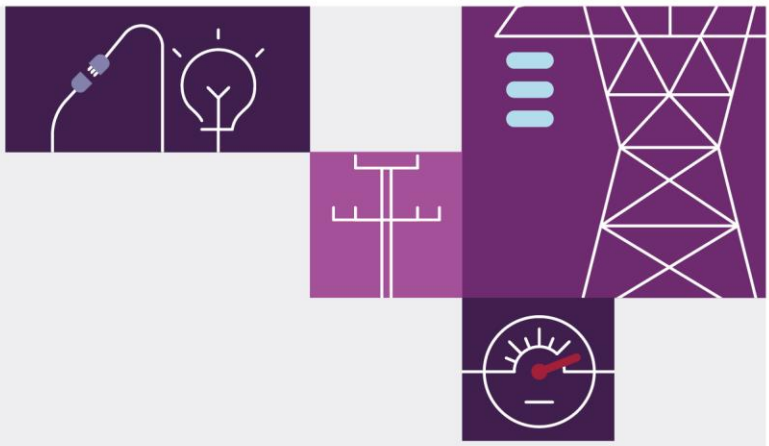
AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Monthly Constraint Report

August 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 August 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
V^^N_MNYS_1	Out = Marulan to Yass (4 or 5) 330kV line, avoid voltage collapse around Murray for loss of all APD potlines	1786 (148.83)	Voltage Stability
V_T_NIL_FCSPS	Basslink limit from Vic to Tas for load enabled for FCSPS	1460 (121.66)	Other
S>NIL_BWMP_HUWT	Out= Nil, avoid O/L Hummocks - Waterloo 132kV on trip of Blyth West-Munno Para 275kV line, Feedback	1325 (110.41)	Thermal
N_X_MBTE_3A	Out= all three Directlink cables, Terranora_I/C_import <= Terranora_Load	1283 (106.91)	Unit Zero
N>NIL_94T	Out= Nil, avoid O/L Molong to Orange North (94T) on trip of Nil, Feedback	1116 (93.0)	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]	1081 (90.08)	Thermal
SVML_ZERO	SA to Vic on ML upper transfer limit of 0 MW	929 (77.41)	Interconnector Zero
N>>NIL_964_84_S	Out= NIL, avoid O/L Port Macquarie to Herron Creek Tee (964/2) on trip of Tamworth to Liddell (84) line, Feedback	898 (74.83)	Thermal
N>Q-NIL_757_758	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	895 (74.58)	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	889 (74.08)	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	1,320,742	Thermal
S>NIL_BWMP_HUWT	Out= Nil, avoid O/L Hummocks - Waterloo 132kV on trip of Blyth West-Munno Para 275kV line, Feedback	1,293,126	Thermal
S_DALNTH1_LE_ZERO	Dalrymple BESS (BDU registration) Energy limit <= 0 MW	1,242,500	Unit Zero
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]	1,036,345	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	497,740	Voltage Stability
S-MWPS2-PV_0	Discretionary upper limit for SA WATER Morgan Whyalla Pump Station 2 PV generation of 0 MW	496,101	Unit Zero
S-MWPS3-PV_0	Discretionary upper limit for SA WATER Morgan Whyalla Pump Station 3 PV generation of 0 MW	480,169	Unit Zero
N_LIMOSF2_FLT_15	Limit Limondale 2 solar farm upper limit to 15 MW to manage post contingent voltage oscillation	475,053	System Strength
S-MWPS1-PV_0	Discretionary upper limit for SA WATER Morgan Whyalla Pump Station 1 PV generation of 0 MW	461,990	Unit Zero
N_LIMOSF1_FLT_50	Limit Limondale 1 solar farm upper limit to 50 MW to manage post contingent voltage oscillation	401,020	System Strength

[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 2.3.1.

