AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Monthly Constraint Report

October 2020

A report for the National Electricity Market

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 2020. 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)	Change Date
Q_NIL_STRGTH_HAUSF	Out = Nil, limit Haughton SF output depends on the number units online in Stanwell, Callide B, Callide C, Gladstone, Townsville GT, Kareeya and Barron Gorge generators, Zero if it does not meet minimum generator online. Refer to Table 7 of SO_OG_NEM_62	4110 (342.5)	9/10/2020
SVML_ZERO	SA to Vic on ML upper transfer limit of 0 MW	3725 (310.41)	21/08/2013
Q_NIL_STRGTH_MEWF	Out = Nil, limit Mt Emerald WF output depends on the number units online in Stanwell, Callide B, Callide C, Gladstone, Townsville GT, Kareeya and Barron Gorge generators, Zero if it does not meet minimum generator online. Refer to Table 7 of SO_OG_NEM_62	2964 (247.0)	9/10/2020
Q_STR_3113103_MEWF	Limit Mt Emerald WF to 25% of Max capacity if Stan>=3+CalB>=1+CalC>=1+Glad>=3+Kar>=3+(Stan+Cal+Glad) >=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG), Zero otherwise	2756 (229.66)	23/09/2020
Q_NIL_STRGTH_SMSF	Out = Nil, limit Sun Metal SF output depends on the number units online in Stanwell, Callide B, Callide C, Gladstone, Townsville GT, Kareeya and Barron Gorge generators, Zero if it does not meet minimum generator online. Refer to Table 7 of SO_OG_NEM_62	2756 (229.66)	9/10/2020
Q_STR_311310_HASF	Limit Haughton SF to 25% of Max capacity if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad) >=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG), Zero otherwise	1822 (151.83)	23/09/2020

Constraint Equation ID (System Normal Bold)	Description	#DIs (Hours)	Change Date
Q_STR_311310_SMSF	Limit Sun Metals SF to 25% of Max capacity if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad) >=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG), Zero otherwise	1608 (134.0)	16/09/2020
N_X_MBTE2_B	Out= two Directlink cables, Qld to NSW limit	1032 (86.0)	25/11/2013
T_MRWF_FOS	Limit Musselroe wind farm due to upper limit on Tasmanian generator events. Limit is 153 MW (effective 144 MW at the connection point at Derby)	1003 (83.58)	1/01/2020
Q_STR_211383_10KIDSF	Limit Kidston SF 80% If Stan>=2+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=8+Kar>=3,NQLD>450&470(AVG),Ross_FN>250&270(AVG),swamp out if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG),Zero otherwise	946 (78.83)	14/10/2020

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	Change Date
Q_NIL_STRGTH_HAUSF	Out = Nil, limit Haughton SF output depends on the number units online in Stanwell, Callide B, Callide C, Gladstone, Townsville GT, Kareeya and Barron Gorge generators, Zero if it does not meet minimum generator online. Refer to Table 7 of SO_OG_NEM_62	2,583,877	9/10/2020
Q_NIL_STRGTH_MEWF	Out = Nil, limit Mt Emerald WF output depends on the number units online in Stanwell, Callide B, Callide C, Gladstone, Townsville GT, Kareeya and Barron Gorge generators, Zero if it does not meet minimum generator online. Refer to Table 7 of SO_OG_NEM_62	1,661,584	9/10/2020
Q_STR_3113103_MEWF	Limit Mt Emerald WF to 25% of Max capacity if Stan>=3+CalB>=1+CalC>=1+Glad>=3+Kar>=3+(Stan+Cal+Glad) >=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG), Zero otherwise	1,468,288	23/09/2020
Q_STR_311310_HASF	Limit Haughton SF to 25% of Max capacity if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad) >=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG), Zero otherwise	822,030	23/09/2020

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.

