System Operator Reports
February 2015

Contents

SYSTEM OPERATOR

TRANSPOWER

Keeping the energy flowing

System Operator Operational and System Performance Report to the Electricity Authority in relation to 1 to 28 February 2015

Purpose of Report

This report summarises Transpower's review of its performance as system operator for the period 1 to 28 February 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 (the Authority). A separate detailed System Performance report will be provided to Authority staff.

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

1.1. Operational

System events

February was a quiet month for system operations with few events of any consequence.

Operational constraints arose in the lower Waitaki Valley/North Otago on 19 February 2015 when a grid emergency was declared for managing post contingent transmission and voltage risks in the Oamaru area. Load was managed to 40MW at the Oamaru GXP for the period 15:54 – 21:00. With recent increases in irrigation and dairy demand, the region has become operationally challenging during the summer months. A contingency plan is now in place with Network Waitaki to aid the management of this tight situation. Transpower and Network Waitaki are currently increasing the capacity of Waitaki GXP to help offload Oamaru and cater for new load from summer 2015/16

Coincidentally, a brief outage occurred in the area on 16 February 2015 when Oamaru – Studholme - Bell's Pond - Waitaki Circuit 2 tripped, resulting in a loss of 6.8MW of load at Bell's Pond to Alpine Energy. This is an N security connection that includes a new dairy plant.

Frequency keeping control operational trials

Frequency keeping control (FKC) trial operations continued during February, with the trial due to end due in mid-March 2015. A reduction in the amount (and, therefore cost) of frequency keeping services – compared to before FKC trial operations - continues to be demonstrated. The FKC trial is being held over three months to ensure system operations is exposed to FKC operations across a range of power system conditions. Notably, to date, no interruptible load event has been experienced during FKC operations.

Frequency keeping operations using a 0MW MFK regulation output commenced on 24 February 2015; this is under a test regime for a 14-day period. The test objective is to understand the system operator's ability to manage frequency (using FKC) in the absence of MFK (noting from time to time the MFK tool is unavailable).

A report on FKC operations will be prepared at the conclusion of the trial. Publication is anticipated in April.

1.2. Market

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

2. Business Performance

Significant Project Update

The Reserves and Frequency Management programme is progressing to the agreed timetable with the Authority. The status of the component projects are as follows:

- South Island Multiple Frequency Keeping is now live with project close-out complete;
- Reserve Management Tool TSAT Implementation is complete and in the project close-out phase;
- Security Tool Implementation solution design is underway, with the Delivery Business Case complete and undergoing final review for approval;
- Inter-island Instantaneous Reserve Sharing was implemented for FIR in December. Scope changes have been approved and work on this new scope is progressing well;
- feedback from the National Market for Instantaneous Reserve (TASC 043) information paper was received from five participants on 17 February 2015. Based on the feedback received, no further work was requested from the Authority for TASC 043, which will now be closed;
- TASC 048 for the Develop Solution Approach was approved, and commenced, in January 2015. A number of workshops were held as part of TASC 048 during February;
- the National Market for Frequency Keeping scope is being reviewed as part of TASC 049 (Frequency Management Strategy); and
- Efficient Procurement of Extended Reserves Implementation is currently on hold, though there is likely to be an additional TASC request for further work.

3. Security of Supply Update

NZ aggregate storage levels are 81% 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.

4. Compliance Report

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

There was one breach of the Code reported to the Authority during February 2015, being a modelling error identified and fixed in the long schedules. This error did not impact real-time pricing.

5. Ancillary Services

There were no substantive issues to report in February.

Ancillary Service Costs

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

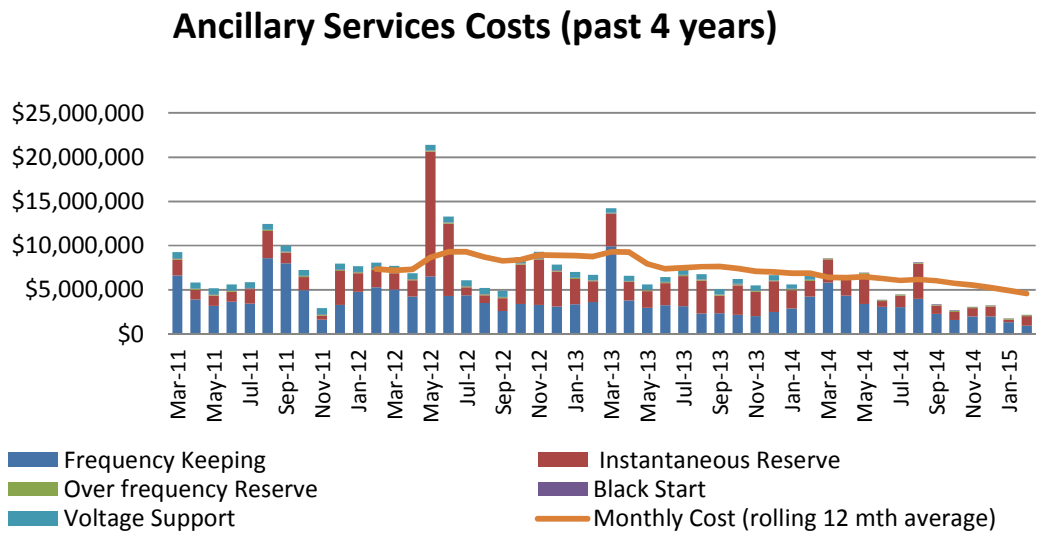
6. Code 7.10: Separation of Transpower Roles