Table 3 Top 10 violating constraint equations

Constraint Equation ID (System Normal Bold)	Description	#DIs (Hours)	Limit Type
Q_STR_8C_7C2K_RGUSF	No limit to Rugby Run SF to if Stan>=3+Cal>=1+Glad>=2+ (Stan+Cal+Glad)>=8+ one SVC(Dysart/ Nebo/Strathmore)OS OR Stan>=2+Cal>=1+Glad>=2+(Stan+Cal+Glad)>=7+Kar>=2+Dysart SVC OS/Haughton Syncon ON,NQLD>350&370(AVG),Ross_FN>150&170(AVG), Zero otherwise	34 (2.83)	System Strength
N_BROKENH1_0INV	Broken Hill Solar Farm inverter limit of zero. Constraint to violate if Broken Hill Solar Farm inverter availability greater than zero. Swamp out otherwise. DS only	8 (0.66)	System Strength
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	6 (0.5)	Network Support
N_METZSF_0INV	Metz Solar Farm inverter limit of zero. Constraint to violate if Metz Solar Farm inverter availability greater than zero. Swamp out otherwise. DS only	5 (0.41)	System Strength
N_MOREESF1_20INV	Moree Solar Farm inverter limit of 20. Constraint to violate if Moree Solar Farm inverter availability greater than 20. Swamp out otherwise. DS only	4 (0.33)	System Strength
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.	4 (0.33)	System Strength
V_STOCKYH_0WT	Stockyard Hill wind farm turbine limit of zero. Constraint to violate if Stockyard Hill Wind Farm number of Turbine ON greater than zero. Swamp out otherwise. DS only	4 (0.33)	System Strength
N_FINLYSF_FLT_30	Limit Finley solar farm upper limit to 30 MW to manage post contingent voltage oscillation	3 (0.25)	System Strength
V_KARSF_10INV	Karadoc Solar Farm inverter limit of 10. Constraint to violate if Karadoc Solar Farm inverter availability greater than 10. Swamp out otherwise. DS only	3 (0.25)	System Strength
T^T_NIL_BL_1	Outage = Nil, one Gordon machine in service, avoid voltage instability or violations for loss of the Gordon machine	2 (0.16)	Voltage Stability

2.3.1 Reasons for constraint equation violations

Table 4 Reasons for constraint equation violations

Constraint Equation ID (System Normal Bold)	Description
Q_STR_8C_7C2K_RGUSF	Constraint equation violated for 34 consecutive DIs between 21/08/2024 1200 hrs and 21/08/2024 1445 hrs with a violation degree of 0.001 MW. Constraint equation violated due to Rugby Run Solar Farm exceeding its MVAr limit.
N_BROKENH1_0INV	Constraint equation violated for 3 consecutive DIs on 09/08/2024 0905, 0910 hrs, and 0915 hrs and for 5 consecutive DIs between 30/08/2024 0705 hrs and 30/08/2024 0725 hrs with a violation degree of 0.001 MW. Constraint equation violated due to Broken Hill Solar Farm inverter availability exceeding its limit.
NSA_Q_BARCALDN	Constraint equation violated for 3 consecutive DIs on 09/08/2024 0905 hrs, 0910 hrs and, 0915 hrs and for 3 non-consecutive DIs on 14/08/2024 0805 hrs, 0810 hrs and 1440 hrs with a max violation degree of 15.57 occurring on 14/08/2024 0810 hrs. Constraint equation violated due to Barcaldine GT non-conforming to Network Service Agreement to meet the local islanded demand requirement.
N_METZSF_0INV	Constraint equation violated for 4 consecutive DIs between 3/08/2024 0605 hrs and 3/08/2024 0620 hrs and for 1 DI on 17/08/2024 1745 hrs with a violation degree of 0.001 MW. Constraint violated due to Metz Solar Farm inverter availability exceeding its limit.
N_MOREESF1_20INV	Constraint equation violated for 4 consecutive DIs between 15/08/2024 0735 hrs and 15/08/2024 0750 hrs with a violation degree of 0.001 MW. Constraint equation violated due to Moree Solar Farm inverter availability exceeding its limit.
Q_STR_7C0K_HASF_2	Constraint equation violated for 4 non-consecutive DIs on 28/08/2024 between 1410 hrs and 1440 hrs and on 30/08/2024 1000 hrs with violation degree of 0.001 MW. Constraint equation violated due to Haughton Solar Farm exceeding its MVAr limit.
V_STOCKYH_0WT	Constraint equation violated for 4 consecutive DIs between 22/08/2024 0705 hrs and 22/08/2024 0720 hrs with a violation degree of 0.001 MW. Constraint equation violated due to Stockyard Hill wind farm number of turbines on exceeding its limit.
N_FINLYSF_FLT_30	Constraint equation violated for 3 non-consecutive DIs on 20/08/2024 at 1045 hrs and 1050 hrs and on 21/08/2024 0850 hrs with a max violation degree of 53.1 MW. Constraint equation violated due to Finley Solar Farm exceeding its upper MW limit.
V_KARSF_10INV	Constraint equation violated for 3 consecutive DIs between 30/08/2024 0705 hrs, 0710 hrs, and 30/08/2024 0715 hrs with a violation degree of 0.001 MW. Constraint equation violated due to Karadoc Solar Farm inverter availability exceeding its limit.
T^T_NIL_BL_1	Constraint equation violated for 1 DI on 18/08/2024 1035 hrs and for 1 DI on 20/08/2024 at 0720 hrs with a max violation degree of 60.47 MW occurring on 20/08/2024 at 0720 hrs. Constraint equation violated due to low reactive power support in Southern Tasmania.

