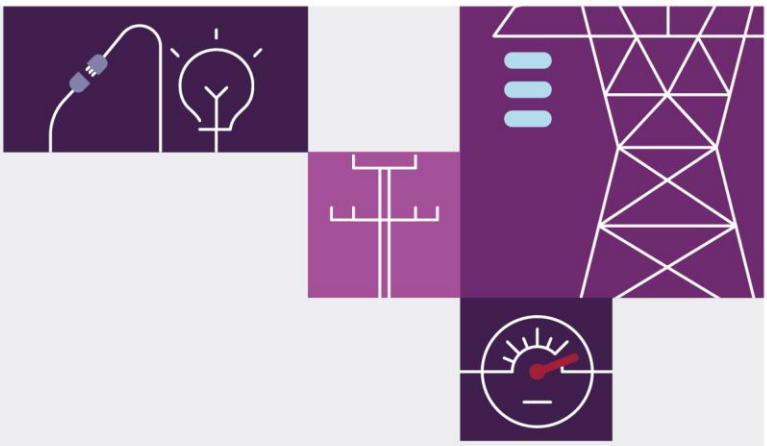
AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Monthly Constraint Report

October 2024

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 October 2024. 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
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	2904 (242.0)	Thermal
V_T_NIL_FCSPS	Basslink limit from Vic to Tas for load enabled for FCSPS	2673 (222.75)	Other
V^^V_BDBU_KGTS	Out = Bundey to Buronga (6F) 330kV line, avoid voltage collapse for loss of Horsham - Murra Warra - Kiamal 220kV line. Murraylink VFRB disabled. Swamp if Murraylink VFRB enabled.	2223 (185.25)	Voltage Stability
N>NIL_94T	Out= Nil, avoid O/L Molong to Orange North (94T) on trip of Nil, Feedback	2206 (183.83)	Thermal
T::T_NIL_1	Out = NIL, prevent transient instability for fault and trip of a Farrell to Sheffield line, Swamp if less than 3 synchronous West Coast units generating or Farrell 220kV bus coupler open or Hampshire 110kV line is closed.	2032 (169.33)	Transient 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	1507 (125.58)	Thermal
N>>BDBU_970_051	Out = Bundey to Buronga (6F) 330kV line, avoid O/L Burrinjuck to Yass (970) on trip of Wagga to Lower Tumut (051) line, Feedback	1501 (125.08)	Thermal
N>NIL_9R4_99A	Out= Nil, avoid O/L Finley to Mulwala 132kV line (9R4) on trip of Finley to Uranquinty (99A) line, Feedback	1440 (120.0)	Thermal
V^^N_MNYS_1	Out = Marulan to Yass (4 or 5) 330kV line, avoid voltage collapse around Murray for loss of all APD potlines	1230 (102.5)	Voltage Stability
Q_STR_7C0K_HASF_2	No limit to Haughton Solar Farm if Stan>=2+Stan+Cal>=3+Glad>=2+ (Stan+Cal+Glad) >=7, NQLD>250&270(AVG),Ross_FN>100&120(AVG),Haughton Syncon is ON, Zero otherwise.	1128 (94.0)	System Strength

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	3,729,104	Thermal
N>>BDBU_970_051	Out = Bundey to Buronga (6F) 330kV line, avoid O/L Burrinjuck to Yass (970) on trip of Wagga to Lower Tumut (051) line, Feedback	3,482,431	Thermal
V^^V_BDBU_KGTS	Out = Bundey to Buronga (6F) 330kV line, avoid voltage collapse for loss of Horsham - Murra Warra - Kiamal 220kV line. Murraylink VFRB disabled. Swamp if Murraylink VFRB enabled.	1,530,598	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	1,282,536	Thermal
NRM_QLD1_NSW1	Negative Residue Management constraint for QLD to NSW flow	1,257,328	Negative Residue
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	1,101,707	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]	979,006	Thermal
N>NIL_9R4_99A	Out= Nil, avoid O/L Finley to Mulwala 132kV line (9R4) on trip of Finley to Uranquinty (99A) line, Feedback	961,544	Thermal
F_Q++LDTW_R6	Out = Liddell to Tamworth (84) line, Qld Raise 6 sec Requirement	806,292	FCAS
N>NIL_94K_1	Out= Nil, avoid O/L Suntop Tee to Wellington (94K/1) on trip of Nil, Feedback	551,573	Thermal

[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.

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 mathematical operator selected for the constraint equation). The following table includes the FCAS constraint equations. Reasons for the violations are covered in 0.