Constraint Equation ID (System Normal Bold)	Description	∑ Marginal Values	Change Date
V>V_NIL_17	Out = NIL, prevent pre-contingent overload of Wemen 220/66 kV txfmr, flow from 66 kV to 220 kV, feedback	692,010	29/09/2020
S_NIL_STRENGTH_1	Upper limit (1300 to 1750 MW) for South Australian non-synchronous generation for minimum synchronous generators online for system strength requirements. Automatically swamps out when required HIGH combination is online.	610,671	19/08/2020
Q_STR_211383_10DAYSF	Limit Daydream SF 80% If Stan>=2+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=8+Kar>=3,NQLD>450&470(AVG),Ross_FN>250&270(AVG),swamp out if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG),Zero otherwise	586,588	14/10/2020
Q_STR_211383_10KIDSF	Limit Kidston SF 80% If Stan>=2+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=8+Kar>=3,NQLD>450&470(AVG),Ross_FN>250&270(AVG),swamp out if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG),Zero otherwise	571,320	14/10/2020
Q_STR_211383_10RRSF	Limit Ross River SF 80% If Stan>=2+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=8+Kar>=3,NQLD>450&470(AVG),Ross_FN>250&270(AVG),swamp out if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG),Zero otherwise	556,784	14/10/2020
Q_STR_211383_10HAMSF	Limit Hamilton SF 80% If Stan>=2+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=8+Kar>=3,NQLD>450&470(AVG),Ross_FN>250&270(AVG),swamp out if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG),Zero otherwise	555,051	14/10/2020

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)	Change Date
Q_STR_211383_10RRSF	Limit Ross River SF 80% If Stan>=2+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=8+Kar>=3,NQLD>450&470(AVG),Ross_FN>250&270(AVG),swamp out if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG),Zero otherwise	25 (2.08)	14/10/2020
Q_STR_311310_SMSF	Limit Sun Metals SF to 25% of Max capacity if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad) >=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG), Zero otherwise	21 (1.75)	16/09/2020
Q_NIL_STRGTH_SMSF	Out = Nil, limit Sun Metal SF output depends on the number units online in Stanwell, Callide B, Callide C, Gladstone, Townsville GT, Kareeya and Barron Gorge generators, Zero if it does not meet minimum generator online. Refer to Table 7 of SO_OG_NEM_62	19 (1.58)	9/10/2020

Constraint Equation ID (System Normal Bold)	Description	#DIs (Hours)	Change Date
Q_STR_211383_10DAYSF	Limit Daydream SF 80% If Stan>=2+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=8+Kar>=3,NQLD>450&470(AVG),Ross_FN>250&270(AVG),swamp out if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG),Zero otherwise	19 (1.58)	14/10/2020
Q_STR_3113103_MEWF	Limit Mt Emerald WF to 25% of Max capacity if Stan>=3+CalB>=1+CalC>=1+Glad>=3+Kar>=3+(Stan+Cal+Glad) >=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG), Zero otherwise	19 (1.58)	23/09/2020
NSA_V_NPSD_100	Newport unit >= 100 MW for Network Support Agreement	18 (1.5)	21/12/2018
Q_STR_211383_10KIDSF	Limit Kidston SF 80% If Stan>=2+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=8+Kar>=3,NQLD>450&470(AVG),Ross_FN>250&270(AVG),swamp out if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG),Zero otherwise	18 (1.5)	14/10/2020
Q_NIL_STRGTH_MEWF	Out = Nil, limit Mt Emerald WF output depends on the number units online in Stanwell, Callide B, Callide C, Gladstone, Townsville GT, Kareeya and Barron Gorge generators, Zero if it does not meet minimum generator online. Refer to Table 7 of SO_OG_NEM_62	14 (1.16)	9/10/2020
Q_STR_311310_HASF	Limit Haughton SF to 25% of Max capacity if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad) >=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG), Zero otherwise	9 (0.75)	23/09/2020
Q_STR_211383_10CLRSF	Limit Clare SF 80% If Stan>=2+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=8+Kar>=3,NQLD>450&470(AVG),Ross_FN>250&270(AVG),swamp out if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG),Zero otherwise	8 (0.66)	14/10/2020

