Operational Constraints Update
7th November 2013

Key Update	*Impact*
• *Update to Dublin Generation Constraints: Change to "N:>= 2 units".*	*Medium*

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1. Introduction

To enable the efficient and secure operation of the system, generation is dispatched to certain levels to prevent equipment overloading, voltages outside limits or system instability. The software used to model the system is the Reserve Constrained Unit Commitment (RCUC).

1.1 Document Objective

The objective of the Operational Constraints Update is to present the key system and generator constraints which are included in the scheduling process (i.e. in the RCUC software). The most common operational constraints that are modelled are:

- North – South tie-line export / import constraint: MWR type
- Moyle import / export constraint: MW type
- Requirement to keep a minimum number of units on in an area: NB type
- Requirement to limit the output of the generators in an area to limit short circuit levels or overloads: MW type or NB type
- Requirement for a minimum output from the generators in an area to support the voltage or to avoid overloads: MW type or NB type
- Requirement to limit the output of stations due to fish spawning: MW type

This document comprises of: (1) Operational Reserve Requirements, and (2) System Constraints.

2. Operating Reserve Requirements

The following tables show the operating reserve requirements on an all-island basis and in each jurisdiction.

Category	All Island Requirement % Largest In-Feed	Ireland Minimum[1] (MW)	Northern Ireland Minimum (MW)
POR[2]	75%	115 / 75	50
SOR	75%	115 / 75	50
TOR 1	100%	115 / 75	50
TOR 2	100%	115 / 75	50

1. Ireland Lower values apply from 00:00 - 07:00 inclusive
2. Minimum values of POR in each jurisdiction must be supplied by dynamic sources

2.1 Operating Reserve Definitions

	Delivered By	Maintained Until
Primary (POR)	5 seconds	15 seconds
Secondary (SOR)	15 seconds	90 seconds
Tertiary 1 (TOR1)	90 seconds	5 minutes
Tertiary 2 (TOR2)	5 minutes	20 minutes

2.2 Source of Reserve

	Ireland	Northern Ireland
Dynamic Reserve	Synchronised Generating Units	
Static Reserve	Turlough Hill Units when in pumping mode Interruptible Load (35MW 07:00 – 00:00) EWIC Interconnector (up to 50 MW)	Moyle Interconnector (up to 75MW)
Negative Reserve (Defined as the MW output of a conventional generator above its minimum load)	100MW	50MW

3. System Constraints

3.1 Tie Line Limits

Tie line flows in both directions have physical limits, the maximum flow that can be sustained without breaching system security rules (line overloads, voltage limits etc) after a credible transmission or generation event. The limits are referred to as the Total Transfer Capacity (TTC) comprising of two values: N-S and S-N. When determining minimum system cost, RCUC respects the TTC values by not allowing the sum of the reserve holding in either jurisdiction and the tie line flow to exceed the TTC.

3.2 Non-Synchronous Generation

To ensure the secure, stable operation of the power system, it is necessary to limit the level of non-synchronous generation of the system. The System Non-Synchronous Penetration (SNSP) is a measure of the non-synchronous generation on the system at an instant in time i.e the non-synchronous generation and net interconnector imports as a percentage of the demand and net interconnector exports (where “Demand” includes pump storage consumption when in pumping mode).

3.3 System Constraint Tables

The following tables set out the system constraints:

- Active System Wide Constraints;
- Active Northern Ireland Constraints, and
- Active Ireland Constraints.

Note that the limits specified in each table represent the normal intact transmission network limit. These limits may vary from time to time due to changing system conditions.

3.3.1 Active System Wide Constraints

Name	TCG Type	Limit Type	Limit	Sources	Description
Inter-Area Flow	MWR	X:<=	400 MW (There is a margin of 20MW on this limit for system safety)	Ireland and Northern Ireland Power Systems	Ensures that the total MW transferred between Ireland and Northern Ireland does not exceed the limitations of the North-South tie line. It takes into account the rescue/reserve flows that could occur immediately post fault inclusive of operating reserve requirements. This is required to ensure the limits of the existing North South tie line are respected.
Inter-Area Flow	MWR	X:<=	450 MW (There is a margin of 20MW on this limit for system safety)	Ireland and Northern Ireland Power Systems	Ensures that the total MW transferred between Northern Ireland and Ireland does not exceed the limitations of the North-South tie line. It takes into account the rescue/reserve flows that could occur immediately post fault inclusive of operating reserve requirements. This is required to ensure the limits of the existing North South tie line are respected.
Non-Synchronous Generation		X:<=	50%	Wind, MOYLE, EWIC	Ensures that the SNSP is kept below 50%.

