Wind Dispatch Down Reports

Proposed Methodology for Calculating Curtailment and Constraint

22 February 2016

EIRGRID GROUP

1. PURPOSE OF DOCUMENT

The purpose of this document is to outline the proposed new and more accurate methodology for calculating the volume of curtailment and constraint applied to windfarms controlled by the Transmission System Operators (TSOs) in Ireland and Northern Ireland. We, EirGrid and SONI, welcome feedback on the proposed new methodology by 7 March 2016. It would be helpful if any comments were aligned to the sub sections used within this document and these can be addressed to Nezar.Kamaluddin@Eirgrid.com, David.Carroll@EirGrid.com and Niall.Maguire@Soni.ltd.uk.

2. BACKGROUND

The EU Renewable Energy Directive (2009/28/EC) requires TSOs to prioritise renewable energy generation. Sometimes measures are taken to turn-off or dispatch-down renewable energy for system security reasons. In these circumstances TSOs must report this to the regulatory authorities.

In 2011 the TSOs began publishing an annual renewable dispatch down report to satisfy the requirements set out in the EU Renewable Energy Directive. This report used data available from the Single Electricity Market (SEM) for a certain type1 of controllable windfarm in Ireland and Northern Ireland. The data in SEM did not define whether dispatch down was due to curtailment or constraint, therefore this was estimated by the TSOs based on an agreed set of assumptions with industry, as outlined in the annual reports.

Since 2013 the TSOs have issued quarterly reports to a certain type1 of controllable windfarm in Ireland and Northern Ireland. The reports and the assumptions were developed in conjunction with industry through the DS3 Advisory Council in order to aid transparency on the level of curtailment and constraint applied to windfarms. Similar to the annual reports, the differentiation of the level of curtailment and constraint is estimated based on available data. These reports were issued one quarter in arrears as the full data set was not available until then.

[1] The data obtained was for windfarms which were registered in the SEM as Variable Price Taking Generators (VPTGs). The level of constraint and curtailment for Autonomous Price Taking Generators (APTGs) was estimated based on the level of constraint and curtailment applied to VPTGs.

3. PROPOSED METHODOLOGY REFINEMENT

3.1. Key Drivers for Methodology Refinement

In late 2014 a new all-island wind dispatch tool went operational in both control centres in Ireland and Northern Ireland. This new wind dispatch tool introduced a number of improvements over the existing systems which were in use to dispatch down-wind as follows:

1. Improved distribution of curtailment levels for controllable windfarms was achievable;
2. Clear categorisation between curtailment or constraint;
3. Clear reasons for why a curtailment or constraint was applied called a 'reason code' was now available;
4. Easier access to dispatch instructions and windfarm data;
5. Each instruction is timestamped with instruction time.

Due to these improvements the TSOs committed to investigating whether a more accurate report could be issued to all controllable windfarms, therefore removing the need to estimate the level of curtailment and constraint applied.

3.2. Work Completed to Date

In mid-2015 the TSOs developed, with the Distribution System Operators in Ireland and Northern Ireland, a report template that each controllable windfarm would receive each quarter on the level of curtailment and constraint applied to them. This individual windfarm report can be seen in Appendix A. An all-island aggregated wind dispatch down report template can also be found as seen in Appendix A. This will be available to clearly show the all-island level of curtailment during the quarter.

This proposed template presented to the DS3 Advisory Council and also issued to industry for feedback, however no feedback on this was received.

3.3. Proposed Calculation

This section outlines the proposed data which will be used, the proposed calculation and clarifies the data which will accompany the report.

3.3.1. Data Sources

The following are the proposed data sources and assumptions used for the proposed calculation:

Active Power Output: The one minute SCADA MW signal of the active power output received from the windfarm will be used in the calculation as this real-time signal received from the windfarm is used by the Wind Dispatch Tool when calculating the level of pro-rata dispatch down to be applied to an individual windfarm. This one minute value is then averaged to a 15 minute value which will be made available in the report due to the volume of data;

Available Active Power: The one minute SCADA MW signal of the available active power received from the windfarm will be used in the calculation as this

real-time signal received from the windfarm is used by the Wind Dispatch Tool when calculating the level of pro-rata dispatch up to be applied to an individual windfarm. This one minute value is then averaged to a 15 minute value which will be made available in the report due to the volume of data. For the avoidance of doubt this signal is subject to minimum quality standards as set out by the TSOs. If the windfarm signal is outside of the minimum quality standards as reported by the TSOs for any one month period during a reporting period then this will be noted on the report as the level of curtailments and/or constraints applied to this windfarm will be disproportional when compared to other windfarms, due to the inaccuracies in the signal sent by the windfarm to the TSOs;