2.3.1 Reasons for constraint equation violations

Table 4 Reasons for constraint equation violations

Constraint Equation ID (System Normal Bold)	Description
Q_STR_211383_10RRSF	Constraint equation violated for 25 non-consecutive intervals on 10/10/2020, 12/10/2020 and 14/10/2020 with violation degree of 0.001 MW. Constraint equation violation occurred due to Ross River Solar Farm exceeding MVar Limit.
Q_STR_311310_SMSF	Constraint equation violated for 21 non-consecutive DIs on 08/10/2020, 11/10/2020 and 13/10/2020 with violation degree of 0.001 MW. Constraint equation violation occurred due to Sun Metal Solar Farm exceeding MVar Limit.
Q_NIL_STRGTH_SMSF	Constraint equation violated for 19 non-consecutive DIs on 13/10/2020 with violation degree of 0.001 MW. Constraint equation violation occurred due to Sun Metal Solar Farm exceeding MVar Limit.
Q_STR_211383_10DAYSF	Constraint equation violated for 19 non-consecutive DIs on 10/10/2020, 12/10/2020, 13/10/2020, 14/10/2020, 15/10/2020 and 16/10/2020 with violation degree of 0.001 MW. Constraint equation violation occurred due to Daydream Solar Farm exceeding MVar Limit.
Q_STR_3113103_MEWF	Constraint equation violated for 18 non-consecutive intervals on 06/10/2020, 07/10/2020, 09/10/2020, 10/10/2020 and 14/10/2020 with violation degree of 0.001 MW. Constraint equation violation occurred due to Mt Emerald Wind Farm exceeding MVar Limit.

Constraint Equation ID (System Normal Bold)	Description
NSA_V_NPSD_100	Constraint equation violated for 18 consecutive intervals on 25/10/2020,26/10/2020, 27/10/2020 and 31/10/2020 with max violation of 75.25 MW. Constraint equation violation occurred due to Newport PS being limited by its start-up profile.
Q_STR_211383_10KIDSF	Constraint equation violated for 18 non-consecutive DIs on 12/10/2020, 13/10/2020, 14/10/2020 and 16/10/2020 with violation degree of 0.001 MW. Constraint equation violation occurred due to Kidston Solar Farm exceeding MVar Limit.
Q_NIL_STRGTH_MEWF	Constraint equation violated for 14 non-consecutive DIs on 02/10/2020, 16/10/2020, 17/10/2020, 19/10/2020, 20/10/2020, 21/10/2020 with violation degree of 0.001 MW. Constraint equation violation occurred due to Mt Emerald Wind Farm exceeding MVar Limit.
Q_STR_311310_HASF	Constraint equation violated for 9 non-consecutive intervals on 06/10/2020, 7/10/2020, 08/10/2020, 09/10/2020 and 12/10/2020 with violation degree of 0.001 MW. Constraint equation violation occurred due to Haughton Solar Farm exceeding MVar Limit.
Q_STR_211383_10CLRSF	Constraint equation violated for 8 non-consecutive DIs on 10/10/2020, 12/10/2020, 13/10/2020 and 14/10/2020.On 10/10/2020 and 12/10/2020 constraint equation violation occurred due to Clare Solar Farm exceeding MVar Limit with violation degree of 0.001 MW. On 13/10/2020 and 14/10/2020 constraint equation violation occurred due to Clare Solar Farm non-conforming with max violation of 5.17 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)
SVML_ZERO	V-S-MNSP1 Import	SA to Vic on ML upper transfer limit of 0 MW	3570 (297.5)	0.0 (0.0)
F_Q++MUTW_L6	NSW1-QLD1 Import	Out = Muswellbrook to Tamworth (88) line, Qld Lower 6 sec Requirement	1857 (154.75)	-290.79 (-627.71)
F_Q++MUTW_L6	N-Q-MNSP1 Import	Out = Muswellbrook to Tamworth (88) line, Qld Lower 6 sec Requirement	1747 (145.58)	-27.29 (-73.3)
F_MAIN++NIL_MG_R6	T-V-MNSP1 Export	Out = Nil, Raise 6 sec requirement for a Mainland Generation Event, Basslink able transfer FCAS	1328 (110.67)	176.82 (459.01)
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	1287 (107.25)	-105.71 (-459.0)
N_X_MBTE2_B	N-Q-MNSP1 Import	Out= two Directlink cables, Qld to NSW limit	1032 (86.0)	-67.98 (-87.5)
F_MAIN++NIL_MG_R60	T-V-MNSP1 Export	Out = Nil, Raise 60 sec requirement for a Mainland Generation Event, Basslink able transfer FCAS	835 (69.58)	98.16 (459.0)