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)
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	1682 (140.17)	782.29 (1302.54)
N_X_MBTE_3A	N-Q-MNSP1 Export	Out= all three Directlink cables, Terranora_I/C_import <= Terranora_Load	1283 (106.92)	-17.4 (27.9)
V_T_NIL_FCSPS	T-V-MNSP1 Import	Basslink limit from Vic to Tas for load enabled for FCSPS	1066 (88.83)	-453.03 (-477.97)
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	973 (81.08)	-406.93 (-478.0)
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	878 (73.17)	94.66 (97.0)
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	866 (72.17)	-880.6 (-1314.36)
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	858 (71.5)	163.41 (185.73)
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	826 (68.83)	52.89 (-88.43)
SVML_ZERO	V-S-MNSP1 Import	SA to Vic on ML upper transfer limit of 0 MW	764 (63.67)	0.0 (0.0)
F_MAIN++APD_TL_L60	T-V-MNSP1 Import	Out = Nil, Lower 60 sec 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	742 (61.83)	-377.97 (-478.0)

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_55E0E615	28/08/2024 09:05 to 28/08/2024 15:10	CA_SYDS_55E0E615 was built to manage the overloading of the Lismore – Koolkhan (967) 132 kV line for a loss of the Lismore – Tenterfield Tee Casino (96L) 132 kV line and visa-versa.
CA_BRIS_55D50B66	19/08/2024 09:15 to 19/08/2024 09:20	CA_BRIS_55D50B66 was built to manage the overloading of a Robertstown transformer for the loss of the other Robertstown transformer.

2.5.1 Further Investigation

CA_SYDS_55E0E615: The constraint equation was invoked and binding. CA_SYDS_55E0E615 controlled import flows on Directlink (QLD to NSW). CA_SYDS_55E0E615 was revoked at 1510 hrs with new constraint equations N>89_967_96L and N>89_96L_967_S built to manage future violation issues.