Dispatch Instruction: The instructed curtailment or constraint MW value, with the exact date and time, will be used in the calculation as per that issued by the Wind Dispatch Tool. Each curtailment and constraint also has a corresponding reason code applied by the control rooms which will also be included in the report;

Windfarm Capacity: The minimum of the installed capacity (MW) and Maximum Export Capacity (MW) will also be used in the reports;

Windfarm Category: The controllability category and the effective date range will be reported if a windfarm changes controllability category within a reporting timeframe. The level of curtailment and constraint will be reported explicitly for each controllability category as for example a windfarm in category (i) will experience higher curtailment and constraint than a windfarm in category (ii);

Region: The region in which the windfarm is located will be reported as follows:

- Ireland: North West (NW), West (W), South West (SW), South East (SE), North East (NE) and Midlands (M).
- Northern Ireland

Furthermore if a windfarm is located behind a regulatory authority approved constraint group then this will also be reported.

Contact Details: The email address of each transmission connected windfarm will be required as the report will be issued to this contact each quarter.

3.3.2. Calculation

The dispatch down energy level of a windfarm is generally defined as the difference between its Available Active Power and Dispatch Instruction. In the case of simultaneous constraint and curtailment Dispatch Instructions the TSOs propose using a methodology called fixed horizontal slicing.

The wind dispatch tool issues Dispatch Down Instructions to windfarms on a pro-rata basis according to their Active Power output at that point in time. The type of dispatch down, either curtailment or constraint, therefore applies to the Active Power values only below this point and down to the new Dispatch Instruction and hence the fixed horizontal slicing approach. The fixed horizontal slicing is shown in Figure 1 and a worked example of this is included in Table 1. In this figure the curtailment layers are coloured green and constraints blue. The Dispatch Instructions are listed along with every Dispatch Instruction (layer), e.g. “CURL 20” indicates a curtailment Dispatch Instruction issued to the windfarm down to 20 MW and LOCL 15 indicates a local constraint Dispatch Instruction issued to the windfarm down to 15 MW. In the case of reduction of the Active Power Output, the layers above the new Dispatch Instruction remain categorised as they were initially i.e. colour on the way down.

When an active Dispatch Instruction is relaxed then the horizontal slicing cuts through the layers as shown in Figure 1 when a constraint Dispatch Instruction to 27 MW (LOCL 27) is issued i.e. do not colour on the way up. Note that a curtailment removal is limited by the lowest active constraint Dispatch Instruction, therefore this methodology may calculate a volume of curtailment even though a curtailment has been removed.