Constraint Equation ID (System Normal Bold)	Interconnector	Description	#DIs (Hours)	Average Limit (Max)
V^^N_NIL_1	VIC1-NSW1 Export	Out = Nil, avoid voltage collapse around Murray for loss of all APD potlines	822 (68.5)	658.84 (1159.49)
VT_ZERO	T-V-MNSP1 Import	Vic to Tas on Basslink upper limit of 0 MW	719 (59.92)	0.0 (0.0)
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	714 (59.5)	-181.02 (-459.0)

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 6 Non-Real-Time Constraint Automation usage

Constraint Set ID	Date Time	Description
CA_BRIS_4EAF4035	31/10/2020 10:55 to 31/10/2020 14:10	The automated constraint equation was created to manage the static rating at 220kV Ararat Terminal station for contingency of Bendigo to Kerang 220 kV line under system normal condition.

2.5.1 Further Investigation

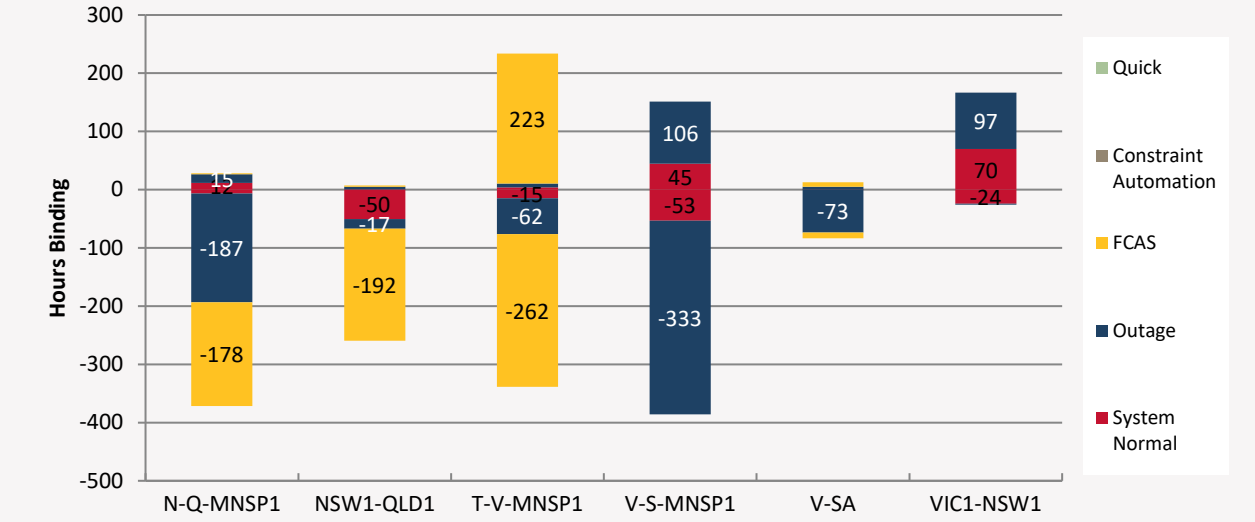
CA_BRIS_4EAF4035: A new constraint equation V>>V_NIL_18 has been created to manage this scenario.

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.

