

System Operator Reports

May 2015

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SYSTEM OPERATOR

TRANSPower



Keeping the energy flowing

System Operator Operational and System Performance Report to the Electricity Authority for May 2015

Purpose of Report

This report summarises Transpower's review of its performance as system operator for May 2015, as required under clause 3.14 of the Electricity Industry Participation Code 2010 (the Code).

Any relevant operational issues are also provided for the information of the Electricity Authority (Authority). A separate detailed System Performance report will be provided to Authority staff.

1. Summary of Month from an Operational and System Performance Perspective

Operational

System events

No significant system events occurred during May 2015. However, there were two minor loss of supply incidents

The first, on 17 May, occurred due to the operation of Waihou Bus Zone Protection, resulting in a 58MW loss of supply to Waihou, Waikino, and Kopu. The second, on 19 May, resulted in a 12MW loss of supply at Wanganui following the tripping of one of the 33kV bus sections.

Outage planning

Manapouri double circuit outage 16 May 2015

Planning for this complex outage was only completed during the week of the outage, impacting our ability to provide market participants with the necessary information in a timely manner. In response to this, the system operator has commenced a review of the planning process, which will utilise participant feedback.

Planning for outages of the MAN_NMA_3 and INV_MAN_2 circuits on 16 May 2015 was complex, given the nature of the outage – Manapouri generation was on a single bus for the duration of the outage. The resulting configuration of the grid at Manapouri meant the in-service bus was treated as an Extended Contingent Event (ECE) risk for the outage period. This required the development of a new voltage stability constraint. The market was only advised of the new constraint four business days prior to the outage.

High levels of local generation (the outage constrained Manapouri generation for the duration), and short notification period for the new stability constraint, provided insufficient time for participants to understand the new constraint and ECE risk arrangement. This impacted participants' ability to mitigate any commercial consequences from the constraint.

As it transpired the new stability constraint was not effective during the outage; the system operator relied instead on a discretionary constraint for a few of the relevant trading periods. Price impacts from the discretionary constraint do not appear to have been material.

The review the system operator has commenced in relation to its planning process is being carried out by an external provider and is expected to be complete by the end of June 2015. Several already-identified improvement initiatives (such as better early identification

practices for market-impacting outages; minimum time requirements for new manual constraints) are now being implemented.

Frequency Keeping Controls operation

Use of frequency keeping control (FKC) has been the system operator's normal mode of operation since conclusion of the FKC trial on 31 March 2015 (FKC operations were suspended on occasions in May 2015 during periods of high HVDC transfer, as the FKC modulation requirement and spinning reserve sharing are unable to be maintained at high transfer).

The system operator's technical review of FKC operations during the trial, from mid-October 2014 to 31 March 2015, will be documented in a report to be published by mid-June 2015. The report will be a record of the market, operational and technical observations collected by the system operator during the trial with recommendations. It is also intended to provide a technical briefing for further operational and policy developments for frequency keeping and instantaneous reserves.

The key observations from the trial are:

- FKC operations with reduced multiple frequency keeping bands will result in material savings of frequency keeping costs – up to \$25m p.a.;
- FKC provides improvements to power system quality and security – tighter management of frequency within the normal ± 0.2 Hz band has been demonstrated;
- an increase in generator governor action, affecting generator plant and operating regimes and also impacting energy and reserve dispatch compliance; and
- FKC can be operationally challenging using the system operator's current market system tools. Issues relating to the interaction of managing system frequency and maintaining time error have been experienced.

Importantly no adverse impact on the system operator's ability to meet its performance objectives for delivering a secure power system with the required power quality (the system operator's principal performance obligations) was seen. Consequently, FKC is now the system operator's normal operating mode.

2. Market

There were no outages, exceeding two hours in duration, to the market systems during May 2015.

3. Business Performance

Business Plan

The draft 2015/16 business plan for the system operator service was provided to the Authority in April for consideration and feedback by the Authority Board. The system operator is carrying out preparatory work to ensure it is in a position to deliver on its business plan next financial year. From 1 July 2015 the system operator will provide an update to the Authority on its performance against the business plan.

Policy Statement Review

The system operator is currently reviewing its Policy Statement. The review is well underway and the system operator is on target to provide a draft for consultation to the Authority in November/December 2015.

Significant Project Update – Reserves and Frequency Management Programme

The Reserves and Frequency Management (RFM) programme is currently progressing as per the schedule agreed between the system operator and the Authority. The next RFM industry forum is scheduled for 19 June 2015, and planning for the next RFM industry engagement group (21 July 2015) has commenced.