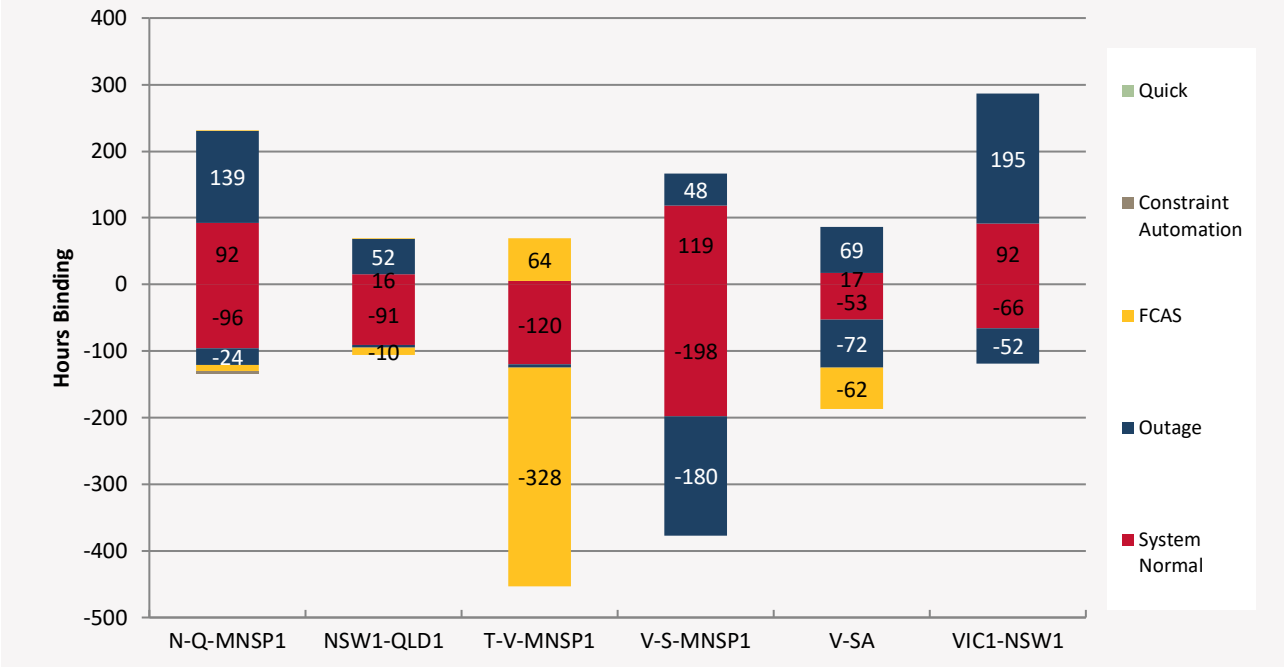
CA_BRIS_55D50B66: The constraint automation equation was invoked but did not bind. CA_BRIS_55D50B66 was invoked due to the Waterloo runback scheme RAS not appearing in RTCA. CA_BRIS_55D50B66 was revoked at 0920 hrs. The Waterloo runback scheme RAS has subsequently been modelled and the issue resolved.

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.

