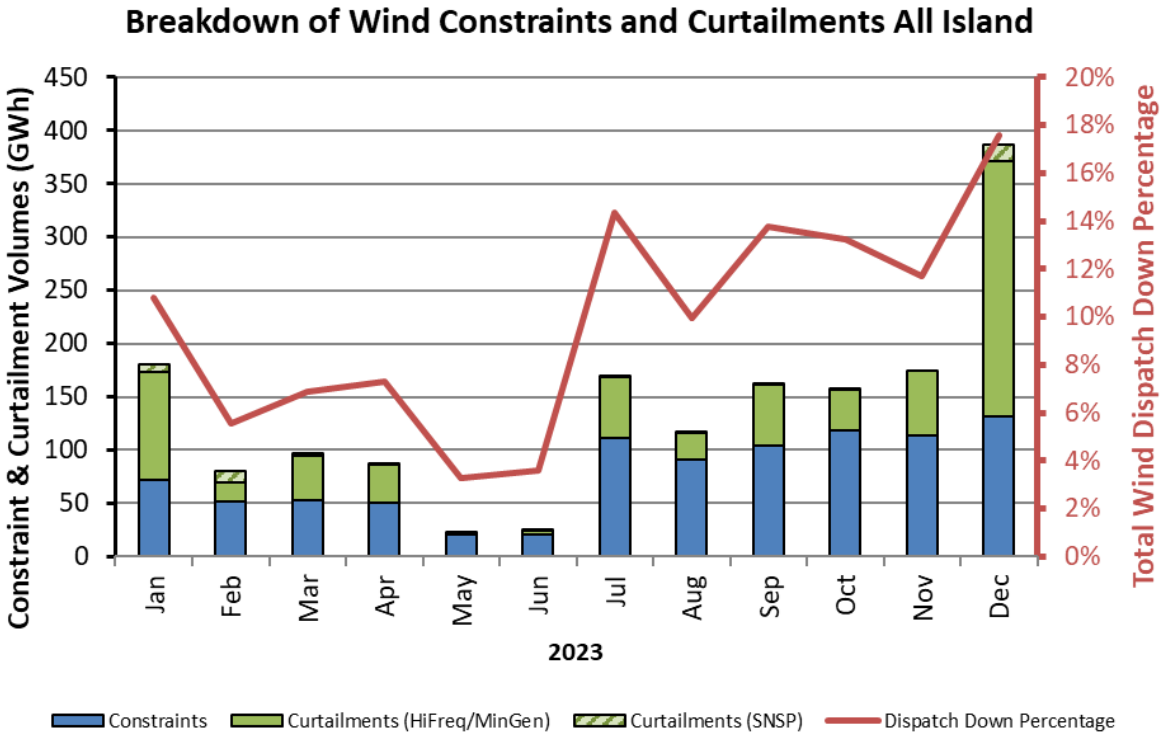
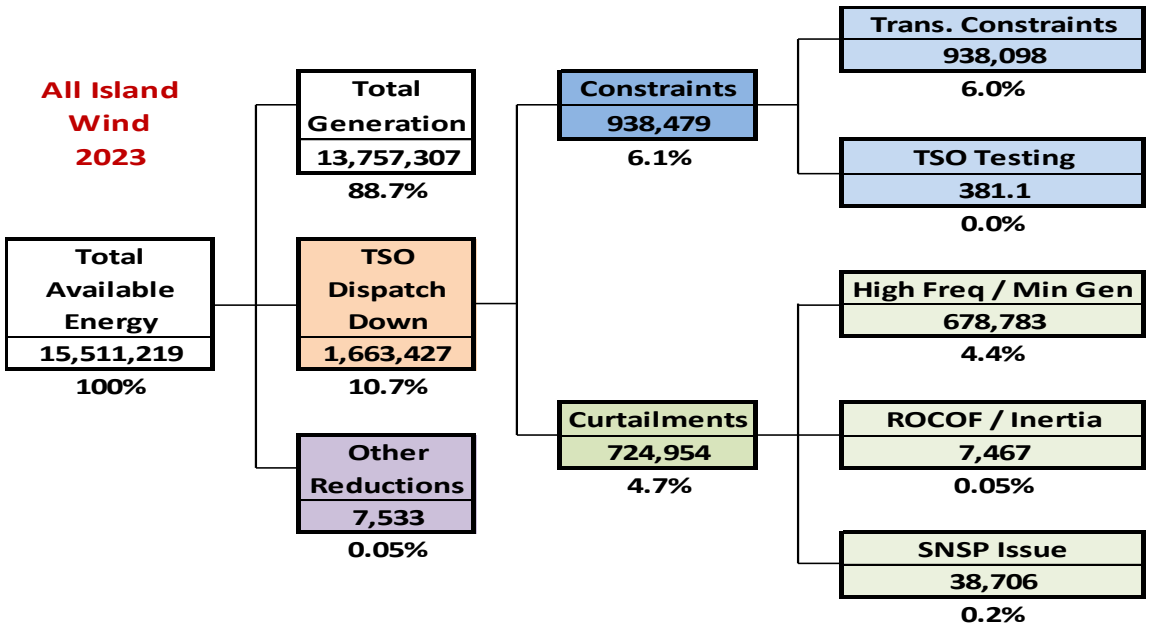


Figure 7: Monthly breakdown of all-island wind constraints and curtailments in 2023



Wind energy breakdowns: Volumes (MWh) and percentages.
Other reductions include DSO constraints, developer outage and developer testing.
Certain types of reductions are outside of the control of the TSO and are not logged.
Therefore, Available Energy ≠ Generation + TSO Dispatch Down + Other Reductions

Figure 8: Graphical representation of all-island wind dispatch-down categories in 2023

6.3 Ireland Wind

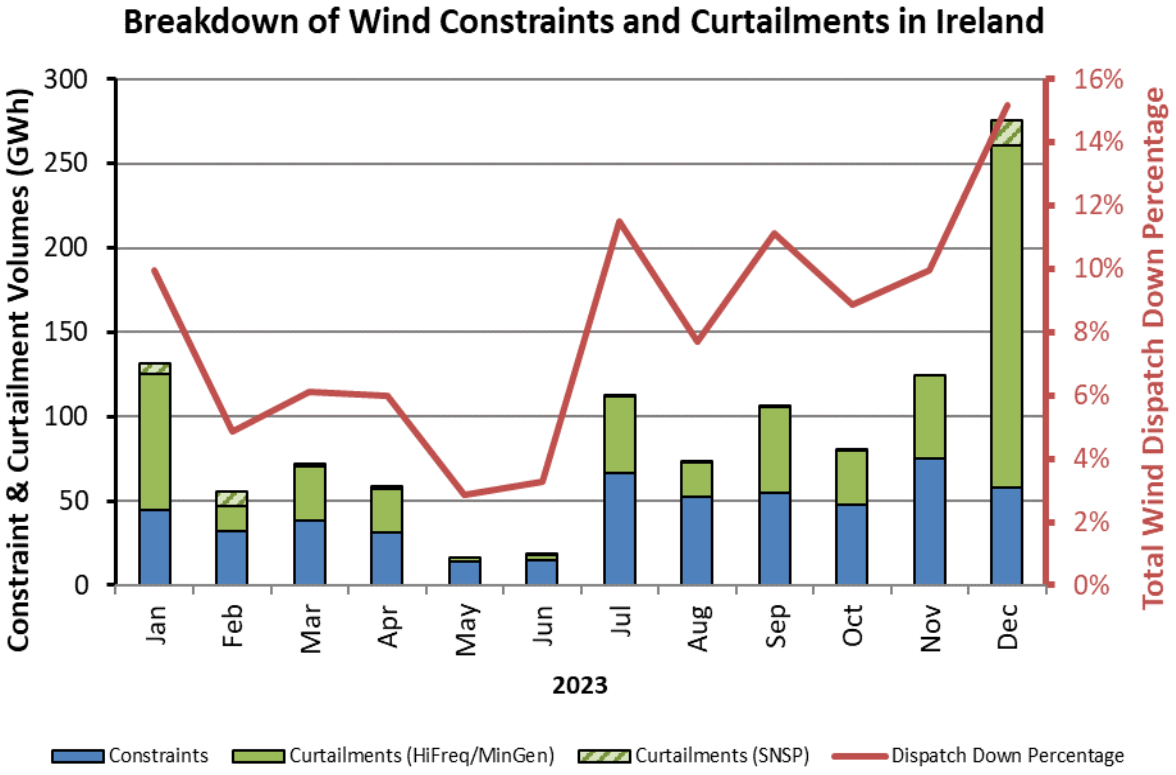
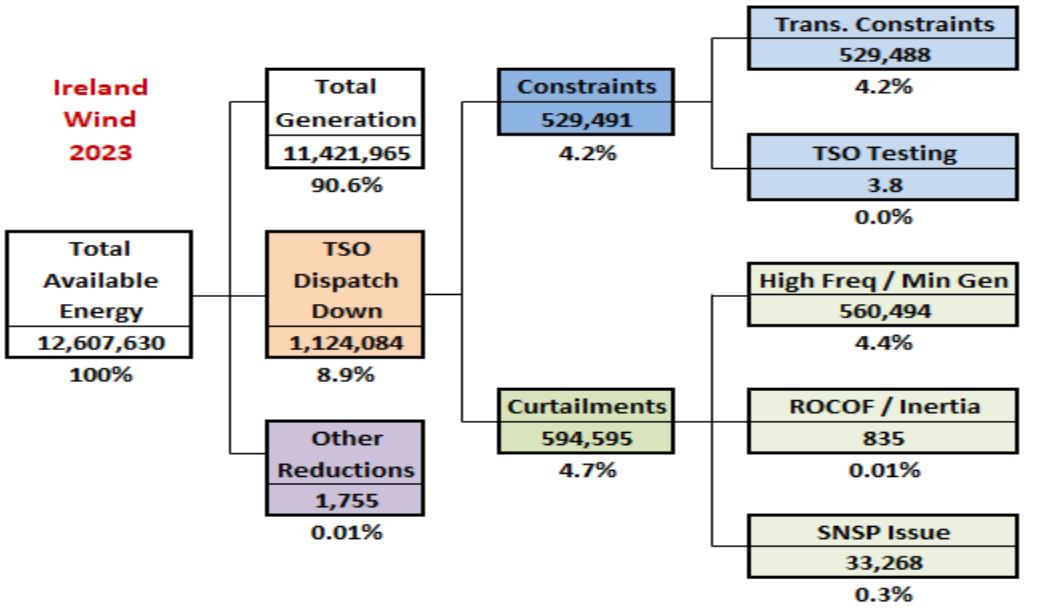


Figure 9: Monthly breakdown of the main wind dispatch-down categories in Ireland in 2023



Wind energy breakdowns: Volumes (MWh) and percentages.
Other reductions include DSO constraints, developer outage and developer testing.
Certain types of reductions are outside of the control of the TSO and are not logged.
Therefore, Available Energy ≠ Generation + TSO Dispatch Down + Other Reductions

Figure 10: Graphical representation of wind dispatch-down categories in Ireland in 2023