3.3.2Active Northern Ireland Constraints

Name	TCG Type	Limit Type	Limit	Sources	Description
System Stability	NB	N:>=	3 units at all times	C30, B31, B32, B10, BPS4, BPS5, BPS6, K1, K2	There must be at least 3 high-inertia machines on-load at all times in NI. Required for dynamic stability
Replacement Reserve	MW	X:<=	211 MW	AGU IPOWER, CGT8, BGT1, BGT2, KGT1, KGT2, KGT3, KGT4	Combined MW output of OCGTs must be less than 211MW (out of a total of 311MW) in NI at all times. 100MW Required for replacement reserve
North West Generation	NB	N:>=	0 or 1 unit depending on NI system demand	C30	Coolkeeragh must be on load when the NI system demand exceeds 1000 MW. This operational constraint is required to ensure voltage stability in the North West of NI and to prevent possible system voltage collapse above the indicated system demand.
Kilroot Generation	NB	N:>=	1 or 2 units depending on NI system demand	K1, K2	There must be at least one Kilroot unit on load when the NI system demand exceeds 1400 MW and 2 units are required above 1550 MW. This operational constraint is required to ensure voltage stability in the Belfast area and to prevent the requirement for an inter area flow reduction in a post fault scenario.
Ballylumford Generation	MW	X:<=	1194MW Dec - Feb, 1024 MW Mar - Nov	B31, B32, B10, BGT1, BGT2, B4, B5, B6.	The output from Ballylumford Power Station must be limited seasonally due to a circuit breaker restriction in the NIE substation.
Moyle Interconnector	MW	B	-295 <MW< 450	Moyle Interconnector	This applies to all units registered as Moyle Interconnector units. It ensures that all flows do not exceed an import of 450MW to Northern Ireland and an export of 295MW to Scotland. This is required to ensure that the limits are respected.

3.3.3 Active Ireland Constraints

Name	TCG Type	Limit Type	Limit	Sources	Description
System Stability	NB	N:>=	5 Units	AD1, AD2, DB1, HNC, HN2, MP1, MP2, MP3, PBC, TB3, TB4, TYC, WG1	There must be at least 5 high-inertia machines on-load at all times in Ireland. Required for dynamic stability.
Replacement Reserve	MW	X:<=	493 MW	AT11, AT12, AT14, ED3, ED5, MRC, NW5, RP1, RP2, TP1, TP3	Combined MW output of OCGTs must be less than 493MW (out of a total of 793MW) in Ireland at all times. Required for replacement reserve. The MW values are subject to change as availability of the units change.
Dublin Generation	NB	N:>=	2 Units	DB1, HNC, HN2, PBC,	There must be at least 2 large generators on-load at all times in the Dublin area. Required for voltage control.
South West Generation	NB	N:>=	2 by night 3 by day	AD1, AD2, AT11, AT12, AT14, SK3, SK4, TB1, TB2, TB3, TB4, WG1 MRC	There must be at least 2/3 generators on-load at all times in the South West area. Required for voltage stability.
Cork Generation	MW	B	0 MW <MW< 880 MW	AD1, AD2, AT11, AT12, AT14, MRC*, WG1 *MRC may be excluded depending on overload security criteria	This restricts the amount of Generation in the Cork area to 880MW. Required due to transmission congestion.
Moneypoint	NB	N:>=	1 Unit	MP1, MP2, MP3	There must be at least one Moneypoint unit on load at all times. Required to support the 400kV network.
Hydro Smolt Protocol	LEESMT ERNE ERNE12 ERNE34	n/a	Varies	ER1, ER2, ER3, ER4, LE1, LE2, LE3	Over the spring and early summer period as the water temperature in the rivers and lakes change, the hydro stations have to be dispatched in a very specific way to allow fish to safely move safely. This affects the generators in Erne and Lee.