Programme component projects are progressing at different stages as described below:

- Efficient Procurement of Extended Reserves Implementation. The SO prepared scope options for the Authority's consideration prior to finalising the scope of work. The SO will present a project plan to the Authority by the 10 June to enable the Authority to prepare a joint project schedule.
- Inter-island Instantaneous Reserve Sharing Implementation. SIR sharing is scheduled to be implemented in early October 2015, following the SO Tools project completion.
- Normal Frequency Management Strategy. The Normal Frequency Management Strategy project (TASC 49) has completed further workshops to define an interim solution for normal frequency management. Options have been documented and reviewed, and were discussed at a challenge session on 6 May 2015.
- National Market for Frequency Keeping. Work on this project is on hold pending the outcomes of TASC 49.
- Review of Instantaneous Reserve Markets. This project is currently on time and budget, with the draft report submitted to the Authority.
- RMT Study Tool. Stakeholder requirements have been signed off, and the Solution Options and Development Approach (SODA) initiated. The SODA have been drafted and endorsed by the Information Systems and Technology design review group, and are currently being reviewed by the business. The benefit identification process has also been initiated in preparation for the development of the initial business case.
- Security Tool Implementation for New HVDC Controls. Functional testing is now underway, with the business currently updating business processes and developing e-learning training. Deployment is scheduled to meet the 10 September 2015 target.

Significant Project Update – PRISM

The completion of the PRISM project to upgrade Transpower's Energy Management System (including SCADA) is due on 23 October 2015. This date was revised in April from a July 2015 commissioning. All other projects with a dependency on PRISM have had their schedules adjusted. These include the HVDC SO tools project (moved ahead of PRISM) and the Enterprise Service Bus project (moved to April 2016).

The PRISM project is currently heavily involved in site acceptance testing (SAT) and a user acceptance testing readiness review scheduled for 24 June 2015.

4. Security of Supply Update

May hydrology was wet and consequently aggregate storage has increased, along with high levels of hydro generation.

NZ aggregate storage levels are 100% of average for this time of year. The hydro risk meter is currently set at "normal". In the unlikely event of significant equipment failure, the Security of Supply status could change quickly.

5. Compliance Report

There were no breaches of the principal performance obligations during May 2015.

One breach of the Code was reported to the Authority during May 2015 relating to the incorrect modelling of risk and an associated over-procurement of reserves. This event has been included in a formal investigation, along with two other similar events from March and April 2015.

6. Ancillary Services

The clearing manager has begun processing the wash-ups required to resolve the reserve cost allocation issues originally reported to the Authority in March 2015. The system operator is working closely with the clearing manager to ensure remaining wash-ups are processed quickly, whilst minimising impact on the affected participants. All wash-ups are expected to be completed by August 2015.

The system operator has almost completed an internal review of its cost allocation processes, intended to identify potential areas for improvement. Once this process is completed, the system operator intends to engage an external auditor to provide an independent opinion on the effectiveness of these processes.

Ancillary Service Costs

The costs of ancillary services for the month of May 2015 are set out in Appendix A (as required by clause 82.1 of the Procurement Plan).

7. Code 7.10: Separation of Transpower Roles

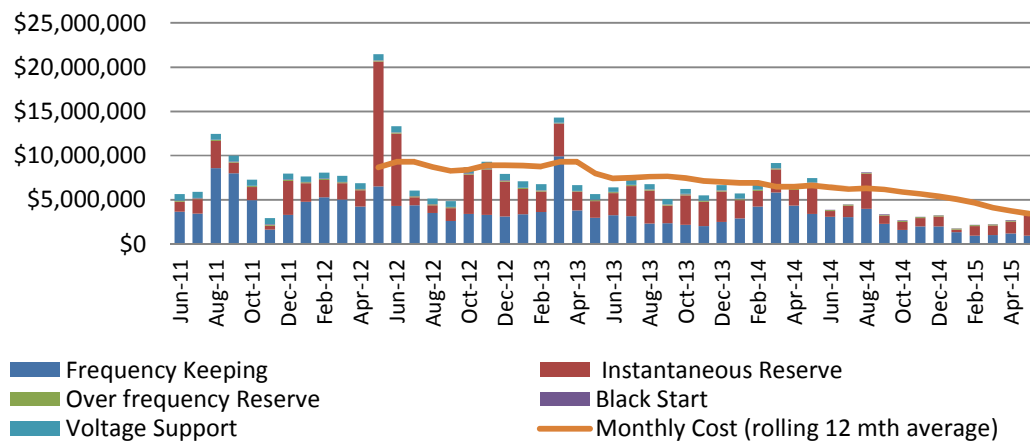
In performing its role as system operator, Transpower has not been materially affected by any other role or capacity Transpower has under the Code or under any agreement.

