2012 Curtailment Report

Contents

Executive Summary

Due to European and Member State legislation, it is necessary for the Transmission System Operators to report on material "curtailment" or dispatch-down of renewable sources of energy. This report provides figures for the Ireland and Northern Ireland power systems for 2012.

The total wind energy generated in Ireland and Northern Ireland was 5,143 GWh. There was an estimated total of 110 GWh of dispatch-down energy of windfarms, which represents 2.1% of the total available wind energy in 2012.

In Ireland, the dispatch-down energy from wind resources was 103 GWh: this is equivalent to 2.5% of the total available wind energy. The dispatch-down energy from variable price-taking generation (VPTG) was 81 GWh, and from autonomous generation was 22 GWh.

In Northern Ireland, the dispatch-down energy from VPTG was 7.2 GWh: this represents 0.7% of total available wind energy. There were no data available to calculate the dispatch-down energy from autonomous wind generation. However, steps are in place to ensure these data will be available for 2013 onwards.

The level of dispatch-down is affected by a number of factors which vary from year to year. The amount of wind installed on the system and the capacity factor of the wind generation will have an impact on the levels of dispatch-down. The total registered capacity of wind generation rose by just over 100 MW in 2012 while the average capacity factor was 28.5%. In 2011 the average capacity factor was 31%. The level of demand is another important factor which can vary from year to year. In Ireland average demand in 2012 was 1.4% lower than in 2011 and in Northern Ireland it was 1.3% lower than in 2011. The testing and commissioning of new units can lead to increased levels of curtailment as new units are afforded priority during this commissioning process. From August 2012, the East-West Interconnector (EWIC) was subject to an extensive commissioning programme.

The fundamental issues which give rise to curtailment are being addressed by the DS3 programme. This programme has been specifically designed to securely and efficiently increase the level of System Non-Synchronous Penetration (SNSP) which can be accommodated on the system and also address other system wide limitations. This programme of work is based on the published Facilitation of Renewable studies.

Currently there are arrangements in place which allow system operator interconnector countertrading of up to 200 MW on each interconnector. One of the aims of interconnector countertrading is to reduce the curtailment of priority dispatch. A number of additional countertrading options are being considered by the TSOs.

The Grid25, RIDP and Network25 programmes have been developed in order to address the network limitations which give rise to constraint of wind. The reinforcement of the network will increase the capacity of wind generation which can be accommodated.

Overall, there was a reduction of about 9 GWh in dispatch-down energy reported in 2012 compared to 2011. However, as mentioned above this figure does not take account of the dispatch-down of autonomous wind generation in Northern Ireland.

1 Overview

1.1 Context

Under the 2009 European Renewables Directive (2009/28/EC) there is an onus on Member States to ensure that if significant measures are taken to curtail renewable energy sources in order to guarantee the security of the national electricity system and security of energy supply, the responsible System Operators report to the regulatory authorities on those measures and indicate which corrective measures they intend to take in order to prevent inappropriate curtailments. This Directive has recently been transposed 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 SEM Committee, in its scheduling and dispatch decision paper SEM-11-062, requires that the TSOs report on this as appropriate to CER and URegNI respectively. This report represents EirGrid and SONI's response to these obligations.

Renewable generation has priority dispatch. 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 have to be imposed, due to both local network and system-wide security issues. It is therefore necessary to reduce the output of renewable generators below their maximum available level on occasions 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.

1.2 Summary

In the calendar year 2012, the share of centrally dispatched generation[1] from renewable sources in Ireland and Northern Ireland was 16.5%, with 14.4% provided by wind and 2.1% by hydro. The total wind energy generated was 5,143 GWh in Ireland and Northern Ireland. There was an estimated total of 110 GWh of dispatch-down energy of windfarms, which is a reduction of approximately 9 GWh compared to 2011. The level of dispatch-down of wind represents just over 2.1% of total available energy from wind resources in Ireland and Northern Ireland. Details of the calculation methodology are provided in Appendix 1.

The level of dispatch-down of hydro resources which ultimately led to spilling of water is difficult to estimate but EirGrid's view is that it was not material in 2012. Work is ongoing on how to report on this more formally. There were no biomass plants on the system which could be dispatched down in 2012.

1.3 Ireland: Level of Dispatch-Down Energy from Wind Resources

In 2012 the total dispatch-down energy from wind generation in Ireland was 103 GWh; this is equivalent to 2.5% of total available wind energy. This is a total overall reduction of approximately 3 GWh in dispatch-down energy from wind generation compared to 2011.

This dispatch-down was spread across variable price taking wind generation (VPTG) and autonomous generation. The dispatch-down energy from VPTG was 81 GWh in Ireland. This represents 4.7% of the available energy from these generators in this period. In addition, there was an estimated 22 GWh of dispatch-down from other controllable wind generation.

[1] Note that since the percentage figures are presented for centrally dispatched generation (based on SCADA data), they do not account for non-dispatchable embedded renewable generation, which includes biomass, land-fill gas and small-scale hydro.

As can be seen from Figure 1, VPTGs constituted, on average in 2012, over 75% of the controllable wind in Ireland. This is one of the reasons that the dispatch-down energy from VPTGs was significantly greater than from autonomous wind.

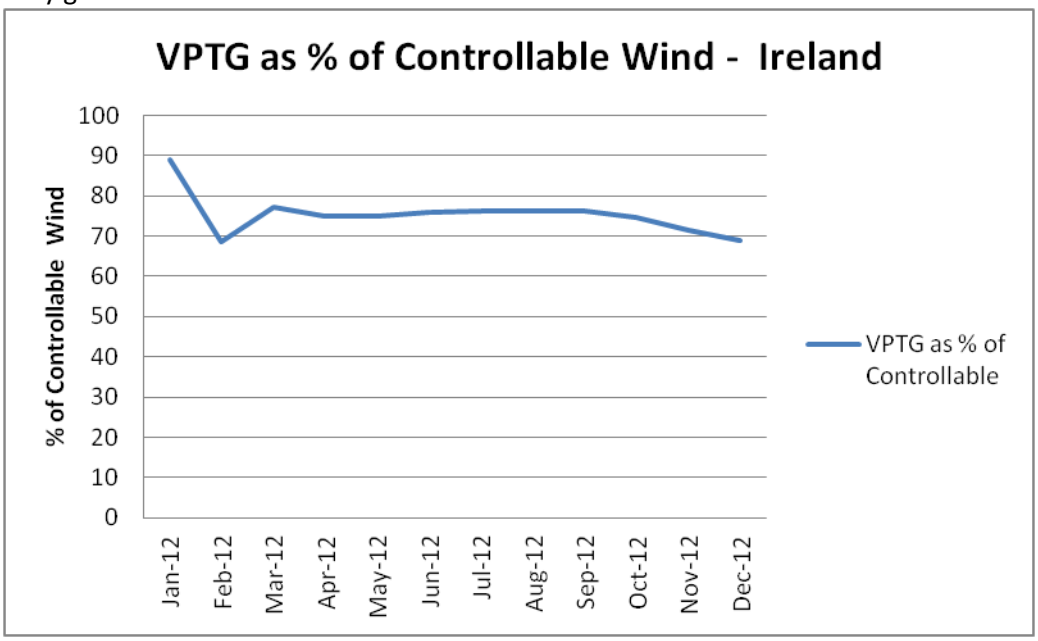

Figure 1 VPTG Wind as % of Total Controllable Wind in Ireland 2012

The dispatch-down of VPTGs occurred across 25 windfarms which had a total registered capacity of approximately 785 MW by the end of 2012. While it is difficult to assign dispatch-down to local network ("constraint") and system-wide ("curtailment") reasons distinctly and unequivocally, two major constraint areas are identifiable: the north-west and the south-west of Ireland. In addition, curtailment is seen to arise mainly during the night time hours (between 11pm and 9am).

1.4 Northern Ireland: Level of Dispatch-Down Energy from Wind Resources

In 2012 the dispatch-down energy from variable price taking wind generation (VPTG) was 7.17 GWh in Northern Ireland. This represents 2.2% of the available energy from these generators in this period. When all other wind generation, including autonomous and non-market generation is considered, this is equivalent to 0.7% of total available wind energy.

Figure 2 shows that VPTGs constituted, on average in 2012, approximately 46% of the controllable wind in Northern Ireland. This implies that in Northern Ireland autonomous wind generation represented, on average, just over half of the overall controllable wind in 2012. "Autonomous" market-classified windfarms represented a greater share of controllable windfarms in Northern Ireland than is the case in Ireland where it represented approximately 25% in 2012. Therefore it is reasonable to expect that in Northern Ireland the dispatch-down of energy was more evenly distributed between VPTGs and autonomous generation than in Ireland. However, it should be noted that dispatch-down of autonomous generation in Northern Ireland was not recorded in 2012. Steps are in place to provide this information in future reports.