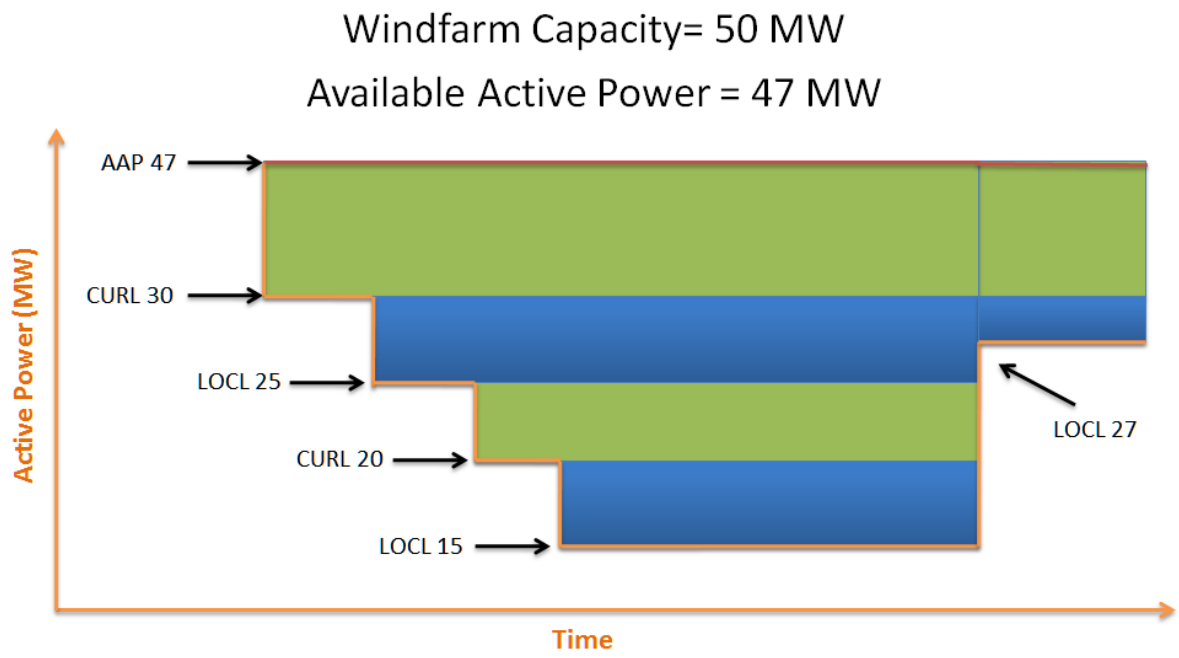


Figure 1 – Horizontal Slicing Methodology

Time	Available Active Power (MW)	Dispatch Instruction	Total Constraint (MW)	Total Curtailment (MW)
15:00	47	NA	0	0
15:30	47	CURL 30	0	(47 – 30) = 17
16:00	47	LOCL 25	(30 – 25) = 5	(47 – 30) = 17
16:30	47	CURL 20	(30 – 25) = 5	(47 – 30) + (25-20) = 22
17:00	47	LOCL 15	(30 – 25) + (20 -15) = 10	(47 – 30) + (25-20) = 22
20:30	47	LOCL 27	(30-27) = 3	(47 – 30) = 17

Table 1: Worked example of Horizontal Slide example in Figure 1

The following calculations are carried out for each minute in the reporting period:

Where

DD is the Dispatched Down Volume in MWh
AO is the Actual Output in MW
AV is the Available Active Power in MW
M_X: Variables used to store intermediate DD levels for each layer in MW.

DD is initially calculated in MW for each minute and these values are aggregated at the end and converted to MWh.

If there is no active dispatch instruction then:

Available Active Power is reset to Active Power Output and DD = 0 MW.

If there are n active setpoints, denoted by M_1, M_2… M_n then:

$$\textbf{Total DD} = \textbf{Max}[\textbf{AV} - \textbf{Max}[\textbf{AO}, M_n], 0]$$

The DD amount of each layer is aggregated into its own category as well depending on type (Curtailments / constraints) and reason (SNSP issue, transmission constraint, inertia, etc.)

These DD layers are calculated individually every minute as follows:

$$DD_{Layer\ X} = \text{Max}[\ \text{Min}[M_{X-1}, AV] - \text{Max}[AO, M_X], 0]$$

Where M_0 = Available Active Power

Finally, all DD values are converted to energy equivalents (MWh) and aggregated for the duration of the reporting period. This is achieved by dividing the total one-minute MW values by 60 in order to convert to MWh.

3.3.2. Reporting

In addition to the report template which was previously published, as shown in Appendix A, the TSOs also propose to include the following raw data in the report which will be issued to each controllable windfarm:

1. Active Power Output: The 15 minute SCADA data as outlined in Section 3.3.1 will be included;
2. Available Active Power: The 15 minute SCADA data as outlined in Section 3.3.1 will be included. Note that periods in which there were no active Dispatch Instructions will be adjusted so that Available Active Power is set equal to the Active Power Output so to avoid the calculation of incorrect dispatch down volumes;
3. Dispatch Instructions: Each curtailment and constraint, with the issue time and reason code will also be included

4. NEXT STEPS

The TSOs welcome feedback in relation to the proposed calculation methodology and the data which will be provided before 7 March 2016. It would be helpful if any comments were aligned to the sub sections used within this document and these can be addressed to Nezar.Kamaluddin@Eirgrid.com and Niall.Maguire@Soni.ltd.uk.

The TSOs will consider all feedback received and incorporate this, where relevant, into the first phase of the reporting. This reporting and the methodology will then be frozen until Q1 2017 when the TSOs will review this again with industry and discuss whether any changes are required.

The TSOs will commence publishing the individual windfarm reports in May 2016 and will cover the period January – March 2016. Thereafter they will be published one month following the end of each quarter.

