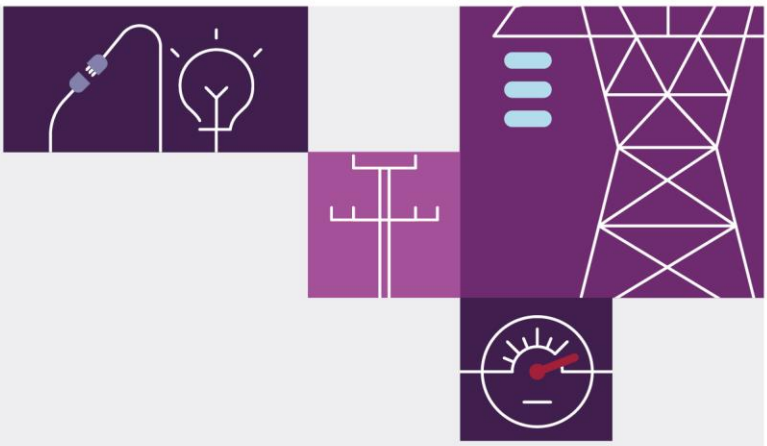
AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Monthly Constraint Report

December 2023

A report for the National Electricity Market on Constraint results.



Important notice

Purpose

This publication has been prepared by AEMO to provide information about constraint equation performance and related issues, as at the date of publication.

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1 Introduction

This report details constraint equation performance and transmission congestion related issues for December 2023. Included are investigations of violating constraint equations, usage of the constraint automation and performance of Pre-dispatch constraint equations. Transmission and generation changes are also detailed along with the number of constraint equation changes.

2 Constraint Equation Performance

2.1 Top 10 binding constraint equations

A constraint equation is binding when the power system flows managed by it have reached the applicable thermal or stability limit or the constraint equation is setting a Frequency Control Ancillary Service (FCAS) requirement. Normally there is one constraint equation setting the FCAS requirement for each of the eight services at any time. This leads to many more hours of binding for FCAS constraint equations - as such these have been excluded from the following table.

Table 1 Top 10 binding network constraint equations

Constraint Equation ID (System Normal Bold)	Description	#DIs (Hours)	Limit Type
N^N-LS_SVC	Out= Lismore SVC O/S or reactive power control mode,avoid Voltage collapse on TL 87/89 trip;[Swamped for 3 DLK cables are O/S Or when ECS is enabled with DLK is exporting to QLD,sets DLK to -29 MW for -29< DLK FLOW<0, checks ETS status & unswamps if O/S)	4441 (370.08)	Voltage Stability
N>NIL_94T	Out= Nil, avoid O/L Molong to Orange North (94T) on trip of Nil, Feedback	3045 (253.75)	Thermal
N>NIL_969	Out= Nil, avoid O/L Gunnedah to Tamworth (969) on trip of Nil, Feedback. Metering is used as specified in OM520 [Note: swamped with 96M or 9UJ or 9UH is O/S]	2584 (215.33)	Thermal
V^^V_NIL_KGTS	Out= Nil, avoid voltage collapse for loss of Horsham - Murra Warra - Kiamal 220kV line. Murraylink VFRB disabled. Swamp if Murraylink VFRB enabled.	2545 (212.08)	Voltage Stability
S>NIL_MHNW1_MHNW2	Out= Nil, avoid O/L Monash-North West Bend #2 132kV on trip of Monash-North West Bend #1 132kV line, Feedback	2464 (205.33)	Thermal
N>NIL_9R6_991	Out= Nil, avoid O/L Wagga North to Wagga (9R6) 132kV line on trip of Wagga North to Murrumburrah (991) 132kV line, Feedback	1736 (144.66)	Thermal
N>>NIL_970_051	Out= NIL, avoid O/L Burrinjuck to Yass (970) on trip of Wagga to Lower Tumut (051) line, Feedback	1531 (127.58)	Thermal
S^NIL_SA_NTH_N-2	Out = NIL, Manage voltage collapse in northern SA for the loss of Robertstown - Tungkillo 275kV line 1 and 2 and the Robertstown No.1 and No.2 synchronous condensers declared credible	1410 (117.5)	Voltage Stability
N>NIL_997_99A	Out= Nil, avoid O/L Corowa to Albury 132kV line (997/1) on trip of Finley to Uranquinty 132kV line (99A), Feedback	1402 (116.83)	Thermal
Q>NIL_YLMR	Out= Nil, avoid overload on 110kV feeders between Yarranlea and Middle Ridge(733/1 and 734/1), Feedback	1381 (115.08)	Thermal

2.2 Top 10 binding impact constraint equations

Binding constraint equations affect electricity market pricing. The binding impact is used to distinguish the severity of different binding constraint equations.

The binding impact of a constraint is derived by summarising the marginal value for each dispatch interval (DI) from the marginal constraint cost (MCC) re-run[1] over the period considered. The marginal value is a mathematical term for the binding impact arising from relaxing the RHS of a binding constraint by one MW. As the market clears each DI, the binding impact is measured in $/MW/DI.

The binding impact in $/MW/DI is a relative comparison and a helpful way to analyse congestion issues. It can be converted to $/MWh by dividing the binding impact by 12 (as there are 12 DIs per hour). This value of congestion is still only a proxy (and always an upper bound) of the value per MW of congestion over the period calculated; any change to the limits (RHS) may cause other constraints to bind almost immediately after.