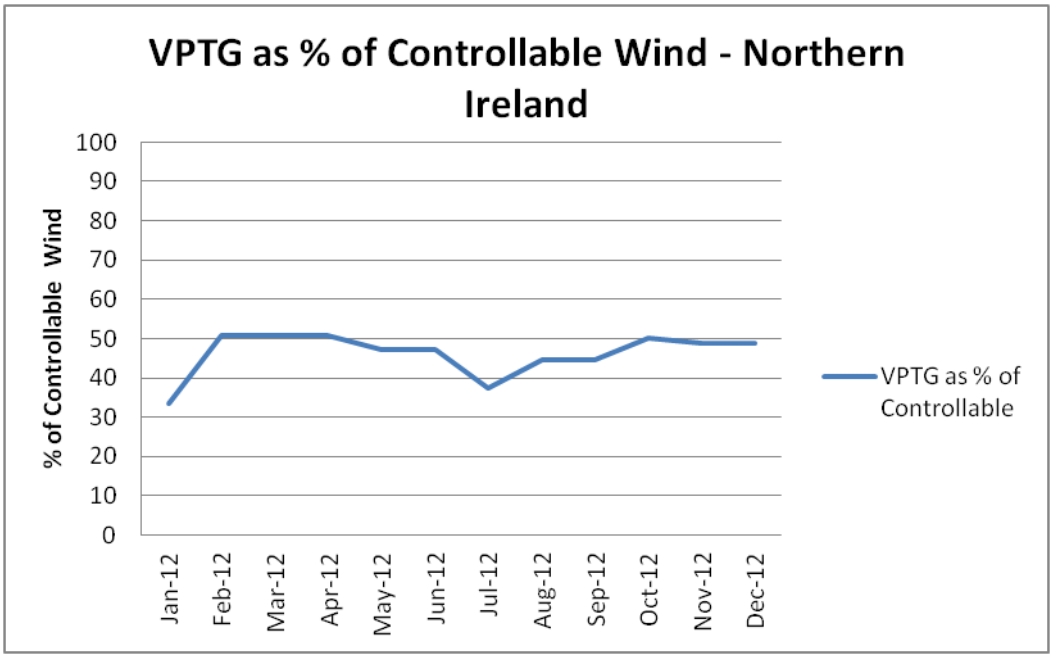

Figure 2 VPTG Wind as % of Total Controllable Wind in Northern Ireland 2012

This dispatched down energy occurred across seven windfarms which had a total registered capacity of approximately 170 MW by the end of 2012.

2 Contributory Factors for Dispatch-Down of Renewables

2.1 Changes to Operational Dispatch Policy

Prior to the SEM-11-062 decision paper, the operational policy in use was to dispatch-down variable price-taking generation before autonomous units. This policy was developed in 2008 to provide clarity on operational practice and reflect the more onerous commercial implications of dispatch-down that existed for autonomous units. Since the introduction of SEM-11-062, there is a requirement to dispatch wind generators down based on their controllability, as defined under Grid Code and as verified through performance monitoring and testing. The implementation of this is described in an operational policy document entitled "Policy for Implementing Scheduling and Dispatch Decisions SEM-11-062" and the associated addendum.

As a result of this SEM-11-062 decision paper, this report accounts for the dispatch-down of both variable price taking wind generation (VPTG) and autonomous wind generation. In the SEM, VPTG units have availability values that are distinct from dispatch quantities and actual output; this allows the dispatch-down of these units to be calculated. In contrast autonomous units have their dispatch, and availability quantities set to the metered outputs. There is no mechanism from SEM data to calculate the dispatch-down of windfarms. Some estimation for Ireland generators has been provided in this report and this broad area is being examined.

Since there is no appropriate SEM data to calculate dispatch-down of autonomous generation, this had to be estimated manually using aggregate SCADA data (which is less accurate than the data for VPTGs). It was estimated that the dispatch-down energy from autonomous windfarms in Ireland was approximately 22 GWh for 2012.

Due to differences in the IT systems which are used for dispatching wind, it is not possible to estimate the dispatch-down energy from autonomous wind in Northern Ireland. However, as can be seen from Figure 2, more than half of the controllable wind in Northern Ireland is autonomous and

therefore the dispatch-down energy from wind in Northern Ireland is likely to be under-estimated in this report.

2.2 Level of Wind

As explained above, it is necessary, at times, 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, *ceteris paribus*, on two factors: the amount of wind generation installed, and the capacity factor of the wind generation.

In January 2012 the total registered capacity[2] of wind generation was 2,013 MW. By the end of the year the figure had risen to 2,114 MW, split 1,663 MW in Ireland and 451 MW in Northern Ireland. Of the total, almost 960 MW was registered in the SEM as Variable Price Taker Generators (VPTG).

Over the year the capacity factor[3] of windfarms was 28.5%. The seasonal variation in the capacity factor is evident (Figure 3). The capacity factor for the six months between April and September was 23.8% while for the remaining six months (January to March and October to December) it was 33.1%. For comparison the annual capacity factor in 2011 was 31%.

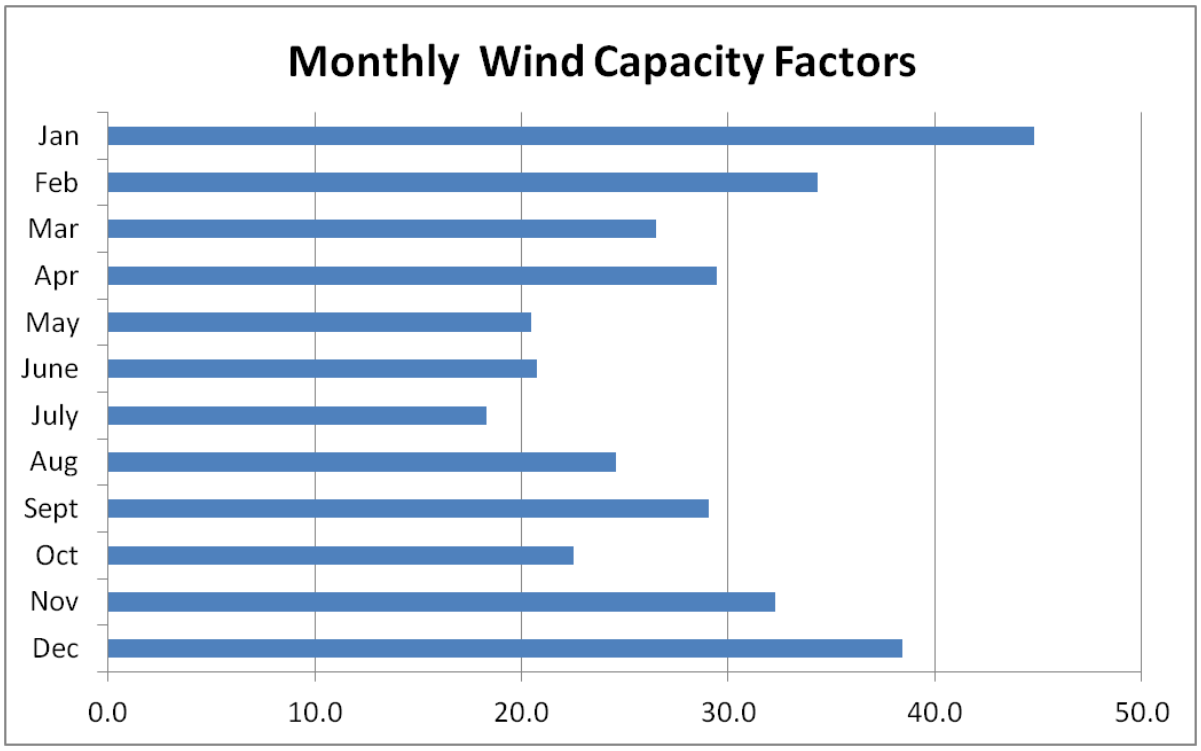

Figure 3 Ireland and Northern monthly capacity factors of wind 2012

[2] Registered Capacity is the maximum capacity, expressed in whole MW, that a generation unit can deliver on a sustained basis.

[3] 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. It therefore represents the average output of the wind generation. This capacity factor is based on SCADA data.

