Weekly Operational Constraints Update

2 December 2024 to 8 December 2024

(Week 49)

29 November 2024

Disclaimer

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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.

Weekly operational constraint document includes both long standing operational constraints and constraints that are updated on a weekly basis.

Weekly Operational Constraints

- The purpose of this Weekly Operational Constraints Update is to provide information on any forecasted significant network congestion or other issues that could potentially restrict dispatchable generation in a particular area or to flag if dispatchable generation is required in a particular area.
- In the analysis, a suite of N-1 contingencies are applied to the base case powerflow, and the resulting flows and voltages are compared against the Operational Security Standards. The N-1 contingencies include the tripping of each item of transmission plant and each generator transformer. Groups of generators / demand / wind etc. can be scaled up or down to determine a secure region of operation (known as transfer analysis or transaction analysis).
- The cases incorporate the latest generation and transmission outage information at the time of the study. This information is published on the EirGrid and SONI websites.
- Typically, from a dispatchable generation perspective the worst thermal constraints occur at peak system demand, and therefore only peak system demand scenarios are studied using transfer analysis. If required, other studies are performed, such as system demand valley where high voltages may be an issue.
- The wind levels in the various scenarios assume a flat profile across Ireland or Northern Ireland. We do not test Ireland wind levels above 2000 MW as, typically above these levels, constraints on dispatchable generation are not as binding due to the availability of the wind generation.
- The binding constraints on the flow on the North-South Tie Line from a thermal and voltage perspective tend to be due to thermal constraints on the Ireland side, save for specific Northern Ireland outages. This is why the Inter-Area Flow (North-South Tie Line Flow) Constraints Forecast below is only studied against Ireland wind generation.

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[1] http://www.soni.ltd.uk/media/documents/Operations/SONI%20Operating%20Security%20Standards%20v1.pdf
https://cms.eirgrid.ie/sites/default/files/publications/EirGrid_Operating-Security-Standards_2021.pdf

[2] https://www.eirgridgroup.com/site-files/library/EirGrid/EirGrid-and-SONI-Balancing-Market-Principles-Statement-V5.0.pdf

- There may be other reasons, apart from voltage and thermal limits that lead to constraints, such as frequency, transient stability and adverse weather conditions. These are usually observed and dealt with close to real-time.
- Should any of the study assumptions materially change during the week, due to a forced outage for example, we will endeavour to perform new studies and publish results on the next working day.

Long Term Constraints

The Long Term Operational Constraints update presents 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
- Moyle import / export constraint
- Requirement to keep a minimum number of units on in an area
- Requirement to limit the output of the generators in an area to limit short circuit levels or overloads
- Requirement for a minimum output from the generators in an area to support the voltage or to avoid overloads

The Long Term Constraints update comprises of (i) Active Constraints, (ii) System Constraints, and (iii) Operating Reserve Requirements.

Weekly Operational Constraints

Generator and Transmission Outages

Generator and transmission plant outages as per published here:

All-Island Generator Outages – Under REMIT Publications

Ireland Transmission Outages

Northern Ireland Transmission Outages

Demand

All studies are performed at Weekday Peak System Demand unless otherwise stated

Jurisdiction	Weekday Peak System Demand (MW)	Weekend Peak System Demand (MW)
Ireland	5700	3700
Northern Ireland	1450	1250

Initial Interconnector and Tie Line Flows

	Flow (MW)
EWIC	At zero wind 250 MW Import (GB to IE) At 2000 MW wind 250 MW Export (IE to GB)
Moyle	N/A
North–South Tie Line Flow	0 MW Northern Ireland to Ireland / Ireland to Northern Ireland

The forecast constraints below are at Weekday Peak System Demand.

