

Wind Dispatch Down Reports

User guide

29 July 2016



1. PURPOSE OF DOCUMENT

The purpose of this document is to provide information on the data inputs, the calculation methodology and the outputs for the wind dispatch down reports which use information from the Wind Dispatch Tool in use in the Belfast and Ireland and Northern Ireland control rooms.

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.

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.

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.

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. Over the last nine months the TSOs have engaged with Industry on developing a new report template and calculation methodology using more accurate data from the Wind Dispatch Tool used by the control centres in Ireland and Northern Ireland.

3. OVERVIEW OF WIND DISPATCH DOWN REPORTS

3.1. Data Inputs

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 30 minute value which will be made available in the excel report due to the volume of data. Note that this 30 minute aggregated value will differ from the metered active power output as it is based on the windfarms own SCADA value;

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 30 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 could result in the level of curtailments and/or constraints applied to this windfarm being disproportional when compared to other windfarms, due to the inaccuracies in the signal sent by the windfarm to the TSOs. This windfarm should cross check the signal accuracy reports in the first instance if there are any queries in relation to the level of dispatch down applied;

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. Dispatch Down by the TSOs is considered applicable if the following reason codes are used:

- Curtailment
 - System Non-Synchronous Penetration (SNSP) Issue
 - Rate of Change of Frequency (RoCoF)/Inertia
 - High Frequency/Minimum Generation
- Constraint
 - TSO Constraints
- TSO Testing

If the following reason codes are utilised the dispatch down is considered to be outside of the control of the TSOs:

- Developer Testing
- Developer Outage
- DSO Constraints

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

Region: The geographical 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

A list of the windfarms and the corresponding categories can be found in Appendix A.

Contact Details: The reports will be issued by email to all controllable distribution and transmission windfarms in Ireland and Northern Ireland. The TSOs will keep a contact list for each windfarm and it will be the responsibility of the windfarm to ensure their contact details are kept up to date. Any changes should be notified to RenewableReports@EirGrid.com.

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 for dispatch down and dispatch up, with a minor difference for removing an active curtailment.

3.2.1. Dispatch Down

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 Figure 1 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.

3.2.1. Dispatch Up

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 if a curtailment is relaxed then this is limited by the lowest active constraint if applicable.

There is however an exception to this approach when there was both curtailment and constraint on a windfarm and the active curtailment is fully removed. In this instance it would not be appropriate to continue to categorise some of the dispatch down volume as curtailment. In this instance the volume of dispatch down will be categorised as constraint. An example of this is shown in Figure 2.