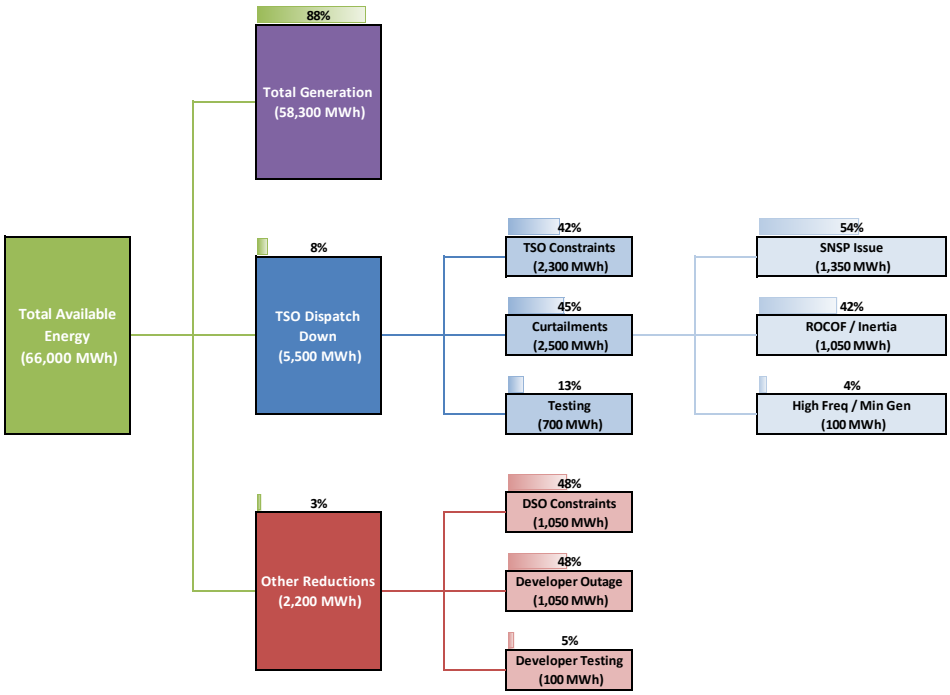
APPENDIX A

Windfarm A Constraint and Curtailment Interim Report

EirGrid Group Operations DRAFT Qtr2, 2015

Windfarm	Category	Size (MW)	Jurisdiction	Region
Wind Farm A	2	30	IRE	NW

Year	2015		2015		2015		2015		2014	
Month / Quarter	Apr-2015		May-2015		Jun-2015		Qtr2		Qtr2	
Total Available Energy (MWh)	25,000		20,000		21,000		66,000		48,000	
Total Generation (MWh)	23,500		17,800		17,000		58,300		42,000	
	MWh	%	MWh	%	MWh	%	MWh	%	MWh	%
Total Energy Reduction from Availability:	1,500	6.0%	2,200	11.0%	4,000	19.0%	7,700	11.7%	6,000	12.5%
TSO Dispatch Down	1,000	4.0%	1,500	7.5%	3,000	14.3%	5,500	8.3%	5,000	10.4%
Other Reductions	500	2.0%	700	3.5%	1,000	4.8%	2,200	3.3%	1,000	2.1%
	MWh	%	MWh	%	MWh	%	MWh	%	MWh	%
TSO Dispatch Down:										
TSO Constraints	300	30.0%	1,000	66.7%	1,000	33.3%	2,300	41.8%	2,000	40.0%
Curtailments	500	50.0%	500	33.3%	1,500	50.0%	2,500	45.5%	2,500	50.0%
TSO Testing	200	20.0%	0	0.0%	500	16.7%	700	12.7%	500	10.0%
Other Reductions:										
DSO Constraints	200	40.0%	400	57.1%	450	45.0%	1,050	47.7%	200	20.0%
Developer Outage	300	60.0%	200	28.6%	550	55.0%	1,050	47.7%	700	70.0%
Developer Testing	0	0.0%	100	14.3%	0	0.0%	100	4.5%	100	10.0%
	MWh	%	MWh	%	MWh	%	MWh	%	MWh	%
Curtailments:										
SNSP Issue	200	40.0%	150	30.0%	1,000	66.7%	1,350	54.0%	500	20.0%
ROCOF / Inertia	200	40.0%	350	70.0%	500	33.3%	1,050	42.0%	1,900	76.0%
High Freq / Min Gen	100	20.0%	0	0.0%	0	0.0%	100	4.0%	100	4.0%
	WF	AI	WF	AI	WF	AI	WF	AI	WF	AI
Windfarm vs All-Island Capacity Factors	30%	29%	41%	35%	28%	32%	18%	21%	30%	27%
All-Island TSO Dispatch Down % (for comparison)	5%		6%		10%		12%		10%	