6.4 Northern Ireland Wind

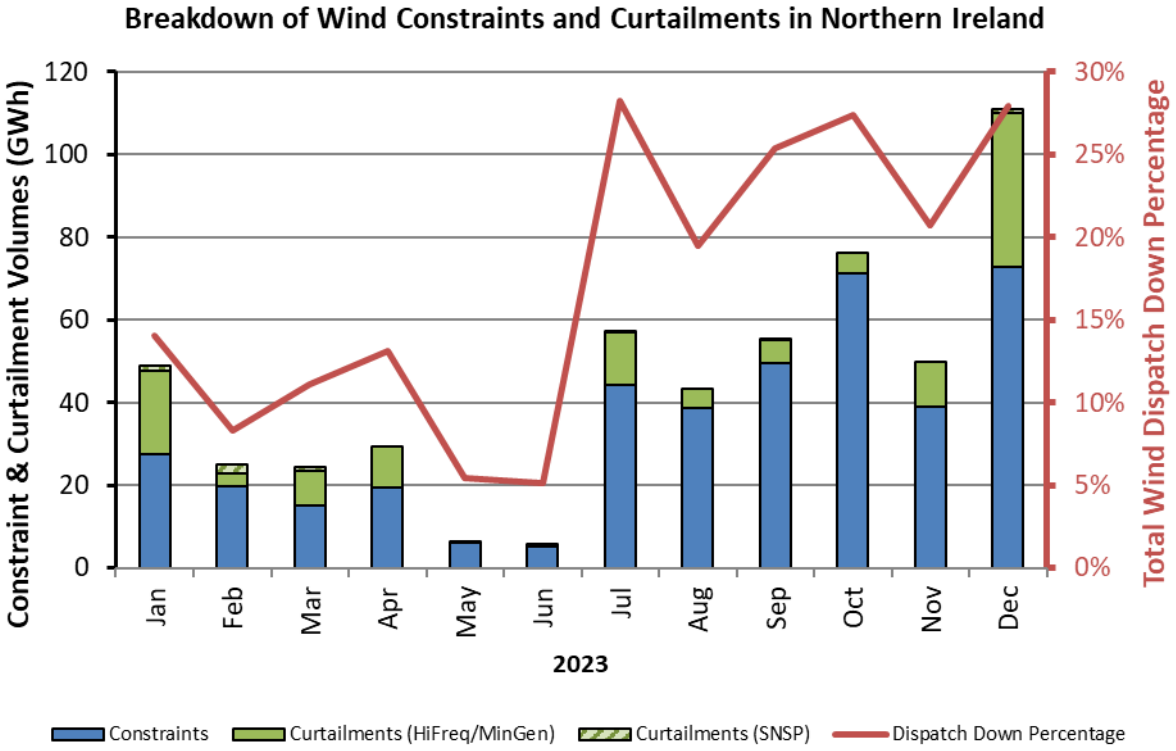


Figure 11: Monthly breakdown of wind dispatch-down categories in Northern Ireland in 2023

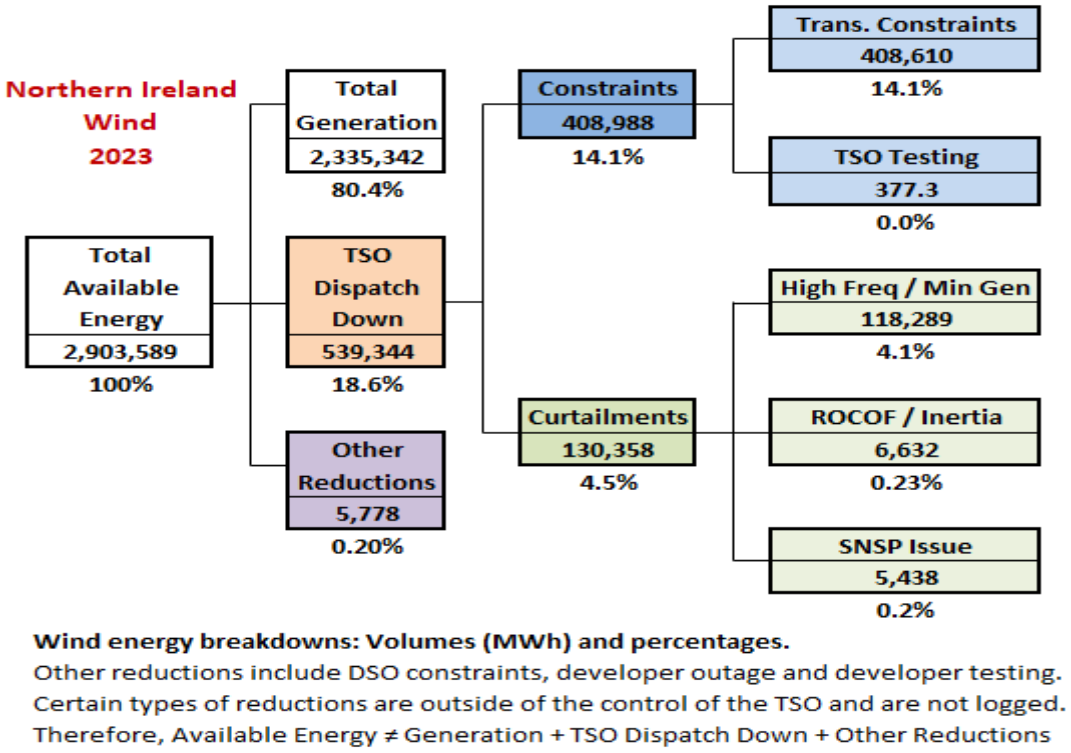


Figure 12: Graphical representation of Northern Ireland wind dispatch-down categories in 2023

6.5 All-Island Solar

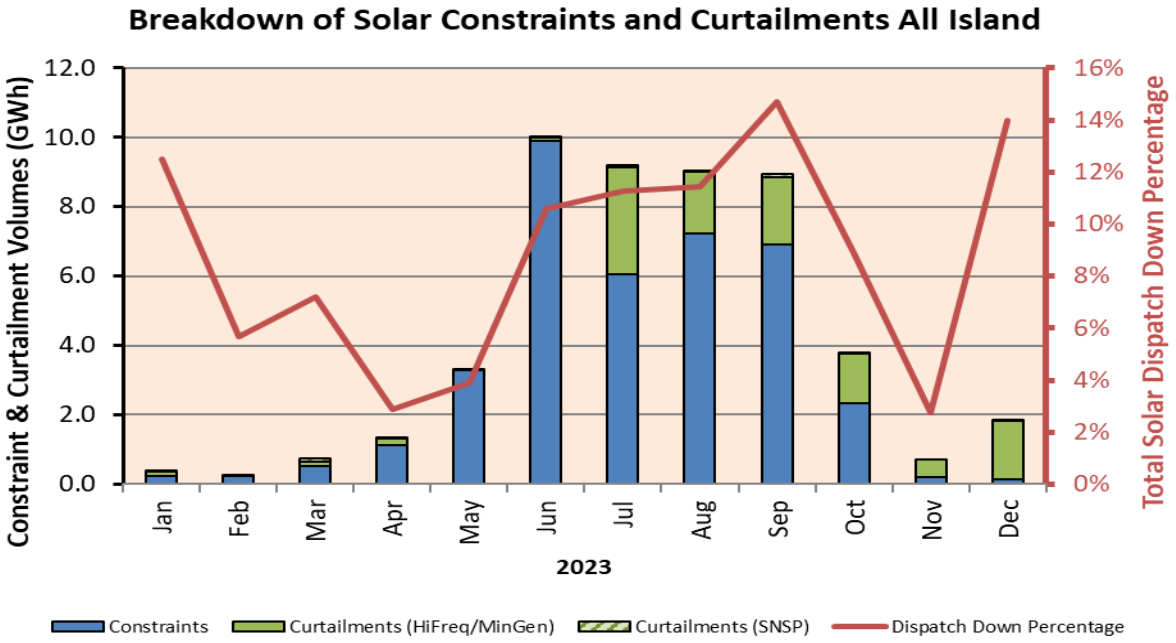
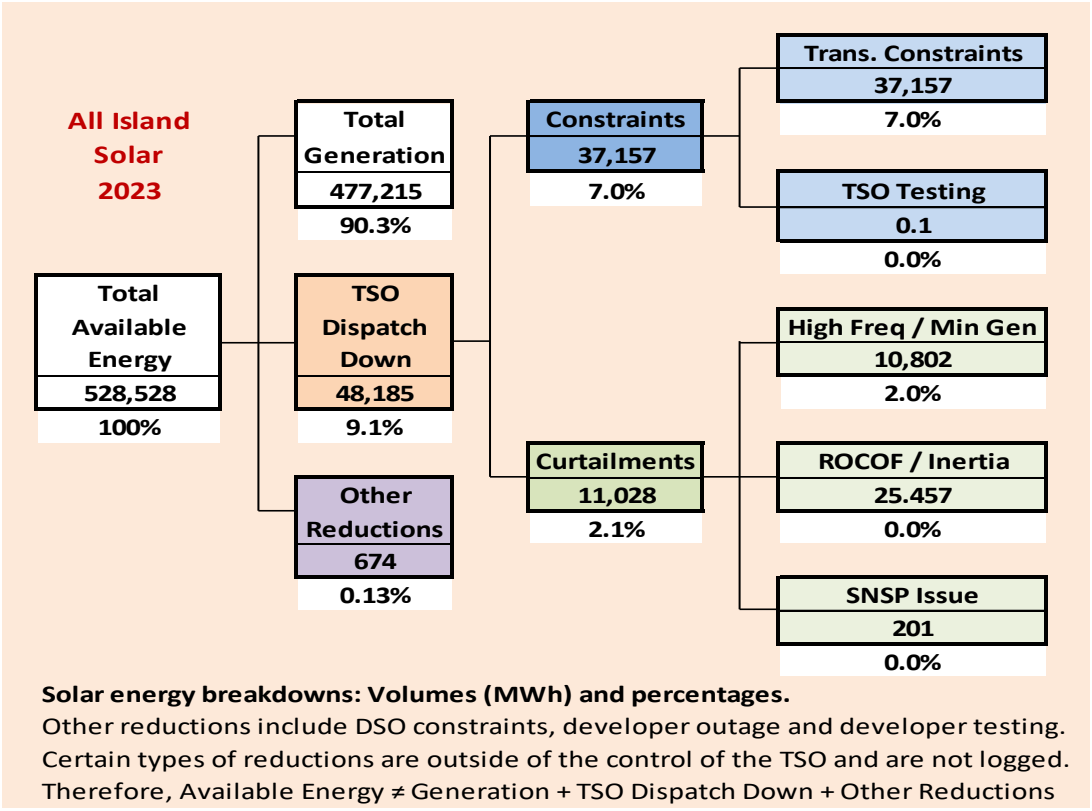


Figure 13: Monthly breakdown of all-island solar constraints and curtailments in 2023



Solar energy breakdowns: Volumes (MWh) and percentages.
Other reductions include DSO constraints, developer outage and developer testing.
Certain types of reductions are outside of the control of the TSO and are not logged.
Therefore, Available Energy ≠ Generation + TSO Dispatch Down + Other Reductions

Figure 14: Graphical representation of all-island solar dispatch-down categories in 2023