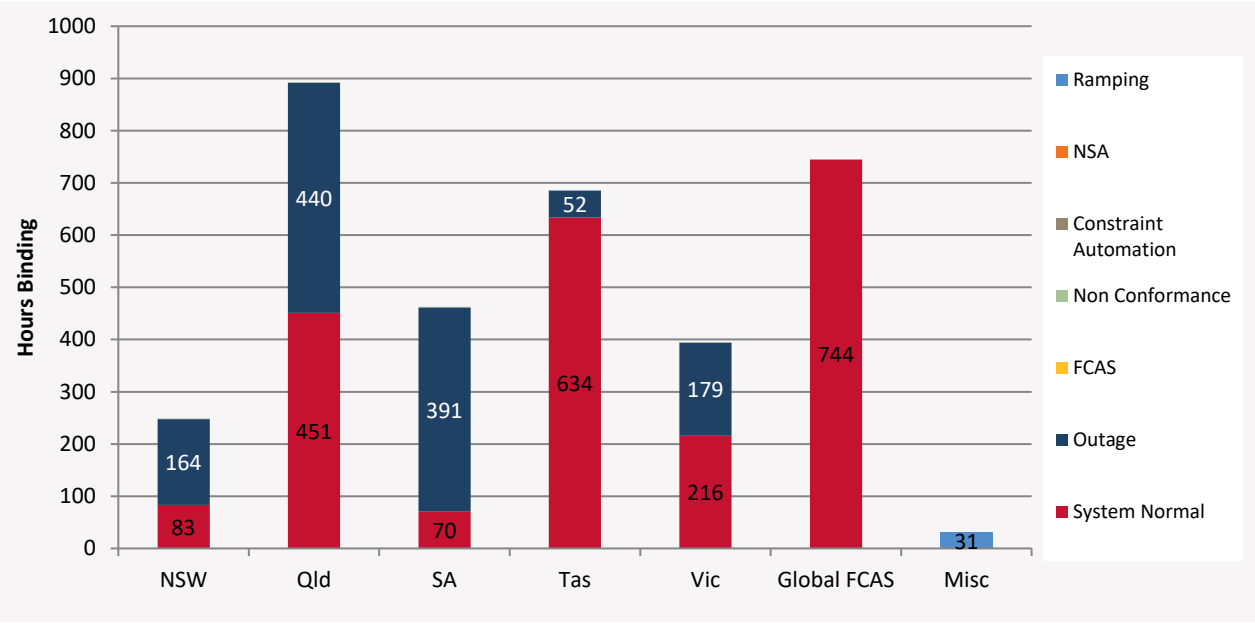
In the following graph the export binding hours are indicated as positive numbers and import with negative values.

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.

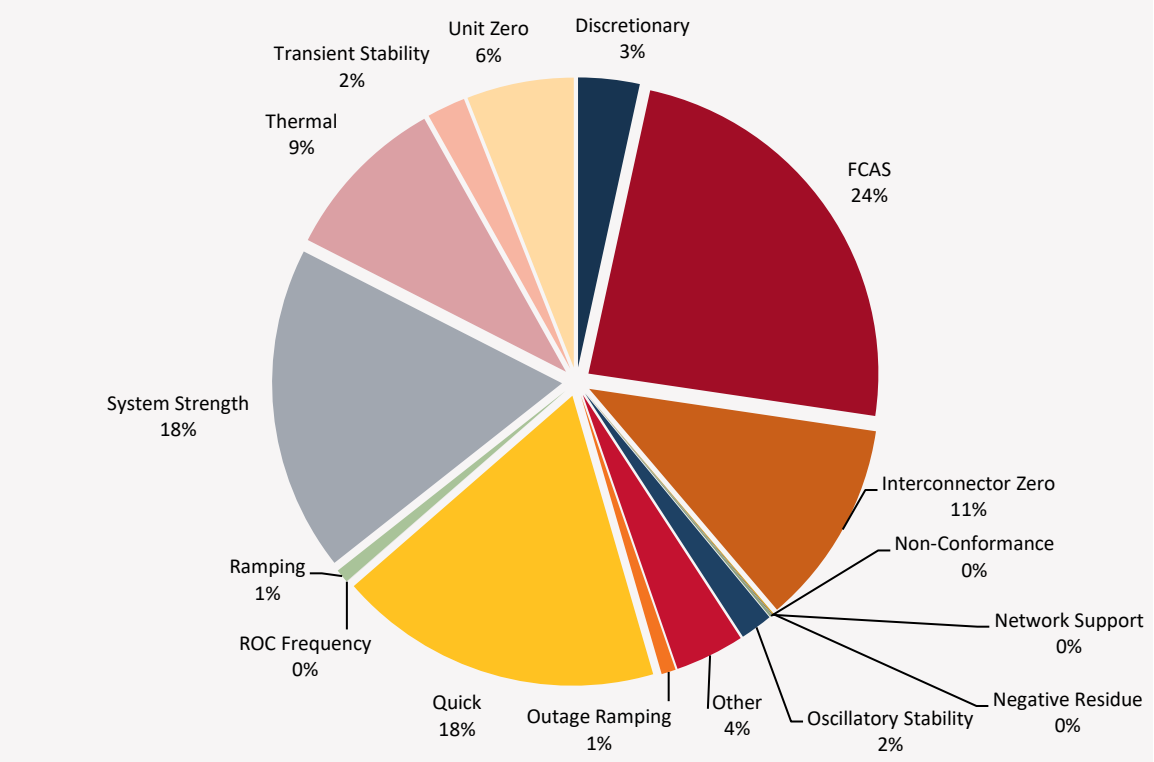
Figure 2 Regional binding dispatch hours



2.7 Binding Constraint Equations by Limit Type

The following pie charts show the percentage of dispatch intervals from for October 2020 that the different types of constraint equations bound.

