Operational Constraints Update
25/02/2021

EIRGRID SONI

Key Updates
• *Section 3.4.1: Removal of C30 must-run*

Disclaimer

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1. Introduction

To enable the efficient and secure operation of the power system, EirGrid and SONI schedule and dispatch units so as to adhere to their respective Operating Security Standards[1]. These standards ensure that the all-island transmission system is operated in a secure and reliable manner.

The process by which the TSOs schedule and dispatch the power system is outlined in the 'Balancing Market Principles Statement'[2]. This includes a description of how the operational constraints outlined in this document are applied.

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. 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

This document comprises of: (i) **Operating Reserve Requirements**, and (ii) **System Constraints**.

1.2 List of Terms

Transmission Constraint Group (TCG) Type	
MW	Limit MW output of unit or units assigned to a TCG
MWR	Limits (the total MW + Primary Reserve - the area demand) from assigned resources
NB	Limit to the status (On/Off) of the unit or units assigned to a TCG

Limit Flag	
E	Equality Constraint (generation = load)
X	Export Constraint - limit output of a group of units <= max limit
N	Import Constraint - limit output of a group of units >= min limit
B	In-between Constraint; >= min and <= max

[1] http://www.soni.ltd.uk/media/documents/Operations/SONI%20Operating%20Security%20Standards%20v1.pdf
http://www.eirgridgroup.com/site-files/library/EirGrid/Operating-Security-Standards-December-2011.pdf

[2] http://www.eirgridgroup.com/site-files/library/EirGrid/EirGrid-and-SONI-Balancing-Market-Principles-Statement-V4-0-(final).pdf

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	75%[3] (S_PRM_TOT)	155/ 150 (S_PRM_ROI)	50 (S_PRM_NI)
Regulating Sources POR[2]		135/ 75 (S_PRM_ROI)	50 (S_PRM_NI)
SOR	75%[4] (S_SEC_TOT)	155/ 150 (S_SEC_ROI)	50 (S_SEC_NI)
TOR1	100% (S_TR1_TOT)	155/ 150 (S_TR1_ROI)	50 (S_TR1_NI)
TOR2	100% (S_TR2_TOT)	155/ 150 (S_TR2_ROI)	50 (S_TR2_NI)

1. Ireland Lower values apply for when there is at least one pump storage unit in pump mode.
2. Minimum values of POR in each jurisdiction must be supplied from regulating sources
3. At times more than 75% POR is held All Island (up to 80%) in order to maintain system security standards based on transient security analysis (this will remain under review by the TSOs).
4. At times more than 75% SOR is held All Island (up to 100%) in order to maintain system security standards based on real-time transient security analysis (this will remain under review by the TSOs).

2.1 Operating Reserve Definitions

Classification	Category	Delivered By	Maintained Until
Frequency Containment Reserves	Primary (POR)	5 seconds	15 seconds
	Secondary (SOR)	15 seconds	90 seconds
Frequency Restoration Reserves	Tertiary 1 (TOR1)	90 seconds	5 minutes
	Tertiary 2 (TOR2)	5 minutes	20 minutes

Frequency Containment Reserves (FCR) means the active power reserves available to contain system frequency after the occurrence of an imbalance, and for EirGrid and SONI shall include Primary Operating Reserve (POR) and Secondary Operating Reserve (SOR) as defined in the EirGrid and SONI Grid Codes.

Frequency Restoration Reserves (FRR) means the active power reserves available to restore system frequency to the nominal frequency, and for EirGrid and SONI shall include Tertiary Operating Reserve 1 (TOR 1) and Tertiary Operating Reserve 2 (TOR 2) as defined in the EirGrid and SONI Grid Codes.

Replacement Reserves (RR) means the active power reserves available to restore or support the required level of FRR to be prepared for additional system imbalances, including generation reserves. For the IE/NI synchronous area to progressively restore the activated FCR and FRR, and for EirGrid and SONI shall include Replacement Reserve as defined in the EirGrid and SONI Grid Codes.