Table 3 Top 10 violating constraint equations

Constraint Equation ID (System Normal Bold)	Description	#DIs (Hours)	Limit Type
NRM_QLD1_NSW1	Negative Residue Management constraint for QLD to NSW flow	458 (38.16)	Negative Residue
NSA_N_BHB1	Network Support Agreement for Broken Hill BESS for island support for outage of X2 (Broken Hill to Buronga) 220kV line	191 (15.91)	Network Support
N_WSTWYSF1_0INV	West Wyalong Solar Farm inverter limit of zero. Constraint to violate if West Wyalong Solar Farm inverter availability greater than zero. Swamp out otherwise. DS only	15 (1.25)	System Strength
N_WELLNSF1_32INV	Wellington North Solar Farm inverter limit of 32. Constraint to violate if Wellington North Solar Farm inverter availability greater than 32. Swamp out otherwise. DS Only	14 (1.16)	System Strength
N_SEBSF1_0INV	Sebastopol Solar Farm inverter limit of zero. Constraint to violate if Sebastopol Solar Farm inverter availability greater than zero. Swamp out otherwise. DS only	12 (1.0)	System Strength
N_AVLSF1_0INV	Avonlie Solar Farm inverter limit of zero. Constraint to violate if Avonlie Solar Farm inverter availability greater than zero. Swamp out otherwise. DS only	11 (0.91)	System Strength
N_BHBESS_G_0INV	Broken Hill Battery inverter limit of zero. Constraint to violate if Broken Hill Battery as a generator and inverter availability greater than zero. Swamp out otherwise. DS only	9 (0.75)	System Strength
N_BHBESS_L_0INV	Broken Hill Battery inverter limit of zero. Constraint to violate if Broken Hill Battery as a load and inverter availability greater than zero. Swamp out otherwise. DS only	9 (0.75)	System Strength
N_LIMOSF21_0INV	Limondale 2 Solar Farm inverter limit of zero. Constraint to violate if Limondale 2 Solar Farm inverter availability greater than zero. Swamp out otherwise. DS only	9 (0.75)	System Strength
V_BULBESS_G_0INV	Bulgana Battery inverter limit of zero. Constraint to violate if Bulgana Battery as a generator and inverter availability greater than zero. Swamp out otherwise. DS only	9 (0.75)	System Strength

2.3.1 Reasons for constraint equation violations

Table 4 Reasons for constraint equation violations

Constraint Equation ID (System Normal Bold)	Description
NRM_QLD1_NSW1	Constraint equation violated for: • 6 consecutive DIs from 9/10/2024 1735 hrs to 9/10/2024 1800 hrs • 8 consecutive DIs from 10/10/2024 0335 hrs to 10/10/2024 0410 hrs • 10 consecutive DIs from 10/10/2024 2015 hrs to 10/10/2024 2100 hrs • 7 consecutive DIs from 10/10/2024 2200 hrs to 10/10/2024 2230 hrs • 6 consecutive DIs from 10/10/2024 2240 hrs to 10/10/2024 2305 hrs • 7 consecutive DIs from 11/10/2024 0005 hrs to 11/10/2024 0035 hrs • 6 consecutive DIs from 11/10/2024 0140 hrs to 11/10/2024 0205 hrs • 6 consecutive DIs from 11/10/2024 1835 hrs to 11/10/2024 1900 hrs • 19 consecutive DIs from 11/10/2024 1940 hrs to 11/10/2024 2110 hrs • 14 consecutive DIs from 11/10/2024 2210 hrs to 11/10/2024 2315 hrs • 9 consecutive DIs from 12/10/2024 0045 hrs to 12/10/2024 0125 hrs • 10 consecutive DIs from 12/10/2024 0245 hrs to 12/10/2024 0330 hrs • 6 consecutive DIs from 12/10/2024 0415 hrs to 12/10/2024 0440 hrs • 9 consecutive DIs from 12/10/2024 0450 hrs to 12/10/2024 0530 hrs • 6 consecutive DIs from 13/10/2024 0220 hrs to 13/10/2024 0245 hrs • 9 consecutive DIs from 13/10/2024 0445 hrs to 13/10/2024 0525 hrs • 6 consecutive DIs from 14/10/2024 2045 hrs to 14/10/2024 2110 hrs • 7 consecutive DIs from 18/10/2024 2235 hrs to 18/10/2024 2305 hrs • 9 consecutive DIs from 18/10/2024 2355 hrs to 19/10/2024 0035 hrs • 11 consecutive DIs from 19/10/2024 0110 hrs to 19/10/2024 0200 hrs • 9 consecutive DIs from 28/10/2024 0310 hrs to 28/10/2024 0350 hrs • 6 consecutive DIs from 28/10/2024 0440 hrs to 28/10/2024 0505 hrs • 11 consecutive DIs from 28/10/2024 0545 hrs to 28/10/2024 0635 hrs • 9 consecutive DIs from 28/10/2024 0645 hrs to 28/10/2024 0725 hrs • 7 consecutive DIs from 28/10/2024 1805 hrs to 28/10/2024 1835 hrs • 7 consecutive DIs from 29/10/2024 0135 hrs to 29/10/2024 0205 hrs • 13 consecutive DIs from 29/10/2024 0215 hrs to 29/10/2024 0315 hrs • 7 consecutive DIs from 29/10/2024 0335 hrs to 29/10/2024 0405 hrs • And 218 additional non-consecutive DIs from 09/10/2024 1705 hrs to 29/10/2024 0535 hrs With a maximum violation degree of 224.711 MW occurring on 28/10/2024 1815 hrs. Constraint equation violated due to competing requirement on the export limits of QNI set by N^^Q_TW_330_BUS3_B1, and export limit of DirectLink set by N^^Q_TW_330_BUS3_B1.
NSA_N_BHB1	Constraint equation violated for: • 7 consecutive DIs from 28/10/2024 1110 hrs to 28/10/2024 1140 hrs • 6 consecutive DIs from 29/10/2024 1025 hrs to 29/10/2024 1050 hrs • 7 consecutive DIs from 30/10/2024 0850 hrs to 30/10/2024 0920 hrs • And 171 additional non-consecutive DIs from 27/10/2024 1500 hrs to 31/10/2024 1640 hrs With a maximum violation degree of 0.0476 MW occurring on 30/10/2024 0855 hrs. Constraint equation violated due to Broken Hill BESS non-conforming to the Network Support Agreement requirement to manage the islanded network resulting from the unplanned Buronga to Broken Hill 220 kV X2 line outage following tower collapses on 16/10/2024 2329 hrs.
N_WSTWYSF1_0INV	Constraint equation violated for 15 consecutive DIs from 31/10/2024 0050 hrs to 31/10/2024 0200 hrs with a violation degree of 0.001 MW. Constraint equation violated due to West Wyalong Solar Farm inverter availability exceeding its limit.
N_WELLNSF1_32INV	Constraint equation violated for:

