EirGrid Group

SEM Decisions on Treatment of Price Taking Generation in Tie-Breaks in Dispatch

Summary of TSO Interpretation of Key Issues

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1 INTRODUCTION

On 21st December 2011 the SEM Committee published a decision paper, SEM-11-105 "Treatment of Price Taking Generation in Tie Breaks in Dispatch in the Single Electricity Market and Associated Issues"[1]. On 29th March 2012 the SEM Committee issued a communication regarding Section 3.5 on 'Curtailment' of the SEM-11-105 Decision Paper and, following a period of consultation, published a decision paper, SEM-13-010[2] "Treatment of Curtailment in Tie-break situations". On 1st March SEM the SEM Committee also published a decision paper SEM-13-012 "Constraint Groups arising from SEM-11-105"[3] on constraint groups".

Following the publication of SEM-11-105 and in the lead up to the publication of SEM-13-10 the TSOs sought clarity from the Regulatory Authorities on a number of key issues pertinent to modelling and implementation of these decisions. On 1st March 2013 the Regulatory Authorities (RAs) wrote to the TSOs indicating "*The RAs note the TSO's documents as a reasonable interpretation of the SEM Committee's decision SEM-11-105 in relation to the specific instances outlined in these documents. Accordingly we suggest that these interpretation notes are published on the TSOs' websites to provide clarity to the Industry.*" This document sets out the interpretation provided and the basis upon which work on analysing constraint groups and specifying changes to the Energy Management Systems in both control rooms is taking place.

2 SUMMARY OF KEY ISSUES

1. **Treatment of Windfarms in Constraint Groups: Extensions and Mergers**
   SEM-11-105 requires the TSO to dispatch windfarms in constraint groups is a specific order i.e. non-firm units before partially and fully firm units and within that, Gate 3 units before pre-Gate 3 units. It is not unusual for existing wind farms to be extended under different Gates or for two existing or proposed windfarms to merge contractually. Often this can result in different units with different levels of firmness or, in RoI, units from different gates being established behind a single connection point. If these units are to be treated as separate units in dispatch as described in SEM-11-105 then it would be necessary for additional metering and control facilities to be provided to manage the dispatch and settlement of these units. In many circumstances existing market and Grid Code rules allow these units to be aggregated and registered as a single unit in SEM and dispatched as a single unit by the TSO. The TSOs sought clarification from the Regulatory Authorities on whether this aggregation process should be allowed and if so how the

[1] http://www.allislandproject.org/GetAttachment.aspx?id=ce9b51a0-01b1-4f31-978a-e4fc17a0ad78
[2] http://www.allislandproject.org/GetAttachment.aspx?id=b86299d3-8e34-4df5-83be-c15c84889b78
[3] http://www.allislandproject.org/GetAttachment.aspx?id=b77b4095-6bff-4a22-9f85-aa0c6b60f592.

aggregated unit should be treated in dispatch. The RAs accepted the following TSO recommendations as a reasonable approach and consistent with the intent of SEM-11-105:

- Outside of the two identified constraint group areas developers can elect to register mergers/extensions behind a single connection point as combined units or as individual units.
- Within a Constraint Group, where a Gate 3 unit is an extension to a Pre-Gate 3 unit or is merged with a Pre-Gate 3 unit behind a single connection point the developer can choose whether the two units are to be separately controlled, metered, dispatched and registered in SEM or combined to form a single unit. However, if the developer chooses to have a Gate 3 unit combined with a Pre-Gate 3 unit to form a single unit, then, from the perspective of the dispatch order set out in SEM-11-105, the combined unit will be treated as Gate 3.
- Within a Constraint Group where two units behind a single connection point with different levels of firmness (i.e. non, partially or full) are merged the developer can choose for the units to be separately controlled, metered, dispatched and registered in SEM or to be combined to form a single unit in SEM. However, if the developer chooses to have a non or partially firm unit combined with a partially or fully firm unit to form a single unit then, from the perspective of the dispatch order set out in SEM-11-105, the combined unit would be treated as the lowest level of firmness (i.e. non or partial) of the individual units until such time as they achieve the same level of firmness (e.g. when both are fully firm).

2. **Treatment of units within a constraint group that do not alleviate a pre-defined contingency.**

The SEM-11-105 paper says that ***"Constraint groups will only be binding for a specific set of contingencies, relatively local to the area in question and due to a tie-break situation."*** In some constraint groups, e.g. the South West, it is possible that when one of the pre-identified contingencies arises not all units in the constraint group can relieve the constraint (e.g. during certain transmission outages). In this scenario two options are available

a) Apply the constraint to all units in the constraint group regardless of their impact
b) Remove any unit from the constraint group that is no longer in a tie break situation. Having done this the remaining units would be dispatched on the Access Rights / Gate approach.

The RAs advised that option b) is consistent with the intent of the SEM Committee decision.