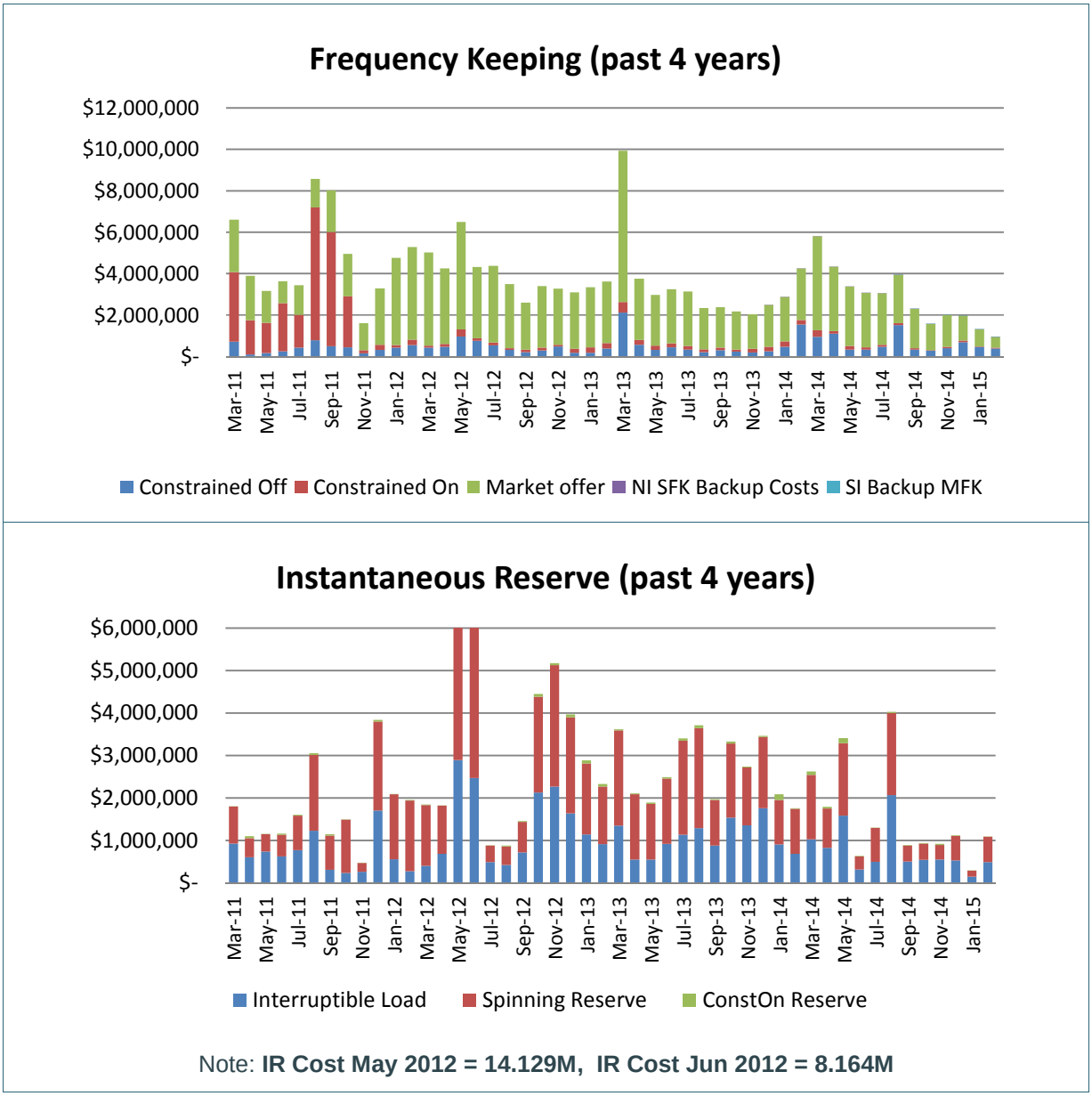
In performing its role as system operator, Transpower has not been materially affected by any other role or capacity Transpower has under the Code or under any agreement.