Constraint Equation ID (System Normal Bold)	Description
	• 9 consecutive DIs from 14/10/2024 0545 hrs to 14/10/2024 0625 hrs • 3 consecutive DIs on 04/10/2024 0800 hrs, 04/10/2024 0805 hrs, and 04/10/2024 0810 hrs • And 2 additional non-consecutive DIs on 01/10/2024 1150 hrs and 04/10/2024 1715 hrs With a violation degree of 0.001 MW. Constraint equation violated due to Wellington Solar Farm inverter availability exceeding its limit.
N_SEBSF1_0INV	Constraint equation violated for 12 consecutive DIs from 31/10/2024 0050 hrs to 31/10/2024 0145 hrs with a violation degree of 0.001 MW. Constraint equation violated due to Sebastopol Solar Farm inverter availability exceeding its limit.
N_AVLSF1_0INV	Constraint equation violated for 11 consecutive DIs from 31/10/2024 0050 hrs to 31/10/2024 0140 hrs with a violation degree of 0.001 MW. Constraint equation violated due to Avonlie Solar Farm inverter availability exceeding its limit.
N_BHBESS_G_0INV	Constraint equation violated for: • 7 consecutive DIs from 31/10/2024 0050 hrs to 31/10/2024 0120 hrs • 2 consecutive DIs on 18/10/2024 0805 hrs and 18/10/2024 0810 hrs With a violation degree of 0.001 MW. Constraint equation violated due to Broken Hill Battery inverter availability exceeding its limit.
N_BHBESS_L_0INV	Constraint equation violated for: • 7 consecutive DIs from 31/10/2024 0050 hrs to 31/10/2024 0120 hrs • 2 consecutive DIs on 18/10/2024 0805 hrs and 18/10/2024 0810 hrs With a violation degree of 0.001 MW. Constraint equation violated due to Broken Hill Battery inverter availability exceeding its limit.
N_LIMOSF21_0INV	Constraint equation violated for 9 consecutive DIs from 31/10/2024 0050 hrs to 31/10/2024 0130 hrs with a violation degree of 0.001 MW. Constraint equation violated due to Limondale 2 Solar Farm inverter availability exceeding its limit.
V_BULBESS_G_0INV	Constraint equation violated for 9 consecutive DIs from 31/10/2024 0050 hrs to 31/10/2024 0130 hrs with a violation degree of 0.001 MW. Constraint equation violated due to Bulgana Battery inverter availability exceeding its limit.