Appendix A – Ancillary Service Costs for May 2015

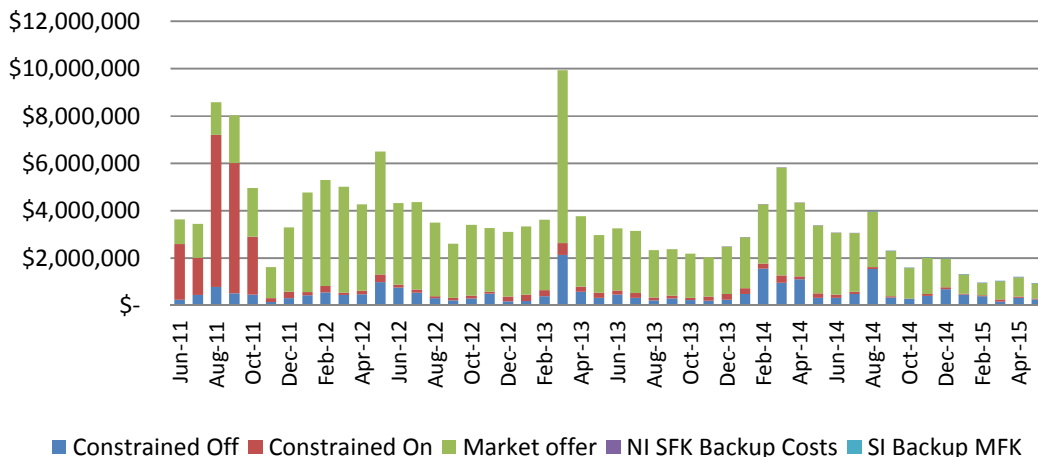
Note: The scale for the Instantaneous Reserve (Past 4 Years) graph has been reduced to clarify detail. Two months data, May and June 2012, overly influenced the graph scale.

		Cost
Frequency Keeping	Constrained Off	\$ 253,274
	Constrained On	\$ 47,507
	Market offer	\$ 625,918
	NI SFK Backup Costs	\$ 2,716.67
	SI Backup MFK	\$ 2,232.00
	Total monthly Cost	\$ 931,648
Instantaneous Reserve	Spinning reserve	\$ 1,345,714
	Interruptible Load	\$ 942,649
	Constrained On	\$ 25,014
	Total monthly Cost	\$ 2,313,377
Over Frequency Reserve	Total monthly Cost	\$ 117,274
Black Start	Total monthly Cost	\$ 52,487
All Ancillary Services	Total monthly Cost	\$ 3,414,786

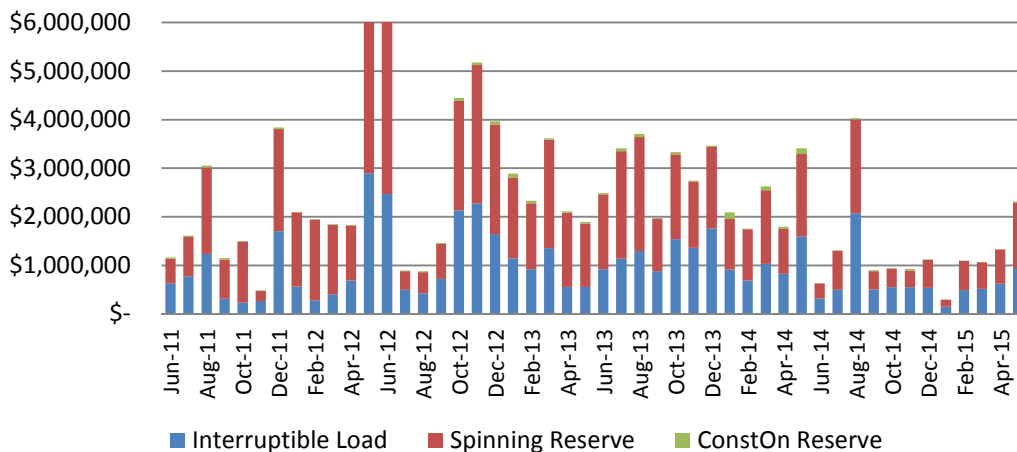
Ancillary Services Costs (past 4 years)



Frequency Keeping (past 4 years)



Instantaneous Reserve (past 4 years)