Table 2 Top 10 binding impact network constraint equations

Constraint Equation ID (System Normal Bold)	Description	∑ Marginal Values	Limit Type
N>NIL_94T	Out= Nil, avoid O/L Molong to Orange North (94T) on trip of Nil, Feedback	3,820,701	Thermal
N>>NIL_970_051	Out= NIL, avoid O/L Burrinjuck to Yass (970) on trip of Wagga to Lower Tumut (051) line, Feedback	2,929,729	Thermal
N>NIL_969	Out= Nil, avoid O/L Gunnedah to Tamworth (969) on trip of Nil, Feedback. Metering is used as specified in OM520 [Note: swamped with 96M or 9UJ or 9UH is O/S]	2,589,471	Thermal
V^^V_NIL_KGTS	Out= Nil, avoid voltage collapse for loss of Horsham - Murra Warra - Kiamal 220kV line. Murraylink VFRB disabled. Swamp if Murraylink VFRB enabled.	1,587,791	Voltage Stability
N>NIL_9R6_991	Out= Nil, avoid O/L Wagga North to Wagga (9R6) 132kV line on trip of Wagga North to Murrumburrah (991) 132kV line, Feedback	1,447,549	Thermal
S^NIL_SA_NTH_N-2	Out = NIL, Manage voltage collapse in northern SA for the loss of Robertstown - Tungkillo 275kV line 1 and 2 and the Robertstown No.1 and No.2 synchronous condensers declared credible	1,225,457	Voltage Stability
Q>NIL_YLMR	Out= Nil, avoid overload on 110kV feeders between Yarranlea and Middle Ridge(733/1 and 734/1), Feedback	1,219,864	Thermal
S>NIL_MHNW1_MHNW2	Out= Nil, avoid O/L Monash-North West Bend #2 132kV on trip of Monash-North West Bend #1 132kV line, Feedback	1,147,646	Thermal
N>NIL_997_99A	Out= Nil, avoid O/L Corowa to Albury 132kV line (997/1) on trip of Finley to Uranquinty 132kV line (99A), Feedback	946,011	Thermal
N>NIL_94K_1	Out= Nil, avoid O/L Suntop Tee to Wellington (94K/1) on trip of Nil, Feedback	778,357	Thermal

2.3 Top 10 violating constraint equations

A constraint equation is violating when NEMDE is unable to dispatch the entities on the left-hand side (LHS) so the summated LHS value is less than or equal to, or greater than or equal to, the right-hand side (RHS) value (depending on the

[1] The MCC re-run relaxes any violating constraint equations and constraint equations with a marginal value equal to the constraint equation's violation penalty factor (CVP) x market price cap (MPC). The calculation caps the marginal value in each DI at the MPC value valid on that date. MPC is increased annually on 1st July.

mathematical operator selected for the constraint equation). The following table includes the FCAS constraint equations. Reasons for the violations are covered in 2.3.1.

Table 3 Top 10 violating constraint equations

Constraint Equation ID (System Normal Bold)	Description	#DIs (Hours)	Limit Type
N^N-LS_SVC	Out= Lismore SVC O/S or reactive power control mode,avoid Voltage collapse on TL 87/89 trip;[Swamped for 3 DLK cables are O/S Or when ECS is enabled with DLK is exporting to QLD,sets DLK to -29 MW for -29< DLK FLOW<0, checks ETS status & unswamps if O/S)	31 (2.58)	Voltage Stability
NSA_Q_BARCALDN	Network Support Agreement for Barcaldine GT to meet local islanded demand for the planned outage of 7153 T71 Clermont to H15 Lilyvale or 7154 T72 Barcaldine to T71 Clermont 132kV line	29 (2.41)	Network Support
Q>NIL_MRTX_MRTX_N-2	Out= Nil, avoid O/L Middle Ridge 275/110kV (1T) transformer on trip of remaining Middle Ridge 275/110kV (2T and 3T) transformers, Feedback	11 (0.91)	Thermal
CA_SYDS_549FBEF5_1	Constraint Automation, O/L XFMR 1_H4@H4_MUGBA@QLD for CTG TQHQ on trip of H4_MUGBA #5 TRANS. Generated by STNET[BNECR3] Host NORREGEEMP7(EMPSYD)	11 (0.91)	Thermal
S_DLBAT-G_ISL	Out= Yorke Peninsula 132kV network islanded (i.e. island formed between Hummocks-Androssan West- Dalrymple 132kV network), Dalrymple Battery (Gen Mode) islanded	8 (0.66)	Islanding - Unit
NSA_T_DVGATE_10	Devils Gate >= 10 MW for Network Support Agreement	7 (0.58)	Network Support
F_T+RREG_0050	Tasmania Raise Regulation Requirement greater than 50 MW	6 (0.5)	FCAS
F_T+LREG_0050	Tasmania Lower Regulation Requirement greater than 50 MW	4 (0.33)	FCAS
N_WR_0WT-0INV	White Rock Wind & Solar Farm inverter limit of zero. Constraint to violate if White Rock Wind & Solar Farm inverter availability greater than zero. Swamp out otherwise. DS only	3 (0.25)	System Strength
S_DLBAT-L_ISL	Out= Yorke Peninsula 132kV network islanded (i.e. island formed between Hummocks-Androssan West- Dalrymple 132kV network), Dalrymple Battery (Load Mode) islanded	2 (0.16)	Islanding - Unit