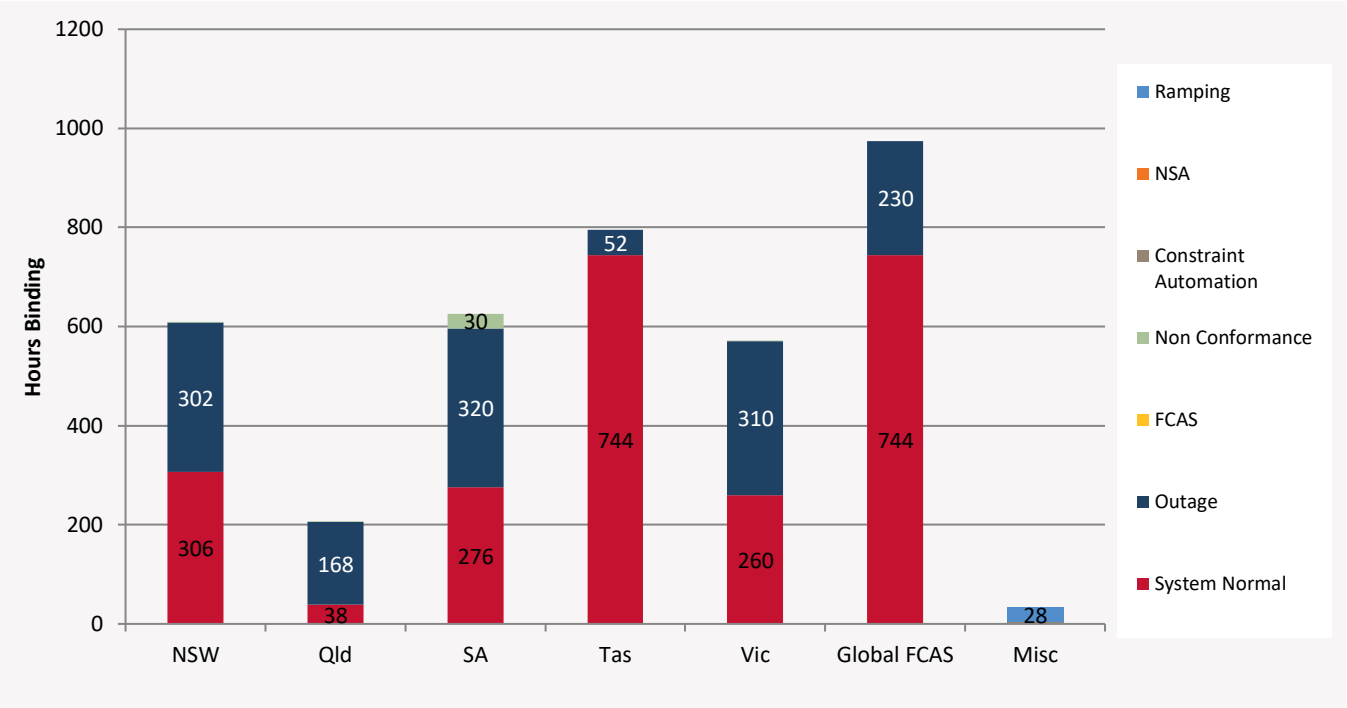
In the following graph the export binding hours are indicated as positive numbers and import with negative values.