2.2 Source of Reserve

	Ireland	Northern Ireland
Regulating Reserve	Synchronised Generating Units	Synchronised Generating Units
Non or Partially Regulating Reserve	Turlough Hill Units when in pumping mode 45 MW of Response from DSUs EWIC Interconnector (up to 75 MW)	10 MW of battery response 5 MW of Response from DSUs Moyle Interconnector (up to 75 MW)
Negative Ramping Reserve Please Note: From 14th of January 2021 the negative reserve trial completed resulting in a permanent reduction of the requirement in Ireland from 100MW to 0MW.	0MW (Defined as the MW output of a conventional generator above its minimum load which can be delivered at or above 5 MW/min)	50MW (Defined as the MW output of a conventional generator above its minimum load which can be delivered at or above 5 MW/min)

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, system stability 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. For more information on Inter-Area Flow (North-South Tie Line) Constraints follow link:
https://www.sem-o.com/documents/general-publications/Information_Note_on_Inter-Area_Flow_Constraints.pdf

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 Ramping Margin Constraints

The Ramping Margin Constraints maintain a level of dispatchable generation and demand to mitigate renewable forecast error.

Classification	Category	Delivered within	Maintained for
Ramping Margin	Ramping Margin 1 (RM1)	1 Hours	2 Hours
	Ramping Margin 3 (RM3)	3 Hours	5 Hours
	Ramping Margin 8 (RM8)	8 Hours	8 Hours

Ramping Margin 1 is the increased MW output or reduction in demand, a unit can provide, within one hour of receiving a dispatch instruction and maintaining that MW output for a further two hours after the one hour period has elapsed.
Ramping Margin 3 is the increased MW output or reduction in demand, a unit can provide, within three hours of receiving a dispatch instruction and maintaining that MW output for a further five hours after the three hour period has elapsed.
Ramping Margin 8 is the increased MW output or reduction in demand, a unit can provide, within eight hours of receiving a dispatch instruction and maintaining that MW output for a further eight hours after the eight hour period has elapsed.

3.4 Adverse Weather and Increased System Risk

During periods of adverse weather or where there is an increased system risk (e.g. high impact generator or interconnector testing), the TSOs may implement measures to mitigate the consequences of this risk. Such measures may include but not limited to scheduling additional reserve and running units out of merit.

There are changes to operational constraints at present associated with the Covid-19 pandemic. These are highlighted in the Run Hours constraints for Ireland and N. Ireland. It is of

critical importance that the security of the power system is maintained during the Covid-19 pandemic period.

As such The TSOs are aware that Covid-19 may have implications for market participants during the pandemic period.

Should market participants identify operational risks related to Covid-19 they should inform the TSO as soon as possible via their normal point of contact. Should this instigate a significant change to scheduling and dispatch the TSOs will update this weekly constraints document to reflect this in a revised publication as soon as possible.

Any changes to operational constraints will be notified through the Weekly Operational Constraints Process.

3.4.1 Current Operational Constraints

Name	Constraint Type	Limit	Resources	Description
Ireland Generator Constraint	NB	N:>=	DB1	Unit is must run for system security reasons.

3.5 Permanent 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.

3.5.1 Active System Wide Constraints

Name	TCG Type	Limit Type	Limit	Resources	Description
Inter-Area Flow **(S_MWR_ROI)**	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 from Ireland to Northern Ireland does not exceed the operational limits 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 operational limits of the existing North South tie line are respected.
Inter-Area Flow **(S_MWR_NI)**	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 from Northern Ireland to 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 **(S_SNSP_TOT)**		X:<=	65%	Wind, PV, Moyle Interconnector, EWIC Interconnector	Ensures that the SNSP is kept below 65%. Please note that the TSOs on 18th January 2021 commenced a 70% SNSP trial.
Operational Limit for RoCoF **(S_RoCoF)**		X:<=	0.5 Hz/s	Ireland and Northern Ireland Power Systems	Ensures that RoCoF does not exceed 0.5 Hz/s. Please note that the TSOs on 17th June 2020, started a 1 Hz/s RoCoF trial
Operational Limit for Inertia **(S_INERTIA_TOT)**		N:>=	23,000MWs	Ireland and Northern Ireland Power Systems	Ensures that all island Inertia does not fall below 23,000 MWs.