2.3.1 Reasons for constraint equation violations

Table 4 Reasons for constraint equation violations

Constraint Equation ID (System Normal Bold)	Description
N^N-LS_SVC	Constraint equation violated for a 7 consecutive DIs on 6/12/2023 from 0605 hrs to 0635 hrs, 8 consecutive DIs on 28/12/2023 from 1745 hrs to 1820 hrs, and 16 non-consecutive DIs between 05/12/2023 1445 hrs and 29/12/2023 1725 hrs with a max violation degree of 33.7 MW occurring on 06/12/2023 1345 hrs. Constraint equation violated due to competing requirement on the import limits of DirectLink set by N_X_MBTE_3B.
NSA_Q_BARCALDN	Constraint equation violated for 29 non-consecutive DIs from 7/12/2023 1745 hrs to 10/12/2023 1455 hrs with a max violation degree of 31.29 MW occurring on 08/12/2023 0630 hrs. Constraint equation violated due to Barcaldine GT non-conforming to the Network Service Agreement requirement to meet local islanded demand.
Q>NIL_MRTX_MRTX_N-2	Constraint equation violated for 10 consecutive DIs on 22/12/2023 from 1915 hrs to 2000 hrs and 1 non-consecutive DI on 30/12/2023 1145 hrs with a max violation degree of 218.1 MW occurring on 30/12/2023 1145 hrs. Constraint equation violated due to unavailability of Oakey GT.

Constraint Equation ID (System Normal Bold)	Description
CA_SYDS_549FBEF5_1	Constraint automation equation violated for 8 consecutive DIs on 29/12/2023 from 1655 hrs to 1730 hrs and 3 consecutive DIs on 28/12/2023 from 1835 hrs to 1845 hrs with a max violation degree of 118.3 MW occurring on 28/12/2023 1835 hrs. Constraint automation equation violated due to competing requirement on the export limits of DirectLink set by N^N-LS_SVC.
S_DLBAT-G_ISL	Constraint equation violated for 8 consecutive DIs on 11/12/2023 from 2115 hrs to 2150 hrs with a violation degree of 0.001 MW. Constraint equation violated due to the availability of Dalrymple Battery being less than the actual MW.
NSA_T_DVGATE_10	Constraint equation violated for 7 consecutive DIs on 4/12/2023 from 0920 hrs to 0950 hrs with a max violation degree of 10 MW occurring for all DIs with exception to 4/12/2023 0920 hrs. Constraint equation violated due to Devils Gate hydro non-conforming to the Network Service Agreement requirement to meet local islanded demand.
F_T+RREG_0050	Constraint equation violated for 6 non-consecutive DIs on 5/12/2023 1445 hrs to 19/12/2023 1225 hrs with a max violation degree of 50 MW occurring on 5/12/2023 1445 hrs, 6/12/2023 0915 hrs and 6/12/2023 1045 hrs respectively. Constraint equation violated due to Tasmania's raise regulation service availability being less than the requirement.
F_T+LREG_0050	Constraint equation violated for 4 non-consecutive DIs on 5/12/2023 1445 hrs to 13/12/2023 2205 hrs with a max violation degree of 50 MW occurring on 6/12/2023 0915 hrs and 6/12/2023 1045 hrs. Constraint equation violated due to Tasmania's lower regulation service availability being less than the requirement.
N_WR_0WT-0INV	Constraint equation violated for 3 non-consecutive DIs on 6/12/2023 0605 hrs, 6/12/2023 1110 hrs and 6/12/2023 1115 hrs with a violation degree of 0.001 MW. Constraint equation violated due to White Rock Wind and Solar farm exceeding its inverter limit.
S_DLBAT-L_ISL	Constraint equation violated for 2 DIs on 11/12/2023 2155 hrs and 28/12/2023 1510 hrs with a max violation degree of 0.04 MW occurring on 11/12/2023 2155 hrs. Constraint equation violated due to the availability of Dalrymple Battery being less than the actual MW.

2.4 Top 10 binding interconnector limit setters

Binding constraint equations can set the interconnector limits for each of the interconnectors on the constraint equation left-hand side (LHS). Table 5 lists the top (by binding hours) interconnector limit setters for all the interconnectors in the NEM and for each direction on that interconnector.

Table 5 Top 10 binding interconnector limit setters

Constraint Equation ID (System Normal Bold)	Interconnector	Description	#DIs (Hours)	Average Limit (Max)
N^N-LS_SVC	N-Q-MNSP1 Export	Out= Lismore SVC O/S or reactive power control mode,avoid Voltage collapse on TL 87/89 trip;[Swamped for 3 DLK cables are O/S Or when ECS is enabled with DLK is exporting to QLD,sets DLK to -29 MW for -29< DLK FLOW<0, checks ETS status & unswamps if O/S)	4198 (349.83)	-66.9 (-29.0)
S>NIL_MHNW1_MHNW2	V-S-MNSP1 Export	Out= Nil, avoid O/L Monash-North West Bend #2 132kV on trip of Monash-North West Bend #1 132kV line, Feedback	2400 (200.0)	166.16 (208.81)
V^^V_NIL_KGTS	V-S-MNSP1 Import	Out= Nil, avoid voltage collapse for loss of Horsham - Murra Warra - Kiamal 220kV line. Murraylink VFRB disabled. Swamp if Murraylink VFRB enabled.	2009 (167.42)	149.18 (-161.26)
F_MAIN++APD_TL_L5	T-V-MNSP1 Import	Out = Nil, Lower 5 min Service Requirement for a Mainland Network Event-loss of APD potlines due to undervoltage following a fault on MOPS-HYTS-APD 500 kV line, Basslink able to transfer FCAS	1680 (140.0)	-444.1 (-462.0)
F_MAIN++BIP_ML_L1	T-V-MNSP1 Import	Out = Nil, Lower 1 sec requirement for a Mainland Load Event, for loss of the largest Boyne Island potline, Basslink able transfer FCAS. Requirement capped at 100 MW	1398 (116.5)	-454.73 (-462.0)
N>>NIL_970_051	VIC1-NSW1 Export	Out= NIL, avoid O/L Burrinjuck to Yass (970) on trip of Wagga to Lower Tumut (051) line, Feedback	1246 (103.83)	-52.11 (1366.66)