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)
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	2803 (233.58)	158.89 (197.32)
V_T_NIL_FCSPS	T-V-MNSP1 Import	Basslink limit from Vic to Tas for load enabled for FCSPS	2396 (199.67)	-348.56 (-413.51)
V^^V_BDBU_KGTS	V-S-MNSP1 Import	Out = Bundey to Buronga (6F) 330kV line, avoid voltage collapse for loss of Horsham - Murra Warra - Kiamal 220kV line. Murraylink VFRB disabled. Swamp if Murraylink VFRB enabled.	1683 (140.25)	139.66 (-162.01)
N>>BDBU_970_051	VIC1-NSW1 Export	Out = Bundey to Buronga (6F) 330kV line, avoid O/L Burrinjuck to Yass (970) on trip of Wagga to Lower Tumut (051) line, Feedback	1413 (117.75)	-225.67 (776.36)
V^^N_MNYS_1	VIC1-NSW1 Export	Out = Marulan to Yass (4 or 5) 330kV line, avoid voltage collapse around Murray for loss of all APD potlines	1206 (100.5)	656.52 (1107.74)
F_Q++85_L6	NSW1-QLD1 Import	Out = Uralla to Tamworth (85) line, Qld Lower 6 sec Requirement	1031 (85.92)	-213.25 (-475.84)
VT_ZERO	T-V-MNSP1 Import	Vic to Tas on Basslink upper limit of 0 MW	991 (82.58)	0.0 (0.0)
N>Q-NIL_757_758	N-Q-MNSP1 Export	Out= Nil, Avoid overloading 757 or 758 (T174 Terranora to H4 Mudgeeraba) 110kV line on trip of the other 758 or 757 (T174 Terranora to H4 Mudgeeraba line), Flow North, Feedback	908 (75.67)	96.4 (97.0)
NRM_NSW1_VIC1	VIC1-NSW1 Import	Negative Residue Management constraint for NSW to VIC flow	876 (73.0)	-107.7 (-1268.83)
N^^Q_TW_330_BUS1_B1	N-Q-MNSP1 Export	Out= Tamworth No.1 330kV bus, NSW to Qld voltage stability limit for trip of Kogan Creek generator	790 (65.83)	-17.9 (0.0)

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_562A9792	23/10/2024 06:40 to 23/10/2024 11:00	CA_SYDS_562A9792 was built to manage post-contingent overloading of Keilor to Deer Park 220 kV Line for loss of Sydenham to Moorabool 500 kV No.2 Line with prior outage of Sydenham to Moorabool 500 kV No.1 Line.
CA_BRIS_562B3098	23/10/2024 17:30 to 24/10/2024 12:10	CA_BRIS_562B3098 was built to manage pre-contingent overloading of 999 (Bango to Cowra) 132kV Line with prior outages of 9GL (Bango to Yass) 132 kV.
CA_SYDS_5632AA58	29/10/2024 09:45 to 29/10/2024 10:45	CA_SYDS_5632AA58 was built to manage post-contingent overloading of Tungkillo to Tailem Bend 275 kV No.2 Line for loss of Tailem Bend 275/132 kV No.4 transformer with prior outage of Tailem Bend 275 kV West Bus.

2.5.1 Further Investigation

CA_SYDS_562A9792: Auto constraint was required due to the impact of concurrent outage Bendigo to Fosterville to Shepparton 220 kV Line. Constraint automation was revoked on 23/10/2024 1100 hrs and constraint set V-X_BESH_MLSY_NOEMTT was built to manage the concurrent outages condition.

CA_BRIS_562B3098: Auto constraint was invoked to address the outlined scenario. Constraint automation was revoked on 24/10/2024 1210 hrs and constraint equation N>9GL_999_NIL_N was built to manage future violation issues.

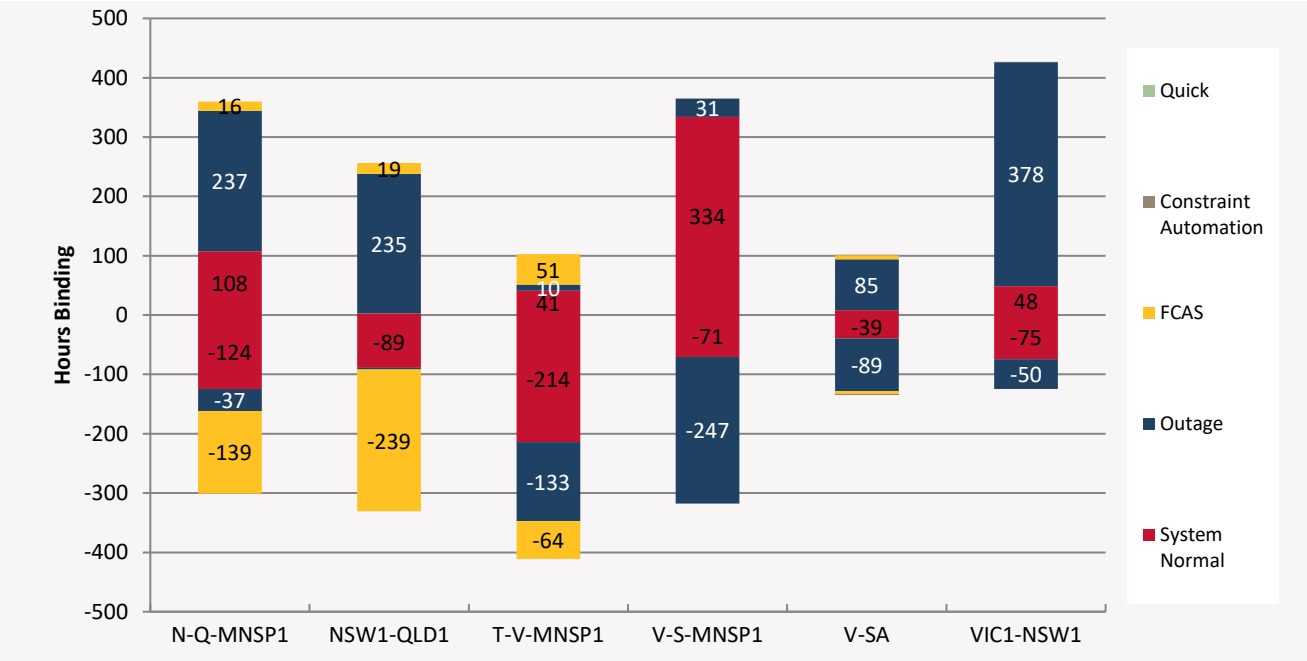
CA_SYDS_5632AA58: Auto constraint was invoked to address the outlined scenario. Constraint automation was revoked on 29/10/2024 1045 hrs and constraint equation S>>TBWBUS_TBX4_TUTB was built to manage future violation issues.