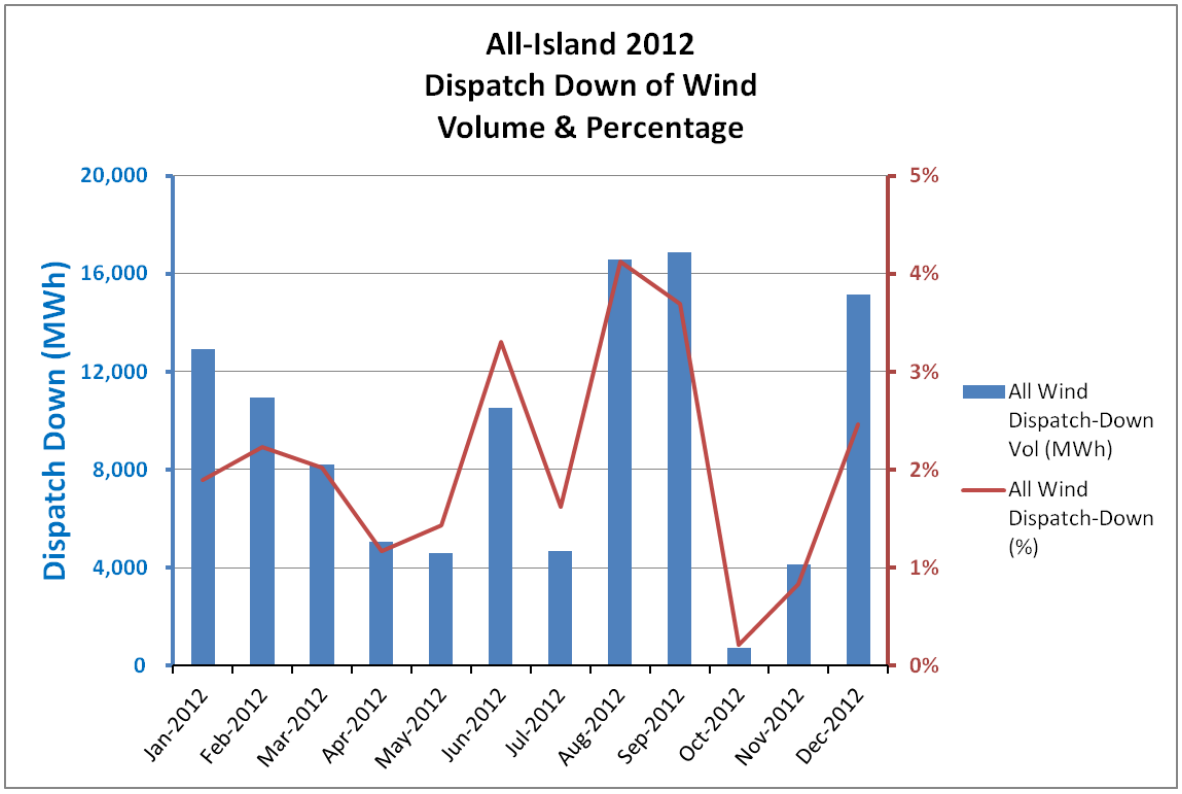

Figure 4 Ireland and Northern Ireland monthly dispatch-down of wind 2012

2.3 Level of Demand

The level of demand is another important factor which affects the dispatch-down of wind. Increased demand generally enables greater levels of wind to be accommodated on the system. As a result of the seasonal variation in demand, which is evident in Figure 5 and Figure 6, less wind can be accommodated in the summer months than in the winter months. In Ireland, the monthly demand in 2012 was on average over 40 MW (approximately 1.4%) less than in 2011 (Figure 5), while in Northern Ireland it was on average over 10 MW (approximately 1.3%) less than in 2011 (Figure 6). All else being equal, the reduced demand in 2012 would be expected to give rise to higher levels of dispatch-down than in 2011.

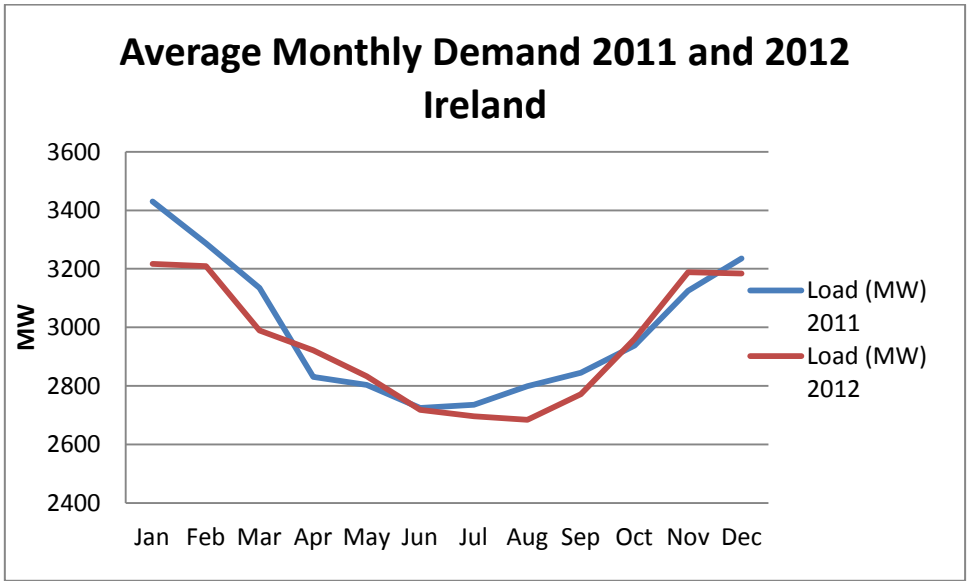

Figure 5 Average Ireland Monthly Demand 2011 and 2012

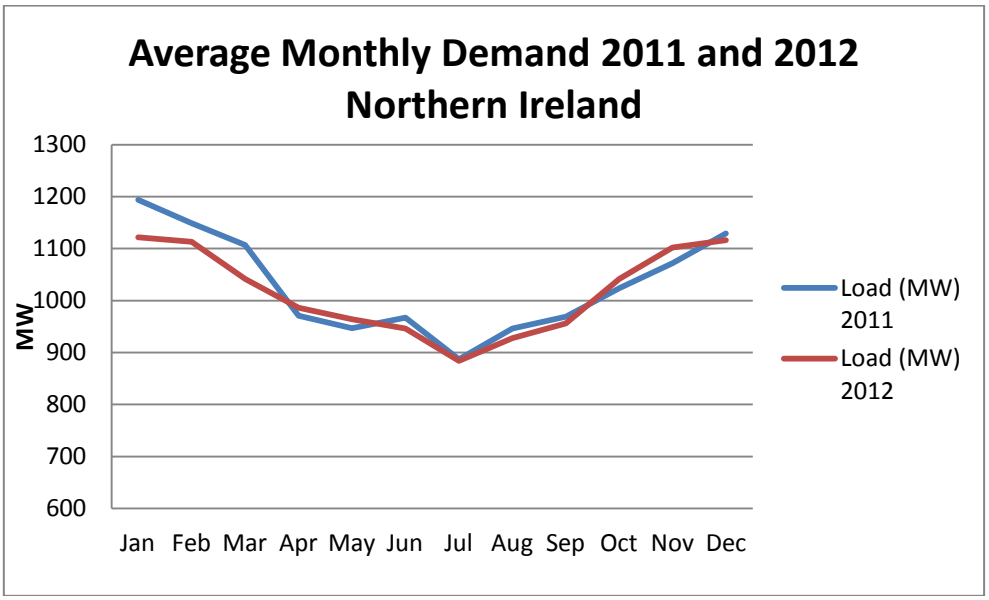

Figure 6 Average Northern Ireland Monthly Demand 2011 and 2012

2.4 Classification of Dispatch-down – Curtailment vs. Constraint

Curtailment refers to the dispatch-down of wind for system-wide reasons (where the reduction of any or all wind generators would alleviate the problem), whereas constraint refers to the dispatch-down of wind generation for more localised network reasons (where only a subset of wind generators can contribute to alleviating the problem).

Due to the interaction and overlap of curtailment and constraint, and the limitations of the systems currently used to dispatch wind generation, it is not possible to categorically distinguish between constraint and curtailment. As a result, the breakdown of dispatch-down energy between constraint and curtailment can only be estimated. For the purposes of this report, for any given half-hour, if dispatch-down occurred in five or more regions (of seven in total), this was attributed to curtailment. Conversely, if there was dispatch-down in four or less regions, this was attributed to constraint.

It is estimated that curtailment accounts for approximately 62% of the dispatch-down, while constraint accounts for 38%. For comparison, in 2011, using the same estimation methodology, approximately 80% of dispatch-down was attributed to curtailment, while constraints accounted for 20%.

2.5 Curtailment

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

i) System stability requirements (synchronous inertia, dynamic and transient stability)
ii) Operating reserve requirements, including negative reserve
iii) Voltage control requirements
iv) Morning load rise requirements
v) System Non-Synchronous Penetration (SNSP[4]) limit (currently 50%)

[4] SNSP is the ratio of non-synchronous generation (wind and HVDC imports) to demand plus HVDC exports

The first four of these limits tend to impose minimum generation requirements on the conventional (synchronous) generation portfolio, which in turn can limit the "room" for wind generation, particularly overnight during the lower demand hours. The current implementation of these security limits are described in the Operational Constraints Update paper, which superseded the Transmission Constraint Groups document. Both of these are published[5] on the EirGrid website.