3.5.2 Active Northern Ireland Constraints

Name	TCG Type	Limit Type	Limit	Resources	Description
System Stability (S_NBMIN_MINNIU)	NB	N:>=	3 Units at all times	B10, B31, B32, C30, K1, K2	There must be at least 3 machines on-load at all times in Northern Ireland. Required for dynamic stability.
System Stability (S_NBMIN_MINNI3)	NB	N:>=	1 Unit at all times	C30, K1, K2	There must be a least 1 machine on-load at all times in Northern Ireland. Required for dynamic stability.
Replacement Reserve (S_REP_NI) (S_MWMAX_NI_GT)	MW	X:<=	272 MW	BGT1, BGT2, CGA, CGT8, EMPOWER , iPOWER, KGT1, KGT2, KGT3, KGT4	Combined MW output of OCGTs and AGUs must be less than 272 MW (out of a total of 397 MW) in Northern Ireland at all times. 125 MW required for replacement reserve. The limit is subject to change based on the availability of the units and transmission constraints that may limit their output.
North West Generation (S_NBMIN_CPS)	NB	N:>=	0 or 1 Unit depending on NI system demand	C30	Coolkeeragh C30 must be on load when the NI system demand is at or above 1,550 MW, CGT8 is unavailable and NI wind generation < 450 MW. This demand limit can be raised to 1,608 MW if CGT8 is available. For NI wind generation in excess of 450 MW there is no constraint. This operational constraint is required to ensure voltage stability in the northwest of Northern Ireland and to prevent possible system voltage collapse above the indicated system demand.

Moyle Interconnector **(S_MWMIN_MOYLE)** **(S_MWMAX_MOYLE)**	MW	B	-400* < MW < 442	Moyle Interconnector[3]	It ensures that all flows do not exceed an import of 442 MW to Northern Ireland and an export of 400 MW* to Scotland (values taken from NI). This is required to ensure that the limits are respected. *Notes: 1. Firm export limit on Moyle increased to 250MW from 80MW on 1st December 2020. There is an agreed process between Moyle and NGET on releasing additional "non-firm" export capacity when GB system conditions allow. 2. BREXIT - Impact on Scheduling Day-Ahead Markets, effective from 31 December 2020, will not include any SEM-GB interconnection capacity. This first day ahead LTS run should be considered more indicative than it would normally be, given that firm interconnector schedules for the first part of the next day (from 23:00 D-1 to 11:00 D) will not be available until post IDA1 (after 18:10). The LTS that is published each evening post IDA1 will reflect the firm interconnector schedules.

[3] Combined Ramp Rate of EWIC and Moyle Interconnectors is limited to 10 MW/Min

3.5.3 Active Ireland Constraints

[A] Scenario A: In this scenario if PBA or PBB are operating in combined cycle mode they will be considered as constraint resources

[B] Scenario B: In this scenario if PBA or PBB are configured to synchronise in 10 minutes they will be considered as constraint resources

Name	TCG Type	Limit Type	Limit	Resources	Description
System Stability **(S_NBMIN_ROImin)**	NB	N:>=	5 Units	AD2, DB1, GI4, HNC, HN2, MP1, MP2, MP3, PBA [A], PBB [A], TB3, TB4, TYC, WG1	There must be at least 5 machines on-load at all times in Ireland. Required for dynamic stability. [A] See Scenario A
Replacement Reserve **(S_REP_ROI)** **(S_MWMAX_ROI_GT)**	MW	X:<=	698 MW [B]	AT1, AT2, AT4, ED3, ED5, RP1, RP2, TP1, TP3. PBA [B], PBB [B]	Combined MW output of OCGTs must be less than 698 MW (out of a total of 1023 MW) in Ireland at all times. 325 MW required for replacement reserve. The limit is subject to change based on the availability of the units and transmission constraints that may limit their output. [B] See Scenario B
Dublin Generation **(S_NBMIN_DubNB2)**	NB	N:>=	1 Units	DB1, HNC, HN2	There must be at least 1 large generator on-load at all times in the Dublin area. Required for voltage control.
Dublin Generation **(S_NBMIN_Dub_NB)**	NB	N:>=	2 Units	DB1, HNC, HN2, PBA [B], PBB [B]	There must be at least 2 large generators on-load at all times in the Dublin area. Required for voltage control. This assumes EWIC is operational. Note that during an outage of EWIC there must be at least 3 large generators on-load at all times in the Dublin area. [B] See Scenario B
Dublin Generation **(S_NBMIN_DUB_L1)**	NB	N:>=	2 Units if Ireland System Demand >4000MW	DB1, HNC, PBA [B], PBB [B],	Requirement for 2 units to be on load when Ireland System Demand is greater than 4000 MW. This operational constraint is required for load flow control in the Dublin area. This assumes EWIC is operational. [B] See Scenario B