Constraint Equation ID (System Normal Bold)	Interconnector	Description	#DIs (Hours)	Average Limit (Max)
F_MAIN++LREG_0210	T-V-MNSP1 Import	Mainland Lower Regulation Requirement greater than 210 MW, Basslink able transfer FCAS	1070 (89.17)	-435.88 (-462.0)
N>>NIL_964_84_S	NSW1-QLD1 Import	Out= NIL, avoid O/L Port Macquarie to Herron Creek Tee (964/2) on trip of Tamworth to Liddell (84) line, Feedback	885 (73.75)	-607.06 (-1184.82)
N>>NIL_964_84_S	N-Q-MNSP1 Import	Out= NIL, avoid O/L Port Macquarie to Herron Creek Tee (964/2) on trip of Tamworth to Liddell (84) line, Feedback	868 (72.33)	-15.95 (-127.36)
N^^Q_LS_SVC_KPP_1	NSW1-QLD1 Export	Out= Lismore SVC O/S or in reactive power control mode, avoid Voltage Collapse on loss of Kogan Creek MW	688 (57.33)	571.25 (750.0)

2.5 Constraint Automation Usage

The constraint automation is an application in AEMO's energy management system (EMS) which generates thermal overload constraint equations based on the current or planned state of the power system. It is currently used by on-line staff to create thermal overload constraint equations for power system conditions where there were no existing constraint equations or the existing constraint equations did not operate correctly.

The following section details the reason for each invocation of the non-real time constraint automation constraint sets and the results of AEMO's investigation into each case.

Table 1 – Non-Real-Time Constraint Automation usage

Constraint Set ID	Date Time	Description
CA_SYDS_549FBEF5	29/12/2023 16:55 to 03/01/2024 14:20	CA_SYDS_549FBEF5 was created to manage DirectLink to prevent overloading on Mudgeeraba 1T for loss of 5T.
CA_SYDS_5494AABA	20/12/2023 08:55 to 22/12/2023 15:35	CA_SYDS_5494AABA was created to manage overloading on 99F Uranquinty – Yanco 132 kV Line under system normal.
CA_SYDS_549FBEF5	28/12/2023 18:35 to 28/12/2023 18:50	CA_SYDS_549FBEF5 was created to manage DirectLink to prevent overloading on Mudgeeraba 1T for loss of 5T.

2.5.1 Further Investigation

CA_SYDS_549FBEF5: Constraint automation equation was invoked and binding. CA_SYDS_549FBEF5 violated in favour of N^N-LS_SVC, coupled with conservative Lismore load. Violation was cleared when Northern NSW load was radialised invoking N-X_LS_VC1+96L+967. This occurred on both 28/12/2023 and 29/12/2023. Constraint automation equation was revoked after new constraint Q>NIL_MUTX_MUTX was built to manage future violation issues.

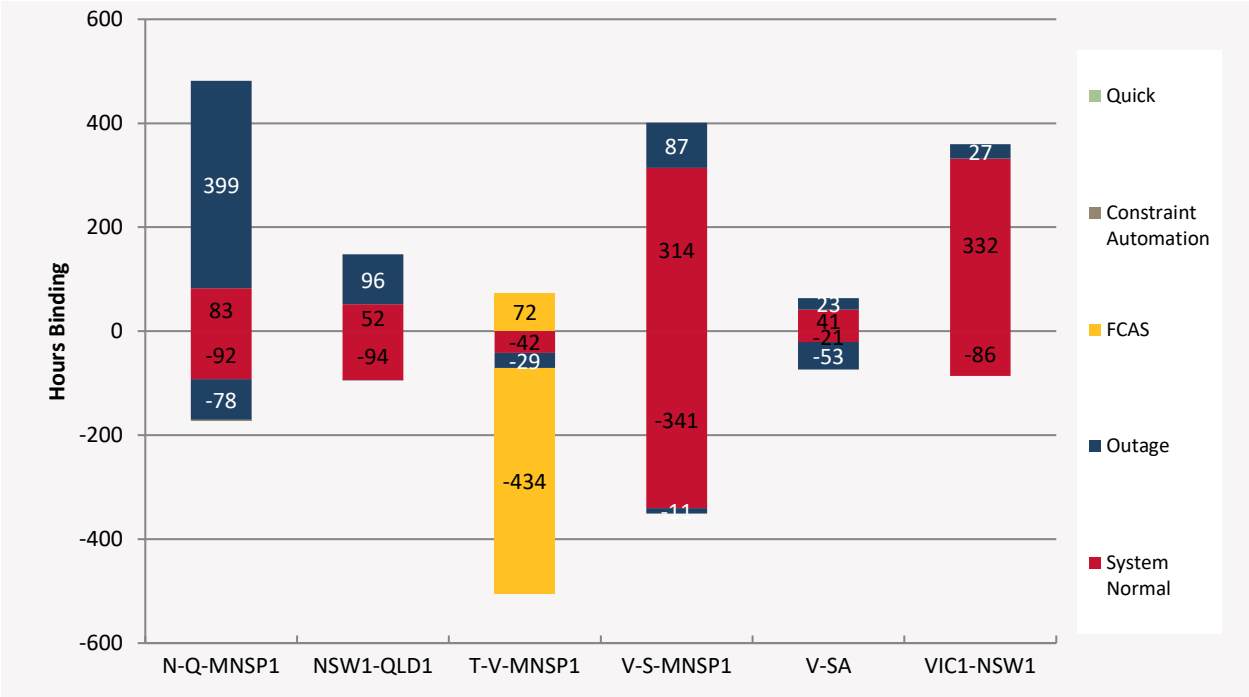
CA_SYDS_5494AABA: Constraint automation equation was invoked and binding. Following its invocation, flows were limited on 99F from 140 MVA to 137 MVA. Constraint was revoked after new constraint N>NIL_99F was built to manage future violation issues.