SNSP is a system security metric that has been established from the results of the Facilitation of Renewables studies. These studies identified 50% as the current maximum permissible level. There were some instances of curtailment to ensure this level was not breached. However, the SNSP limit is often superseded by the other minimum generation limits described above as the demand falls during nights with high wind.

As detailed in section 2.4, it is estimated that curtailment accounts for approximately 62% of the dispatch-down in 2012. The impact of curtailment can be seen in Figure 7 below, which shows the total all-island dispatch-down by half-hour. The predominance of curtailment (which tends to be confined to the night hours 23:00 – 09:00) over local constraints (which arise throughout the day) is evident.

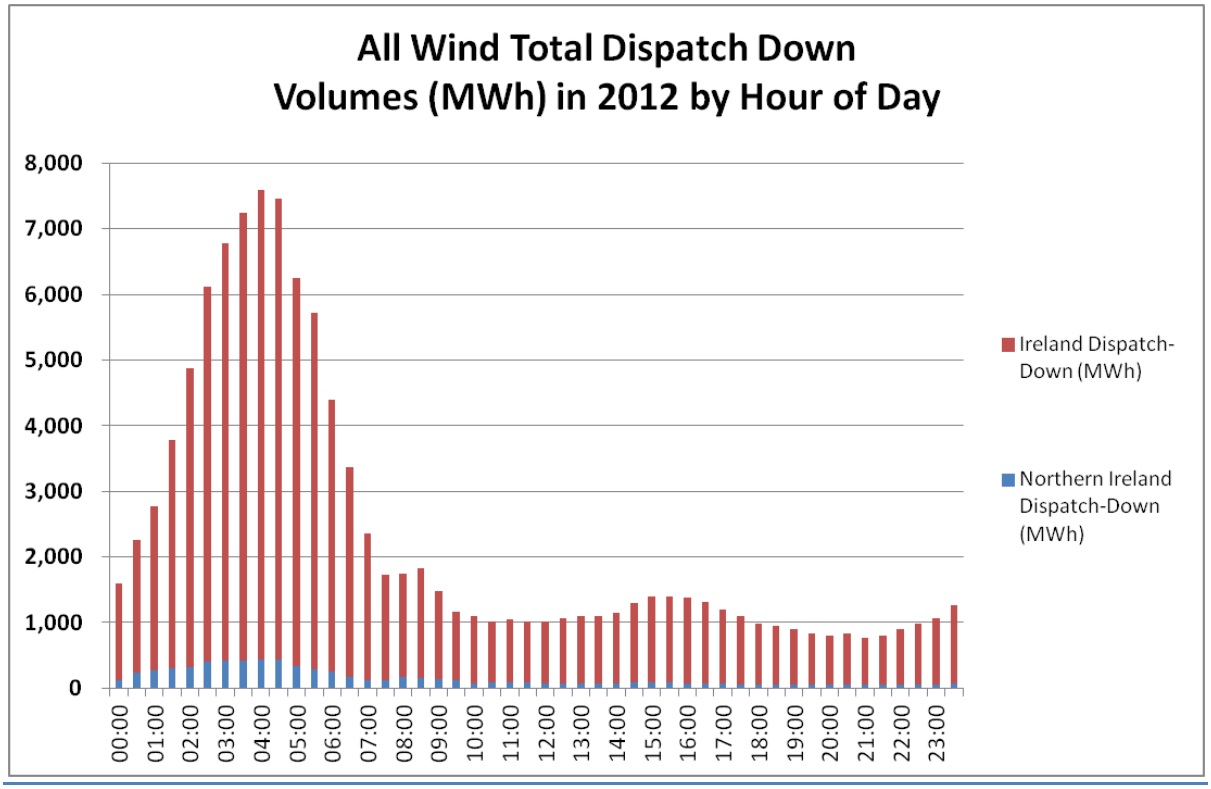

Figure 7 Ireland and Northern Ireland 24 hour clock of dispatch-down of wind 2012

2.6 Observed Network Limitations

The dispatch-down of wind for network reasons is referred to as constraint. Constraint of wind can occur for intact network conditions (due to more wind generation than the capacity of the network) or during outages (which can be for maintenance, upgrade works or due to faults). The Grid25 strategy and associated programmes are in place to directly address these issues in Ireland. Similar programmes are being envisioned in Northern Ireland. The RIDP and Network25 programmes will also address these limitations. The major capital works associated with these types of projects may

[5] http://www.eirgrid.com/aboutus/publications/

reduce the capacity of the network for the duration of the work. In the short term, this leads to a rise in the levels of constraint in these areas. However, in the long term, the reinforcement of the network increases its capacity, enabling the accommodation of more generation in that area.

From a network perspective it would appear that the north-west and south-west of the Irish system have the greatest level of restrictions for the export of wind when compared to the other parts of the wider system (Figure 8). In Donegal, even when there is a fully intact network, there are often restrictions, resulting in high levels of constraint of wind in this area. There is also evidence that other areas on the system have at times seen restrictions but these are generally associated with transmission outages.

The proportion of dispatch-down attributable to constraint (rather than curtailment) has increased to 38% compared to 20% in 2011. This is due partly to an increase in installed wind generation but more significantly to the transmission outages in 2012, many of which are to facilitate the upgrading and uprating of the transmission system. To illustrate, some of the transmission outages that resulted in significant constraint of wind generation are described below.

- **NW:** Outages of circuits in Donegal for uprating: Cathleen's Fall – Srananagh 1 (23-Apr-12 to 26-Oct-12) and Cathleen's Fall – Golagh (16-May-12 to 20-Sep-12) 110 kV lines: windfarms in Donegal constrained down during these outages.
- **NI:** Slieve Kirk – Killymallaght 110 kV line outage (13-Aug-12 to 14-Aug-12) and outage at Killymallaght (16-Aug-12 to 24-Aug-12) for the installation of an additional circuit breaker: Slieve Kirk windfarm constrained off for duration.
- **SE:** Crane 110 kV half station outage (29-May-12 to 20-Jun-12) for busbar uprating: Ballywater windfarm constrained off for duration of outage.
- **SW:** Forced outage of the Clonkeen – Coomagearlahy 110 kV line (14-Feb-12 to 26-Feb-12): Coomagearlahy and Glanlee windfarms constrained off for duration of outage.

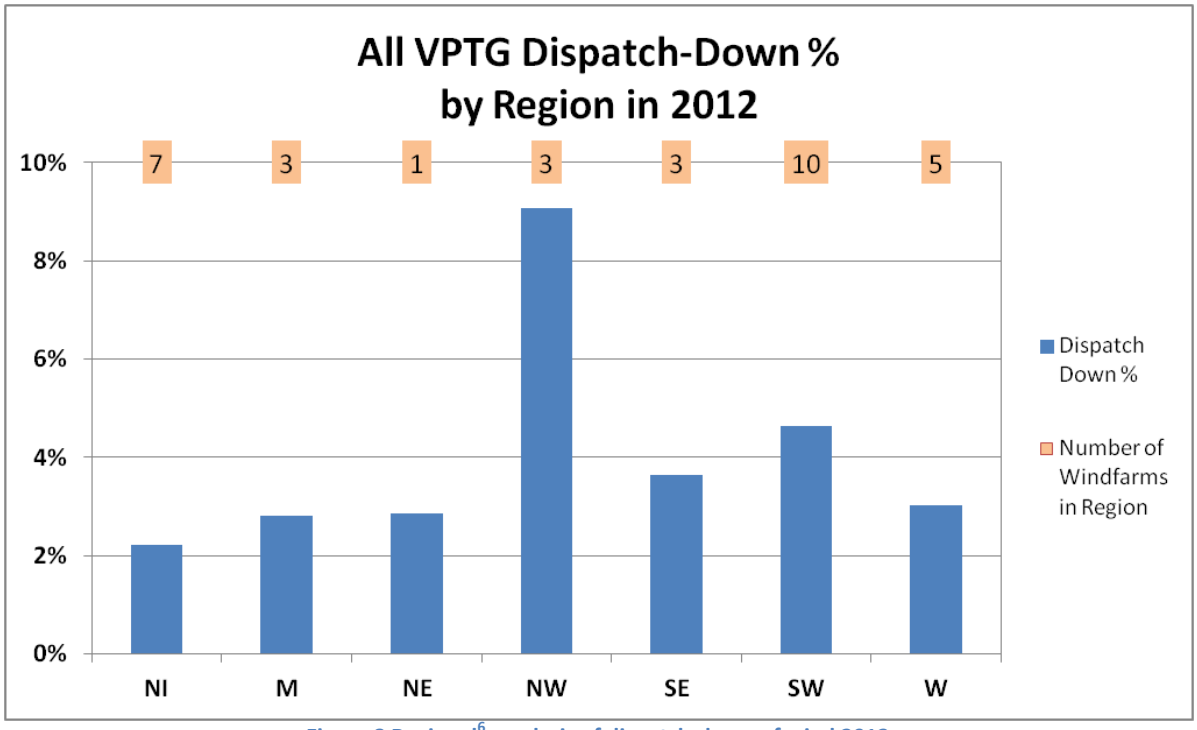

Figure 8 Regional[6] analysis of dispatch-down of wind 2012

[6] The allocation of windfarms to the regions listed is described in Table 4

2.7 Commissioning Units

Units are afforded priority while undergoing commissioning. This process, particularly during sustained periods of running at high outputs (i.e. a "reliability run"), can result in increased levels of curtailment. There was no significant or material commissioning of conventional plant in 2012 that had a material impact on the level of dispatch-down of renewable generation.