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.

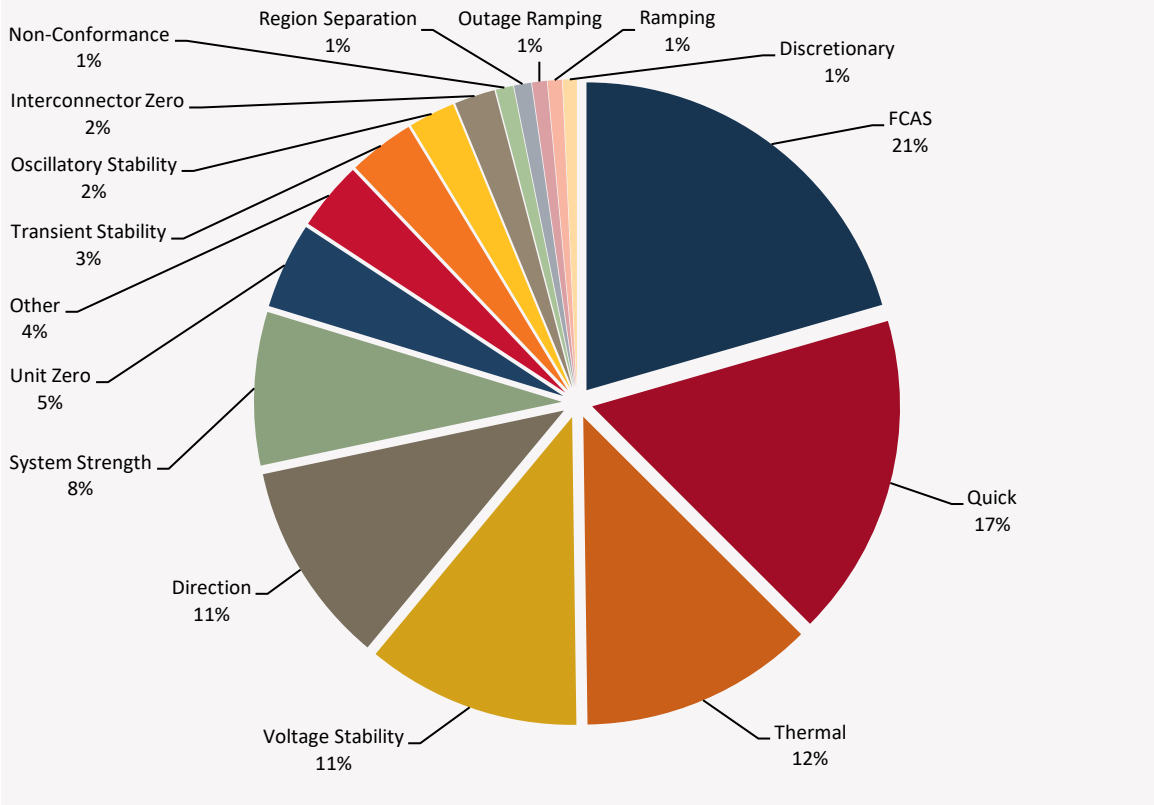
Figure 2 Regional binding dispatch hours