2.6 Binding Dispatch Hours

This section examines the number of hours of binding constraint equations on each interconnector and by region. The results are further categorized into five types: system normal, outage, FCAS (both outage and system normal), constraint automation and quick constraints.

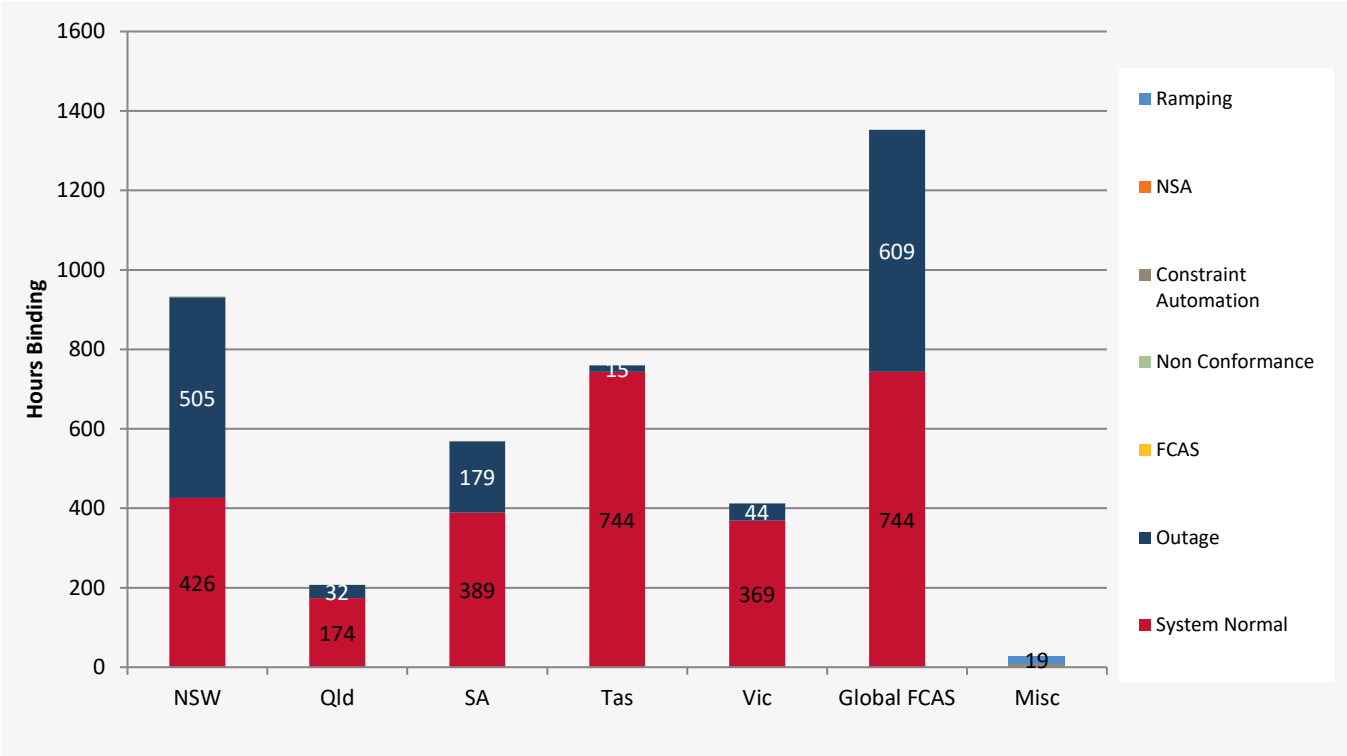
In the following graph the export binding hours are indicated as positive numbers and import with negative values.

Figure 1 Interconnector binding dispatch hours



The regional comparison graph below uses the same categories as in Figure 1 as well as non-conformance, network support agreement and ramping. Constraint equations that cross a region boundary are allocated to the sending end region. Global FCAS covers both global and mainland requirements.