The first power transfer on the East-West Interconnector (EWIC) linking Ireland and Wales took place in August 2012 and an extensive commissioning programme was then undertaken. As is the case with any unit, the commissioning process of an interconnector can lead to higher levels of curtailment for the duration of the process.

The majority of the high import and high export testing took place in August and September 2012 and the consequential increase in curtailment can be seen in Figure 4, which shows the highest dispatch-down levels in the year occurred in these months.

2.8 Recommissioning/Return of Units

The Turlough Hill pumped storage facility is a key reserve provider, particularly when pumping at night. In addition, the pumping demand at night can help reduce the impact of the system security limits by providing more "room" for wind generation. A major station refurbishment project rendered Turlough Hill unavailable for all of 2011. The four units were recommissioned over a period of time in 2012; unit 2 was the first to be recommissioned on 14th March 2012 while unit 3 was the last to come back into operation on 25th August 2012. The return of Turlough Hill has helped reduce the need for curtailment of wind generation.

In 2011 the Moyle DC interconnector had been reduced to half capacity due to a cable fault from 26th June 2011 until 24th August 2011, while on 24th August it became fully unavailable for the rest of 2011. When the Moyle HVDC interconnector is out of service the static primary reserve that it normally provides needs to be made up from other resources. This, at times, resulted in open cycle gas turbines being dispatched on at night or larger units being run at levels higher than their minimum stable generation to maintain adequate reserves. It returned to a capacity of 225 MW in each direction on 18th January 2012. On 19th February, this was changed to a capacity of 450 MW from Great Britain to Northern Ireland and 295MW in the opposite direction, while on 25th June the capacity was reduced to 250 MW in each direction.

While the availability of reserve from the Moyle interconnector helps reduce curtailment, imports on interconnectors are equivalent to wind generation from an SNSP perspective. Thus imports can give rise to curtailment by reducing the room for wind generation.

3 Mitigation Measures

3.1 Observed Network Limitations:

As mentioned above, the Grid25, RIDP and Network25 programmes are the primary methods of addressing network issues in the coming years. The outages necessary to deliver the network upgrades may result in additional constraints in the short term but will reduce constraints on wind generation in the long run. In addition, consideration will be given to the use and deployment of new technologies including dynamic line rating and special protection schemes.

3.2 Operational Policy and the DS3 Programme

The fundamental issues that give rise to curtailment have been identified in section 2.5 above, and these issues will be addressed by EirGrid and SONI's Delivering a Secure Sustainable Electricity System (DS3) programme[7]. This is a multi-stakeholder, multi-year programme of work designed specifically to securely and efficiently increase the capability of the power system from operating at a maximum of 50% System Non-Synchronous Penetration (SNSP) level to a maximum of 75% and also address the other limits identified in section 2.5. Based on published modelling (Facilitation of Renewables studies[8]), this has the capability of ensuring that curtailment issues will lead to low levels of dispatch-down (circa 6% total) when there is sufficient installed windfarms to meet both governments' policy targets for 2020.

The DS3 programme was formally launched in August 2011 and is designed to reduce curtailment. However, the success of the programme is dependent on appropriate and positive engagement from all industry stakeholders including conventional and renewable generators, the Regulatory Authorities, Transmission System Operators and Distribution System Operators.

As part of the DS3 programme of work there are studies underway to investigate the optimisation of operational policy and to minimise curtailment.

[7] www.eirgrid.com/operations/ds3
[8] www.eirgrid.com/renewables/facilitationofrenewables

3.3 Operational Policy – Interconnection

There are currently arrangements in place to allow for system operator countertrading of up to 200 MW on each interconnector. One of the aims of interconnector countertrading is to reduce the curtailment of priority dispatch plant within a regulatory approved pricing framework. There are a number of additional counter-trading options being considered by the TSOs in order to further reduce the curtailment of priority dispatch:

1. System Operator countertrading via a UK Power Exchange
2. Procure a third party service
3. Interconnector Trade exchange

No countertrading took place on EWIC in 2012 as it was undergoing commissioning and testing. A net total of approximately 65 GWh was countertraded on the Moyle Interconnector on 21 separate days in 2012.

3.4 Controllability of Wind Generators

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 windfarms. To this end all non-compliant windfarms were given until 1st December 2012 to demonstrate controllability. Furthermore, a comprehensive operational policy to implement the decisions in SEM-11-62 was published on the EirGrid website in November 2011.

As a result of the introduction of these measures, there was a large increase in the level of controllable wind farms in 2012. In November 2011, approximately 43% of the all-island registered capacity of wind generation was controllable; 60% of the Northern Ireland registered capacity was controllable while 38% of the Ireland registered capacity was controllable. By the end of 2012 this figure had risen to 70% on an all-island basis; 77% in Northern Ireland and 68% in Ireland. The increase in both the controllable and VPTG wind through the year is illustrated in Figure 9, Figure 10 and Figure 11.

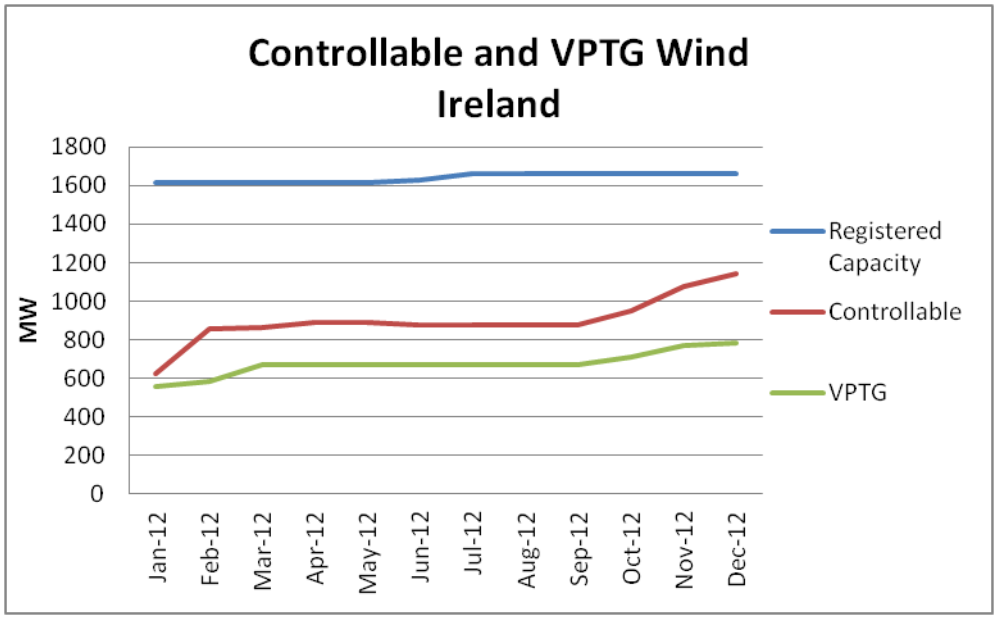

Figure 9 Ireland Controllable Wind Generation and VPTG Wind Generation 2012

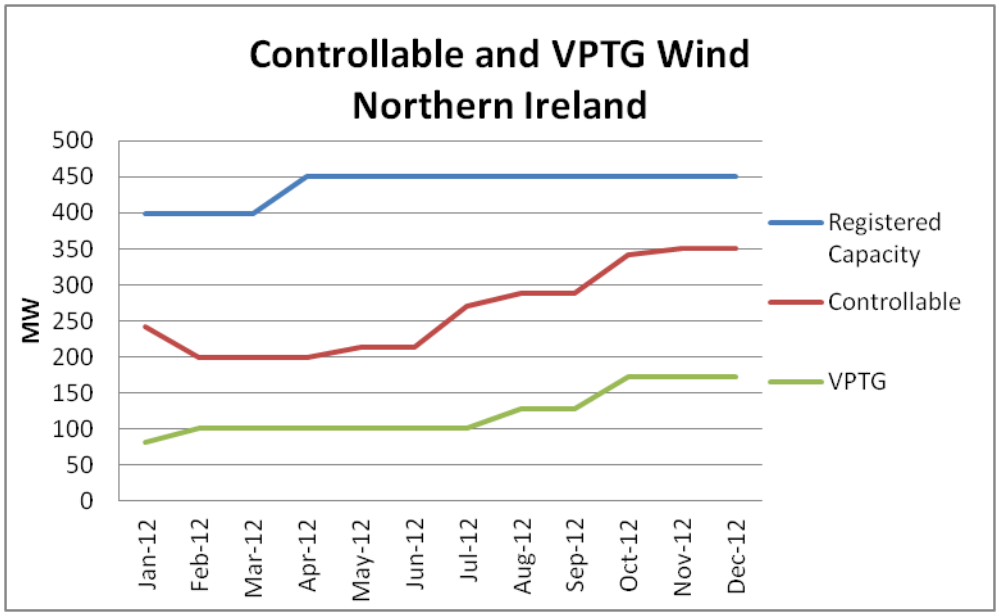

Figure 10 Northern Ireland Controllable Wind Generation and VPTG Wind Generation 2012