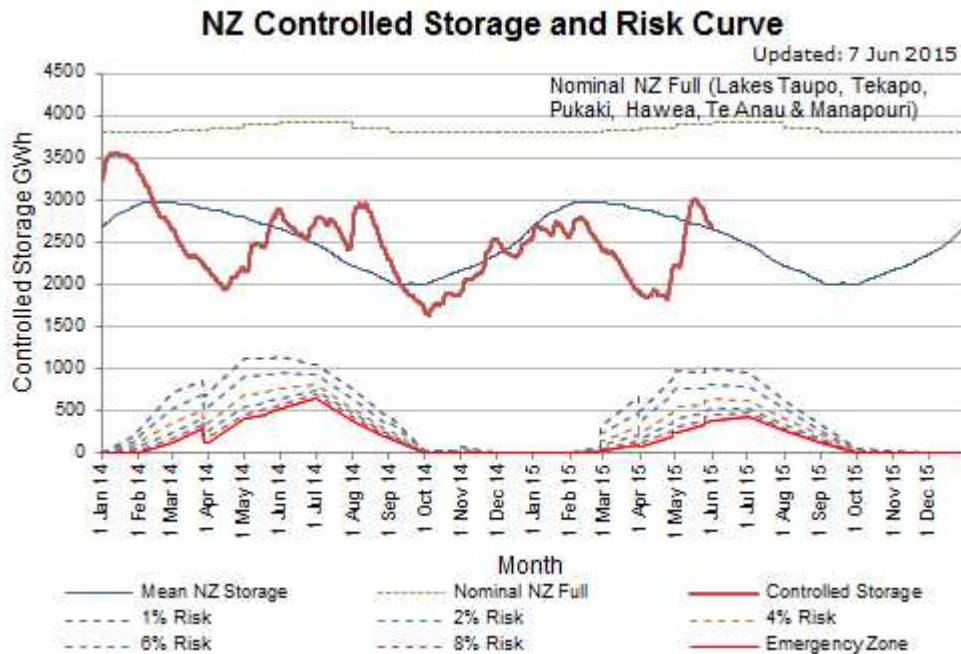
Note: IR Cost May 2012 = 14.129M, IR Cost Jun 2012 = 8.164M

Appendix B – Security of Supply

New Zealand Hydro Storage and Hydro Risk Curves

As at 9 June 2015, aggregate primary New Zealand storage is 100% of average.

The graph below compares New Zealand hydro storage to the hydro risk curves.



Hydro Storage and Generation

North Island inflows during May 2015 were 114% of average.

South Island inflows during May 2015 were 170% of average.

Measurements are based on daily inflow values.

Hydro generation met 68% of demand during May 2015.

System Performance Report

To the Electricity Authority

May 2015

Purpose

This System Performance Report summarises power system performance each month. The detailed reporting of system events is intended to provide an understanding of the nature of system events that occur in the normal course of the real time co-ordination of security and to identify emerging issues in system operation.



SYSTEM OPERATOR

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1. SUMMARY OF SYSTEM PERFORMANCE

This system performance report covers the month of May 2015.

Principal Performance Obligations

- The system operator met the Principal Performance Obligations during the reporting period.

System Events

- On 16th May at 11:10 an emergency potline off-load at Tiwai Point Aluminium Smelter resulted in a momentary frequency rise in the South Island to 50.63 Hz.
- On 17th May at 22:03 a fault occurred on the 110 kV bus at Waihou Substation, resulting in a loss of connection to Waihou, Waikino, and Kopu Substations. Supply was restored to Waikino after 109 minutes, Kopu after 110 minutes, and Waihou after 114 minutes.
- On 19th May at 14:01 Wanganui 33 kV bus A tripped, resulting in a partial loss of supply to Wanganui Substation. Supply was restore after 100 minutes.
- On 25th May Takapu Road Supply transformer T1 tripped twice during a planned outage on the parallel T2 bank, at 07:13 and again at 07:47. These resulted in losses of supply. Supply was restored after 12 and 10 minutes respectively.

Other noteworthy events occurring during the reporting period:

- On 19th May at 21:43 and again on 22nd May at 04:29, Wilton 220 / 110 kV inter-connecting transformer T8 tripped.