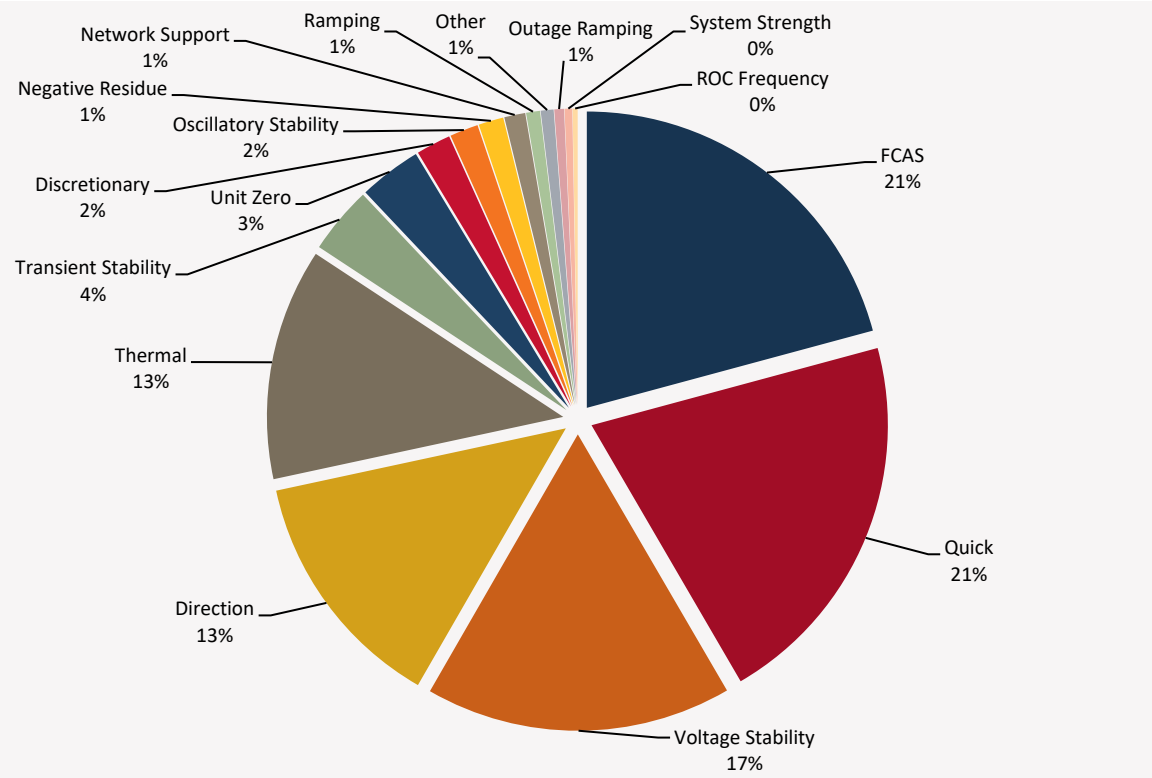
Figure 2 Regional binding dispatch hours



2.7 Binding Constraint Equations by Limit Type

The following pie charts show the percentage of dispatch intervals for December 2023 that the different types of constraint equations bound.