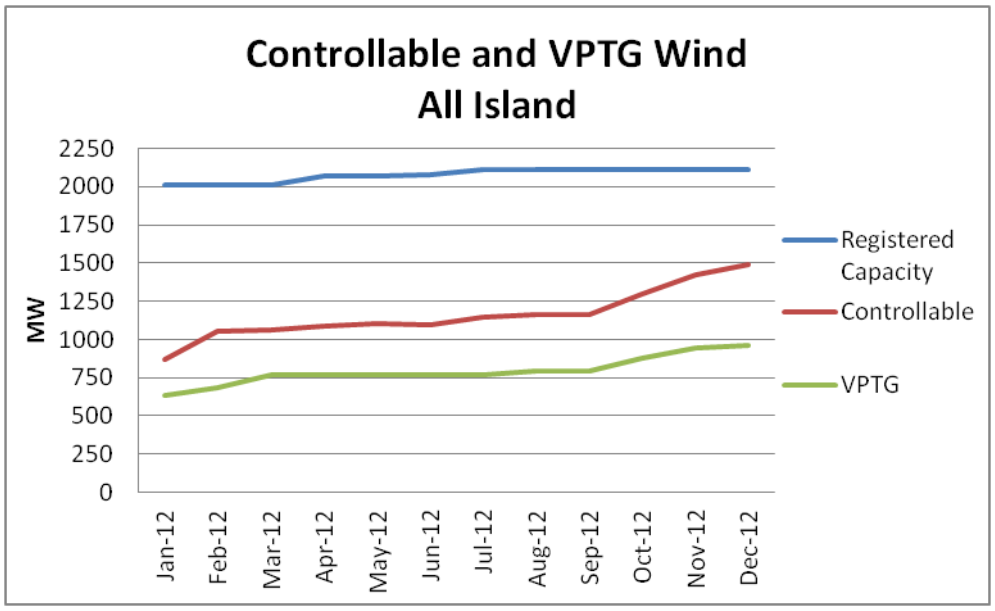

Figure 11 All-island Controllable Wind Generation and VPTG Wind Generation 2012

4 Summary of Results

In addition to the graphs presented above, the following tables provide a detailed summary of the dispatch-down of wind (in MWh and in terms of percentage of available energy). The data is provided for Northern Ireland and Ireland individually and in aggregate.

Table 1 Northern Ireland monthly, quarterly and yearly dispatch-down of wind 2012

	Northern Ireland				
Month	All Wind Generation (MWh)	All Wind Dispatch-Down Vol (MWh)	All Wind Dispatch-Down (%)	VPTG Dispatch-Down Vol (MWh)	Non-VPTG Dispatch-Down Vol (MWh)
Jan-2012	134,050	669	0.5%	669	-
Feb-2012	106,380	229	0.2%	229	-
Mar-2012	86,100	698	0.8%	698	-
Apr-2012	72,030	147	0.2%	147	-
May-2012	59,550	335	0.6%	335	-
Jun-2012	64,800	293	0.4%	293	-
Jul-2012	55,350	276	0.5%	276	-
Aug-2012	74,250	3,065	4.0%	3,065	-
Sep-2012	111,540	408	0.4%	408	-
Oct-2012	61,870	3	0.0%	3	-
Nov-2012	102,050	114	0.1%	114	-
Dec-2012	113,520	936	0.8%	936	-
2012 Qtr 1	326,530	1,596	0.5%	1,596	-
2012 Qtr 2	196,380	775	0.4%	775	-
2012 Qtr 3	241,140	3,749	1.5%	3,749	-
2012 Qtr 4	277,440	1,053	0.4%	1,053	-
Total 2012	1,041,490	7,174	0.7%	7,174	-

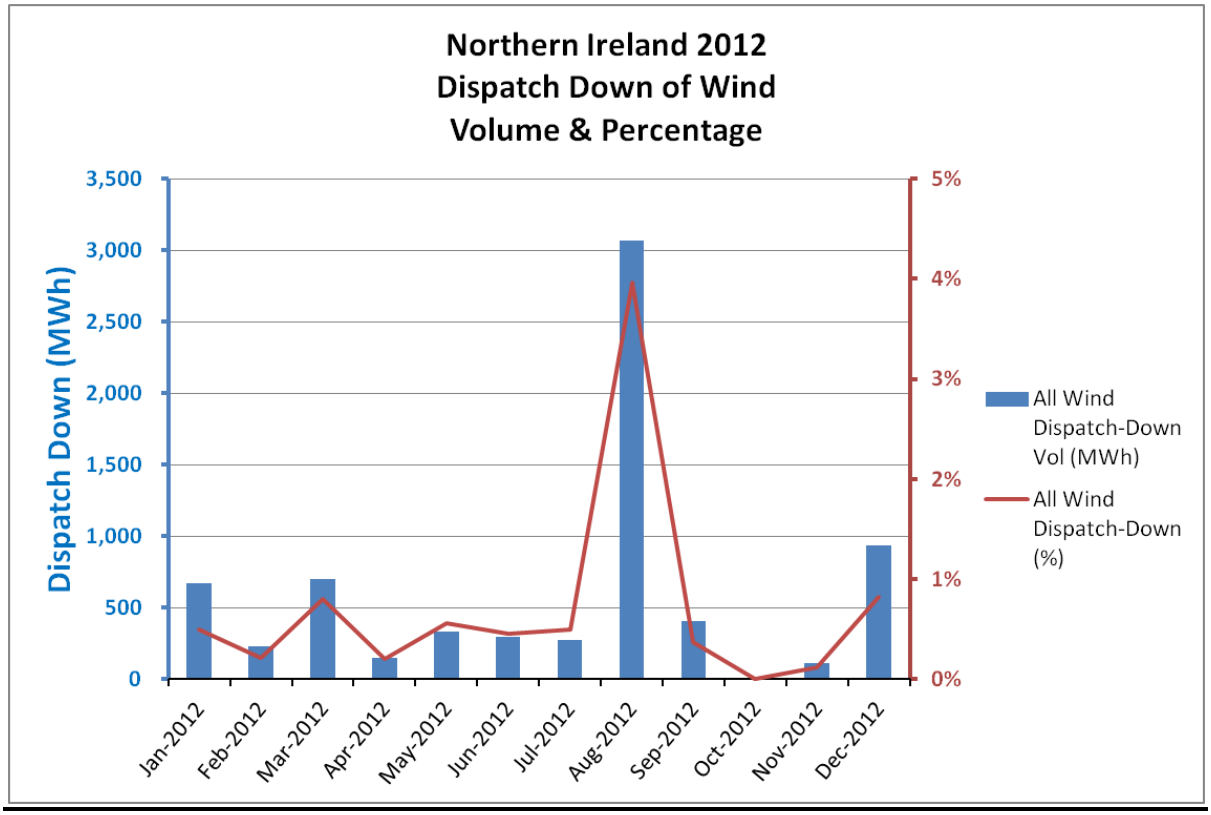

Figure 12 Northern Ireland dispatch-down of wind 2012

Table 2 Ireland monthly, quarterly and yearly dispatch-down of wind 2012

	Ireland				
Month	All Wind Generation (MWh)	All Wind Dispatch-Down Vol (MWh)	All Wind Dispatch-Down (%)	VPTG Dispatch-Down Vol (MWh)	Non-VPTG Dispatch-Down Vol (MWh)
Jan-2012	533,656	12,233	2.2%	8,763	3,470
Feb-2012	373,333	10,707	2.8%	10,458	250
Mar-2012	310,377	7,494	2.4%	5,715	1,778
Apr-2012	356,499	4,919	1.4%	3,796	1,123
May-2012	256,408	4,243	1.6%	3,247	996
Jun-2012	243,311	10,226	4.0%	8,318	1,908
Jul-2012	229,792	4,414	1.9%	3,754	661
Aug-2012	310,828	13,495	4.2%	10,787	2,708
Sep-2012	328,259	16,450	4.8%	13,091	3,359
Oct-2012	289,328	743	0.3%	450	294
Nov-2012	384,763	3,997	1.0%	2,984	1,013
Dec-2012	485,250	14,196	2.8%	9,545	4,652
2012 Qtr 1	1,217,366	30,434	2.4%	24,936	5,498
2012 Qtr 2	856,219	19,388	2.2%	15,362	4,027
2012 Qtr 3	868,879	34,359	3.8%	27,631	6,728
2012 Qtr 4	1,159,342	18,937	1.6%	12,978	5,958
Total 2012	4,101,805	103,117	2.5%	80,908	22,210