2. PRINCIPAL PERFORMANCE OBLIGATIONS

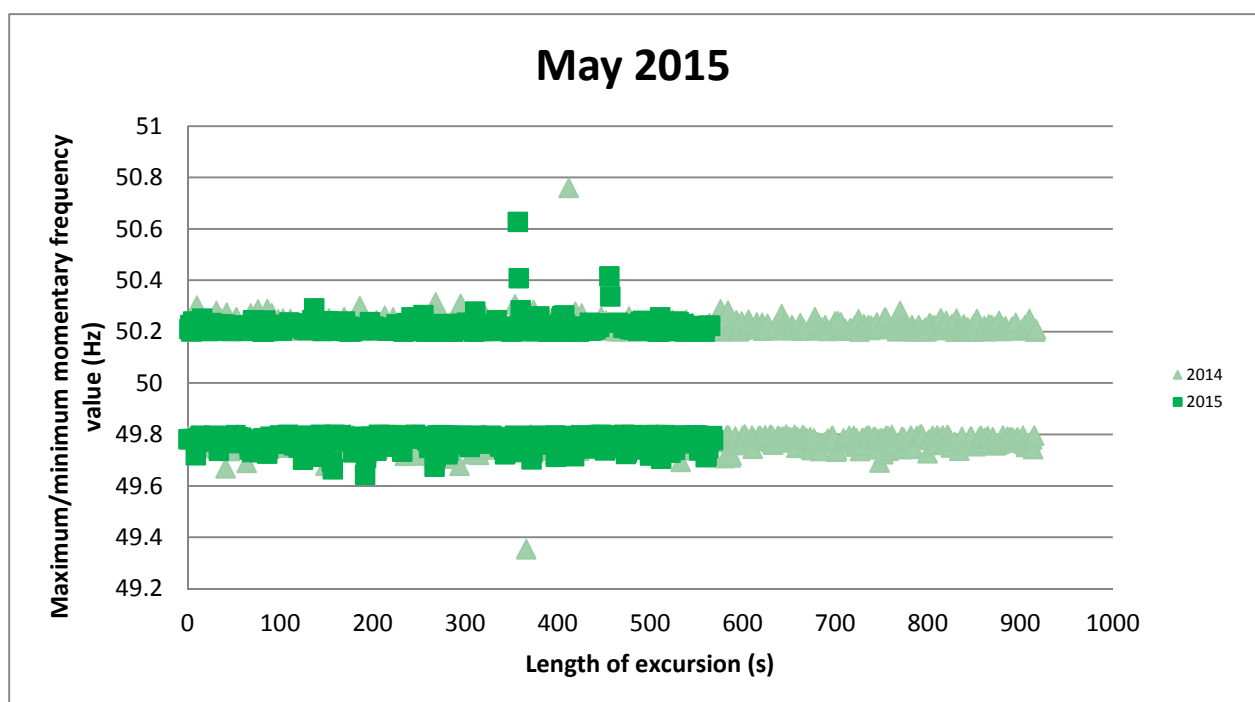
2.1 AVOID CASCADE FAILURE

No instances of cascade failure occurred during the reporting period.

2.2 FREQUENCY

Maintain frequency in normal band and recover quickly from a fluctuation

The chart below shows the maximum or minimum frequency reached and length of each frequency excursion outside the normal band (49.8 to 50.2 Hz) during the reporting period. The majority of excursions are within 0.4 Hz of the normal band and frequency typically returns to within the normal band within 2 minutes.



Maintain Frequency and limit rate occurrences during momentary fluctuations

The table below shows the total number of momentary fluctuations outside the frequency normal band, recorded in both Islands, over the last 12 months. The 12 month cumulative totals, grouped by frequency band, are compared to the frequency performance objective (PPO).

Frequency Band	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Annual rate	PPO target
55.00 > Freq >= 53.75														0.2*
53.75 > Freq >= 52.00														2*
52.00 > Freq >= 51.25														7
51.25 > Freq >= 50.50	1	1	1	1		2			1	2	1	1	11	50
50.50 > Freq >= 50.20	206	336	345	420	244	360	165	26	25	47	153	252	2579	
50.20 > Freq > 49.80														
49.80 >= Freq > 49.50	208	452	401	585	351	375	204	24	15	44	174	315	3148	
49.50 >= Freq > 48.75			1		2	5	2	1	1	1			13	60
48.75 >= Freq > 48.00						1							1	6
48.00 >= Freq > 47.00														0.2
47.00 >= Freq > 45.00														0.2

* South Island

Manage time error and eliminate time error once per day

- The time error performance criteria are:
- Time error must be managed within +/- 5 seconds.
- Time error must be eliminated at least once every day.

Time Error Compliance Table		Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15
Time Error Management	NI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	SI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Error Elimination	NI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	SI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

3. OPERATIONAL MANAGEMENT

3.1 SECURITY NOTICES

The following table shows the number of Warning Notices, Grid Emergency Notices and Customer Advice Notices issued over the last 12 months.