2.7 Binding Constraint Equations by Limit Type

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

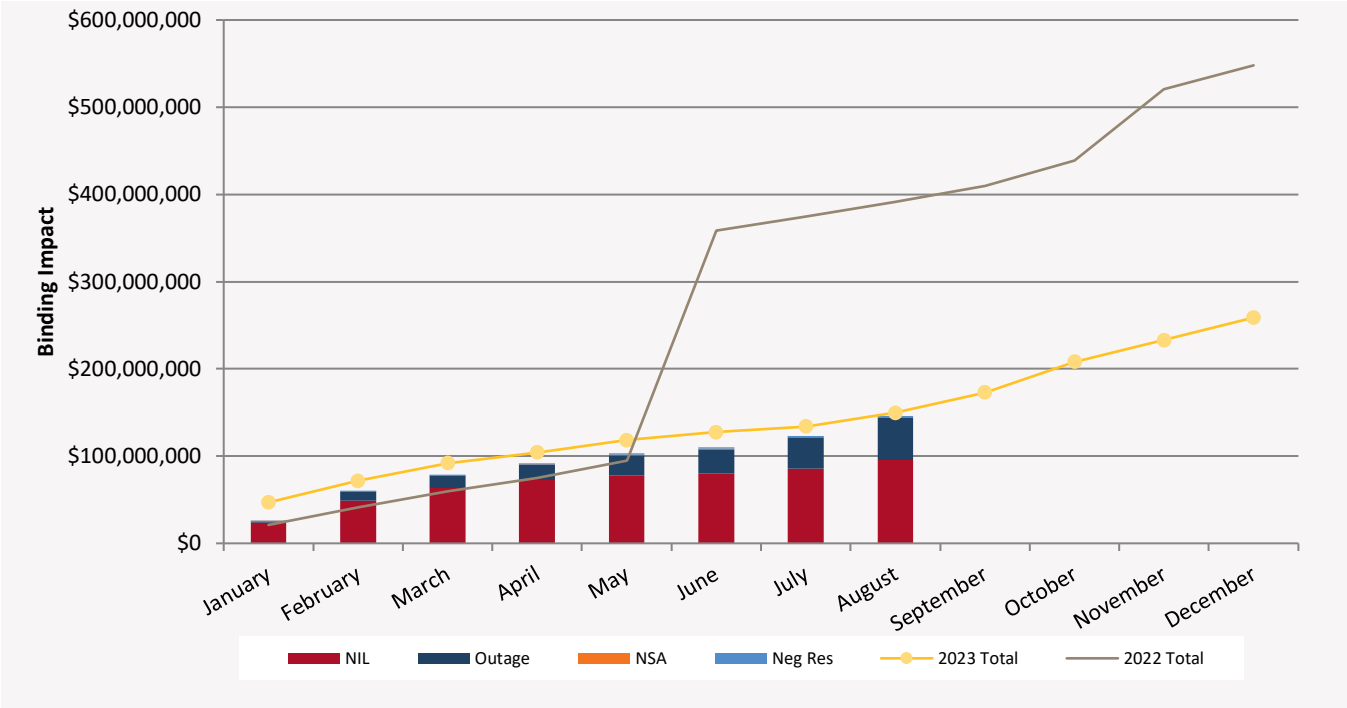
Figure 3 Binding by limit type



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 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^SML_KGRC_4	Out = Kerang to Wemen or Red Cliffs to Wemen 220kV line sections, or full Kerang to Wemen to Red Cliffs 220kV line, avoid voltage collapse for loss of Horsham to Ararat 220kV line	33	9,053% (102.28)	403% (34.66)
T^T_NIL_BL_6	Outage = Nil, avoid voltage instability or violations for loss of a Liapootah-Waddamana-Palmerston 220 kV line	28	2,739% (193.21)	480% (84.31)
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.	16	1,390% (240.34)	224% (75.31)
N_X_MBTE_3B	Out= all three Directlink cables, Terranora_I/C_import <= Terranora_Load	86	750% (22.3)	70.3% (5.5)
N_X_MBTE_3A	Out= all three Directlink cables, Terranora_I/C_import <= Terranora_Load	221	645% (33.5)	40.54% (5.37)
V^SML_HORC_3	Out = Horsham to Murra Warra to Red Cliffs 220kV line OR Murra Warra to Red Cliffs 220kV line, avoid voltage collapse for loss of Bendigo to Kerang 220kV line	12	335% (52.38)	128.34% (26.88)
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	25	318% (30.76)	55.37% (15.05)
N::Q_ARSR_1	Out= Armidale - Saphhire (8E) 330kV line, NSW to QLD Transient Stability limit on loss of largest Qld unit	15	293% (64.45)	72.26% (23.01)
V::N_HYSE_V2	Out = Heywood to South East 275kV line, prevent transient instability for fault and trip of a HWTS-SMTS 500 kV line, VIC accelerates, Yallourn W G1 on 500 kV.	6	262% (208.71)	97.7% (86.62)

2.9.1 Further Investigation

The following constraint equation(s) have been investigated:

T^T_NIL_BL_6: 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.

N::Q_ARSR_1: Investigated and no improvement can be made to the constraint equation at this stage.

V^SML_KGRC_4: Investigated and no improvement can be made to the constraint equation at this stage.

N_X_MBTE_3B: Investigated and no improvement can be made to the constraint equation at this stage.

N_X_MBTE_3A: Investigated and no improvement can be made to the constraint equation at this stage.

V^SML_HORC_3: Investigated and no improvement can be made to the constraint equation at this stage.

NSA_Q_BARCALDN: 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.

V::N_HYSE_V2: 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 August 2024.