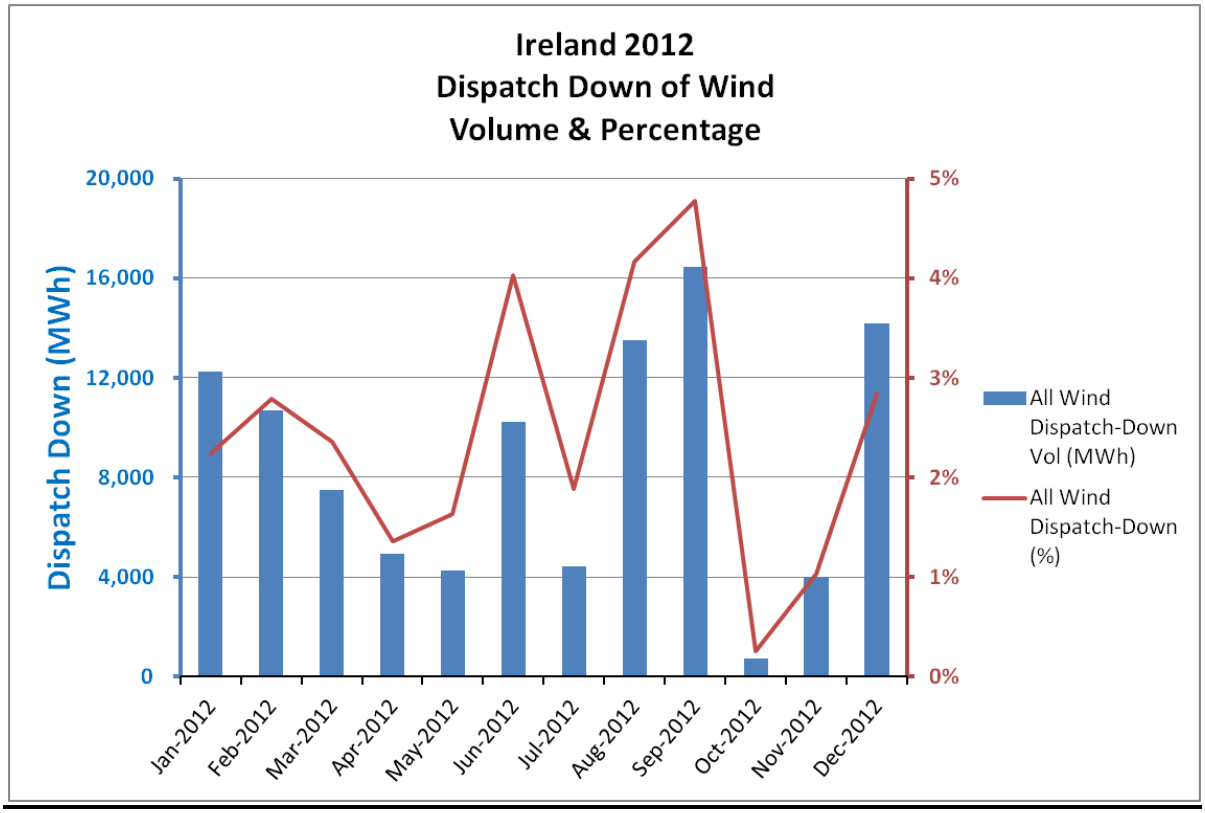

Figure 13 Ireland dispatch-down of wind 2012

Table 3 Ireland and Northern Ireland monthly, quarterly and yearly dispatch-down of wind 2012

	All-Island				
Month	All Wind Generation (MWh)	All Wind Dispatch-Down Vol (MWh)	All Wind Dispatch-Down (%)	VPTG Dispatch-Down Vol (MWh)	Non-VPTG Dispatch-Down Vol (MWh)
Jan-2012	667,706	12,902	1.9%	9,432	3,470
Feb-2012	479,713	10,937	2.2%	10,687	250
Mar-2012	396,477	8,191	2.0%	6,413	1,778
Apr-2012	428,529	5,066	1.2%	3,943	1,123
May-2012	315,958	4,579	1.4%	3,583	996
Jun-2012	308,111	10,518	3.3%	8,611	1,908
Jul-2012	285,142	4,690	1.6%	4,030	661
Aug-2012	385,078	16,560	4.1%	13,852	2,708
Sep-2012	439,799	16,858	3.7%	13,499	3,359
Oct-2012	351,198	747	0.2%	453	294
Nov-2012	486,813	4,111	0.8%	3,098	1,013
Dec-2012	598,770	15,132	2.5%	10,481	4,652
2012 Qtr 1	1,543,896	32,030	2.0%	26,532	5,498
2012 Qtr 2	1,052,599	20,163	1.9%	16,137	4,027
2012 Qtr 3	1,110,019	38,108	3.3%	31,381	6,728
2012 Qtr 4	1,436,782	19,990	1.4%	14,031	5,958
Total 2012	5,143,295	110,291	2.1%	88,081	22,210

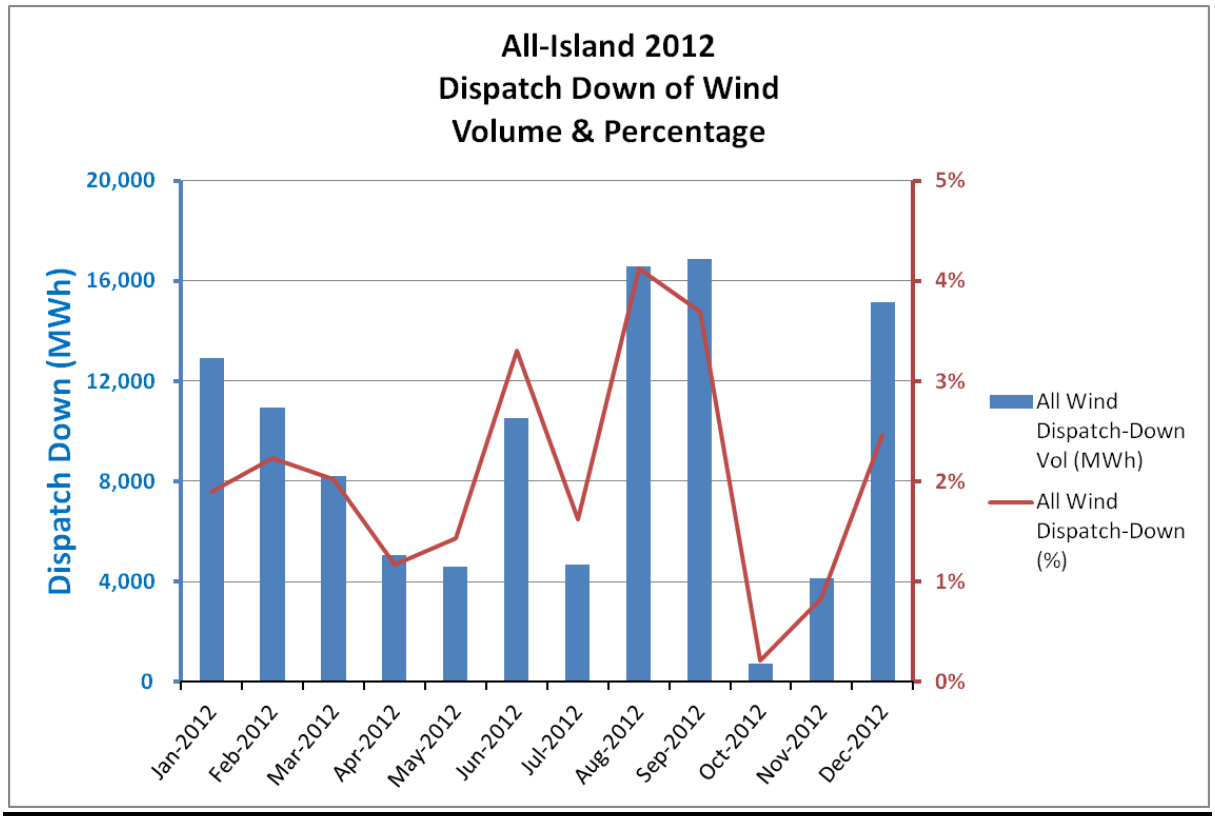

Figure 14 Ireland and Northern Ireland dispatch-down of wind 2012

Table 4 Individual dispatch-down of windfarms 2012[9]