6.6 Ireland Solar

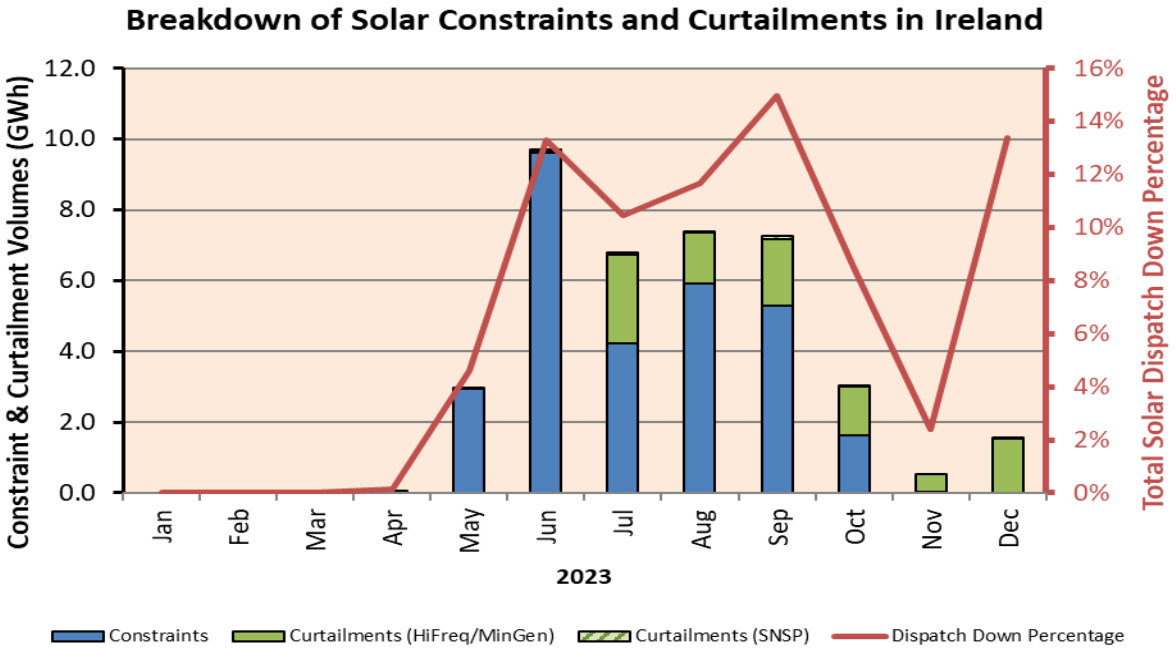
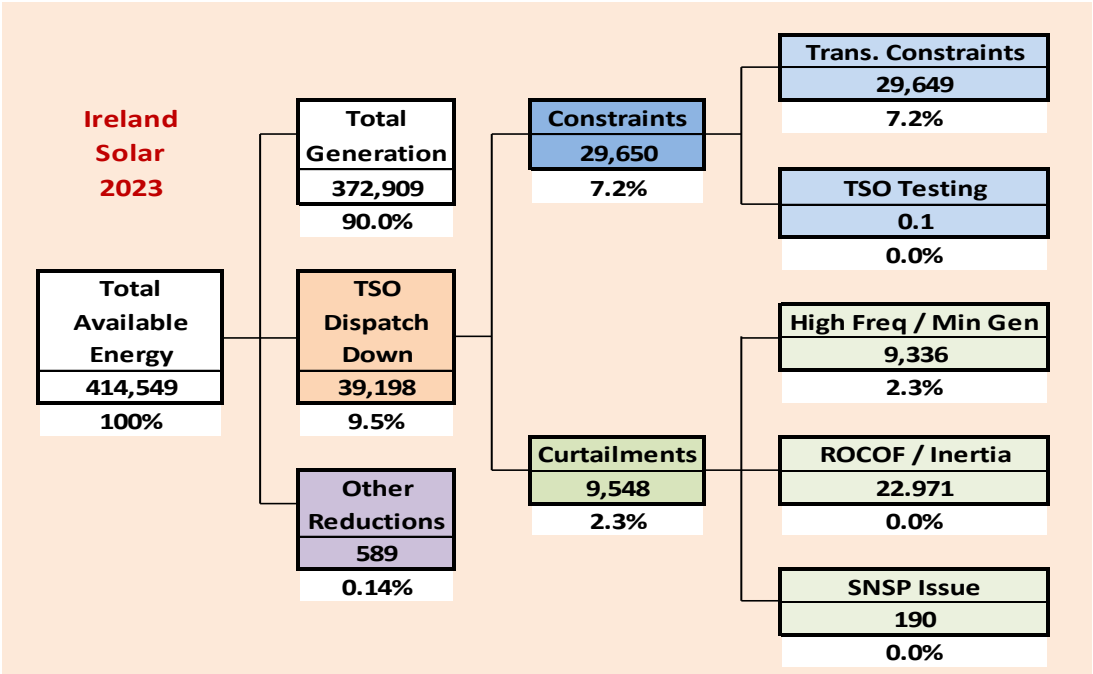


Figure 15: Monthly breakdown of the main solar dispatch-down categories in Ireland in 2023



Solar energy breakdowns: Volumes (MWh) and percentages.
Other reductions include DSO constraints, developer outage and developer testing.
Certain types of reductions are outside of the control of the TSO and are not logged.
Therefore, Available Energy ≠ Generation + TSO Dispatch Down + Other Reductions

Figure 16: Graphical representation of Ireland solar dispatch-down categories in 2023

6.7 Northern Ireland Solar

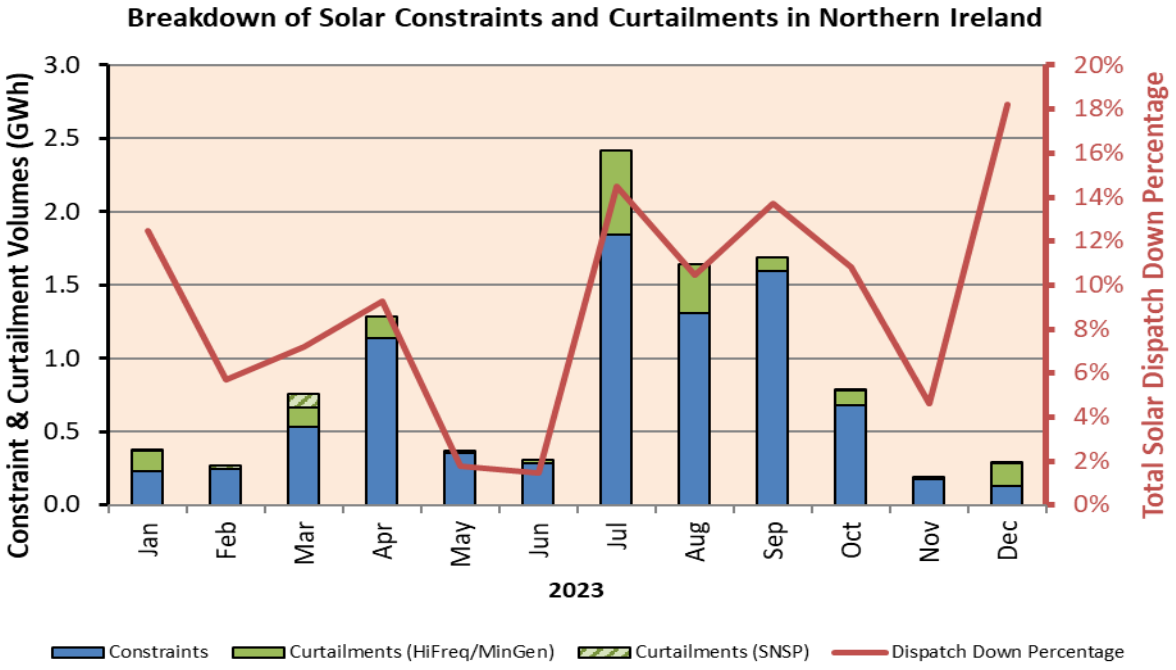


Figure 17: Monthly breakdown of solar dispatch-down categories in Northern Ireland in 2023

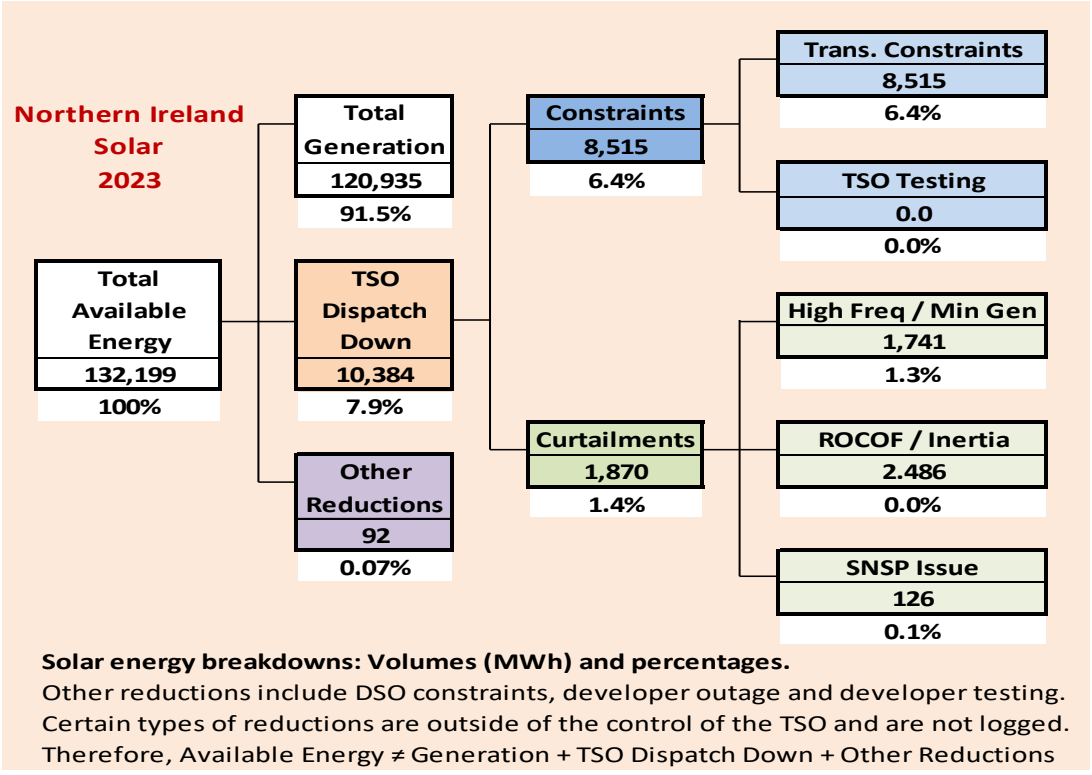


Figure 18: Graphical representation of Northern Ireland solar dispatch-down categories in 2023

Table 3: Historical Wind Dispatch-Down Summary in Ireland, Northern Ireland and All-Island

Historical Wind Dispatch Down (Constraint and Curtailment) Percentages for Ireland (IE), Northern Ireland (NI) and All Island (AI)