Windfarm Capacity= 50 MW
 Available Active Power = 47 MW

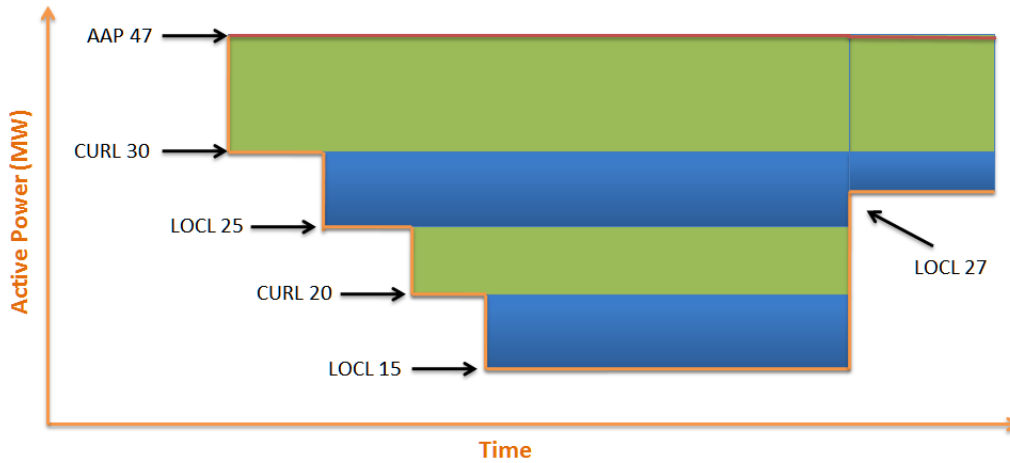


Figure 1 – Horizontal Slicing Methodology

| 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

Windfarm Capacity = 50MW
 Available Active Power = 47MW

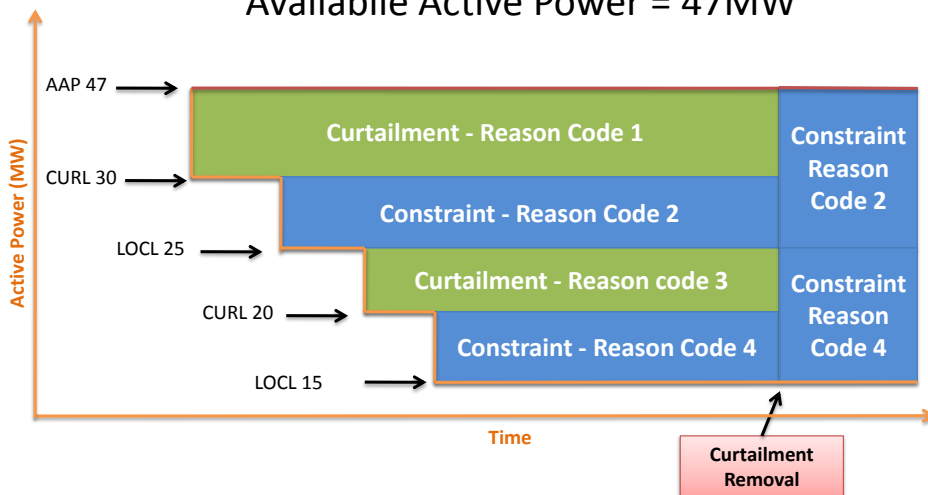


Figure 2 – Horizontal Slicing Methodology during Curtailment removal

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 $M_1, M_2 \dots M_n$ then:

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

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:

$$\text{DD}_{\text{Layer } x} = \text{Max}[\text{Min}[M_{x-1}, \text{AV}] - \text{Max}[\text{AO}, M_x], 0]$$

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. Reporting

The reports will be issued quarterly to each controllable windfarm on the distribution and transmission system. The quarterly reports will be issued from 2016 and will be issued one month following the end of each quarter².

The reports will consist of three aspects as follows:

A. Individual Windfarm Report (PDF)

- This will be a .pdf containing a monthly breakdown of the dispatch down of the windfarm and also the quarterly average. A sample is included in Appendix B;
- A comparison to the previous quarter will also be shown (from Q1 2016);
- A comparison to the overall all-island dispatch down of controllable windfarms. Note that this figure does not contain uncontrollable wind, therefore this figure is not the definitive all-island dispatch down figure and is included here for comparison purposes only. The overall all-island dispatch down is included in the Overall Wind Dispatch Down Report;

B. Individual Windfarm Report (Excel .xls)

- This contains the aggregated 30 minute Available Active Power, Active Power Output and breakdown of the dispatch down reason codes;
- The individual dispatch instructions with the effective time, broken down into curtailment and constraints, are also 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.

C. Overall Wind Dispatch Down Report (PDF)

- This contains the aggregated dispatch down figures for Ireland, Northern Ireland and all-island. A sample is included in Appendix B;
- The figures include all wind i.e. it includes non-controllable wind;
- Contains the definitive dispatch down percentages.

² The first reports for Q1 2016 were issued two months following the end of the quarter to allow the TSOs further time to test the new system being used to prepare these reports.

4. QUERIES

The TSOs will be freezing the calculation methodology and reporting templates for 12 months following the publication of the first batch of reports in May 2016.

If you have any questions on the calculation methodology or report template which is not covered within this user guide please contact RenewableReports@EirGrid.com.