Table 7 Generator and transmission changes

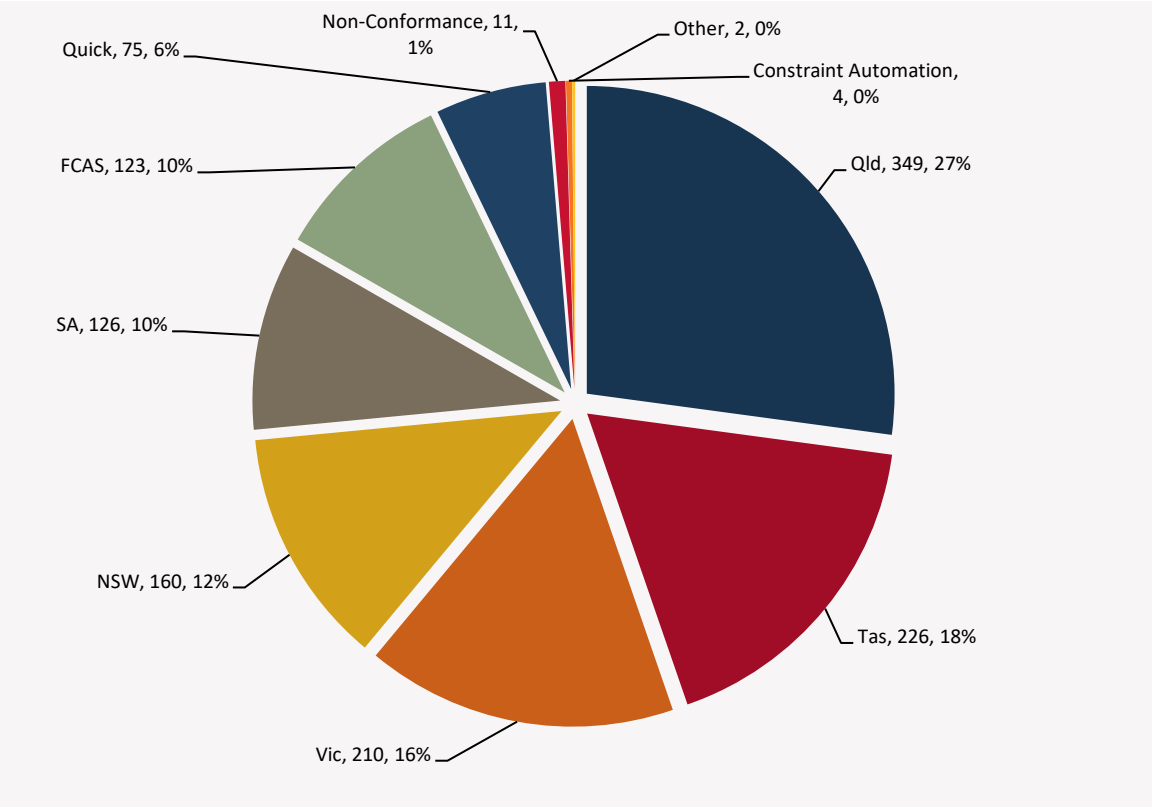
Project	Date	Region	Notes
Golden Plain Wind Farm Gen Set 3	6 August 2024	Victoria	New Generator
Golden Plain Wind Farm Gen Set 2	6 August 2024	Victoria	New Generator
Golden Plain Wind Farm Gen Set 1	6 August 2024	Victoria	New Generator
Queanbeyan Battery BDU	9 August 2024	NSW	Existing battery changed to BDU
Macintyre Wind Farm	13 August 2024	Qld	New Generator
Range Bank Bess BDU	13 August 2024	Victoria	Existing battery changed to BDU
Gannawarra Battery (Load Component)	14 August 2024	Victoria	Deregistered Generator
Gannawarra Battery (Generation Component)	14 August 2024	Victoria	Deregistered generator due to BDU cut over.
Darlington Point Battery (Load Mode) 25 Mw	14 August 2024	NSW	Deregistered generator due to BDU cut over.
Darlington Point Battery (Gen Mode) 25 Mw	14 August 2024	NSW	Deregistered generator due to BDU cut over.
Riverina Battery 2 (Load Mode) 65 Mw	14 August 2024	NSW	Deregistered generator due to BDU cut over.
Ballarat Battery (Generation Component)	14 August 2024	Victoria	Deregistered generator due to BDU cut over.
Ballarat Battery (Load Component)	14 August 2024	Victoria	Deregistered generator due to BDU cut over.
Riverina Battery 2 (Gen Mode) 65 Mw	14 August 2024	NSW	Deregistered generator due to BDU cut over.
Hazelwood Battery BDU	15 August 2024	Victoria	Existing battery changed to BDU
Phillip Island Battery BDU	15 August 2024	Victoria	Existing battery changed to BDU
Blyth Battery BdDU	20 August 2024	SA	Existing battery changed to BDU
Queanbeyan Bess (Gen Component)	28 August 2024	NSW	Deregistered generator due to BDU cut over.
Queanbeyan Bess (Load Component)	28 August 2024	NSW	Deregistered generator due to BDU cut over.
Munmorah to Waratah BESS 2W 330kV line	15 August 24	NSW	Line commissioned
Munmorah to Waratah BESS 2Y 330kV line	16 August 24	NSW	Line commissioned
Golden Plains Terminal Station	27 August 24	Victoria	New Substation

Project	Date	Region	Notes
Cressy – Golden Plains No.1 220 kV Line	27 August 24	Victoria	Line 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



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

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