	2011			2012			2013			2014			2015			2016			2017			2018			2019			2020			2021			2022			2023		
Month	**NI**	**IE**	**AI**	**NI**	**IE**	**AI**	**NI**	**IE**	**AI**	**NI**	**IE**	**AI**	**NI**	**IE**	**AI**	**NI**	**IE**	**AI**	**NI**	**IE**	**AI**	**NI**	**IE**	**AI**	**NI**	**IE**	**AI**	**NI**	**IE**	**AI**	**NI**	**IE**	**AI**	**NI**	**IE**	**AI**	**NI**	**IE**	**AI**
Jan	0.0%	0.8%	0.6%	0.5%	2.2%	1.9%	0.7%	0.4%	0.5%	2.9%	4.9%	4.5%	4.3%	4.3%	4.3%	3.4%	3.5%	3.5%	2.4%	1.9%	2.0%	5.7%	3.5%	3.9%	9.7%	3.8%	5.1%	12.3%	9.0%	9.8%	5.2%	5.3%	5.3%	8.6%	9.1%	8.9%	14.1%	9.9%	10.8%
Feb	0.0%	0.6%	0.5%	0.2%	2.8%	2.2%	0.3%	0.7%	0.6%	3.2%	3.7%	3.6%	4.6%	4.1%	4.2%	2.3%	3.3%	3.1%	2.0%	1.7%	1.7%	2.9%	2.0%	2.2%	10.7%	6.8%	7.7%	17.4%	12.3%	13.4%	11.5%	10.2%	10.5%	8.0%	8.1%	8.1%	8.3%	4.9%	5.6%
Mar	2.7%	1.8%	2.0%	0.8%	2.4%	2.0%	0.6%	0.3%	0.3%	1.8%	4.0%	3.5%	11.4%	8.0%	8.8%	0.9%	2.4%	2.1%	3.0%	3.4%	3.3%	5.9%	4.4%	4.7%	11.8%	9.2%	9.8%	14.5%	10.7%	11.4%	9.8%	12.8%	12.2%	6.0%	7.4%	7.1%	11.1%	6.1%	6.9%
Qtr1	0.7%	1.0%	0.9%	0.5%	2.4%	2.0%	0.6%	0.4%	0.5%	2.7%	4.2%	3.9%	6.9%	5.4%	5.8%	2.4%	3.2%	3.0%	2.4%	2.3%	2.4%	4.9%	3.3%	3.6%	10.8%	6.8%	7.7%	14.9%	10.9%	11.7%	9.4%	9.7%	9.6%	7.7%	8.2%	8.1%	11.3%	7.1%	7.9%
Apr	1.3%	1.2%	1.3%	0.2%	1.4%	1.2%	2.6%	4.7%	4.3%	1.8%	4.2%	3.7%	2.8%	1.8%	2.0%	0.8%	1.4%	1.3%	4.2%	3.5%	3.6%	19.2%	7.4%	9.8%	11.4%	9.0%	9.6%	21.8%	9.0%	11.8%	4.7%	2.1%	2.5%	6.5%	5.5%	5.7%	13.1%	6.0%	7.3%
May	2.2%	3.5%	3.2%	0.6%	1.6%	1.4%	3.7%	6.1%	5.6%	1.5%	2.8%	2.5%	3.8%	4.5%	4.3%	1.1%	1.2%	1.2%	3.6%	3.5%	3.5%	6.1%	4.7%	5.0%	3.8%	4.1%	4.0%	19.8%	12.6%	13.9%	10.1%	11.8%	11.5%	6.7%	10.2%	9.4%	5.5%	2.9%	3.3%
Jun	0.4%	0.8%	0.7%	0.4%	4.0%	3.3%	1.9%	3.7%	3.4%	0.6%	3.3%	2.7%	4.2%	5.0%	4.8%	0.3%	0.7%	0.7%	4.7%	3.9%	4.1%	11.0%	8.0%	8.6%	11.2%	5.6%	6.7%	26.2%	15.4%	17.5%	2.1%	2.4%	2.4%	13.1%	10.1%	10.7%	5.2%	3.3%	3.6%
Qtr2	1.6%	2.3%	2.2%	0.4%	2.2%	1.9%	2.9%	5.0%	4.6%	1.5%	3.4%	3.0%	3.7%	3.9%	3.8%	0.8%	1.2%	1.1%	4.2%	3.7%	3.8%	13.0%	6.6%	8.0%	9.4%	6.6%	7.2%	22.7%	12.7%	14.6%	6.0%	6.1%	6.1%	8.6%	8.6%	8.6%	9.2%	4.4%	5.3%
Jul	0.2%	3.3%	2.8%	0.5%	1.9%	1.6%	0.8%	4.2%	3.4%	1.6%	3.9%	3.4%	2.8%	3.8%	3.7%	6.2%	2.3%	3.1%	4.4%	2.8%	3.2%	2.1%	1.9%	2.0%	8.2%	3.8%	4.8%	12.4%	9.2%	9.8%	5.9%	0.5%	1.2%	11.4%	3.2%	5.0%	28.2%	11.5%	14.4%
Aug	0.0%	0.7%	0.5%	4.0%	4.2%	4.1%	2.4%	5.4%	4.7%	3.8%	3.5%	3.6%	5.0%	5.8%	5.6%	7.0%	4.6%	5.0%	3.1%	2.8%	2.9%	5.8%	2.2%	3.0%	15.2%	8.4%	9.8%	14.4%	11.4%	11.9%	7.0%	7.1%	7.1%	8.9%	3.5%	4.6%	19.5%	7.7%	9.9%
Sep	2.4%	3.9%	3.7%	0.4%	4.8%	3.7%	0.5%	4.2%	3.3%	0.1%	2.2%	1.8%	1.5%	2.7%	2.5%	5.8%	5.6%	5.6%	4.2%	5.4%	5.1%	13.1%	5.5%	7.4%	8.4%	8.2%	8.2%	9.0%	9.0%	9.0%	7.5%	5.5%	5.9%	8.1%	7.0%	7.2%	25.4%	11.1%	13.8%
Qtr3	1.5%	3.1%	2.8%	1.5%	3.8%	3.3%	1.3%	4.6%	3.9%	2.4%	3.3%	3.1%	3.1%	4.1%	3.9%	6.3%	4.4%	4.8%	3.9%	3.9%	3.9%	8.7%	3.6%	4.8%	11.0%	7.3%	8.0%	11.6%	9.8%	10.2%	7.1%	5.1%	5.4%	9.4%	4.8%	5.8%	24.3%	10.1%	12.7%
Oct	2.4%	4.7%	4.3%	0.0%	0.3%	0.2%	1.6%	5.9%	5.0%	4.5%	8.2%	7.4%	4.2%	3.8%	3.9%	1.9%	1.8%	1.8%	14.6%	9.2%	10.6%	10.2%	6.9%	7.7%	7.4%	6.4%	6.6%	12.4%	13.9%	13.6%	9.7%	8.0%	8.4%	13.8%	11.8%	12.2%	27.4%	8.9%	13.2%
Nov	1.2%	2.3%	2.1%	0.1%	1.0%	0.8%	4.0%	3.0%	3.2%	2.0%	3.2%	3.0%	6.9%	6.8%	6.9%	2.7%	1.0%	1.3%	3.2%	2.5%	2.6%	10.2%	5.2%	6.4%	7.4%	3.9%	4.5%	12.8%	13.4%	13.3%	6.4%	6.1%	6.2%	11.3%	9.3%	9.7%	20.7%	10.0%	11.7%
Dec	0.7%	2.2%	1.9%	0.8%	2.8%	2.5%	2.0%	4.4%	3.8%	4.5%	5.0%	4.9%	6.2%	6.3%	6.3%	3.8%	3.1%	3.3%	5.3%	2.5%	3.1%	14.9%	7.2%	8.9%	16.2%	9.6%	11.0%	9.8%	9.7%	9.7%	6.4%	5.4%	5.6%	10.0%	7.5%	7.9%	28.0%	15.2%	17.6%
Qtr4	1.4%	2.9%	2.6%	0.4%	1.6%	1.4%	2.4%	4.5%	4.0%	3.9%	5.7%	5.3%	6.1%	6.0%	6.0%	3.0%	2.1%	2.3%	8.5%	4.9%	5.7%	11.7%	6.4%	7.7%	11.1%	6.9%	7.8%	11.6%	12.3%	12.2%	7.5%	6.4%	6.6%	11.9%	9.7%	10.1%	26.0%	12.1%	14.8%
Year Total DD	**1.3%**	**2.4%**	**2.2%**	**0.7%**	**2.5%**	**2.1%**	**1.9%**	**3.5%**	**3.2%**	**2.8%**	**4.4%**	**4.1%**	**5.3%**	**5.1%**	**5.1%**	**3.2%**	**2.8%**	**2.9%**	**5.0%**	**3.7%**	**4.0%**	**9.4%**	**5.0%**	**6.0%**	**10.7%**	**6.9%**	**7.7%**	**14.8%**	**11.4%**	**12.1%**	**7.8%**	**7.3%**	**7.4%**	**9.4%**	**8.3%**	**8.5%**	**18.6%**	**8.9%**	**10.7%**
Constraints	0.3%	0.5%	0.4%	0.3%	0.9%	0.8%	0.5%	1.0%	0.9%	1.0%	1.5%	1.4%	1.9%	1.8%	1.8%	1.3%	1.4%	1.4%	1.9%	1.0%	1.2%	4.0%	1.7%	2.2%	4.7%	3.8%	4.0%	6.6%	6.1%	6.2%	4.2%	4.5%	4.4%	5.8%	4.8%	5.0%	14.1%	4.2%	6.1%
Curtailments	1.1%	2.0%	1.8%	0.4%	1.5%	1.3%	1.3%	2.5%	2.3%	1.8%	2.9%	2.6%	3.4%	3.3%	3.3%	1.9%	1.4%	1.5%	3.1%	2.6%	2.7%	5.4%	3.3%	3.8%	6.0%	3.1%	3.7%	8.2%	5.3%	5.9%	3.6%	2.8%	3.0%	3.6%	3.5%	3.5%	4.5%	4.7%	4.7%
Wind Installed Capacity (MW)	512	1,585	2,097	600	1,703	2,303	640	1,923	2,563	729	2,266	2,996	751	2,447	3,198	943	2,795	3,737	1,154	3,312	4,466	1,276	3,667	4,943	1,276	4,120	5,396	1,276	4,300	5,576	1,351	4,332	5,683	1,351	4,527	5,878	1,364	4,730	6,095
Wind Generation (GWh)	943	4,256	5,198	1,020	4,102	5,122	1,259	4,642	5,901	1,453	5,116	6,568	1,803	6,537	8,339	1,725	6,115	7,840	2,051	7,229	9,280	2,391	8,685	11,076	2,462	9,532	11,994	2,630	11,138	13,768	2,168	9,527	11,695	2,781	10,895	13,676	2,335	11,422	13,757
Wind Capacity Factors	21%	31%	28%	21%	28%	27%	23%	29%	28%	24%	28%	27%	28%	32%	31%	23%	27%	26%	22%	27%	26%	22%	28%	27%	22%	28%	26%	24%	30%	29%	19%	25%	24%	24%	28%	27%	20%	28%	26%
SNSP Limit	50%			50%			50%			50%			55% Trial from Oct			55% Perm from Mar 60% Trial from Nov			60% Perm from Mar 65% Trial from Nov			65% Perm from Apr			65%			65%			70% Trial from Jan 70% Perm from Apr 75% Trial from Apr			75% Perm from Apr			75%		

Notes:

"Dispatch Down" consists of constraints + curtailments. All wind figures included (controllable + non-controllable).

The darker shaded cells indicate higher dispatch-down percentages in order to produce a graphical representation similar to a heat map.

A more accurate methodology for calculating wind dispatch down was implemented from 2016. Figures from previous years are best estimates.

Wind installed capacities, generation and capacity factors are indicative and based on the latest available information.

SNSP (System Non-Synchronous Penetration) is the sum of non-synchronous generation (such as wind, solar and HVDC imports) as a percentage of total demand and exports.

When the SNSP limit is raised, a trial period takes place before it becomes permanent. During the trial period, the system is operated at this increased SNSP limit except in times of extreme system events or during system testing.

For more infomration see our annual and monthly dispatch down reports on: http://www.eirgridgroup.com/how-the-grid-works/renewables/ or: https://www.soni.ltd.uk/how-the-grid-works/renewables/

Wind Dispatch Down Percentages and Breakdown per Region (Controllable Windfarms only)