Notices issued	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	
Demand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	12	5	4	3	7	3	5	1	4	-	2	3
Warning Notice	-	8	21	7	8	11	23	29	27	31	10	12
Customer Advice Notice	4	33	16	10	28	22	20	11	12	12	13	32

3.2 GRID EMERGENCIES

The following table shows grid emergencies declared by the system operator in the reporting period.

Date	Time	Summary Details	Island
17/05/15	22:31	A Grid Emergency was declared to facilitate load restoration to Kopu, Waikino, & Waihou Substations after the tripping of the Waihou 110 kV bus.	N
20/05/15	01:30	A Grid Emergency was declared to shift to single frequency keeping after an unplanned outage of the Multiple Frequency Keeping application.	N + S
20/05/15	02:16	A grid emergency was declared to allow the 110 kV Arapuni bus split to be closed due to insufficient generation offers.	N

A summary of grid emergencies that have occurred in the last 12 months is shown in the following table.

Island	Region	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	Total	
North Island	Northland	-	-	-	-	-	-	-	-	-	-	-	0	
	Auckland	-	-	-	-	4	-	-	-	-	-	-	4	
	Zone 1	6	3	1	-	-	-	-	-	-	-	1	11	
	Waikato	-	-	-	2	2	2	4	1	2	-	-	3	16
	Bay of Plenty	-	-	-	-	-	-	-	-	-	-	-	-	0
	Hawkes Bay	-	-	-	-	-	-	-	-	-	-	-	-	0
	Taranaki	-	-	-	-	-	-	-	-	-	-	-	-	0
	Bunbury	-	-	-	-	-	-	-	-	-	-	-	-	0
	Wellington	-	1	-	-	-	-	-	-	-	-	-	-	1
	North Island (all)	-	1	-	-	-	-	-	-	-	-	-	-	1
Lower North Island	1	-	1	-	-	-	-	-	-	-	-	-	2	
North & South Islands		1	1	1	-	1	-	-	-	-	-	-	1	5
South Island & HVDC	Nelson Marlborough	1	-	-	-	-	-	-	-	-	-	-	-	1
	West Coast	-	-	-	-	-	-	-	-	-	-	-	-	0
	Christchurch	-	-	-	-	-	-	-	-	-	-	-	-	0
	Canterbury	-	-	-	-	-	-	-	-	-	-	-	-	0
	Zone 3	3	-	1	1	-	1	-	-	-	-	-	-	6
	Otago	-	-	-	-	-	-	-	-	1	-	-	-	1
	Southland	-	-	-	-	-	-	-	-	1	-	1	-	2
	South Island (all)	-	-	-	-	-	-	1	-	-	-	-	-	1
HVDC	-	-	-	-	-	-	-	-	-	-	-	-	0	



3.3 CUSTOMER ADVICE NOTICES (CANs)

Thirty-two CANs were issued in the reporting period:

- twenty-two related to the planned activation and deactivation of HVDC Frequency Keeping Control;
- four related to the planned double circuit outage on 220 kV Invercargill – Manapouri 1 and Manapouri – North Makarewa 3;
- one advised the resumption of multiple frequency keeping after an unplanned outage of the function on 20th May;
- one related to a planned outage on HVDC Pole 2;
- one related to a new manual outage constraint for Kumara;
- one related to a new manual outage constraint for Hawera;
- one related to the post-contingent management of the Redclyffe inter-connecting transformers; and
- one advised of a change to Winter conductor ratings on 10 May.

3.4 STANDBY RESIDUAL CHECK (SRC) NOTICES

A total of twenty-four SRC notices were issued during the reporting period based on the SDS (system operator's own load forecasting tool). These SRC notices were in respect of trading periods on 7th, 14th, 19th, & 20th May.

3.5 VOLTAGE MANAGEMENT

Grid voltages did not exceed the Code voltage ranges during the reporting period.

3.6 OUTAGE MANAGEMENT

The following table shows the number of outages over the last 12 months where operational measures (generation agreements, load management agreements or grid re-configurations) were required to allow the outage to proceed.¹ Grid re-configurations typically involve splitting the network during the outage to manage post contingency power flows. Security of supply is sometimes reduced by grid re-configuration.