3. **Treatment of units not in constraint groups**

The SEM-11-105 paper stipulates "***for constraints not included in the Year 1 fixed constraints list or outside of a tie-break situation the TSOs will dispatch down wind generation units in a manner that best relieves the constraint, whilst minimising the dispatching down of wind***

generation". The following statement summarises how the TSOs intend to handle this. If a constraint arises not in a constraint group (or not associated with a pre-defined contingency within a constraint group) the TSOs will use power flow information to determine in so far as possible which unit will best alleviate the constraint and will dispatch that unit down first (regardless of FAQ or Gate). If a tie break situation exists i.e. more than one unit can alleviate the constraint the TSO will dispatch down these units on a pro-rata basis.

4. Treatment of Units on a temporary connection

The paper stipulates that ***"temporary connections will be placed in the 0% FAQ constraint category."*** It was not entirely clear if the unit remained within its Gate. The TSOs have since confirmed with the RAs that this should be interpreted to mean that a unit with a temporary connection should be constrained (when required) alongside Gate 3 non-firm units. Note, in the event that a temporary unit is merged with a firm unit, then if the newly formed unit is registered as a single unit then this would be constrained alongside Gate 3 non-firm units as per item 1 above.

5. **Managing constraints and curtailments simultaneously**

The SEM-11-105 paper includes an example of how this should be managed. For the avoidance of doubt the TSOs confirmed that all constraint and curtailment calculations should be done on the basis of the **output** of the windfarm at the time the calculation is being made (and not its availability). When removing constraints or curtailments (but not removing them entirely) the program will calculate the new set points using the difference between the availability of the windfarm and its output. When removing a curtailment from a unit that is constrained this is the difference between the output and the constraint level. Appendix 1 provides some worked examples and Appendix 2 provides more detail on the difference between Constraint and Curtailment.

6. **Applying and Removing Constraints and curtailments that co-exist**

The SEM-11-105 paper states that "***where there are both constraints and curtailment issues arising, the TSOs shall first dispatch to manage the constraint issues and then work to address the curtailment issues***". The TSOs can confirm that when removing curtailments the units that are also under a constraint instruction will not revert to a level which exceeds the constraint level. All other units may return to full output.

7. **All-Island Dispatch – Apportioning Curtailment**

The SEM-11-105 paper states that "***The burden sharing process for curtailment between Ireland and Northern Ireland will be based on the ratio of wind availability in each jurisdiction.*** " The dispatch process is not presently carried out from a single location on an all-island basis hence implementation of this rule will be a proxy rather than a real-time calculation. The TSOs share curtailment on an all-island basis in proportion to the amount of installed controllable wind connected to each system rather than the availability of controllable wind at any

exact point in time; any sharing will also respect system security issues. Such a proxy should result in a fair apportionment across time.

8. **Placing new units into constraint groups**.
   The TSOs will base their modelling assumptions on the principle that new units connecting to new or existing nodes within the electrical boundary of a constraint group will be assigned to that constraint group.

9. **Remedial Action Schemes**
   There are some locations on the networks where Remedial Action Schemes are installed to minimise the quantity of generation that must be dispatched down pre-fault. The most common scheme is one that, on detection of a post fault overload, trips a generation unit off the system where an overload has occurred. This allows the TSOs to operate the network with a potential overload on the understanding that should a contingency occur, the Remedial Action Scheme (RAS) will immediately resolve the overload. Where the TSOs determine that the RAS activation on its own is insufficient to resolve the overload the TSOs will continue to dispatch down generation pre-fault. In this scenario there is no benefit in dispatching down the unit which is connected via the RAS, hence, in terms of SEM-11-105, any wind unit connected via a RAS may be ignored in pre-fault dispatch for some transmission constraints. This is done to minimise the amount of renewable energy being dispatched down.

3 CURRENT STATUS OF TSO WORK

The TSOs have completed assessments of constraint groups and presented the findings to the Regulatory Authorities who have since approved these groups in SEM Decision SEM-13-012 "Constraint Groups arising from SEM-11-105"[4]. The TSOs will communicate to the industry, both on the TSO websites and by written communication to those windfarms in constraints groups when the constraint group is going live and when dispatching for constraints in tie-break situations in that Group will be carried out.

The TSOs are developing a final specification of changes for the Energy Management Systems which are scheduled to be implemented by 1st April 2014. It should be noted however that until the new EMS system is delivered certain aspects of the Tie Break decisions cannot be fully implemented. In SONI this means that dispatch of windfarms will continue on a rota basis and in EirGrid it means that dispatch of windfarms in constraint groups will continue to be on a pro-rata basis until the wind dispatch tools are delivered.

[4] http://www.allislandproject.org/GetAttachment.aspx?id=b77b4095-6bff-4a22-9f85-aa0c6b60f592.