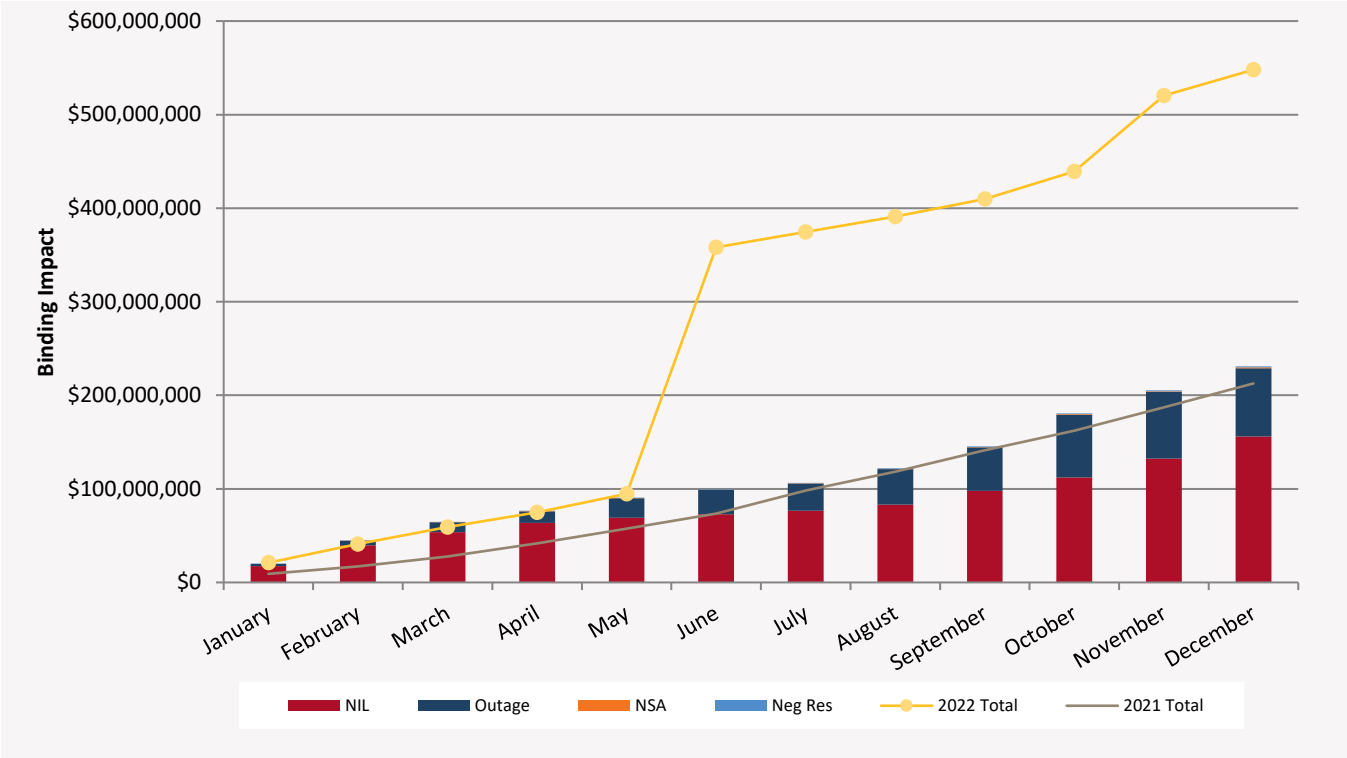
Figure 3 Binding by limit type



2.8 Binding Impact Comparison

The following graph compares the cumulative binding impact (calculated by summating the marginal values from the MCC re-run – the same as in section 2.2) for each month for the current year (indicated by type as a stacked bar chart) against the cumulative values from the previous two years (the line graphs). The current year is further categorised into system normal (NIL), outage, network support agreement (NSA) and negative residue constraint equation types.

Figure 4 Binding Impact comparison



2.9 Pre-dispatch RHS Accuracy

Pre-dispatch RHS accuracy is measured by the comparing the dispatch RHS value and the pre-dispatch RHS value forecast four hours in the future. The following table shows the pre-dispatch accuracy of the top ten largest differences for binding (in dispatch or pre-dispatch) constraint equations. This excludes FCAS constraint equations, constraint equations that violated in Dispatch, differences larger than ±9500 (this is to exclude constraint equations with swamping logic) and constraint equations that only bound for one or two Dispatch intervals. AEMO investigates constraint equations that have a Dispatch/Pre-dispatch RHS difference greater than 5% and ten absolute difference which have either bound for greater than 25 dispatch intervals or have a greater than $1,000 binding impact. The investigations are detailed in 2.9.1.

Table 6 Top 10 largest Dispatch / Pre-dispatch differences

Constraint Equation ID (System Normal Bold)	Description	#DIs	% + Max Diff	% + Avg Diff
V::N_HWSM_V1	Out = Hazelwood to South Morang OR Hazelwood to Rowville 500kV line, prevent transient instability for fault and trip of a HWTS-SMTS 500 kV line, VIC accelerates, Yallourn W G1 on 220 kV.	61	12,045% (331.09)	452% (86.83)
V::N_NIL_V2	Out = NIL, prevent transient instability for fault and trip of a HWTS-SMTS 500 kV line, VIC accelerates. Yallourn W G1 on 500kV.	14	1,493% (310.11)	114.43% (56.64)
N_X_MBTE_3A	Out= all three Directlink cables, Terranora_I/C_import <= Terranora_Load	19	970% (13.4)	173% (7.08)
N_X_MBTE_3B	Out= all three Directlink cables, Terranora_I/C_import <= Terranora_Load	64	640% (14.9)	109.18% (5.66)
V::N_NIL_O1	Out = NIL, prevent transient instability for fault and trip of a HWTS-SMTS 500 kV line, Other than VIC accelerates. Yallourn W G1 on 220kV.	90	450% (432.47)	23.28% (56.17)

Constraint Equation ID (System Normal Bold)	Description	#DIs	% + Max Diff	% + Avg Diff
N^N-LS_SVC	Out= Lismore SVC O/S or reactive power control mode,avoid Voltage collapse on TL 87/89 trip;[Swamped for 3 DLK cables are O/S Or when ECS is enabled with DLK is exporting to QLD,sets DLK to -29 MW for -29< DLK FLOW<0, checks ETS status & unswamps if O/S)	506	429% (124.41)	51.55% (26.12)
V::N_NIL_O2	Out = NIL, prevent transient instability for fault and trip of a HWTS-SMTS 500 kV line, Other than VIC accelerates. Yallourn W G1 on 500kV.	79	291% (237.34)	23.95% (53.2)
V::N_HWSM_S1	Out = Hazelwood to South Morang OR Hazelwood to Rowville 500kV line, prevent transient instability for fault and trip of a HWTS-SMTS 500 kV line, SA accelerates	31	281% (171.27)	30.32% (90.67)
N>NIL_LSDU	Out = Nil, avoid overloading Lismore to Dunoon line (9U6 or 9U7) on trip of the other Lismore to Dunoon line (9U7 or 9U6), Feedback	207	156% (74.33)	36.86% (25.31)

2.9.1 Further Investigation

The following constraint equation(s) have been investigated:

N>NIL_9R6_9R5: Investigated and no improvement can be made to the constraint equation at this stage.

V::N_NIL_O1: Investigated and no improvement can be made to the constraint equation at this stage.

V::N_NIL_O2: Investigated and no improvement can be made to the constraint equation at this stage.

N>>NIL_998: Investigated and no improvement can be made to the constraint equation at this stage.