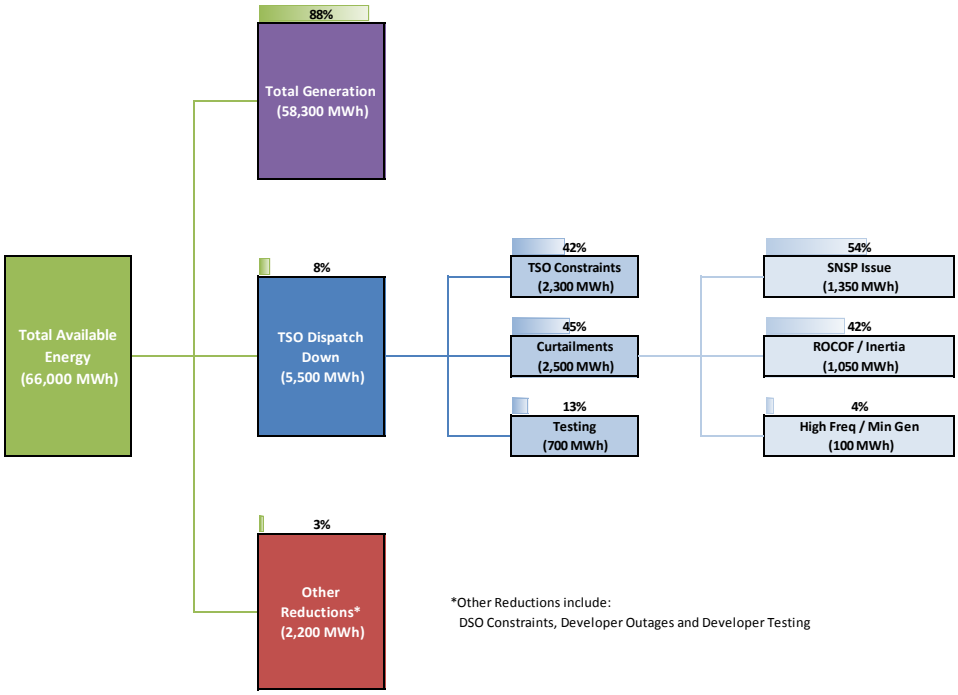
Page 1

Individual Windfarm Report Template

Ireland Wind Constraint and Curtailment Interim Report

EirGrid Group Operations DRAFT Qtr2, 2015

Year	2015		2015		2015		2015		2014	
Month / Quarter	Apr-2015		May-2015		Jun-2015		Qtr2		Qtr2	
Total Available Energy (MWh)	25,000		20,000		21,000		66,000		48,000	
Total Generation (MWh)	23,500		17,800		17,000		58,300		42,000	
	MWh	%	MWh	%	MWh	%	MWh	%	MWh	%
Total Energy Reduction from Availability:	1,500	6.0%	2,200	11.0%	4,000	19.0%	7,700	11.7%	6,000	12.5%
TSO Dispatch Down	1,000	4.0%	1,500	7.5%	3,000	14.3%	5,500	8.3%	5,000	10.4%
Other Reductions	500	2.0%	700	3.5%	1,000	4.8%	2,200	3.3%	1,000	2.1%
	MWh	%	MWh	%	MWh	%	MWh	%	MWh	%
TSO Dispatch Down:										
TSO Constraints	300	30.0%	1,000	66.7%	1,000	33.3%	2,300	41.8%	2,000	40.0%
Curtailments	500	50.0%	500	33.3%	1,500	50.0%	2,500	45.5%	2,500	50.0%
TSO Testing	200	20.0%	0	0.0%	500	16.7%	700	12.7%	500	10.0%
	MWh	%	MWh	%	MWh	%	MWh	%	MWh	%
Curtailments:										
SNSP Issue	200	40.0%	150	30.0%	1,000	66.7%	1,350	54.0%	500	20.0%
ROCOF / Inertia	200	40.0%	350	70.0%	500	33.3%	1,050	42.0%	1,900	76.0%
High Freq / Min Gen	100	20.0%	0	0.0%	0	0.0%	100	4.0%	100	4.0%
	WF	AI	WF	AI	WF	AI	WF	AI	WF	AI
Windfarm vs All-Island Capacity Factors	30%	29%	41%	35%	28%	32%	18%	21%	30%	27%
All-Island TSO Dispatch Down % (for comparison)	5%		6%		10%		12%		10%	



Aggregated Windfarm Report Template

ABBREVIATIONS

TSO	Transmission System Operator
SEM	Single Electricity Market
VPTG	Variable Price Taking Generator
APTG	Autonomous Price Taking Generator
SCADA	Supervisory Control and Data Acquisition
MW	Megawatt
MWh	Megawatt Hour
CURL	Curtailment
LOCL	Constraint
AAP	Available Active Power
DD	Dispatch Down
AO	Actual Output
AV	Available Active Power
M_X	Variables used to store intermediate DD levels for each layer in MW