Island	Region	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Total
North Island	Northland	6	-	1	2	5	3	3	3	7	6	12	8	56
	Auckland	5	2	3	6	4	3	1	1	6	4	8	11	54
	Waikato	6	3	5	10	10	9	3	4	10	9	8	11	88
	Bay of Plenty	5	5	5	-	6	7	6	3	4	4	6	4	55
	Hawkes Bay	-	1	-	-	5	2	2	2	4	6	6	7	35
	Taranaki	2	-	1	1	2	7	-	4	4	3	2	5	31
	Bunnythorpe	-	-	-	2	7	4	1	5	4	4	8	7	42
	Wellington	6	3	4	3	12	9	10	11	9	8	9	6	90
Total		30	14	19	24	51	44	26	33	48	44	59	59	451
South Island	Nelson Marlborough	7	5	2	4	10	14	8	7	6	4	6	8	81
	West Coast	7	10	6	4	10	11	8	8	8	6	5	10	93
	Christchurch	5	4	2	4	7	10	6	5	8	7	7	7	72
	Canterbury	5	4	4	2	6	7	4	4	5	2	2	6	51
	Otago	-	-	2	9	2	4	2	1	3	2	3	5	33
	Southland	6	5	5	2	1	3	3	1	2	4	5	3	40

¹ Load agreements generally require the distributor to manage load at one or more grid exit points. Generation agreements are required to ensure that sufficient regional generation is available to provide energy or reactive support during the outage to maintain security standards.



Total		30	28	21	25	36	49	31	26	32	25	28	39	370
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3.7 CONSTRAINTS

SUMMARY: Security constraints binding during the month

The following table shows the binding constraints during the reporting period.

Additional information on security constraints can be found on the following website address: <http://www.systemoperator.co.nz/security-management#cs-147305>. This information includes constraint equations and a brief summary of their purpose.

Island	Region	Branch	Description	Total
North Island	Hawkes Bay	RDF_T3&T4_W_P_1	The effect of this constraint is to manage flows through Redclyffe T3 & T4 to prevent the in service transformer from overloading for a contingency of the other transformer.	6
South Island & HVDC	HVDC	BEN_HAYP2max	The purpose of this constraint is to limit the flow on HVDC from Benmore to Haywards to the Asset Owner offered capability for Pole 2.	2
	Otago	NSY_ROX.1__CYD_TWZ2.1__CYD_TWZ2__ROX__LN	This is an SFT generated constraint. Its purpose is to protect Naseby-Roxburgh 1 for a tripping of Clyde-Twizel 2.	73
		NSY_ROX.1__CYD_TWZ1.1__CYD_TWZ1__ROX__LN	This is an SFT generated constraint. Its purpose is to protect Naseby-Roxburgh 1 for a tripping of Clyde-Twizel 1.	10
	West Coast	COL_HOR2.1__GYM_KUM.1__GYM_KUM__COL__LN	This is an SFT generated constraint. Its purpose is to protect Coleridge-Hororata 2 for a tripping of Greymouth-Kumara 1.	1
		COL_HOR2.1__COL_HOR3.1__COL_HOR3__COL__LN	This is an SFT generated constraint. Its purpose is to protect Coleridge-Hororata 2 for a tripping of Coleridge-Hororata 3	29
		COL_HOR3.1__COL_HOR2.1__COL_HOR2__COL__LN	This is an SFT generated constraint. Its purpose is to protect Coleridge-Hororata 3 for a tripping of Coleridge-Hororata 2	30
Grand Total				151

Constraints binding during last 12 months

The following table shows constraints which bound during the reporting period for a duration of more than 4 trading periods and those binding for more than 48 trading periods during the previous 12 months.

Island	Region	Constraint	Reporting period		Previous 12 months	
			Number of trading periods that constraint bound	Percentage of trading periods	Number of trading periods that constraint bound	Percentage of Trading periods
North Island	Hawkes Bay	RDF_T3&T4_W_P_1	6	0.40%	21	0.12%
		RDF_T3&T4_S_P_1	0	0.00%	87	0.50%
South Island & HVDC	West Coast	COL_HOR2.1__COL_HOR3.1__COL_HOR3__COL__LN	29	1.95%	54	0.31%
		COL_HOR3.1__COL_HOR2.1__COL_HOR2__COL__LN	30	2.02%	41	0.23%



		HOR_KBY_ISL1.2__HOR_KB Y_ISL2.2__S__HOR_ISL2__I SL__LN	0	0.00%	128	0.73%
	Otago	NSY_ROX.1__CYD_TWZ1.1_ __CYD_TWZ1__ROX__LN	10	0.67%	17	0.10%
		NSY_ROX.1__CYD_TWZ2.1_ __CYD_TWZ2__ROX__LN	73	4.91%	29	0.17%
	HVDC	BEN_HAYP2max	2	0.13%	112	0.64%

4. SYSTEM EVENTS

4.1 SIGNIFICANT SYSTEM EVENTS

The following table shows significant events (frequency excursions and connection point events) which occurred during the reporting period.