Appendix A – Ancillary Service Costs for February 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	$	388,373
	Constrained On	$	40,994
	Market offer	$	517,623
	NI SFK Backup Costs	$	2,716
	SI Backup MFK	$	2,232
	Total monthly Cost	**$**	**951,939**
Instantaneous Reserve	Spinning reserve	$	596,431
	Interruptible Load	$	491,664
	Constrained On	$	1,620
	Total monthly Cost	**$**	**1,089,715**
Over Frequency Reserve	**Total monthly Cost**	**$**	**115,229**
Black Start	**Total monthly Cost**	**$**	**39,882**
Voltage Support	**Total monthly Cost**	**$**	**-**
All Ancillary Services	**Total monthly Cost**	**$**	**2,196,765**





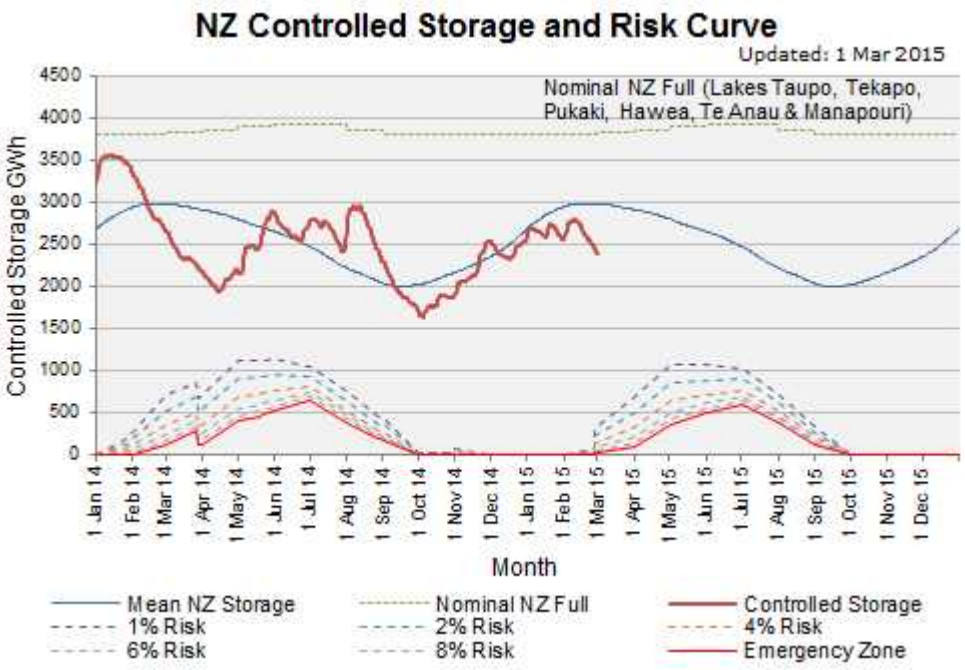
Note: **IR Cost May 2012 = 14.129M, IR Cost Jun 2012 = 8.164M**

Appendix B – Security of Supply

New Zealand Hydro Storage and Hydro Risk Curves

As at 1 March 2015, aggregate primary New Zealand storage is 81% of average.

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



Hydro Storage and Generation

North Island inflows during February 2015 were 60% of average.

South Island inflows during February 2015 were 84% of average.

Measurements are based on daily inflow values.

Hydro generation met 58% of demand during February 2015.

System Performance Report

To the Electricity Authority

February 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

TRANSPOWER

Keeping the energy flowing

Transpower New Zealand Ltd The National Grid

Table of Contents

1. Summary of System Performance

This system performance report covers the month of February 2015.

Principal Performance Obligations

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

System Events

- On 6 February at 06:24 110 kV Bunnythorpe-Mangahao Circuit 1 and T4, the transformer connecting Mangahao to Bunnythorpe-Mangahao Circuit 2, tripped resulting in a loss of supply to the Mangahao grid exit point and a loss of connection to Mangahao Power Station. Connection was restored after 48 minutes.
- On 16 February at 08:39 110 kV Oamaru-Bells Pond-Studholme-Waitaki Circuit 2 tripped resulting in a loss of supply to Bells Pond Substation. Supply was restored after 96 minutes.
- On 23 February at 01:51, multiple generating units tripped at Wairakei Power Station resulting in a momentary drop in North Island frequency.
- On 27 February at 17:44 an emergency potline off-load at Tiwai Point Aluminium Smelter resulted in a momentary frequency rise in the South Island to 50.61 Hz.