APPENDIX A

| Windfarm | Region |
|-----------------|--------|
| Bruckana | M |
| Garracummer | M |
| Glenough | M |
| Gortahile | M |
| Hollyford | M |
| Kill Hill | M |
| Lisheen 1 | M |
| Lisheen 2 | M |
| Monaincha Bog | M |
| Mountlucas | M |
| Mountain Lodge | NE |
| Mullananalt | NE |
| Ratrussan | NE |
| Beam Hill | NW |
| Binbane 1 | NW |
| Corkermore | NW |
| Drumlough Hill | NW |
| Flughland | NW |
| Golagh 1 | NW |
| Loughderryduff | NW |
| Meenachullalan | NW |
| Meentycat | NW |
| Sorne Hill | NW |
| Spaddan | NW |
| Altagowlan | W |
| Black Banks 2 | W |
| Booltiagh 1 | W |
| Booltiagh 2 | W |
| Carrickheeney | W |
| Carrowleagh | W |
| Derrybrien | W |
| Faughary | W |
| Garvagh 1 | W |
| Garvagh 2 | W |
| Kingsmountain 1 | W |
| Kingsmountain 2 | W |
| Knockastanna | W |
| Lackan | W |
| Leitir Guingaid | W |
| Raheen Barr 2 | W |
| Spion Kop | W |
| Tullynamoyle | W |

| Windfarm | Region |
|-------------------|--------|
| Athea | SW |
| Ballincollig Hill | SW |
| Ballybane 1 | SW |
| Ballybane 2 | SW |
| Bawnmore | SW |
| Boggeragh 1 | SW |
| Boggeragh 2 | SW |
| Caherdowney | SW |
| Carraigcannon | SW |
| Clahane | SW |
| Cloghboola | SW |
| Coomacheo | SW |
| Coomagearlahy 1 | SW |
| Coomagearlahy 2 | SW |
| Coomagearlahy 3 | SW |
| Coomatallin | SW |
| Dromada | SW |
| Dromdeeven | SW |
| Garranereagh | SW |
| Glanlee | SW |
| Gneeves | SW |
| Grouse Lodge | SW |
| Kealkil | SW |
| Knockacummer | SW |
| Knockaneden | SW |
| Knockawarriga | SW |
| Knocknagoum | SW |
| Muingnaminnane | SW |
| Rathcahill West | SW |
| Taurbeg | SW |
| Tournafulla 1 | SW |
| Tournafulla 2 | SW |
| Arklow 1 | SE |
| Ballycadden 1 | SE |
| Ballycadden 2 | SE |
| Ballymartin 1 | SE |
| Ballymartin 2 | SE |
| Ballywater | SE |
| Barranafaddock | SE |
| Castledockrell | SE |
| Cronelea 1 | SE |
| Cronelea 2 | SE |
| Gibbet Hill | SE |
| Knocknalour | SE |
| Richfield | SE |
| Woodhouse | SE |

| Windfarm | Region |
|-----------------|--------|
| Altahullion 1 | NI |
| Altahullion 2 | NI |
| Bessey Bell 1 | NI |
| Bessey Bell 2 | NI |
| Bin Mountain | NI |
| Callagheen | NI |
| Carn Hill | NI |
| Carrickatane | NI |
| Churchill | NI |
| Corkey | NI |
| Crighshane | NI |
| Crockagarran | NI |
| Curryfree | NI |
| Dunbeg | NI |
| Dunmore NI | NI |
| Elliots Hill | NI |
| Garves | NI |
| Gruig | NI |
| Hunters Hill | NI |
| Lendrums Bridge | NI |
| Lough Hill | NI |
| Molly Mountain | NI |
| Monnaboy | NI |
| Owenreagh 1 | NI |
| Owenreagh 2 | NI |
| Rigged Hill | NI |
| Screggagh | NI |
| Seegronan | NI |
| Slieve Divena | NI |
| Slieve Kirk | NI |
| Slieve Rushen | NI |
| Snugborough | NI |
| Tappaghan | NI |
| Thornog | NI |
| Wolf Bog | NI |