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.

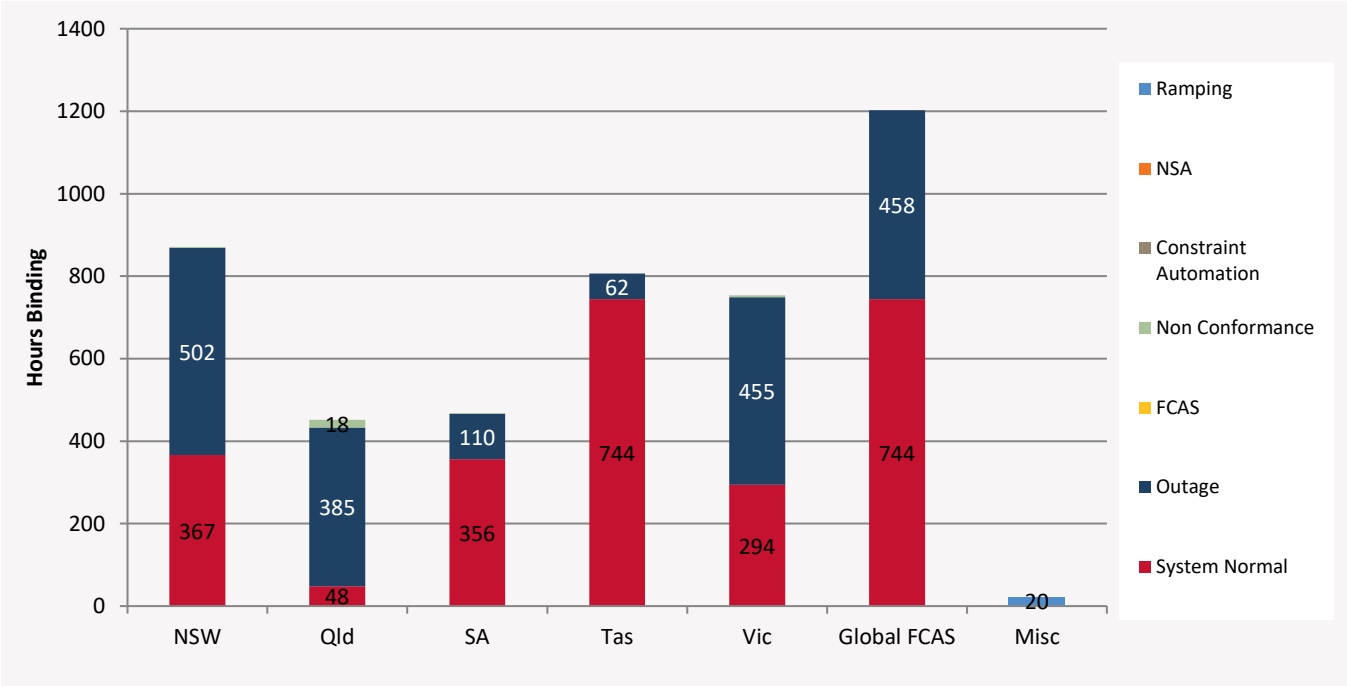
In the following graph the export binding hours are indicated as positive numbers and import with negative values.

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.