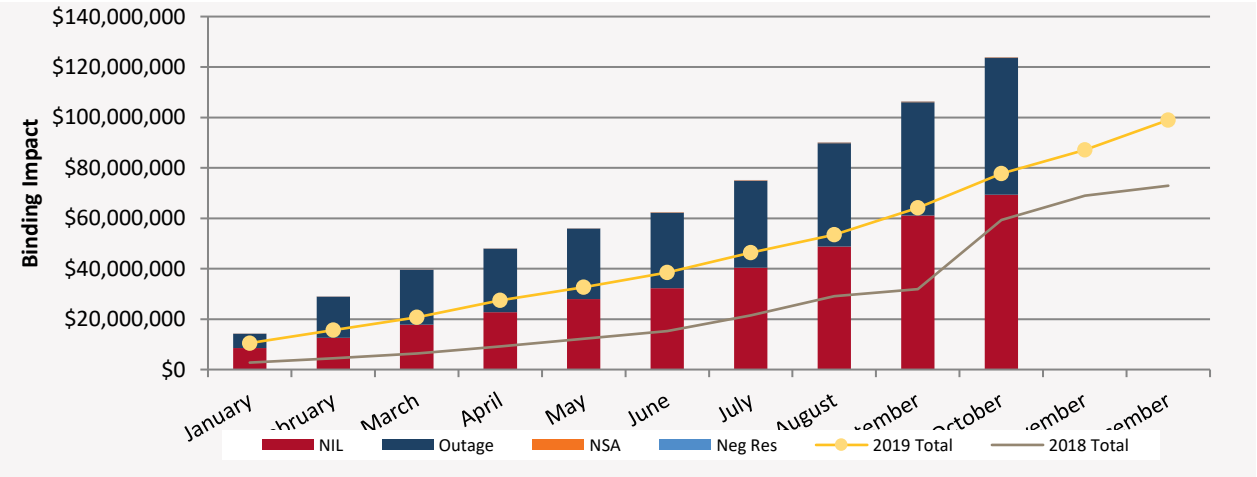
Figure 3 Binding by limit type



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 7 Top 10 largest Dispatch / Pre-dispatch differences

Constraint Equation ID (System Normal Bold)	Description	#DIs	% + Max Diff	% + Avg Diff
N^N-LS_SVC	Out= Lismore SVC O/S or in reactive power control mode, avoid Voltage collapse on Armidale to Coffs Harbour (87) trip; TG formulation only	6	652% (65.29)	181% (35.93)
N_X_MBTE_3B	Out= all three Directlink cables, Terranora_I/C_import <= Terranora_Load	15	363% (25.7)	136.76% (16.77)
T^^V_GTSH_1	Out = Sheffield to Georgetown 220 kV line, prevent voltage collapse at Georgetown 220 kV bus for loss of the remaining Sheffield to Georgetown 220kV line.	12	265% (111.94)	118.11% (70.72)
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.	246	255% (438.21)	76.92% (200.61)
S>NIL_HUWT_STBG2	Out = Nil; Limit Snowtown WF generation to avoid Snowtown - Bungama line OL on loss of Hummocks - Waterloo line.[Note: Wattle PT trips when generating >=80 MW when Dalymple Battery (i.e. both Gen and Load component) is I/S]	5	162% (79.91)	52.49% (38.33)
Q_NIL_STRGTH_HAUSF	Out = Nil, limit Haughton SF output depends on the number units online in Stanwell, Callide B, Callide C, Gladstone, Townsville GT, Kareeya and Barron Gorge generators, Zero if it does not meet minimum generator online. Refer to Table 7 of SO_OG_NEM_62	303	100.01% (50.)	45.% (15.56)
Q_STR_211383_10DAYSF	Limit Daydream SF 80% If Stan>=2+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=8+Kar>=3,NQLD>450&470(AVG),Ross_FN>250&270(AVG),swamp out if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG),Zero otherwise	9	100.% (120.)	11.11% (13.33)
Q_STR_211383_10RGBSF	Limit Rugby Run SF 80% If Stan>=2+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=8+Kar>=3,NQLD>450&470(AVG),Ross_FN>250&270(AVG),swamp out if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG),Zero otherwise	15	100.% (52.)	6.66% (3.46)
Q_STR_311310_SMSF	Limit Sun Metals SF to 25% of Max capacity if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad) >=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG), Zero otherwise	184	100.% (26.)	53.26% (23.45)
Q_STR_211383_10HAYSF	Limit Hayman SF 80% If Stan>=2+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=8+Kar>=3,NQLD>450&470(AVG),Ross_FN>250&270(AVG),swamp out if Stan>=3+CalB>=1+CalC>=1+Glad>=3+(Stan+Cal+Glad)>=10,NQLD>650&670(AVG),Ross_FN>350&370(AVG),Zero otherwise	45	100.% (40.)	2.22% (0.88)