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In accordance with the requirements of SEM-13-012 the TSOs will propose a dispatch report template to the RAs by end Q2 2013.

In RoI, the process to prepare and issue Constraint Reports for Gate 3 applicants is underway and progress on this process and the impacts for Gate 3 Offers will be communicated by EirGrid separately from this briefing note.

APPENDIX 1 - EXAMPLES OF CONSTRAINT AND CURTAILMENT CALCULATIONS

Example 1 - Constraint in a Constraint Group

In this example there are 8 units within the constraint group that could equally resolve a transmission constraint. The output of the units totals 191MW and this must be reduced to 100MW to resolve the transmission constraint. The units are a mixture of firm, partially firm and non-firm units and are also a mixture of Gate 3 and Pre-Gate 3 units with their pre-constraint status shown below:

Unit	Gate	Firm Access Quantity	Controllable	SEM – 105 Hierarchy Level	MEC	Available Active Power	Output
A	3	0%	Yes	(iii)	41	16	16
B	2	0%	Yes	(iii)	30	11	11
C	3	60%	Yes	(ii)	24	20	20
D	3	80%	Yes	(ii)	16	8	8
E	2	15%	Yes	(ii)	85	60	60
F	2	15%	Yes	(ii)	45	23	23
G	1	25%	Yes	(ii)	35	15	15
H	3	100%	Yes	(i)	52	24	24
I	2	100%	Yes	(i)	34	14	14
Total					362	191	191

In accordance with the SEM-11-105 rules Constraint is applied to Units A and B first as they have non-firm access. Although units C and D are partially firm they will be constrained ahead of units E, F and G as they are Gate 3 wind farms. The remaining 36MW is then applied on a pro-rata basis among the pre-Gate 3 partially firm wind farms (combined 98MW capacity). This will allow therefore allow 62MW of generation from these farms. The Post-Constraint Status is shown below:

Unit	Gate	SEM – 105 Hierarchy Level	Available Active Power	Output Before Constraint	Output Following Constraint
A	3	(iii)	16	16	0
B	2	(iii)	11	11	0
C	3	(ii)	20	20	0
D	3	(ii)	8	8	0
E	2	(ii)	60	60	= 60 – ([98-62] * [60/98])= 38
F	2	(ii)	23	23	= 23 – ([98-62] * [23/98]) = 15
G	1	(ii)	15	15	= 15 – ([98-62] * [15/98]) = 9
H	3	(i)	24	24	24
I	2	(i)	14	14	14
Total			191 MW	191 MW	**100 MW**

Example 2 – Curtailment applied (Pro-Rata per proposed SEM-12-90 decision)[5].
In this example there are three Wind Generation Units on the system and they are all controllable and have a pre-curtailment output of 200MW. Assume that for system wide reasons no more than 140MW of wind is allowable on the system then the curtailment calculation is as follows.

Unit Name	Available Active Power	Output Before Curtailment	Curtailment Set Point	Curtailment Quantity	Constraint Quantity
A	50	50	50 – ([200-140]*[50/200]) = 35MW	15	0 MW
B	50	50	50 – ([200-140]*[50/200]) = 35MW	15	0 MW
C	100	100	100 – ([200-140]*[100/200]) = 70MW	30	0 MW
TOTAL	**200 MW**	**200 MW**	**140 MW**	**60MW**	**0 MW**

Example 3 – Curtailment applied - some units already constrained (Pro-Rata per proposed SEM-12-90 decision)
This is the same example as example 2 however before the curtailment applied Unit A had already been already constrained to 30 MW for transmission reasons the curtailment calculation is as follows.

Unit Name	Available Active Power	Output Before Curtailment	Curtailment Calculation	Curtailment Quantity	Constraint Quantity
A	50	30	30 – ([180-140]*[30/180]) = 23MW	7 MW	20 MW
B	50	50	50 – ([180-140]*[50/180]) = 39MW	11 MW	0 MW
C	100	100	100 – ([180-140]*[100/180]) = 78MW	22 MW	0 MW
TOTAL	**200 MW**	**180 MW**	**140 MW**	**40 MW**	**20 MW**

Example 4 – Curtailment lifted, constraint remains
In this example the curtailment applied in Example 3 is lifted from 140MW to 160MW. When curtailment is being lifted the calculation is based on the difference between Availability and Output for unconstrained units and between constraint level and output for constrained units.

Unit Name	Available Active Power	Output Before Curtailment Lifted	Difference between Avail and Output or Constraint and Output	Curtailment Calculation On availability	Curtailment Quantity	Constraint Quantity
A	50	23	7 MW	23 + ([160-140]*[7/40]) = 26.5MW	3.5 MW	20 MW
B	50	39	11 MW	39 + ([160-	5.5 MW	0 MW

[5] This example also applies to a tie break situation arising from the need to resolve constraints outside of constraint groups where units must be dispatched down pro-rata.