South Generation Constraints Forecast (TCG Type: MW; Limit Type B) as per Operational Constraints Update

Ireland Wind Generation (MW)	Minimum South Generation (MW)	Maximum South Generation (MW)
0	Mon: 0	Mon: 1655
0	Tue, Fri: 0	Tue, Fri: 1215
0	Wed-Thu: 0	Wed-Thu: 1165
1000	Mon: 0	Mon: 1665
1000	Tue, Fri: 0	Tue, Fri: 1250
1000	Wed-Thu: 0	Wed-Thu: 995
2000	Mon: 0	Mon: 1350
2000	Tue, Fri: 0	Tue, Fri: 1350
2000	Wed-Thu: 0	Wed-Thu: 970

Cork Generation Constraints Forecast (TCG Type: MW; Limit Type B) as per Operational Constraints Update

Ireland Wind Generation (MW)	Minimum Cork Generation (MW)	Maximum Cork Generation (MW)
0	Mon: 0	Mon: 1200
0	Tue, Fri: 0	Tue, Fri: 1215
0	Wed-Thu: 0	Wed-Thu: 1165
1000	Mon: 0	Mon: 1665
1000	Tue, Fri: 0	Tue, Fri: 1250
1000	Wed-Thu: 0	Wed-Thu: 995
2000	Mon: 0	Mon: 1350
2000	Tue, Fri: 0	Tue, Fri: 1350
2000	Wed-Thu: 0	Wed-Thu: 970

Inter-Area Flow (North-South Tie Line Flow) Constraints Forecast

Ireland Wind Generation (MW)	Maximum Northern Ireland to Ireland flow* (MW)	Maximum Ireland to Northern Ireland flow* (MW)
0	Tue-Fri: 450	Tue-Fri: 220
1000	Tue-Fri: 450	Tue-Fri: 400
2000	Tue-Fri: 450	Tue-Fri: 400

* These figures relate to MMS scheduled flows only, the dispatch limits of Tie Line flows are determined by real-time system security analysis.

Ireland Wind Generation (MW)	Maximum EWIC Import (MW)*	Maximum EWIC Export (MW)*	Maximum Moyle Import (MW)*	Maximum Moyle Export (MW)*
0	504	526	441	410
1000	504	526	441	410
2000	504	526	441	410

* Values pertain to the Ireland/Northern Ireland side of the interconnectors only when available.

Coolkeeragh C30 Running

Northern Ireland Wind Generation (MW)	Northern Ireland Demand (MW) above which C30 must be running with GT8 off	Northern Ireland Demand (MW) above which C30 must be running with GT8 operating as a synchronous compensator	Northern Ireland Demand (MW) above which C30 must be running with GT8 operating as a generator
0	1550	1608	Not required
450	Not required	Not required	Not required
900	Not required	Not required	Not required

Other Constraints/Notes/Risks

Jurisdiction	Constraint/Note	Reason
Ireland	Winter transmission ratings are in place.	Seasonal.
Northern Ireland	Winter transmission ratings are in place.	Seasonal.
Ireland	Synchronous condenser MP5 is must run where export flows on EWIC are >= 200 MW, when MP2 is not scheduled on.	System Stability
Northern Ireland	Update to System Wide Transmission Constraint Group System Stability (S_NBMIN_MINNI3) Minimum 1 at all times C30, KGT6 Limit Type: N: >=	Security of Supply

Long Term Operational Constraints

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

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.

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:<=	75%	Wind, PV, Moyle Interconnector, EWIC Interconnector	Ensures that the SNSP is kept below 75%.
Operational Limit for RoCoF **(S_RoCoF)**		X:<=	1 Hz/s	Ireland and Northern Ireland Power Systems	Ensures that RoCoF does not exceed 1 Hz/s.
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.

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, KGT6	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: >=	Minimum 1 at all times	C30, KGT6	Security of supply.
Replacement Reserve (S_REP_NI) (S_MWMAX_NI_GT)	MW	X:<=	272 MW	BGT1, BGT2, CGA, CGT8, EMPOWER , iPOWER, KGT1, KGT2, KGT3, KGT4, KGT6	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	-410* < MW < 441	Moyle Interconnector[3]	It ensures that all flows do not exceed an import of 441 MW to Northern Ireland and an export of 410 MW* to Scotland (values taken from NI). This is required to ensure that the limits are respected. Note that emergency flows may be -500 < MW < 500 due to reserve provision. *Notes: 1. Firm export limit on Moyle increased to 400 MW from 1st April 2022 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