Individual Windfarm Report Template



Windfarm A Quarterly Dispatch Down Report

DRAFT

Qtr1, 2016

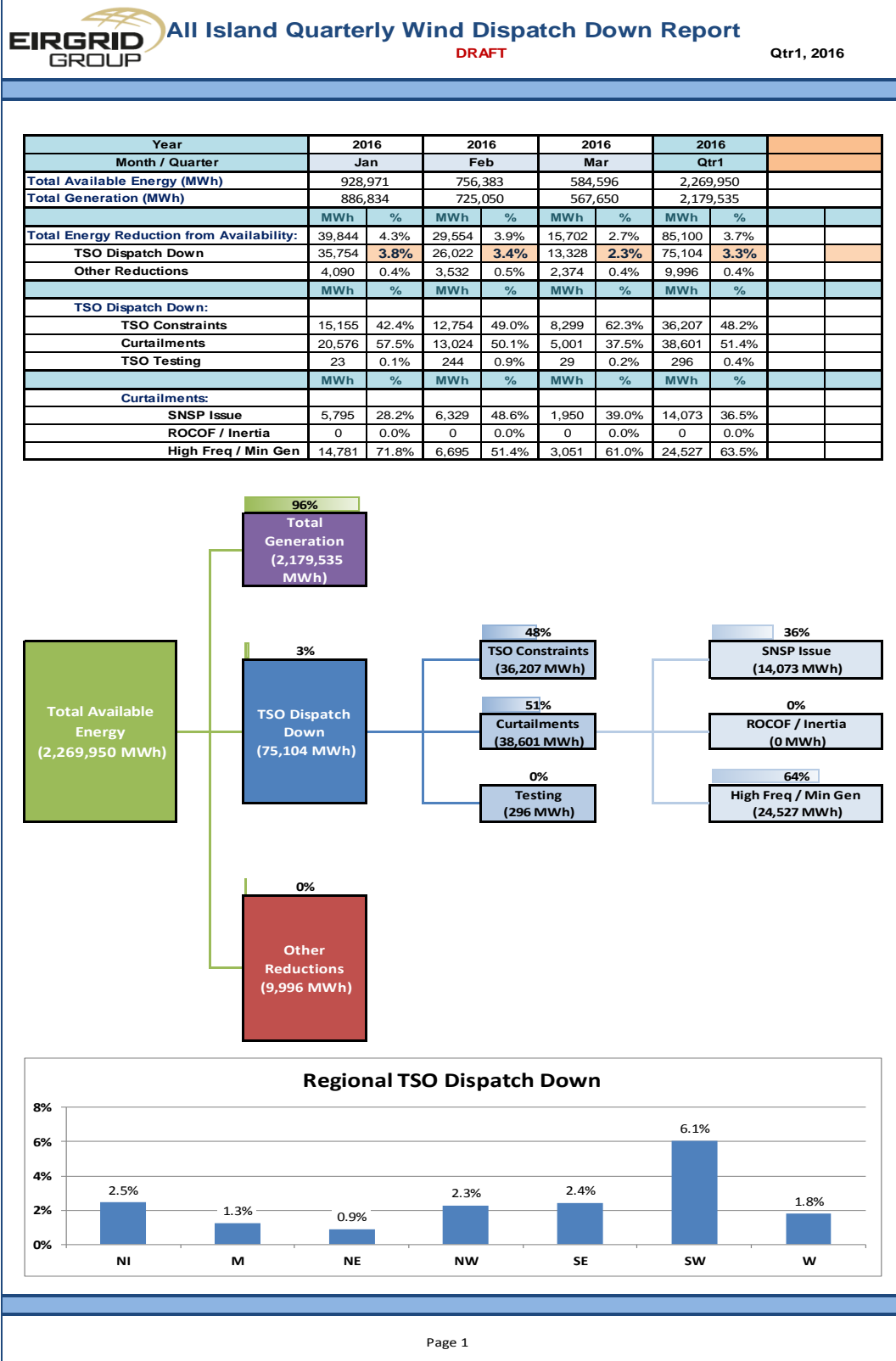
| Windfarm | Connection | Size (MW) | Jurisdiction | Region |
|------------|------------|-----------|--------------|--------|
| Windfarm A | TSO | 100 | Ireland | SW |