				140]*[11/40]) = 44.5MW		
C	100	78	22 MW	78 + ([160-140]*[22/40]) = 89MW	11 MW	0 MW
TOTAL	**200 MW**	**140 MW**	**40 MW**	**160 MW**	**20 MW**	**20 MW**

APPENDIX 2 - CURTAILMENT AND CONSTRAINT DEFINITION

Operational Rule for determination of Constraint or Curtailment

If the Control Centre is assumed to have control over every wind farm on the island of Ireland and the security issue presented could only be resolved by reducing the output of one or a small group of wind farms then that reduction is deemed a constraint and logged as such.

If the Control Centre is assumed to have control over every wind farm on the island of Ireland and the security issue presented could be resolved by reducing the output of any or all of the wind farms then that reduction is deemed a curtailment and logged as such.

For the avoidance of doubt, if there are control decisions that need to be made, at a time, for both curtailment and constraint reasons, the constraint decisions must be dealt with first. When the constraint has been dealt with any remaining wind farms that need to have their output reduced to address the curtailment issue will then be curtailed.

General

Curtailment and Constraint instructions are issued as Active Power Control setpoints – i.e. the windfarm should reduce/increase its output to the Active Power Control setpoint and the units Active Power output should not exceed this level. A single windfarm can have concurrent Curtailment and Constraint Active Power Control setpoints.

Principles of Application of Curtailment or Constraint Setpoints

When applying a Curtailment or a Constraint to a windfarm or group of windfarms the Active Power Control setpoints are both calculated on the basis of distributing a reduction in output between wind farms using the Active Power output[1] of each Windfarm to be curtailed or constrained.

For Application of Curtailment or Constraint

X_A = Reference Quantity = Actual Active Power output[1] of Wind Farm A

Y = Maximum active power output allowable from all relevant Windfarms after Curtailment or Constraint is applied

Z = Sum of Reference Quantities of all Windfarms to be constrained or curtailed

Active Power Control setpoint for Wind Farm A= X_A – ([Z-Y] * [X_A/Z])

In general, when Curtailment and Constraints are required simultaneously, the Constraint is applied first and then Curtailment.

[1] In cases when the level of Curtailment/Constraint required is low and ramping capability is required, setpoints may be calculated on the basis of distributing a reduction in output between wind farms using the difference between Active Power output and Design Minimum Operating Level rather than Available Active Power. Design Minimum Operating Level (DMOL) is the minimum Active Power output of a Controllable WFPS where all WTGs are generating electricity and capable of ramping upwards at any of the specified ramp rates (given available wind), and shall not be greater than 12% of Registered Capacity.

Principles of Removal of all or part of a Curtailment or Constraint Setpoint

When removing Curtailment, Active Power Control setpoints are calculated on the basis of distributing an increase in output between wind farms on a pro-rata basis whilst ensuring that following the removal of a curtailment the Active Power Control setpoint for no unit exceeds any constraint setpoint that was already in place. The following equation sets out the calculation that is used:

For Removal of Curtailment

V_A = Actual Active Power output[1] of Wind Farm A

W = Sum of the Actual Active Power outputs[1] of all Windfarms where Curtailment is to be removed

*X_A = Reference Quantity = Min [Available Active Power **and** Constraint Active Power Control setpoint] **-** Actual Active Power output[1].*

Y = Maximum active power output allowable from all relevant Windfarms after Curtailment is removed

Z = Sum of Reference Quantities of all Windfarms where Curtailment is to be removed

Active Power Control setpoint for Wind Farm A= V_A + ([Y-W] * [X_A/Z])

When removing Constraints, Active Power Control setpoints are calculated on the basis of distributing an increase in output between wind farms using the difference between Available Active Power and the Active Power output as follows

For Removal of Constraint

V_A = Actual Active Power output[1] of Wind Farm A

W = Sum of the Actual Active Power outputs[1] of all Windfarms where Constraint is to be removed

X_A = Reference Quantity = [Available Active Power - Actual Active Power output] of Windfarm A

Y = Maximum active power output allowable from all relevant Windfarms after Constraint is removed

Z = Sum of Reference Quantities of all Windfarms where Constraint is to be removed

Active Power Control setpoint for Wind Farm A= V_A + ([Y-W] * [X_A/Z])

In general, when Curtailment and Constraints are active simultaneously, Curtailment is removed first and then Constraints.

Principles to Calculate Volume of Energy Constrained and/or Curtailed for Reporting Purposes

When there is either Curtailment or Constraint (but not both active), the energy Constrained or Curtailed is Available Active Power less Active Power output. When a number of Curtailment and Constraint setpoints have been issued which overlap in time, the curtailment/curtailment volume is defined as the difference between the relevant setpoints limited by Available Active Power at the time applied.