2021

Controllable Wind By Region	Cap (MW)	Jan	Feb	Mar	Qtr1	Apr	May	Jun	Qtr2	Jul	Aug	Sep	Qtr3	Oct	Nov	Dec	Qtr4	2021
MID	612	3.9%	6.3%	6.0%	5.5%	0.8%	5.7%	0.6%	2.7%	0.0%	7.8%	3.7%	4.7%	5.6%	3.8%	4.8%	4.8%	4.6%
Constraints		0.4%	0.5%	1.3%	0.7%	0.2%	2.7%	0.6%	1.3%	0.0%	2.8%	0.2%	1.2%	1.7%	0.4%	0.0%	0.6%	0.9%
Curtailments		3.5%	5.9%	4.7%	4.8%	0.6%	3.0%	0.0%	1.4%	0.0%	5.0%	3.6%	3.4%	4.0%	3.4%	4.8%	4.1%	3.7%
NE	166	2.9%	6.6%	5.4%	5.2%	1.3%	4.8%	0.0%	2.3%	0.0%	3.1%	3.3%	2.7%	3.0%	3.0%	4.3%	3.5%	3.8%
Constraints		0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Curtailments		2.9%	6.6%	5.4%	5.2%	1.0%	4.8%	0.0%	2.2%	0.0%	3.0%	3.3%	2.6%	3.0%	3.0%	4.3%	3.5%	3.8%
NW	385	5.3%	13.9%	9.8%	10.4%	2.4%	21.6%	2.0%	8.9%	1.4%	5.5%	8.1%	6.3%	8.5%	7.0%	9.8%	8.5%	9.0%
Constraints		3.1%	7.3%	5.1%	5.5%	1.8%	18.6%	2.0%	7.7%	1.4%	1.6%	7.0%	4.4%	3.8%	4.8%	4.4%	4.3%	5.5%
Curtailments		2.2%	6.6%	4.7%	4.8%	0.6%	3.0%	0.0%	1.2%	0.0%	3.9%	1.1%	1.8%	4.8%	2.2%	5.4%	4.2%	3.5%
SE	320	3.2%	5.7%	5.5%	4.9%	0.6%	7.1%	0.1%	3.1%	0.0%	3.9%	3.4%	2.9%	3.1%	3.6%	5.3%	4.1%	4.0%
Constraints		0.0%	0.0%	1.1%	0.3%	0.0%	3.7%	0.0%	1.5%	0.0%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.4%
Curtailments		3.2%	5.7%	4.5%	4.6%	0.6%	3.5%	0.1%	1.6%	0.0%	3.7%	3.4%	2.8%	3.1%	3.6%	5.3%	4.1%	3.6%
SW	1,502	7.0%	12.9%	19.4%	13.2%	3.1%	12.9%	1.5%	6.8%	0.8%	5.8%	6.7%	4.8%	10.2%	8.1%	4.9%	7.3%	8.8%
Constraints		4.7%	8.3%	16.1%	9.6%	2.7%	11.0%	1.5%	5.9%	0.8%	2.8%	4.4%	2.8%	6.9%	4.8%	1.6%	4.1%	6.1%
Curtailments		2.4%	4.6%	3.3%	3.6%	0.4%	1.9%	0.0%	0.9%	0.0%	3.1%	2.3%	2.0%	3.3%	3.3%	3.3%	3.3%	2.7%
W	1,106	6.5%	12.8%	16.1%	12.1%	2.4%	18.1%	6.7%	9.7%	0.3%	13.6%	6.8%	8.7%	11.5%	7.7%	8.1%	9.1%	10.2%
Constraints		4.2%	7.4%	12.4%	8.2%	1.9%	16.3%	6.6%	8.8%	0.3%	9.2%	4.7%	6.0%	8.5%	5.4%	3.7%	5.8%	7.2%
Curtailments		2.3%	5.4%	3.6%	4.0%	0.5%	1.9%	0.1%	0.9%	0.0%	4.4%	2.1%	2.7%	3.0%	2.3%	4.5%	3.3%	3.0%
Controllable Wind Totals:																		
AI	5,196	5.7%	11.4%	13.3%	10.4%	2.8%	12.5%	2.6%	6.6%	1.3%	7.7%	6.4%	5.9%	9.1%	6.7%	6.1%	7.2%	8.0%
Constraints		2.9%	5.7%	9.2%	6.0%	2.3%	10.0%	2.6%	5.5%	1.3%	4.2%	4.0%	3.5%	5.8%	3.5%	2.0%	3.6%	4.8%
Curtailments		2.8%	5.6%	4.1%	4.4%	0.5%	2.5%	0.0%	1.2%	0.0%	3.5%	2.5%	2.4%	3.3%	3.2%	4.1%	3.6%	3.2%
IE	4,091	5.8%	11.2%	14.1%	10.6%	2.3%	13.0%	2.7%	6.7%	0.5%	7.8%	6.1%	5.6%	8.8%	6.7%	6.0%	7.1%	8.0%
Constraints		3.2%	5.9%	10.2%	6.5%	1.8%	10.7%	2.7%	5.6%	0.5%	4.0%	3.7%	3.1%	5.4%	3.7%	1.9%	3.5%	4.9%
Curtailments		2.6%	5.3%	3.9%	4.1%	0.5%	2.3%	0.0%	1.1%	0.0%	3.8%	2.4%	2.5%	3.4%	3.0%	4.1%	3.5%	3.1%
NI	1,105	5.4%	12.0%	10.2%	9.8%	4.9%	10.5%	2.2%	6.2%	6.2%	7.3%	7.8%	7.4%	10.1%	6.7%	6.7%	7.8%	8.2%
Constraints		1.7%	5.2%	5.1%	4.3%	4.6%	7.2%	2.1%	4.8%	6.2%	5.4%	5.1%	5.4%	7.1%	2.6%	2.5%	4.0%	4.4%
Curtailments		3.7%	6.9%	5.1%	5.5%	0.4%	3.3%	0.0%	1.4%	0.0%	2.0%	2.7%	2.0%	3.1%	4.2%	4.2%	3.8%	3.8%
All Wind (Controllable + Non-Controllable) Totals:																		
AI		5.3%	10.5%	12.2%	9.6%	2.5%	11.5%	2.4%	6.1%	1.2%	7.1%	5.9%	5.4%	8.4%	6.2%	5.6%	6.6%	7.4%
Constraints		2.7%	5.3%	8.4%	5.5%	2.1%	9.2%	2.3%	5.0%	1.2%	3.9%	3.6%	3.2%	5.3%	3.2%	1.8%	3.3%	4.4%
Curtailments		2.6%	5.2%	3.8%	4.1%	0.4%	2.3%	0.0%	1.1%	0.0%	3.2%	2.2%	2.2%	3.1%	2.9%	3.8%	3.3%	3.0%
IE		5.3%	10.2%	12.8%	9.7%	2.1%	11.8%	2.4%	6.1%	0.5%	7.1%	5.5%	5.1%	8.0%	6.1%	5.4%	6.4%	7.3%
Constraints		2.9%	5.4%	9.3%	5.9%	1.7%	9.7%	2.4%	5.1%	0.5%	3.7%	3.3%	2.9%	4.9%	3.4%	1.7%	3.2%	4.5%
Curtailments		2.4%	4.8%	3.5%	3.8%	0.4%	2.1%	0.0%	1.0%	0.0%	3.4%	2.2%	2.2%	3.1%	2.7%	3.8%	3.2%	2.8%
NI		5.2%	11.5%	9.8%	9.4%	4.7%	10.1%	2.1%	6.0%	5.9%	7.0%	7.5%	7.1%	9.7%	6.4%	6.4%	7.5%	7.8%
Constraints		1.6%	4.9%	4.9%	4.1%	4.4%	6.9%	2.0%	4.6%	5.9%	5.1%	4.9%	5.2%	6.8%	2.5%	2.4%	3.8%	4.2%
Curtailments		3.6%	6.6%	4.9%	5.3%	0.4%	3.2%	0.0%	1.3%	0.0%	1.9%	2.6%	1.9%	3.0%	4.0%	4.0%	3.7%	3.6%

2022

Controllable Wind By Region	Cap (MW)	Jan	Feb	Mar	Qtr1	Apr	May	Jun	Qtr2	Jul	Aug	Sep	Qtr3	Oct	Nov	Dec	Qtr4	2022
MID	612	11.4%	5.3%	5.4%	7.0%	4.2%	2.8%	1.9%	3.0%	0.9%	0.7%	2.5%	1.5%	8.2%	5.8%	7.1%	7.0%	5.5%
Constraints		1.9%	0.0%	2.1%	1.1%	1.2%	0.0%	1.1%	0.7%	0.1%	0.4%	0.4%	0.3%	0.0%	1.0%	0.1%	0.4%	0.6%
Curtailments		9.6%	5.2%	3.4%	5.9%	3.0%	2.8%	0.8%	2.3%	0.8%	0.3%	2.1%	1.2%	8.2%	4.8%	7.0%	6.7%	4.8%
NE	166	8.6%	4.5%	6.4%	6.3%	3.0%	3.4%	0.6%	2.4%	0.5%	0.2%	1.6%	0.8%	5.8%	3.1%	6.9%	5.1%	4.4%
Constraints		0.0%	0.4%	2.1%	0.7%	0.3%	1.1%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.2%	0.4%
Curtailments		8.6%	4.1%	4.3%	5.6%	2.7%	2.2%	0.6%	1.9%	0.5%	0.2%	1.6%	0.8%	5.3%	3.1%	6.9%	4.9%	4.0%
NW	385	9.8%	9.6%	7.1%	9.0%	6.7%	24.8%	18.4%	17.0%	3.0%	7.3%	13.6%	8.2%	31.4%	24.9%	8.2%	23.0%	14.9%
Constraints		1.4%	5.5%	2.6%	3.4%	4.0%	23.4%	18.0%	15.5%	2.6%	7.2%	11.3%	7.2%	26.8%	22.0%	0.2%	18.2%	11.2%
Curtailments		8.4%	4.2%	4.4%	5.6%	2.7%	1.4%	0.4%	1.5%	0.4%	0.1%	2.3%	1.0%	4.6%	2.9%	8.0%	4.8%	3.7%
SE	320	8.9%	6.1%	3.1%	6.0%	2.9%	2.5%	1.0%	2.2%	0.5%	0.3%	2.1%	1.1%	6.3%	5.1%	7.0%	6.1%	4.5%
Constraints		0.2%	0.2%	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.1%	0.1%
Curtailments		8.8%	5.9%	3.1%	5.9%	2.8%	2.5%	1.0%	2.1%	0.5%	0.3%	2.1%	1.1%	6.3%	5.0%	7.0%	6.0%	4.4%
SW	1,502	9.3%	10.6%	10.5%	10.2%	6.5%	5.7%	9.2%	7.1%	3.4%	1.4%	6.9%	4.3%	9.6%	7.0%	6.8%	7.8%	7.9%
Constraints		0.8%	6.7%	8.3%	5.5%	3.9%	3.9%	8.7%	5.4%	2.9%	1.1%	4.5%	3.1%	2.9%	3.4%	0.6%	2.5%	4.1%
Curtailments		8.6%	4.0%	2.1%	4.7%	2.6%	1.8%	0.6%	1.7%	0.5%	0.3%	2.4%	1.2%	6.7%	3.6%	6.1%	5.4%	3.8%
W	1,106	10.6%	9.2%	8.1%	9.4%	7.4%	20.3%	19.4%	16.0%	6.4%	8.4%	13.6%	9.7%	18.8%	15.9%	11.1%	15.5%	12.9%
Constraints		4.3%	6.1%	4.9%	5.2%	5.0%	19.4%	19.0%	14.8%	6.2%	8.2%	12.7%	9.2%	13.5%	12.8%	6.1%	11.2%	9.9%
Curtailments		6.2%	3.1%	3.2%	4.1%	2.4%	1.0%	0.4%	1.2%	0.3%	0.2%	1.0%	0.5%	5.2%	3.1%	5.0%	4.4%	3.0%
Controllable Wind Totals:																		
AI	5,196	9.8%	8.8%	7.7%	8.8%	6.2%	10.2%	11.7%	9.3%	5.3%	5.1%	7.9%	6.2%	13.2%	10.4%	8.5%	10.9%	9.2%
Constraints		1.8%	4.4%	4.8%	3.7%	3.6%	8.4%	11.0%	7.6%	5.0%	4.9%	6.1%	5.4%	7.0%	6.9%	2.3%	5.6%	5.4%
Curtailments		8.0%	4.4%	3.0%	5.1%	2.5%	1.8%	0.6%	1.7%	0.4%	0.2%	1.8%	0.9%	6.3%	3.6%	6.2%	5.3%	3.8%
IE	4,091	9.9%	8.9%	8.2%	9.0%	6.0%	11.1%	11.1%	9.4%	3.4%	3.9%	7.8%	5.3%	12.9%	10.1%	8.0%	10.5%	9.1%
Constraints		1.9%	4.8%	5.3%	4.1%	3.4%	9.4%	10.6%	7.7%	3.0%	3.7%	5.8%	4.3%	6.6%	6.4%	1.8%	5.2%	5.3%
Curtailments		8.0%	4.1%	2.9%	4.9%	2.6%	1.7%	0.6%	1.7%	0.5%	0.2%	1.9%	1.0%	6.3%	3.7%	6.2%	5.3%	3.8%
NI	1,105	9.5%	8.6%	6.2%	8.2%	6.7%	6.9%	13.6%	8.9%	11.8%	9.2%	8.4%	9.8%	14.4%	11.7%	10.4%	12.3%	9.9%
Constraints		1.4%	3.2%	3.0%	2.6%	4.6%	4.8%	12.7%	7.2%	11.8%	9.2%	7.2%	9.3%	8.1%	8.7%	4.3%	7.3%	6.1%
Curtailments		8.1%	5.4%	3.3%	5.6%	2.1%	2.2%	0.9%	1.7%	0.1%	0.1%	1.2%	0.5%	6.3%	3.0%	6.1%	5.0%	3.8%
All Wind (Controllable + Non-Controllable) Totals:																		
AI		8.9%	8.1%	7.1%	8.1%	5.7%	9.4%	10.7%	8.6%	5.0%	4.6%	7.2%	5.8%	12.2%	9.7%	7.9%	10.1%	8.5%
Constraints		1.6%	4.1%	4.4%	3.4%	3.4%	7.7%	10.2%	7.0%	4.6%	4.5%	5.6%	4.9%	6.4%	6.4%	2.1%	5.2%	5.0%
Curtailments		7.3%	4.0%	2.7%	4.7%	2.3%	1.7%	0.6%	1.6%	0.4%	0.2%	1.7%	0.8%	5.8%	3.3%	5.8%	4.9%	3.5%
IE		9.1%	8.1%	7.4%	8.2%	5.5%	10.2%	10.1%	8.6%	3.2%	3.5%	7.0%	4.8%	11.8%	9.3%	7.5%	9.7%	8.3%
Constraints		1.7%	4.4%	4.8%	3.7%	3.1%	8.6%	9.6%	7.1%	2.7%	3.3%	5.3%	3.9%	6.1%	5.9%	1.7%	4.8%	4.8%
Curtailments		7.3%	3.8%	2.6%	4.5%	2.4%	1.6%	0.5%	1.5%	0.4%	0.2%	1.8%	0.9%	5.7%	3.4%	5.8%	4.9%	3.5%
NI		8.6%	8.0%	6.0%	7.7%	6.5%	6.7%	13.1%	8.6%	11.4%	8.9%	8.1%	9.4%	13.8%	11.3%	10.0%	11.9%	9.4%
Constraints		1.2%	2.9%	2.9%	2.4%	4.4%	4.6%	12.2%	6.9%	11.3%	8.8%	6.9%	8.9%	7.8%	8.4%	4.1%	7.1%	5.8%
Curtailments		7.4%	5.1%	3.2%	5.3%	2.1%	2.1%	0.9%	1.7%	0.1%	0.1%	1.2%	0.5%	6.0%	2.9%	5.9%	4.8%	3.6%