Significant frequency excursions

Date	Time	Summary Details	Island	Freq (Hz)
16/05/15	11:10	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.63

Connection point events

Date	Time	Summary Details	Generation / Load interrupted (MW)	Restoration time (minutes)
17/05/15	22:03	Waihou 110 kV bus tripped resulting in a loss of supply to Waihou, Waikino, & Kopu Substations.	WHU 20 WKO 16 KPU 21	114 109 110
19/05/15	14:01	Wanganui 33 kV 'A' Bus tripped.	12	100
25/05/15	07:13	Takapu Road Supply transformer T1 tripped during a planned outage on the parallel T2 bank.	64	12
25/05/15	07:47	Takapu Road Supply transformer T1 tripped during a planned outage on the parallel T2 bank.	68	10

4.2 SYSTEM EVENTS DURING REPORTING PERIOD

System events that occurred during the reporting period were:

Contingent events

Event	Number	Summary
Loss of single AC transmission circuit	8	These related to trippings of <ul style="list-style-type: none"> • Arapuni-Bombay 1 • Arapuni-Hamilton 2 (auto reclose) • Coleridge-Hororata 3 • Hokitika-Otira 1 • Islington-Kikiwa 1 (auto reclose) • Kaikohe-Maungatapere 1 (auto reclose) • Mangamaire-Masterton 1 (auto reclose) • Otahuhu-Whakamaru 2 (auto reclose)
HVDC Start/Stop	0	
Supply Transformer	3	These related to trippings of <ul style="list-style-type: none"> • Hamilton T2 • Takapu Rd T1 (2 x)



Event	Number	Summary
Loss of grid reactive plant	6	This related to tripping of <ul style="list-style-type: none"> Albany Static Var Compensator SVC7 Haywards Synchronous Condenser SC10 (2 x) Islington Capacitor Bank C26 Kikiwa Static Synchronous Compensator STC2A (2 x)
Loss of single generation units	11	These related to trippings of <ul style="list-style-type: none"> Aniwhenua Generation (3 x) Highbank G1 Kinleith Co-generation Kapuni GT1 Rotokawa generation Tauhara Generation Whareroa generation White Hills generation (2 x)
Total during reporting period	28	

Extended contingent events

Event	Number	Summary
Loss of both HVDC poles	0	
Loss of interconnecting transformer	2	This related to tripping of <ul style="list-style-type: none"> Wilton T8 (2 x)
Loss of bus bar section	1	This related to tripping of <ul style="list-style-type: none"> Waihou 110 kV bus
Total during reporting period	3	

Other events

Event	Number	Summary
Loss of multiple AC transmission circuits	1	This related to <ul style="list-style-type: none"> Islington-Kikiwa 1 (auto reclose), Kikiwa STC2A
Demand change	2	These related to <ul style="list-style-type: none"> Tiwai NZAS Standby Potline 1 Emergency off-load Wanganui 33 kV supply bus trip
Generation	1	This related to <ul style="list-style-type: none"> Coleridge Power Station G1-3, G8, & G9 tripping
Total during reporting period	4	

Other disturbances

Event	Number	Summary
Feeder trippings	33	Various locations
Total during reporting period	33	



4.3 SYSTEM EVENTS – TREND

	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Total	Average Events per month
Contingent Event – transmission	9	16	8	14	19	9	11	13	10	8	13	8	138	11.5
Contingent Event – generation	7	23	12	12	1	16	12	19	10	14	6	11	143	11.9
Contingent Event – Supply transformer	3	0	2	4	4	1	1	2	3	2	3	3	28	2.3
Contingent Event – Reactive plant	2	0	1	9	1	2	1	7	4	2	3	6	38	3.2
Contingent Event - HVDC	0	0	0	2	2	7	0	1	0	3	0	0	15	1.3
Extended Contingent Event HVDC	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Extended Contingent Event Inter-connecting Transformers	1	0	0	0	1	0	0	0	0	1	0	2	5	0.4
Extended Contingent Event Busbar	1	1	0	0	2	0	1	0	0	1	2	1	9	0.8
Other Event – AC transmission	1	1	1	0	2	3	0	2	1	4	0	1	16	1.3
Other Event – Demand	1	1	1	2	1	5	0	1	2	1	1	2	18	1.5
Other Event – Generation	0	0	1	2	1	1	0	3	1	4	0	1	14	1.2