						During VPTG Period only		
Jurisdiction	Region	Unit ID	UNIT_NAME	Capacity (MW)	Dispatch-Down Volume (MWh)	PE (MWh)	Dispatch-Down %	VPTG_DATE
NI	NI	ALT2	Altahullion 2	11.7	639	27,868	2.3%	
NI	NI	Curryfree	Curryfree	15	242	10,813	2.2%	18/10/2012
NI	NI	GAR	Garves	15	822	39,923	2.1%	
NI	NI	SLI2	Slieve Rushen 2	54	935	158,109	0.6%	
NI	NI	Screggagh	Screggagh	20	1,411	37,766	3.7%	09/02/2012
NI	NI	Slieve Kirk	Slieve Kirk	27.6	2,810	32,549	8.6%	09/08/2012
NI	NI	TAP	Tappaghan	28.5	316	17,796	1.8%	11/10/2012
NI Total					**7,174**	**324,824**	**2.2%**	
IRE	M	GE1	Gortahile	20	1,687	64,226	2.6%	
IRE	M	GU1	Glenough	32.5	1,833	77,720	2.4%	27/03/2012
IRE	M	LS1	Lisheen	36	3,344	101,779	3.3%	
IRE	NE	BD1	Bindoo	48	3,133	109,910	2.9%	
IRE	NW	BM1	Beamhill	14	3,461	37,052	9.3%	
IRE	NW	MCT	Meentycat	84.96	20,201	217,515	9.3%	
IRE	NW	SN1	Sornehill	38.9	7,382	87,772	8.4%	
IRE	SE	BW1	Ballywater	42	4,195	83,909	5.0%	
IRE	SE	CK1	Castledockrell	41.4	546	27,974	2.0%	10/10/2012
IRE	SE	RF1	Richfield	27	1,827	68,754	2.7%	
IRE	SW	BCw	Ballincollig Hill	13.3	689	27,634	2.5%	28/02/2012
IRE	SW	CG1	Coomagearlahy 1	42.5	8,008	105,283	7.6%	
IRE	SW	CG2	Coomagearlahy 2	8.5	1,707	24,404	7.0%	
IRE	SW	CJ1	Clahane	37.8	2,507	102,004	2.5%	
IRE	SW	CZ1	Coomacheo	59.225	1,004	35,149	2.9%	06/11/2012
IRE	SW	DV1	Dromdeeveen	27	1,115	64,768	1.7%	13/03/2012
IRE	SW	GLC	Glanlee	29.8	7,033	78,056	9.0%	
IRE	SW	GW1	Grouse Lodge	15	795	36,091	2.2%	21/02/2012
IRE	SW	RC1	Rathcahill West	12.5	738	35,075	2.1%	13/03/2012
IRE	SW	TN2	Tournafulla	17.2	229	4,294	5.3%	12/12/2012
IRE	W	BT1	Booltiagh	19.45	1,072	38,646	2.8%	
IRE	W	DY1	Derrybrien	59.5	4,357	126,139	3.5%	
IRE	W	GH1	Garvagh 1	26	1,906	78,176	2.4%	17/01/2012
IRE	W	GH2	Garvagh 2	22	1,630	52,402	3.1%	17/01/2012
IRE	W	KG2	Kingsmountain 2	11.05	509	18,603	2.7%	27/03/2012
IRE Total					**80,908**	**1,703,334**	**4.7%**	
All-Island					**88,081**	**2,028,159**	**4.3%**	

4.1 Discussion

In Ireland, 2.5% of total available wind energy was dispatched down while in Northern Ireland the value was 0.7%. This figure for Northern Ireland is likely to be understated and the following factors must be taken into account when comparing the dispatch-down levels in Ireland and Northern Ireland:

- The figures for Northern Ireland do not take into account the autonomous wind generation which was dispatched down. As explained above, this is due to differences in the IT systems which are used to dispatch wind. More than half the wind generation in Northern Ireland is autonomous and therefore it is reasonable to expect that a significant proportion of the total energy dispatched down was from autonomous generation.
- Northern Ireland has fewer transmission constraints than Ireland, therefore there is less congestion related dispatch-down in Northern Ireland.
- Slieve Rushen 2 accounts for over 30% of the VPTG wind in Northern Ireland. Due to problems with signals provided by the windfarm, there were times throughout 2012 when the availability signal of this windfarm reduced to zero or a fixed low value at the same time that the windfarm was dispatched down. Therefore, on these occasions, it incorrectly

[9] Note that the data provided here is based on publicly available SEM data

appears that the reduction in output from Slieve Rushen 2 was not as a result of being dispatched down. This problem reduces the level of dispatch-down which was reported in Northern Ireland.

As mentioned in section 2.6 above, Slieve Kirk was constrained off continuously between the 13th and 24th August 2012 due to a transmission outage. As a result, it can be seen in Figure 12, that the dispatch-down level of wind in Northern Ireland in August was approximately 6 times higher than the average for the rest of the year.

It is evident in Table 4 that the dispatch-down of individual VPTG windfarms which are within the same region is generally similar. However, there are some exceptions, notably the South West region, where the level of dispatch-down on an individual windfarm basis ranges from 1.7% to 9%. This is attributable to some localised transmission outages in that region that only affected a subset of the windfarms in the Southwest. In particular, a forced outage in February constrained off Coomagearlahy 1, Coomagearlahy 2 and Glanlee windfarms.

Windfarms that became VPTGs during 2012 have only a partial year of data and therefore their dispatch-down figures may differ from other windfarms nearby. In particular, where a windfarm has a very small dataset, its dispatch-down percentage may appear significantly skewed. This is captured in Table 4 by the VPTG_date column.

Appendix 1 - Methodology

Data Used

The following figures were obtained from the Single Energy Market settlement system:

- DQ (Dispatch Quantities in MW)
- AO (Actual Output in MW)
- AP (Profiled Availabilities in MW)
- TPD (Market Trading Period Duration = 0.5 hr)

Data from other sources:

- Total wind generation: EirGrid & SONI Operations
- Total half hourly wind availabilities and generation from SCADA (Ireland only)

Calculation Methodology

Dispatch-down of wind energy is calculated individually for generators that are registered in the SEM as VPTGs. Prior to the SEM-11-062 decision the majority of units dispatched down were VPTGs. Since SEM-11-062 this has changed to the dispatch-down of controllable windfarms, which includes some autonomous generation. Due to the market rules for autonomous generators (APTGs) it is not possible to use validated SEM data to calculate the dispatch-down of APTGs; instead, this is estimated on an aggregate basis using SCADA data.

The calculation steps for dispatch-down of wind are as follows:

Step 1: Dispatch-Down Calculation for VPTG Wind using SEM Data:

a) Dispatch-down volume V (MWh) in each trading period:

IF AP = DQ
THEN V = 0
ELSE V = TPD * Max[0, AP-Max(AO,DQ)]

Total dispatch-down volume R = $\sum_{rp} V$

Where ***rp*** is the reporting period – the year 2012 in this case.

b) Dispatch-down level (%):
The dispatch-down levels for a VPTG wind generator are calculated based on the dispatch-down volume R from part (a) above and the wind generator's maximum possible energy generation PE (MWh):

PE = Σ[Max(AO,AP)] * TPD
(Only during those trading periods where the wind generator is registered as VPTG in SEM)

VPTG dispatch-down level (%) = 100 * $\frac{R}{PE}$

Step 2: Dispatch-Down Calculation for Autonomous (Non-VPTG) Wind:

SCADA data is used here to estimate autonomous wind dispatch-down in Ireland only.

a) Estimating all wind dispatch-down in Ireland from SCADA:

The difference between total wind availabilities (Avail) and total wind output (WO) is used as an indicator of the dispatch-down volume of all wind in Ireland. However, the accuracy of SCADA data is not high.

To improve the accuracy, this difference (Avail – WO) is used only during the trading periods where there was a dispatch-down in the market in Ireland ($V_I \neq 0$). Market dispatch-down volumes in Ireland (V_I) can give us a better indication of when there was active dispatching down of wind taking place in Ireland.

Total Dispatch-Down Volume in Ireland DD (MWh) = $\Sigma Max[V_I, (Avail-WO)*TPD]$

(Note: DD will be zero when V_I is zero, i.e. during periods where there was no dispatching down of VPTG wind in Ireland.)

All wind Dispatch-Down % in Ireland = $100 * DD / (DD + \Sigma(WO_I*TPD))$
All wind Dispatch-Down % in Northern Ireland = $100 * R_{NI} / (R_{NI} + \Sigma(WO_{NI}*TPD))$
Where R is the dispatch-down volume calculated for Northern Ireland in Step 1.
Actual total wind output is used for Northern Ireland (WO).

b) Estimating autonomous dispatch-down of wind in Ireland:

It is calculated by getting the difference between the estimated total wind dispatch-down volume in Ireland and the VPTG dispatch-down in Ireland = $DD – R_I$