| Year | 2016 | | 2016 | | 2016 | | 2016 | |
|--|--------|-------|--------|--------|--------|--------|--------|-------|
| Month / Quarter | Jan | | Feb | | Mar | | Qtr1 | |
| Total Available Energy (MWh) | 25,000 | | 20,000 | | 21,000 | | 66,000 | |
| Total Generation (MWh) | 23,500 | | 17,800 | | 58,300 | | 42,000 | |
| | 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% |
| TSO Dispatch Down | 1,000 | 4.0% | 1,500 | 7.5% | 3,000 | 14.3% | 5,500 | 8.3% |
| Other Reductions | 500 | 2.0% | 700 | 3.5% | 1,000 | 4.8% | 2,200 | 3.3% |
| TSO Dispatch Down: | | | | | | | | |
| TSO Constraints | 300 | 30.0% | 1,000 | 66.7% | 1,000 | 33.3% | 2,300 | 41.8% |
| Curtailments | 500 | 50.0% | 1,500 | 100.0% | 1,500 | 50.0% | 3,500 | 63.6% |
| TSO Testing | 200 | 20.0% | 500 | 33.3% | 500 | 16.7% | 1,200 | 21.8% |
| Other Reductions: | | | | | | | | |
| DSO Constraints | 200 | 40.0% | 400 | 57.1% | 450 | 45.0% | 1,050 | 47.7% |
| Developer Outage | 300 | 60.0% | 200 | 28.6% | 550 | 55.0% | 1,050 | 47.7% |
| Developer Testing | 0 | 0.0% | 100 | 14.3% | 0 | 0.0% | 100 | 4.5% |
| | MWh | % | MWh | % | MWh | % | MWh | % |
| Curtailments: | | | | | | | | |
| SNSP Issue | 200 | 40.0% | 150 | 10.0% | 1,500 | 100.0% | 1,850 | 52.9% |
| ROCOF / Inertia | 200 | 40.0% | 350 | 23.3% | 500 | 33.3% | 1,050 | 30.0% |
| High Freq / Min Gen | 100 | 20.0% | 0 | 0.0% | 0 | 0.0% | 100 | 2.9% |
| All Island and Regional Comparison: | | | | | | | | |
| TSO Dispatch Down - All Island Controllable Wind | 4.1% | | 3.7% | | 2.4% | | 3.5% | |
| TSO Dispatch Down - Same Region (SW) Controllable Wind | 7.1% | | 6.8% | | 3.7% | | 6.1% | |


```

graph LR
    A[Total Available Energy  
66,000 MWh] --> B[TSO Dispatch Down  
5,500 MWh]
    A --> C[Other Reductions  
2,200 MWh]
    B --> D[TSO Constraints  
2,300 MWh]
    B --> E[Curtailments  
3,500 MWh]
    B --> F[Testing  
1,200 MWh]
    C --> G[DSO Constraints  
1,050 MWh]
    C --> H[Developer Outage  
1,050 MWh]
    C --> I[Developer Testing  
100 MWh]
    D --> J[SNSP Issue  
1,850 MWh]
    D --> K[ROCOF / Inertia  
1,050 MWh]
    D --> L[High Freq / Min Gen  
100 MWh]
  
```

Aggregated Windfarm Report Template (All-Island)



FREQUENTLY ASKED QUESTIONS (FAQ)

1. Why does the Available Energy ≠ Generation + TSO Dispatch Down + Other Reductions?

The purpose of the reporting is to quantify the volume of dispatch down instructed by the TSOs. In certain instances a windfarm may not correctly follow the dispatch instruction issued by the TSOs due to issues with their control system. These issues are outside of the control of the TSO, therefore as outlined in Section 3.2 the calculation of the volume of the dispatch down is:

$$\text{Total DD} = \text{Max}[\text{AV} - \text{Max}[\text{AO}, \text{Mn}], 0]^3$$

A graphical example of uninstructed dispatch is shown in Figure 3.