2023

Controllable Wind By Region	Cap (MW)	Jan	Feb	Mar	Qtr1	Apr	May	Jun	Qtr2	Jul	Aug	Sep	Qtr3	Oct	Nov	Dec	Qtr4	2023
MID	612	8.1%	3.3%	5.4%	5.8%	4.4%	1.3%	1.5%	2.8%	11.8%	5.3%	10.8%	9.4%	7.5%	6.0%	14.7%	10.4%	7.5%
Constraints		0.5%	0.3%	1.5%	0.8%	1.1%	0.7%	1.0%	1.0%	5.9%	2.1%	2.8%	3.7%	2.3%	1.1%	1.3%	1.5%	1.7%
Curtailments		7.6%	3.1%	3.9%	5.0%	3.2%	0.6%	0.5%	1.8%	5.9%	3.1%	8.0%	5.7%	5.2%	4.9%	13.4%	8.9%	5.8%
NE	166	6.5%	2.1%	4.1%	4.4%	3.7%	0.8%	0.5%	2.1%	10.0%	11.6%	5.6%	9.2%	4.0%	5.1%	15.0%	9.4%	6.6%
Constraints		0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.1%	2.3%	8.7%	0.6%	3.9%	0.7%	0.8%	0.6%	0.6%	1.0%
Curtailments		6.5%	2.1%	4.1%	4.4%	3.7%	0.6%	0.5%	2.0%	7.8%	2.9%	5.1%	5.3%	3.4%	4.3%	14.4%	8.8%	5.6%
NW	385	15.1%	5.3%	12.3%	10.8%	8.5%	3.2%	8.8%	7.2%	21.8%	17.9%	25.5%	21.6%	16.7%	28.6%	28.0%	24.9%	17.1%
Constraints		8.3%	3.6%	7.9%	6.5%	5.8%	2.5%	8.4%	5.6%	16.0%	16.4%	19.3%	17.2%	13.9%	22.1%	12.2%	15.2%	11.4%
Curtailments		6.9%	1.7%	4.4%	4.4%	2.6%	0.7%	0.4%	1.6%	5.7%	1.5%	6.2%	4.4%	2.8%	6.5%	15.8%	9.7%	5.6%
SE	320	7.1%	3.5%	2.5%	4.5%	3.3%	0.4%	0.6%	1.7%	5.7%	2.9%	9.5%	6.1%	4.2%	4.8%	15.0%	9.3%	5.9%
Constraints		0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.3%	0.0%	3.4%	1.2%	0.0%	0.0%	0.0%	0.0%	0.3%
Curtailments		7.0%	3.5%	2.5%	4.5%	3.3%	0.4%	0.4%	1.7%	5.4%	2.9%	6.1%	4.9%	4.2%	4.8%	15.0%	9.3%	5.6%
SW	1,502	9.6%	3.3%	3.9%	5.7%	4.5%	2.7%	2.4%	3.5%	11.4%	5.8%	9.5%	9.0%	8.0%	9.0%	13.2%	10.7%	7.6%
Constraints		1.1%	0.5%	0.9%	0.8%	0.8%	2.3%	1.9%	1.5%	6.3%	3.3%	2.9%	4.2%	3.3%	5.2%	0.1%	2.5%	2.3%
Curtailments		8.5%	2.9%	3.0%	4.9%	3.7%	0.4%	0.5%	1.9%	5.1%	2.5%	6.6%	4.7%	4.7%	3.8%	13.1%	8.2%	5.4%
W	1,106	14.4%	9.2%	11.7%	11.8%	10.9%	5.5%	6.3%	8.2%	14.4%	11.4%	14.1%	13.3%	12.2%	14.3%	19.2%	16.0%	12.9%
Constraints		8.9%	8.0%	9.0%	8.6%	8.7%	5.1%	5.5%	6.8%	10.5%	9.5%	10.1%	10.0%	9.2%	10.4%	7.7%	8.9%	8.7%
Curtailments		5.5%	1.2%	2.8%	3.2%	2.2%	0.5%	0.9%	1.4%	3.9%	2.0%	4.0%	3.3%	3.0%	3.9%	11.5%	7.1%	4.2%
Controllable Wind Totals:																		
AI	5,196	11.6%	6.0%	7.4%	8.5%	7.9%	3.6%	3.9%	5.7%	15.5%	10.7%	14.9%	13.7%	14.4%	12.6%	19.0%	16.0%	11.6%
Constraints		4.7%	3.9%	4.1%	4.2%	4.5%	3.1%	3.3%	3.8%	10.2%	8.4%	9.6%	9.4%	11.0%	8.3%	6.3%	8.0%	6.5%
Curtailments		7.0%	2.2%	3.3%	4.3%	3.4%	0.4%	0.6%	1.9%	5.3%	2.4%	5.3%	4.3%	3.4%	4.3%	12.7%	7.9%	5.0%
IE	4,091	10.8%	5.3%	6.6%	7.7%	6.5%	3.1%	3.6%	4.8%	12.5%	8.4%	12.1%	11.0%	9.7%	10.8%	16.6%	13.2%	9.7%
Constraints		3.7%	3.0%	3.5%	3.4%	3.4%	2.7%	3.0%	3.1%	7.4%	6.0%	6.2%	6.6%	5.8%	6.5%	3.5%	5.0%	4.6%
Curtailments		7.1%	2.3%	3.1%	4.3%	3.1%	0.5%	0.6%	1.7%	5.1%	2.4%	5.9%	4.5%	3.9%	4.3%	13.1%	8.2%	5.1%
NI	1,105	14.6%	8.6%	11.6%	11.8%	13.6%	5.7%	5.3%	9.5%	29.2%	20.2%	26.5%	25.1%	28.7%	21.4%	29.0%	27.0%	19.3%
Constraints		8.2%	6.8%	7.2%	7.4%	9.0%	5.4%	4.9%	7.0%	22.7%	18.0%	23.8%	21.5%	26.8%	16.7%	18.0%	20.3%	14.6%
Curtailments		6.4%	1.9%	4.4%	4.3%	4.6%	0.3%	0.5%	2.5%	6.4%	2.2%	2.7%	3.7%	1.9%	4.7%	11.0%	6.7%	4.7%
All Wind (Controllable + Non-Controllable) Totals:																		
AI		10.8%	5.6%	6.9%	7.9%	7.3%	3.3%	3.6%	5.3%	14.4%	9.9%	13.8%	12.7%	13.2%	11.7%	17.6%	14.8%	10.7%
Constraints		4.3%	3.6%	3.8%	3.9%	4.2%	2.9%	3.1%	3.5%	9.4%	7.8%	8.9%	8.7%	10.1%	7.7%	5.9%	7.4%	6.1%
Curtailments		6.5%	2.0%	3.1%	4.0%	3.1%	0.4%	0.5%	1.7%	4.9%	2.2%	4.9%	4.0%	3.1%	4.0%	11.7%	7.3%	4.7%
IE		9.9%	4.9%	6.1%	7.1%	6.0%	2.9%	3.3%	4.4%	11.5%	7.7%	11.1%	10.1%	8.9%	10.0%	15.2%	12.1%	8.9%
Constraints		3.4%	2.8%	3.2%	3.1%	3.1%	2.4%	2.8%	2.9%	6.8%	5.5%	5.7%	6.0%	5.3%	6.0%	3.2%	4.6%	4.2%
Curtailments		6.6%	2.1%	2.9%	4.0%	2.8%	0.4%	0.5%	1.6%	4.7%	2.2%	5.4%	4.1%	3.6%	3.9%	12.0%	7.5%	4.7%
NI		14.1%	8.3%	11.1%	11.3%	13.1%	5.5%	5.2%	9.2%	28.2%	19.5%	25.4%	24.3%	27.4%	20.7%	28.0%	26.0%	18.6%
Constraints		7.9%	6.5%	6.9%	7.2%	8.6%	5.2%	4.7%	6.8%	22.0%	17.4%	22.8%	20.7%	25.6%	16.2%	17.3%	19.5%	14.1%
Curtailments		6.2%	1.8%	4.2%	4.1%	4.5%	0.3%	0.5%	2.4%	6.2%	2.1%	2.6%	3.6%	1.8%	4.5%	10.6%	6.5%	4.5%

Table 4: Historical breakdown of wind dispatch down percentages by region and jurisdiction

			2023																
			Jan	Feb	Mar	Qtr1	Apr	May	Jun	Qtr2	Jul	Aug	Sep	Qtr3	Oct	Nov	Dec	Qtr4	2023
Wind	AI	Dispatch Down	10.8%	5.6%	6.9%	7.9%	7.3%	3.3%	3.6%	5.3%	14.4%	9.9%	13.8%	12.7%	13.2%	11.7%	17.6%	14.8%	10.7%
		Constraints	4.3%	3.6%	3.8%	3.9%	4.2%	2.9%	3.1%	3.5%	9.4%	7.8%	8.9%	8.7%	10.1%	7.7%	5.9%	7.4%	6.1%
		Curtailments	6.5%	2.0%	3.1%	4.0%	3.1%	0.4%	0.5%	1.7%	4.9%	2.2%	4.9%	4.0%	3.1%	4.0%	11.7%	7.3%	4.7%
	IE	Dispatch Down	9.9%	4.9%	6.1%	7.1%	6.0%	2.9%	3.3%	4.4%	11.5%	7.7%	11.1%	10.1%	8.9%	10.0%	15.2%	12.1%	8.9%
		Constraints	3.4%	2.8%	3.2%	3.1%	3.1%	2.4%	2.8%	2.9%	6.8%	5.5%	5.7%	6.0%	5.3%	6.0%	3.2%	4.6%	4.2%
		Curtailments	6.6%	2.1%	2.9%	4.0%	2.8%	0.4%	0.5%	1.6%	4.7%	2.2%	5.4%	4.1%	3.6%	3.9%	12.0%	7.5%	4.7%
	NI	Dispatch Down	14.1%	8.3%	11.1%	11.3%	13.1%	5.5%	5.2%	9.2%	28.2%	19.5%	25.4%	24.3%	27.4%	20.7%	28.0%	26.0%	18.6%
		Constraints	7.9%	6.5%	6.9%	7.2%	8.6%	5.2%	4.7%	6.8%	22.0%	17.4%	22.8%	20.7%	25.6%	16.2%	17.3%	19.5%	14.1%
		Curtailments	6.2%	1.8%	4.2%	4.1%	4.5%	0.3%	0.5%	2.4%	6.2%	2.1%	2.6%	3.6%	1.8%	4.5%	10.6%	6.5%	4.5%
Solar	AI	Dispatch Down	12.5%	5.7%	7.2%	7.7%	2.9%	3.9%	10.6%	6.5%	11.3%	11.4%	14.7%	12.3%	8.9%	2.8%	14.0%	7.8%	9.1%
		Constraints	7.7%	5.2%	5.0%	5.5%	2.5%	3.9%	10.5%	6.4%	7.4%	9.2%	11.3%	9.1%	5.5%	0.8%	1.0%	3.2%	7.0%
		Curtailments	4.7%	0.5%	2.2%	2.1%	0.4%	0.0%	0.1%	0.1%	3.9%	2.3%	3.4%	3.2%	3.4%	2.0%	13.0%	4.5%	2.1%
	IE	Dispatch Down					0.1%	4.6%	13.3%	7.5%	10.5%	11.7%	14.9%	12.1%	8.5%	2.4%	13.4%	7.4%	9.5%
		Constraints					0.0%	4.6%	13.2%	7.4%	6.5%	9.3%	10.9%	8.7%	4.6%	0.1%	0.0%	2.4%	7.2%
		Curtailments					0.1%	0.0%	0.1%	0.1%	4.0%	2.3%	4.0%	3.4%	3.8%	2.3%	13.4%	5.0%	2.3%
	NI	Dispatch Down	12.5%	5.7%	7.2%	7.7%	9.3%	1.8%	1.4%	3.5%	14.5%	10.5%	13.7%	12.9%	10.8%	4.6%	18.2%	9.8%	7.9%
		Constraints	7.7%	5.2%	5.0%	5.5%	8.2%	1.7%	1.3%	3.2%	11.0%	8.4%	12.9%	10.6%	9.4%	4.3%	7.9%	7.5%	6.4%
		Curtailments	4.7%	0.5%	2.2%	2.1%	1.1%	0.1%	0.1%	0.3%	3.4%	2.1%	0.8%	2.2%	1.4%	0.3%	10.3%	2.2%	1.4%