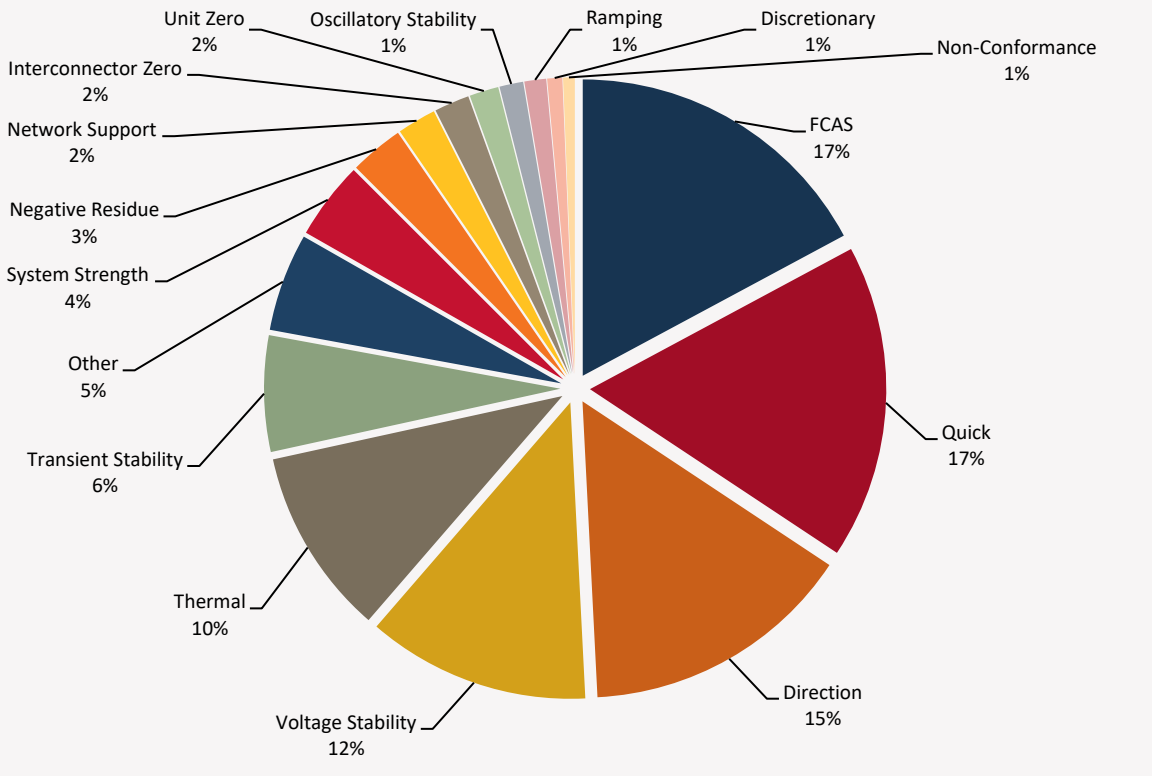
Figure 2 Regional binding dispatch hours



2.7 Binding Constraint Equations by Limit Type

The following pie charts show the percentage of dispatch intervals for October 2024 that the different types of constraint equations bound.