Active Ireland Constraints

- Note that the South Generation NB constraint groups STHLO1, STHLO2 & STHHI1 have been implemented on a trial basis and are subject to review
- Scenario A: In this scenario if PBA or PBB are operating in combined cycle mode they will be considered as constraint resources
- 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:>=	4 Units	AD2, DB1, GI4, HNC, HN2, MP1, MP2, MP3, PBA □□, PBB □□, TYC, WG1	There must be at least 4 machines on-load at all times in Ireland. Required for dynamic stability. □□ See Scenario A
Replacement Reserve **(S_REP_ROI)** **(S_MWMAX_ROI_GT)**	MW	X:<=	See Description	AT1, AT2, AT4, ED3, ED5, FG2, IS3, RP1, RP2, TP1, TP3, PBA □, PBB □, PB7	Combined MW output of peaking units must be limited such that 325 MW remains available in Ireland at all times. The limit is subject to change based on the availability of the units, transmission constraints that may limit their output and on whether units PBA and/or PBB are operating in open cycle mode. □ 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 □, PBB □	There must be at least 2 large generators on-load at all times in the Dublin area. Required for

Name	TCG Type	Limit Type	Limit	Resources	Description
					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. See Scenario B
Dublin Generation **(S_NBMIN_DUB_L1)**	NB	N:>=	2 Units if Ireland System Demand >4000MW	DB1, HNC, PBA , PBB ,	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. See Scenario B
Dublin Generation **(S_NBMIN_DUB_L2)**	NB	N:>=	3 Units if Ireland System Demand > 4700 MW	DB1, HNC, HN2, PBA , PBB	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. See Scenario B
South Generation **(S_NBMIN_STHLO1)**	NB	N:>=	1 Unit if Ireland System Demand < 2950 MW	AD2, GI4, WG1	Requirement for at least one Unit to be on load when Ireland System Demand is less than 2950 MW. This operational constraint is required for voltage stability in the South East.
South Generation	NB	N:>=	1 Unit if Ireland	AD2, SK3, SK4, WG1	Requirement for at least one Unit to be

Name	TCG Type	Limit Type	Limit	Resources	Description
(S_NBMIN_STHLO2)			System Demand < 2950 MW		on load when Ireland System Demand is less than 2950 MW. This operational constraint is required for voltage stability in the South West.
South Generation **(S_NBMIN_STHHI1)**	NB	N:>=	1 Unit if Ireland System Demand > 5050 MW	AD2, AT1, AT2, AT4, GI4, WG1	Requirement for at least one Unit to be on load when Ireland System Demand is greater than 5050 MW. This operational constraint is required for voltage stability in the South East.
Cork Generation **(S_MWMIN_CRK_MW)** **(S_MWMAX_CRK_MW)**	MW	B	0 MW <MW< 1200 MW	AD2, AD3. AD4, AD5, 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, AD3. AD4, AD5, 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, MP5, 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.

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

Name	TCG Type	Limit Type	Limit	Resources	Description
					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.
Moneypoint Generation **(MP5_NB)**	NB	N:<=	1 Unit	MP2, MP5	Moneypoint units 2 and 5 cannot be run simultaneously due to station arrangements.

System Constraints

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

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).

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.

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.

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

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]		75/ 75 (S_PRM_ROI)	50 (S_PRM_NI)
SOR	75%[4] (S_SEC_TOT)	155/ 150 (S_SEC_ROI)	50 (S_SEC_NI)
Regulating Sources SOR[2]		75/75 (S_SEC_ROI)	50 (S_SEC_NI)
TOR1	100% (S_TR1_TOT)	155/ 150 (S_TR1_ROI)	50 (S_TR1_NI)
Regulating Sources TOR1[2]		87/87 (S_TR1_ROI)	50 (S_TR1_NI)
TOR2	100% (S_TR2_TOT)	155/ 150 (S_TR2_ROI)	50 (S_TR2_NI)
Regulating Sources TOR2[2]		87/87 (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).

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.

Source of Reserve

	Ireland	Northern Ireland
Regulating Reserve	Synchronised Generating Units	Synchronised Generating Units
Non or Partially Regulating Reserve Please Note: Since 1st April 2021 the TSOs are operating the battery portfolio on a trial basis which will evolve as the TSOs' operational experience, business processes and IT tools mature.	Turlough Hill Units when in pumping mode 54 MW of Response from DSUs EWIC Interconnector (up to 75 MW) Response from 50% of available battery capacity assumed	11 MW of Response from DSUs Moyle Interconnector (up to 75 MW) Response from 50% of available battery capacity assumed
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.	0 MW (Defined as the MW output of a conventional generator above its minimum load)	50 MW (Defined as the MW output of a conventional generator above its minimum load)