2.9.1 Further Investigation

The following constraint equation(s) have been investigated:

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.

T^^V_GTSH_1: 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.

S>NIL_HUWT_STBG2: Investigated and no improvement can be made to the constraint equation at this stage.

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

Q_STR_211383_10DAYSF: Investigated and no improvement can be made to the constraint equation at this stage.

Q_STR_211383_10RGBSF: Investigated and no improvement can be made to the constraint equation at this stage.

Q_STR_311310_SMSF: Investigated and no improvement can be made to the constraint equation at this stage.

Q_STR_211383_10HAYSF: 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 for October 2020.

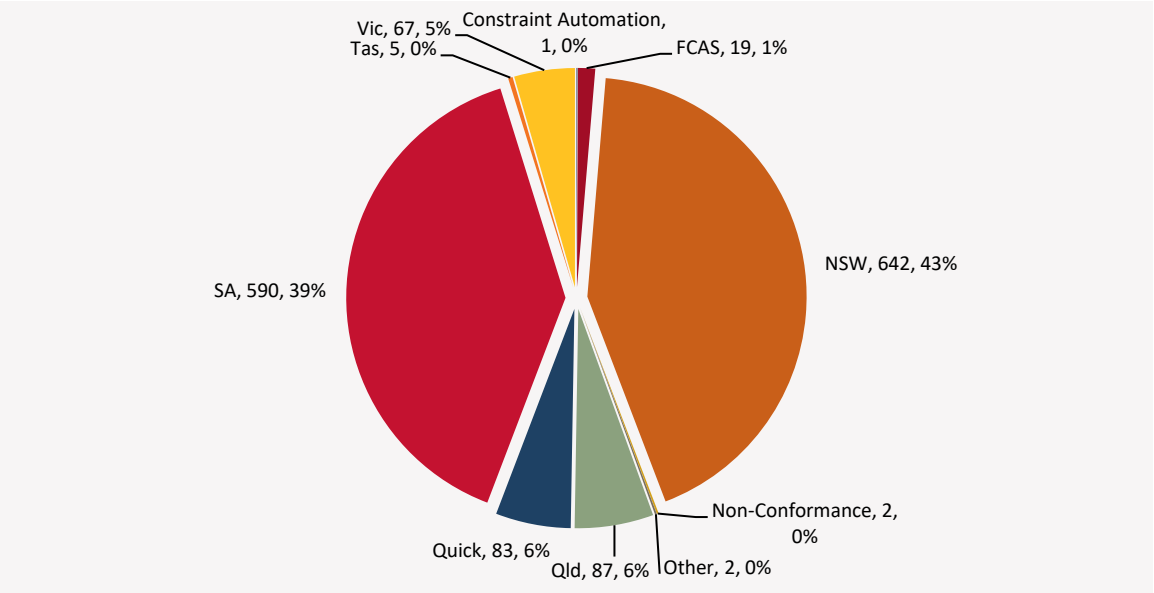
Table 8 Generator and transmission changes