Table 5: Wind and solar monthly dispatch down percentages and breakdowns in 2023

	All Island						Ireland						Northern Ireland					
Year	Wind	Solar	Renewable Waste	Hydro	Other RES	Total RES	Wind	Solar	Renewable Waste	Hydro	Other RES	Total RES	Wind	Solar	Renewable Waste	Hydro	Other RES	Total RES
2016	2.9%	0.0%	0.0%	0.0%	0.0%	2.3%	2.8%	0.0%	0.0%	0.0%	0.0%	2.2%	3.2%	0.0%	0.0%	0.0%	0.0%	2.7%
2017	4.0%	0.0%	0.0%	0.0%	0.0%	3.3%	3.7%	0.0%	0.0%	0.0%	0.0%	3.0%	5.0%	0.0%	0.0%	0.0%	0.0%	4.3%
2018	6.0%	0.0%	10.0%	0.0%	0.0%	5.1%	5.0%	0.0%	10.0%	0.0%	0.0%	4.2%	9.4%	0.0%	0.0%	0.0%	0.0%	8.0%
2019	7.7%	4.2%	8.2%	0.0%	0.0%	6.5%	6.9%	0.0%	8.2%	0.0%	0.0%	5.8%	10.7%	4.2%	0.0%	0.0%	0.0%	9.3%
2020	12.1%	6.3%	10.2%	0.0%	0.0%	10.6%	11.4%	0.0%	10.2%	0.0%	0.0%	10.0%	14.8%	6.3%	0.0%	0.0%	0.0%	12.9%
2021	7.4%	2.9%	4.9%	0.0%	0.0%	6.5%	7.3%	0.0%	4.9%	0.0%	0.0%	6.4%	7.8%	2.9%	0.0%	0.0%	0.0%	6.6%
2022	8.5%	4.6%	5.5%	0.0%	0.0%	7.6%	8.3%	0.0%	5.5%	0.0%	0.0%	7.4%	9.4%	4.6%	0.0%	0.0%	0.0%	8.4%
2023	10.7%	9.1%	3.7%	0.0%	0.0%	9.5%	8.9%	9.5%	3.7%	0.0%	0.0%	8.0%	18.6%	7.9%	0.0%	0.0%	0.0%	16.0%

Table 6: All renewable sources dispatch down in from 2016 to 2023

Notes:

RES: Renewable Energy Sources.

Other RES category consists of generation from Biomass, Biogas and Landfill Gas.

A more detailed version of the above table is available online in spreadsheet format including monthly DD volumes and percentages for all renewable types.

7 Appendix B - Wind and Solar Dispatch Down by Hour of Day

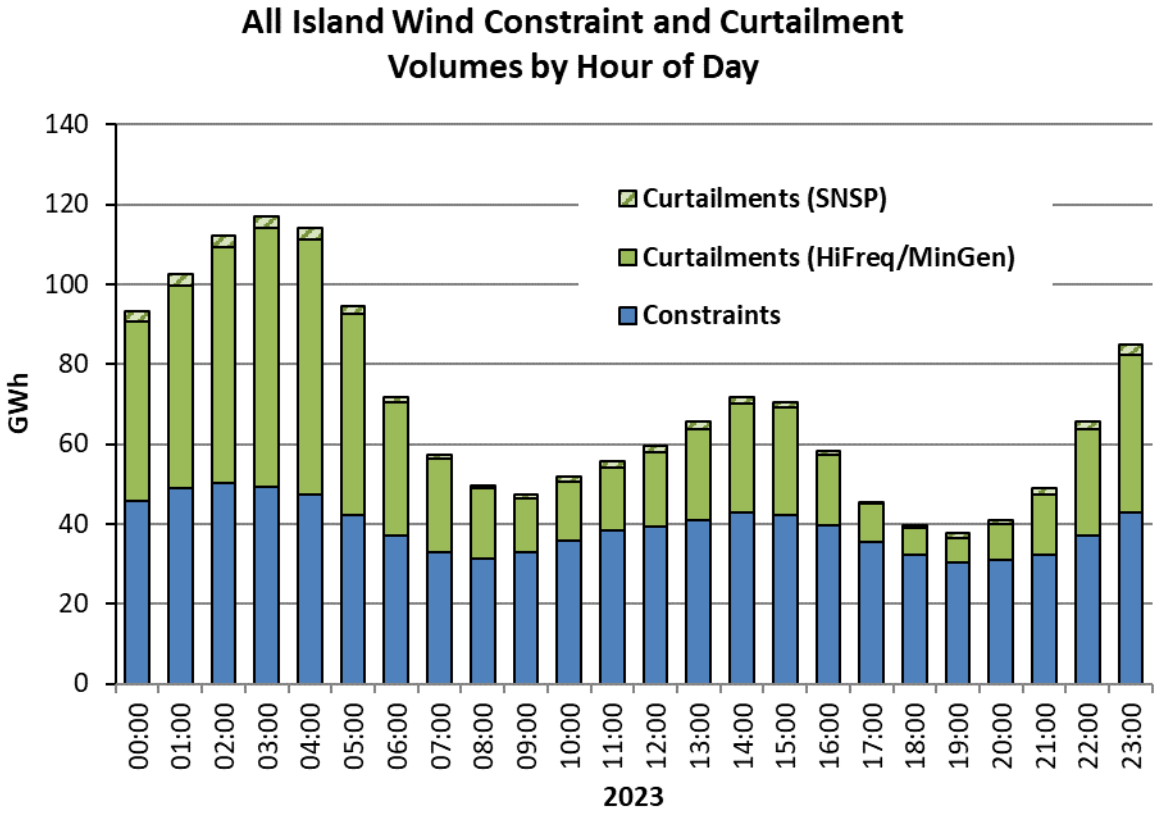


Figure 19: All-Island breakdown of wind constraints and curtailments in 2023 by hour of day

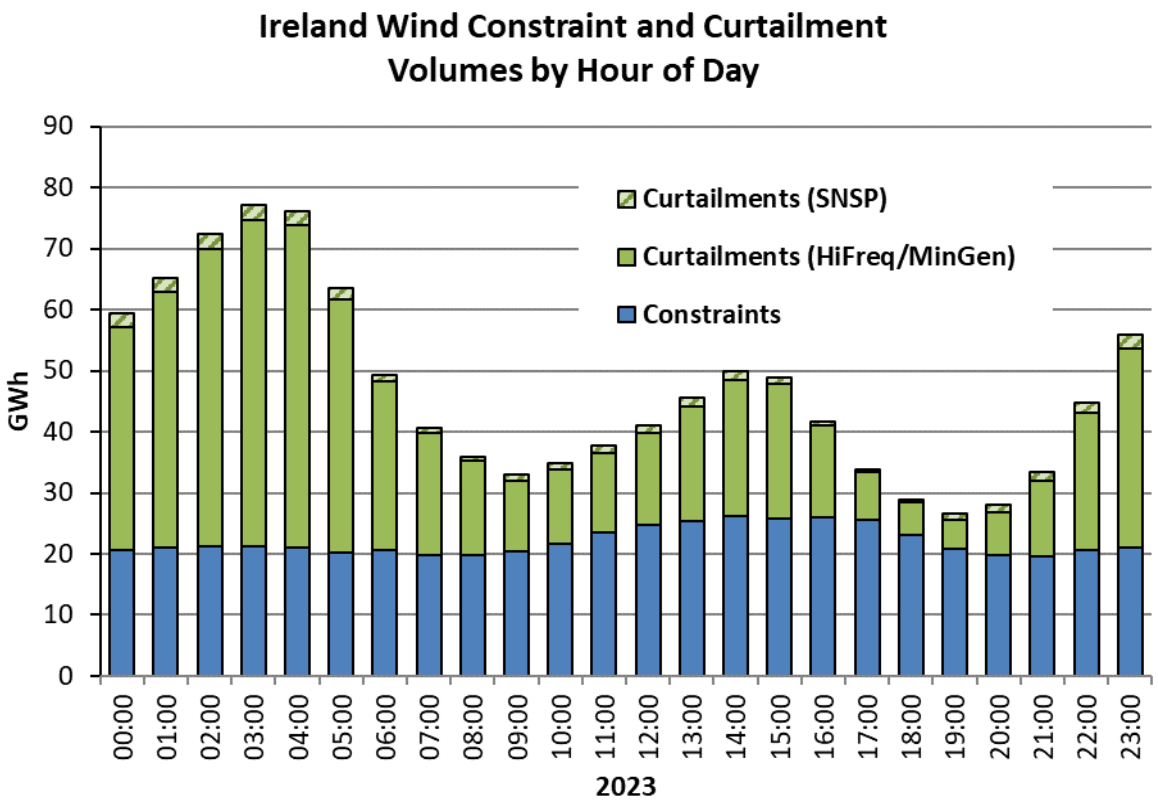


Figure 20: Breakdown of wind constraints and curtailments In Ireland in 2023 by hour of day