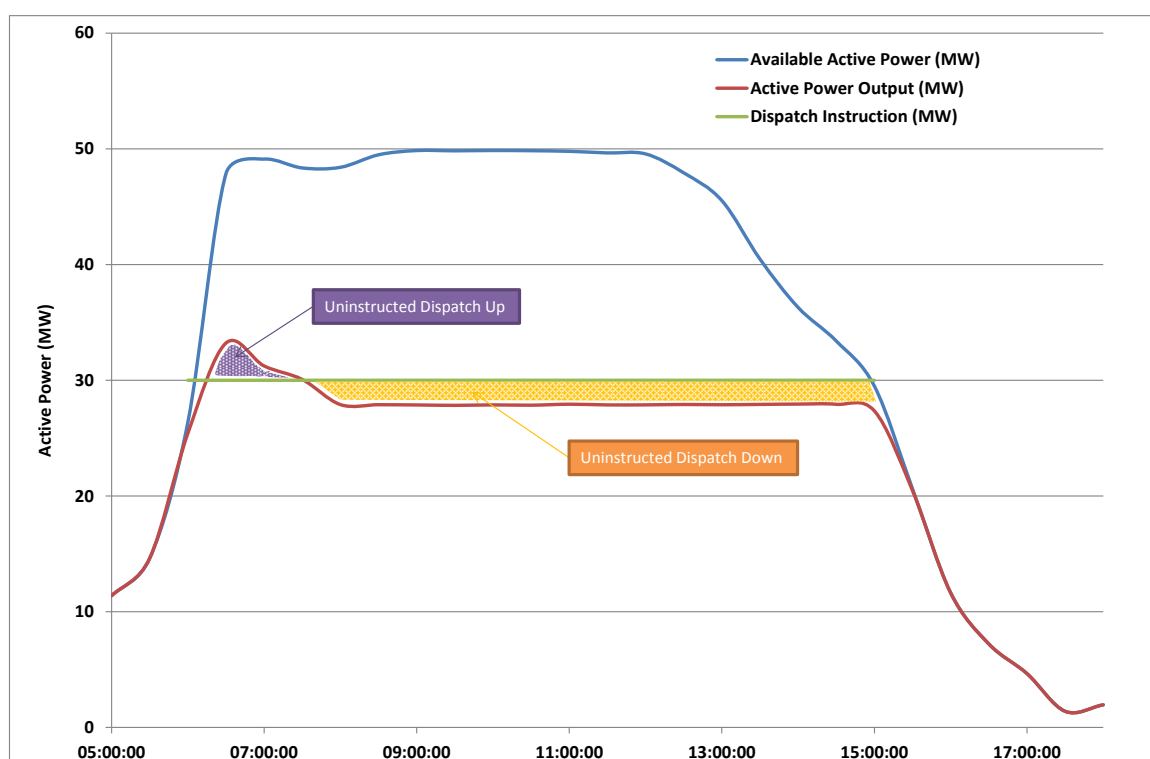


Figure 3 – Uninstructed Dispatch Down

2. Can I get the data prior to 2016?

The new dispatch down reports were designed to utilise data from the all island wind dispatch tool and the new Energy Management System (EMS). The data is readily available from 2016 onwards. Prior to 2016 the data is contained in several different databases with different sampling rates. The extraction of this data is manual and resource intensive. Prior to the freeze of the application design no feedback was received from windfarms that information prior to 2016 was required, therefore these requests cannot be facilitated at present.

³ A detailed description of this calculation is provided in Section 3.2.

3. Can greater resolution data be provided for 2016?

One minute data for the Available Active Power and Active Power Output are utilised in the application used to create the report. Due to the volume of data per windfarm per quarter (over 250,000 rows of data) it was decided to aggregate this data to 30 minute to reduce the size of the .xls files issued to windfarms. Prior to the freeze of the application design no feedback was received from windfarms that higher resolution data was required, therefore these requests cannot be facilitated at present. The Enhanced Performance Monitoring system is due to go-live in Q4 2016 and this will provide all generating units with access to higher resolution data.

4. Why is the data in the previous report different to the most recent version?

Once the quarterly reports are issued we may be notified of an issue with data for certain windfarms e.g. Available Active Power signal may be incorrect. This data is checked and corrected where appropriate and when we carry out the next batch of quarterly reports there may therefore be minor changes in volumes and percentages of dispatch down. The customer should also therefore use the most recent version of the reports issued.

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 |