Name	TCG Type	Limit Type	Limit	Resources	Description
Dublin Generation **(S_NBMIN_DUB_L2)**	NB	N:>=	3 Units if Ireland System Demand > 4700 MW	DB1, HNC, HN2, PBA [B], PBB [B]	Requirement for 3 units to be on load when Ireland System Demand is greater than 4700 MW. This operational constraint is required for load flow control in the Dublin area. This assumes EWIC is operational. [B] See Scenario B
South Generation **(S_NBMIN_STHLD1)**	NB	N:>=	1 Unit if Ireland System Demand > 1500 MW	AD2, AT1, AT2, AT4, SK3, SK4, WG1	Requirement for at least one Unit to be on load when Ireland System Demand is greater than 1500 MW. This operational constraint is required for voltage stability in the South.
South Generation **(S_NBMIN_STHLD2)**	NB	N:>=	2 Units if Ireland System Demand > 2500 MW 3 Units if Ireland System Demand > 3500 MW	AD2, AT1, AT2, AT4, GI4, SK3, SK4, WG1	Requirement for at least two Units, to be on load when Ireland System Demand is greater than 2500 MW. Requirement for at least three Units, to be on load when Ireland System Demand is greater than 3500 MW. This operational constraint is required for voltage stability in the South.
South Generation **(S_NBMIN_STHLD3)**	NB	N:>=	1 Unit if Ireland System Demand > 2500 MW	AD2, AT1, AT2, AT4, GI4, WG1	Requirement for at least one Unit to be on load when Ireland System Demand is greater than 2500 MW. This operational constraint is required for voltage stability in the South.
South Generation **(S_NBMIN_STHLD4)**	NB	N:>=	1 Unit if Ireland System Demand > 3500 MW AND Ireland Wind < 500 MW	AD2, AT1, AT2, AT4, WG1	Requirement for at least one Unit to be on load when Ireland System Demand is greater than 3500 MW AND Ireland Wind total is below 500 MW.This operational constraint is required for voltage stability in the South.

Name	TCG Type	Limit Type	Limit	Resources	Description
South Generation (S_NBMIN_STHLD5)	NB	N:>=	1 Unit if Ireland System Demand > 4200 MW	AD2, GI4, WG1	Requirement for at least one Unit to be on load when Ireland System Demand is greater than 4200 MW. This operational constraint is required for voltage stability in the South.
Cork Generation (S_MWMIN_CRK_MW) (S_MWMAX_CRK_MW)	MW	B	0 MW <MW< 1100 MW	AD2, AT1, AT2, AT4, WG1	Generation restriction in the Cork area: this will be determined week ahead and available in the Weekly Operational Constraints Update.
South Generation (S_MWMIN_STH_MW) (S_MWMAX_STH_MW)	MW	B	0 MW <MW< 1800 MW	AD2, AT1, AT2, AT4, GI4, WG1	Generation restriction in the Southern Region: this will be determined week ahead and available in the Weekly Operational Constraints Update.
400 kV Network (S_NBMIN_MP_NB)	NB	N:>=	1 unit when Ireland wind < 1,000 MW	MP1, MP2, MP3, TYC	There must be at least one unit on load at all times; required to support the 400kV network.
EWIC Interconnector (S_MWMIN_EWIC) (S_MWMAX_EWIC)	MW	B	-526 <MW< 504	EWIC Interconnector[4]	It ensures that all flows do not exceed an import of 504MW to Ireland and an export of 526MW to GB (values taken from Portan). This is required to ensure that the limits are respected. Note: BREXIT - Impact on Scheduling Day-Ahead Markets, effective from 31 December 2020, will not include any SEM-GB interconnection capacity. This first day ahead LTS run should be considered more indicative than it would normally be, given that firm interconnector schedules for the first part of the next day (from 23:00 D-1 to 11:00 D) will not be available until post IDA1 (after 18:10). The LTS that is published each evening post IDA1 will reflect the firm interconnector schedules.

[4] Combined Ramp Rates on EWIC and Moyle Interconnectors are limited to 10 MW/Min

Name	TCG Type	Limit Type	Limit	Resources	Description
South West Generation **(S_NBMIN_SW_NB)**	NB	N:>=	1 Unit	TB3, TB4	To support South West voltage, at times of low demand and very low wind generation output in the south-west, additional generation may be required
South West Generation **(S_NBMIN_SWENB2)**	NB	N:>	1 Unit	AD2, WG1	To support South-West voltage, at times of low demand and very low wind generation output in the South-West, additional generation may be required.