N>NIL_LSDU: Investigated and no improvement can be made to the constraint equation at this stage.

N>NIL_997/1_62: Investigated and no improvement can be made to the constraint equation at this stage.

V::N_HWSM_V1: Investigated and no improvement can be made to the constraint equation at this stage.

V::N_NIL_V2: Investigated and no improvement can be made to the constraint equation at this stage

N_X_MBTE_3B: Investigated and the mismatch was due to issues with forecasting of the Terranora load. The forecasting of the Terranora load has been improved in November 2018.

N^N-LS_SVC: Investigated and constraint equation was updated on 27/08 to improve PD performance.

V::N_HWSM_S1: Investigated and no improvement can be made to the constraint equation at this stage.

T::T_NIL_1: Investigated and no improvement can be made to the constraint equation at this stage.

3 Generator / Transmission Changes

One of the main drivers for changes to constraint equations is from power system change, whether this is the addition or removal of plant (either generation or transmission). The following table details changes that occurred in December 2023.

Table 7 Generator and transmission changes

Project	Date	Region	Notes
Wellington – Wellington North Solar Farm 7H 330 kV Line	8 December 2023	NSW	Line Commissioned
Robertstown – Bundey No.1 275 kV Line	9 December 2023	SA	Line Commissioned
Bundey 275 kV Switchyard	9 December 2023	SA	Switchyard Commissioned
Mannum 2 Solar Farm	12 December 2023	SA	New Generator
Robertstown – Bundey No.2 275 kV Line	12 December 2023	SA	Line Commissioned
Bundey 330 kV Substation	15 December 2023	SA	330 kV East bus, 330 kV West Bus

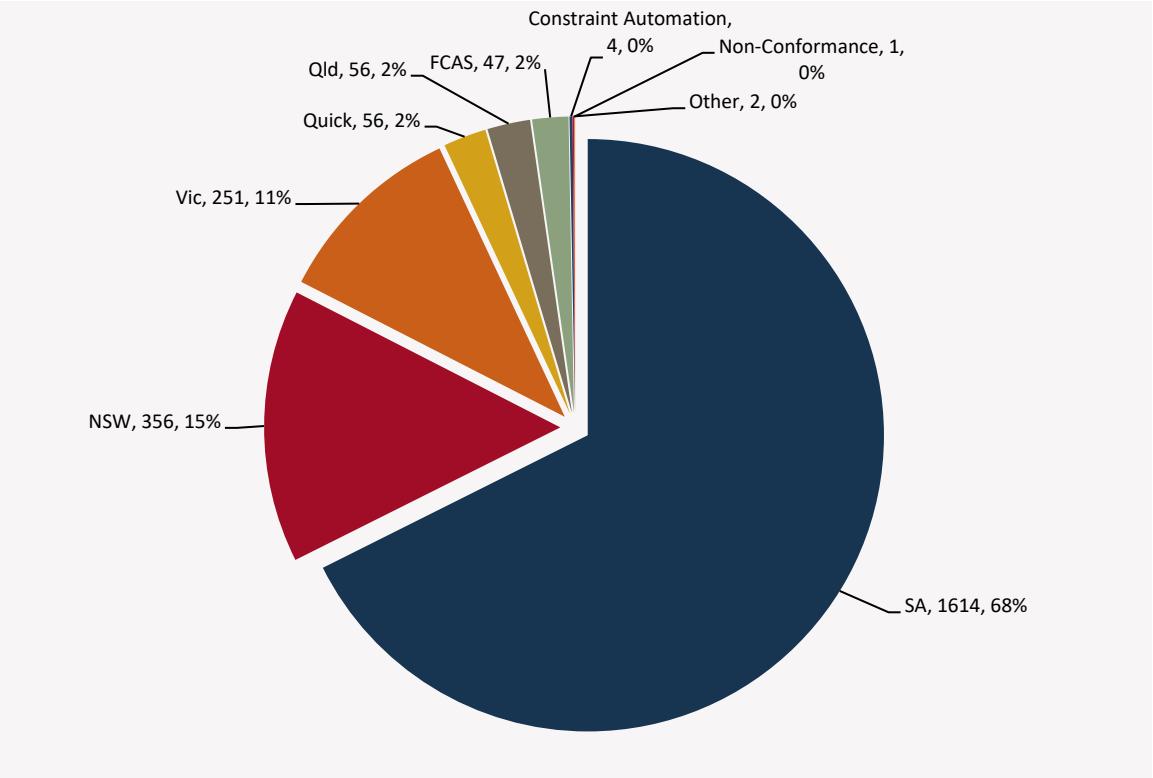
3.1 Constraint Equation Changes

The following pie chart indicates the regional location of constraint equation changes. For details on individual constraint equation changes refer to the Weekly Constraint Library Changes Report[2] or the constraint equations in the MMS Data Model[3].

[2] AEMO. *NEM Weekly Constraint Library Changes Report.* Available at: http://www.nemweb.com.au/REPORTS/CURRENT/Weekly_Constraint_Reports/

[3] AEMO. *MMS Data Model.* Available at: https://www.aemo.com.au/energy-systems/market-it-systems/nem-guides/wholesale-it-systems-software

Figure 5 Constraint equation changes



The following graph compares the constraint equation changes for the current year versus the previous two years. The current year is categorised by region.

Figure 6 Constraint equation changes per month compared to previous two years