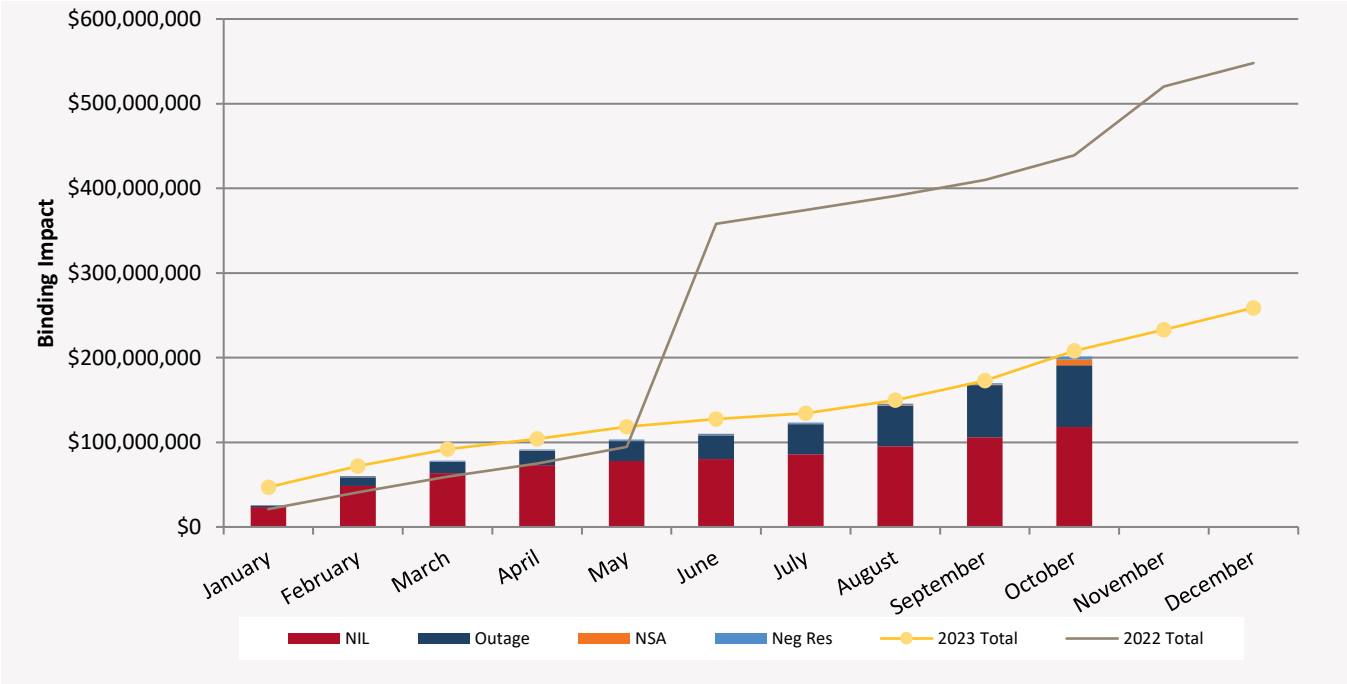
Figure 3 Binding by limit type



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 0) 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
NSA_N_BHB1	Network Support Agreement for Broken Hill BESS for island support for outage of X2 (Broken Hill to Buronga) 220kV line	199	122,350% (6.)	1,307% (1.96)
V_S_HEYWOOD_UFLS	Out= Nil, Limit Heywood flows when SA under frequency load shedding (UFLS) is insufficient (i.e. when UFLS blocks in SA <1000 MW) to manage for double-circuit loss of Heywood IC. Note: Constraint is swamped if UFLS blocks >= 1000 MW.	11	1,589% (9,408)	189% (965)
N_X_MBTE_3B	Out= all three Directlink cables, Terranora_I/C_import <= Terranora_Load	32	880% (14.1)	66.02% (4.1)
V::N_MLSY_V2	Out = Moorabool to Sydenham 500kV line, prevent transient instability for fault and trip of a HWTS-SMTS 500 kV line, VIC accelerates. Yallourn W G1 on 500kV.	5	531% (157.75)	266% (81.14)
V::N_MLSY_O1	Out = Moorabool to Sydenham 500kV line, prevent transient instability for fault and trip of a HWTS-SMTS 500 kV line, Other than VIC accelerates. Yallourn W G1 on 220kV.	43	520% (182.99)	50.17% (44.13)
V::N_MLSY_V1	Out = Moorabool to Sydenham 500kV line, prevent transient instability for fault and trip of a HWTS-SMTS 500 kV line, VIC accelerates. Yallourn W G1 on 220kV.	3	518% (186.56)	294% (87.21)
T::T_HA_GT_PM_4	Out = Hadspen to George Town or Hadspen to Palmerston 220 kV line, prevent poorly damped TAS North - South oscillations following fault and trip of Palmerston to Sheffield 220 kV line, Tamar CCGT out of service.	62	167% (195.5)	42.65% (78.58)
V::N_MLSY_O2	Out = Moorabool to Sydenham 500kV line, prevent transient instability for fault and trip of a HWTS-SMTS 500 kV line, Other than VIC accelerates. Yallourn W G1 on 500kV.	29	158% (181.96)	30.45% (46.93)
N_X_MBTE_3A	Out= all three Directlink cables, Terranora_I/C_import <= Terranora_Load	38	128.18% (18.1)	35.21% (5.75)

2.9.1 Further Investigation

The following constraint equation(s) have been investigated:

V::N_MLSY_O1: Investigated and no improvement can be made to the constraint equation at this stage.

V::N_MLSY_O2: 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_901: Investigated and no improvement can be made to the constraint equation at this stage.

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

N>NIL_997/1_6Y: Solutions are being tested for improved performance.

S>>BDBU_TUTB_TUTB_1: Investigated and no improvement can be made to the constraint equation at this stage.

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

N>NIL_999: 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 October 2024.