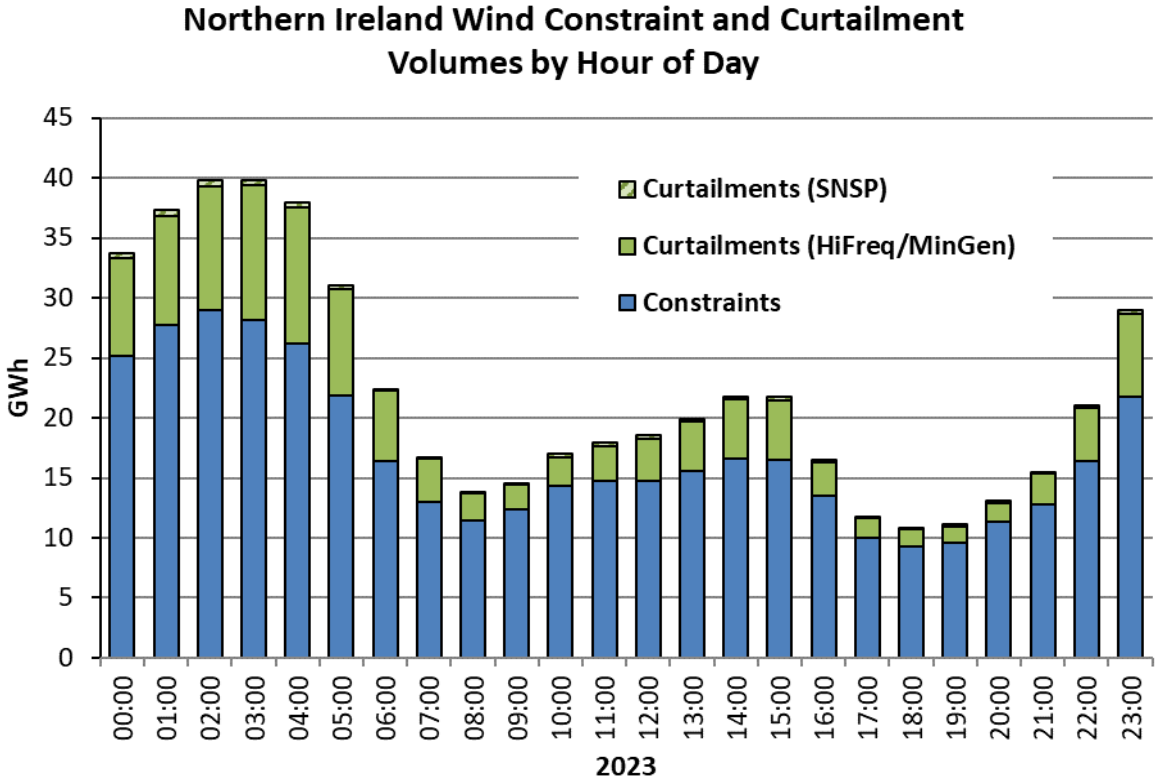


Figure 21: Breakdown of wind constraints and curtailments in NI in 2023 by hour of day

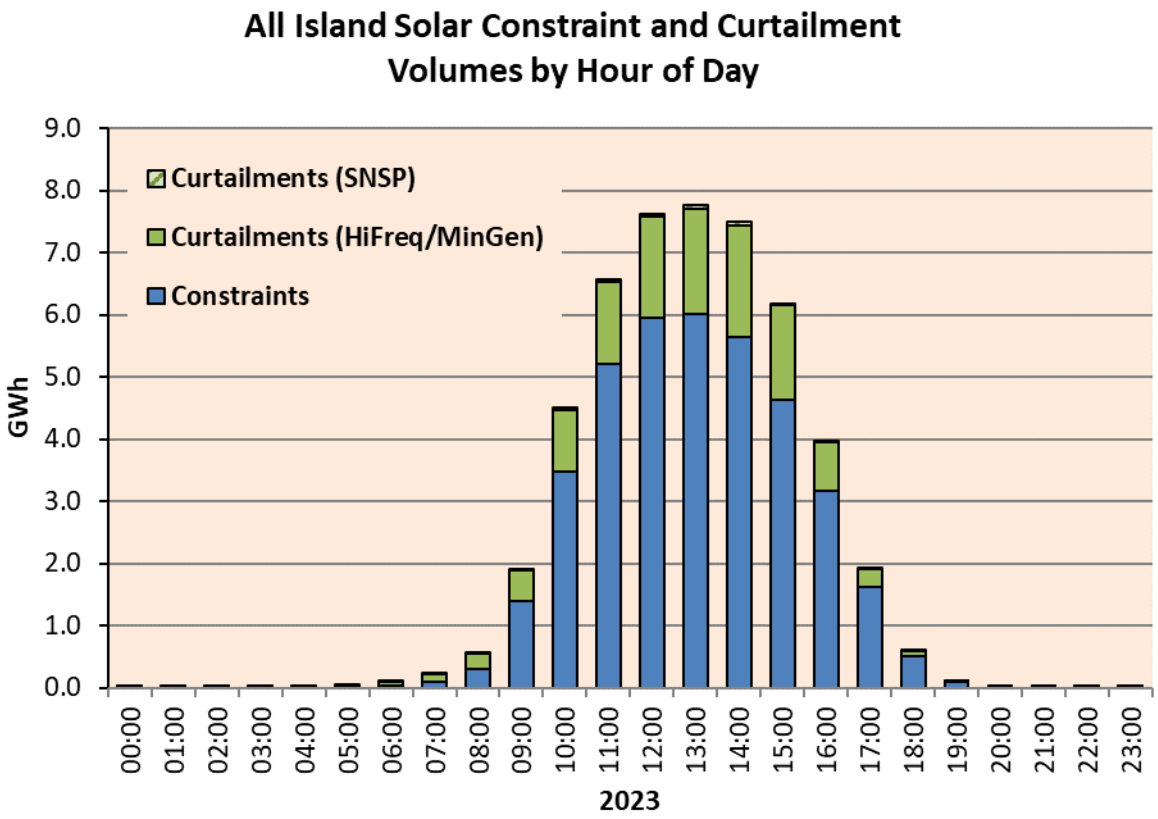


Figure 22: All-Island breakdown of solar constraints and curtailments in 2023 by hour of day

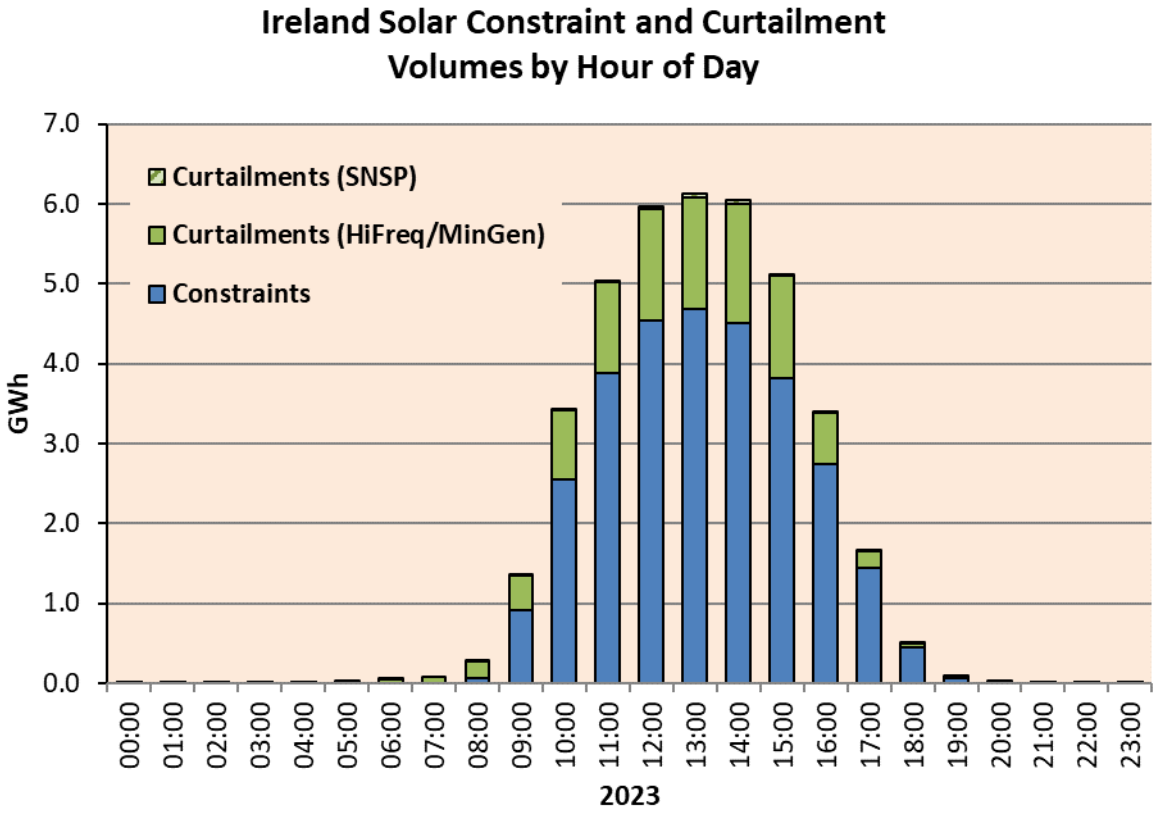


Figure 23: Breakdown of solar constraints and curtailments In Ireland in 2023 by hour of day

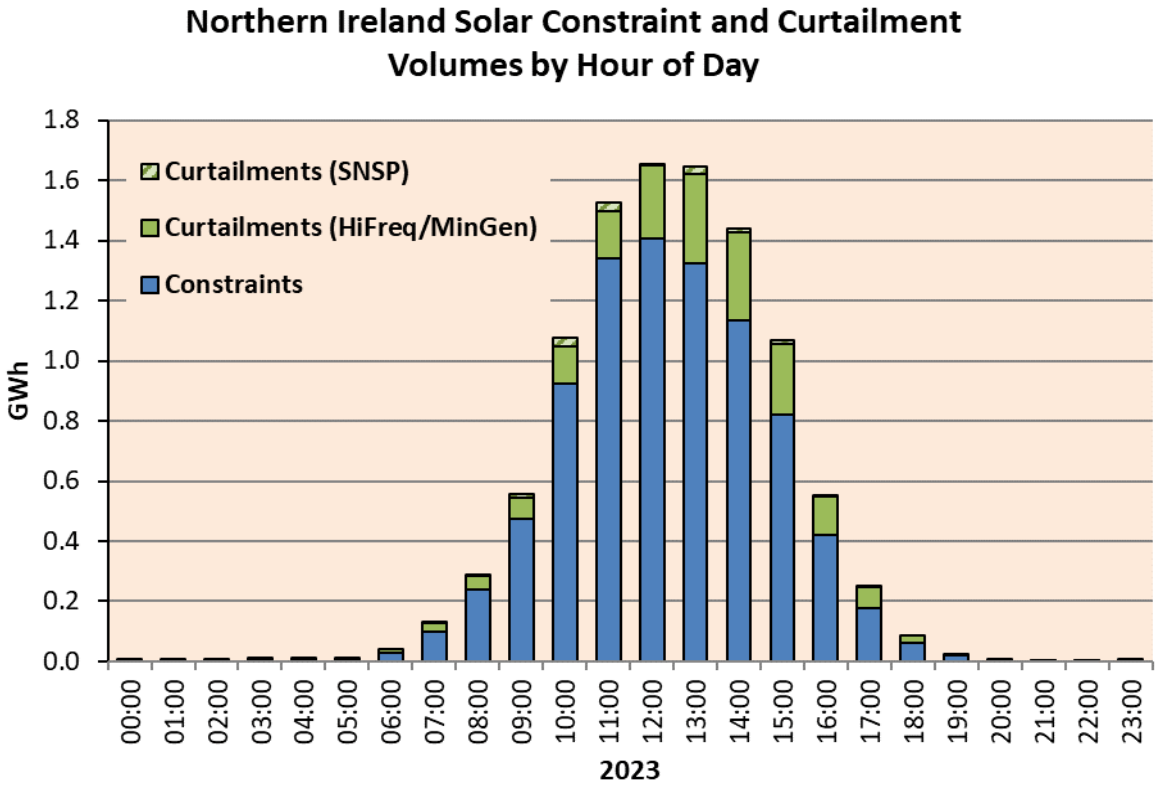


Figure 24: Breakdown of solar constraints and curtailments in NI in 2023 by hour of day

Appendix C – Abbreviations

CHP	Combined Heat and Power
CRU	Commission for Regulation of Utilities
DfE	Department for Economy, Northern Ireland
DNO	Distribution Network Operator
DSO	Distribution System Operator
EWIC	East West Interconnector
GW	Gigawatt
GWh	Gigawatt-hour
HVDC	High Voltage Direct Current
IT	Information Technology
kV	Kilovolt
MID	Midlands (region)
MW	Megawatt
MWh	Megawatt-hour
NI	Northern Ireland
NW	North West
RES-E	Renewable Energy Sources (Electricity)
RoCoF	Rate of Change of Frequency
S.I.	Statutory Instrument
SCADA	Supervisory Control and Data Acquisition
SEF	Strategic Energy Framework
SEM	Single Electricity Market
SNSP	System Non-Synchronous Penetration
SO	System Operator
SOEF	Shaping Our Electricity Future
SONI	System Operator Northern Ireland
TCG	Transmission Constraint Group
TSO	Transmission System Operator
UR	Utility Regulator Northern Ireland