Project	Date	Region	Notes
Gin Gin bypass project (feeder 813 & 815 bypassed)	1 October 2020	QLD	Feeder 813 from Calliope river to Gin Gin joined feeder 815 from Gin Gin to Woolooga to form one feeder.
SA Water Morgan Whyalla Pump Station 3	26 October 2020	SA	New Generator
Collector Wind Farm Substation and transmission lines	27 October 2020	NSW	Collector Wind Farm substation has been cut into the existing Marulan - Yass (4) 330 kV Line to form the following lines: Collector WF - Marulan (4) 330 kV line Collector WF - Yass (3L) 330 kV line
Haunted Gully No 1 and No 2 Capacitor Banks	28 October 2020	VIC	Haunted Gully No.1 and No.2 132 kV 50 MVAr harmonic filter capacitor banks
Stockdill Substation	29 October 2020	NSW	Stockdill Substation has been cut into the existing Canberra - Upper Tumut (01) 330 kV line to form the following lines: Canberra - Stockdill (3C) 330 kV line Stockdill - Upper Tumut (1) 330 kV line

3.1 Constraint Equation Changes

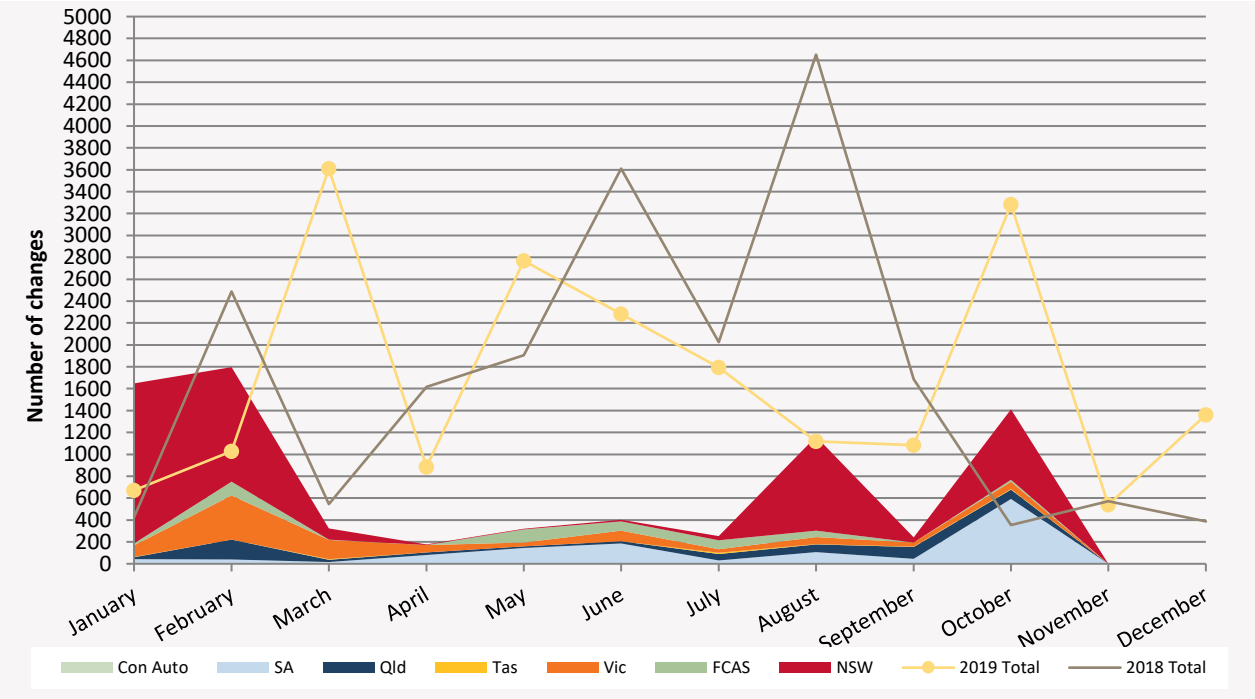
The following pie chart indicates the regional location of constraint equation changes. For details on individual constraint equation changes refer to the Weekly Constraint Library Changes Report[2] or the constraint equations in the MMS Data Model.[3]

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.

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



[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