Table 7 Generator and transmission changes

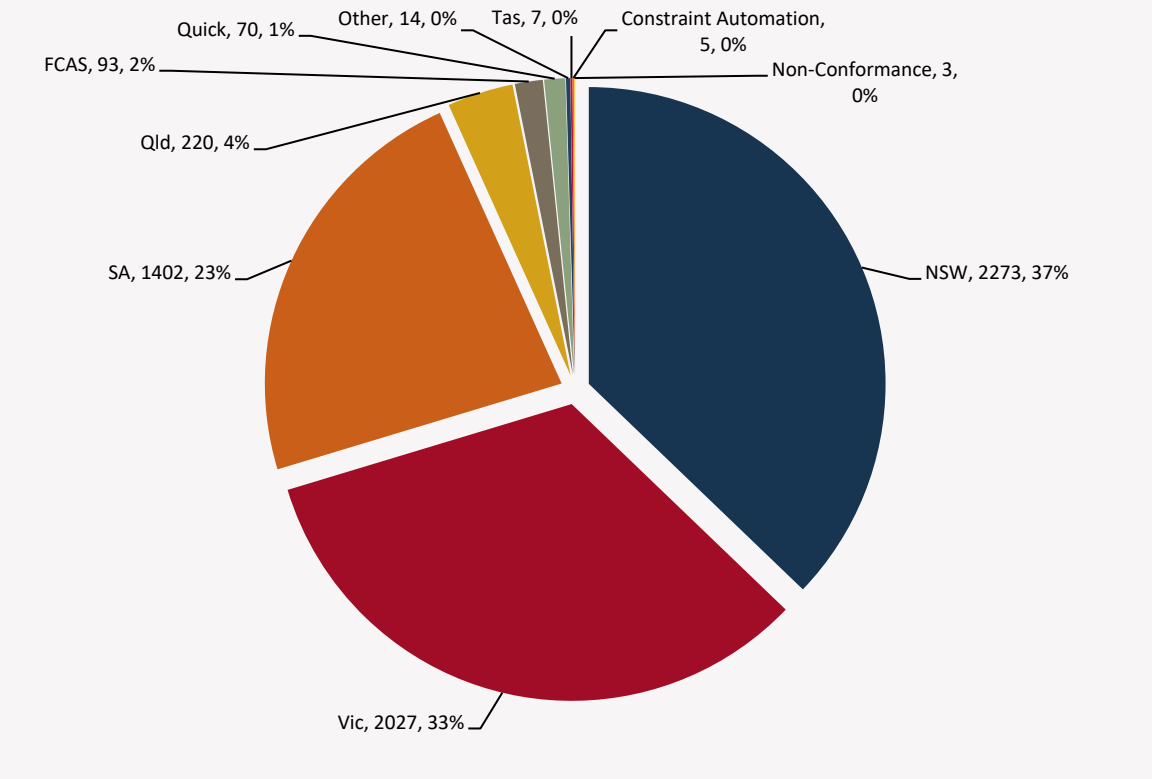
Project	Date	Region	Notes
Clarke Creek Wind Farm 1	1 October 2024	Qld	New Generator
Bolivar Battery 3.08 MW - Gen Component	2 October 2024	SA	Deregistered Generator due to BDU cut-over
Bolivar Battery 3.08 MW - Load Component	2 October 2024	SA	Deregistered Generator due to BDU cut-over
Adelaide Desalination Plant Battery 7.76 MW - Gen Component	2 October 2024	SA	Deregistered Generator due to BDU cut-over
Adelaide Desalination Plant Battery 7.76 MW - Load Component	2 October 2024	SA	Deregistered Generator due to BDU cut-over
Hornsdale Battery Power Reserve (Load Component)	2 October 2024	SA	Deregistered Generator due to BDU cut-over
Hornsdale Battery Power Reserve (Generation Component)	2 October 2024	SA	Deregistered Generator due to BDU cut-over
Happy Valley Battery 5.518 MW (Load Component) (MW) - SA Water	2 October 2024	SA	Deregistered Generator due to BDU cut-over
Happy Valley Battery 5.518 MW (Generation Component) (MW) - SA Water	2 October 2024	SA	Deregistered Generator due to BDU cut-over
Christie Beach Battery (Load Component (MW) - SA Water (2.16 MW)	2 October 2024	SA	Deregistered Generator due to BDU cut-over
Christie Beach Battery (Generation Component (MW) - SA Water (2.16 MW)	2 October 2024	SA	Deregistered Generator due to BDU cut-over
Capital Battery 125.4 MW (Load Mode)	2 October 2024	NSW	Deregistered Generator due to BDU cut-over
Capital Battery 125.4 MW (Gen Mode)	2 October 2024	NSW	Deregistered Generator due to BDU cut-over
Bouldercombe Battery BDU	4 October 2024	Qld	New Battery
Bulgana Battery (Load Component)	9 October 2024	Victoria	Deregistered Generator due to BDU cut-over
Victorian Big Battery (Load Component)	9 October 2024	Victoria	Deregistered Generator due to BDU cut-over
Victorian Big Battery (Generator Component)	9 October 2024	Victoria	Deregistered Generator due to BDU cut-over
Bulgana Battery (Generation Component)	9 October 2024	Victoria	Deregistered Generator due to BDU cut-over
Riverina 1 Battery BDU	10 October 2024	NSW	New Battery
Lake Bonney Battery (Generation Mode) MW	16 October 2024	SA	Deregistered Generator due to BDU cut-over
Lake Bonney Battery (Load Mode) MW	16 October 2024	SA	Deregistered Generator due to BDU cut-over
Wallgrove Battery – Load Component	16 October 2024	NSW	Deregistered Generator due to BDU cut-over

Project	Date	Region	Notes
Wallgrove Battery – Gen Component	16 October 2024	NSW	Deregistered Generator due to BDU cut-over
Chinchilla Battery BDU	18 October 2024	Qld	New Battery
Stubbo Substation	18 October 2024	NSW	New Substation
Bouldercombe BESS (Load Component)	23 October 2024	Qld	Deregistered Generator due to BDU cut-over
Bouldercombe BESS (Gen Component)	23 October 2024	Qld	Deregistered Generator due to BDU cut-over
Buronga No. 4 330 kV Synchronous Condenser	31 October 2024	NSW	Network augmentation commissioned

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].

Figure 5 Constraint equation changes



[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

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