Other noteworthy events occurring during the reporting period:

- On 6 February at 09:01 110 kV Inangahua-Murchison-Kikiwa Circuit 1 tripped and auto-reclosed, resulting in a momentary loss of supply to Murchison Substation.
- On 14 February at 06:16 Tuai Supply transformer T15 tripped resulting in a loss of supply to the Tuai grid exit point. Supply was restored after 47 minutes.

2. Principal Performance Obligations

2.1 Avoid Cascade Failure

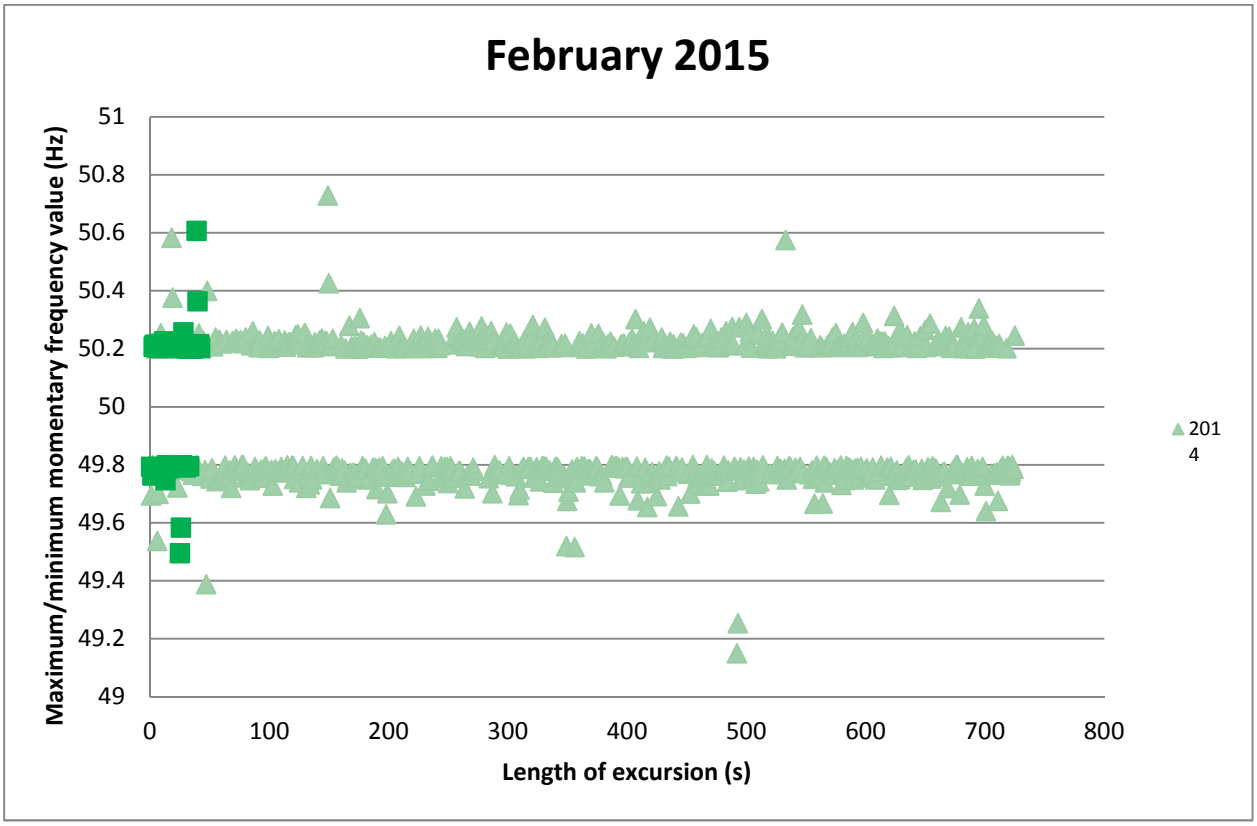
No instances of cascade failure occurred during the reporting period.

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	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-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	0	1	1	1	1	1		2			1	**9**	**50**
50.50 > Freq >= 50.20	398	545	430	206	336	345	420	244	360	165	26	25	**3500**	
50.20 > Freq > 49.80														
49.80 >= Freq > 49.50	610	639	485	208	452	401	585	351	375	204	24	15	**4349**	
49.50 >= Freq > 48.75	1	2				1		2	5	2	1	1	**15**	**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		Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-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	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15
Demand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	5	14	19	12	5	4	3	7	3	5	1	4
Warning Notice	-	-	1	-	8	21	7	8	11	23	29	27
Customer Advice Notice	18	24	17	4	33	16	10	28	22	20	11	12

3.2 Grid Emergencies

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

Date	**Time**	**Summary Details**	**Island**
11/02/15	09:00	A grid emergency was declared to enable the reconfiguration of Huntly due to the number of bus coupler breakers being below the minimum agreed number.	N
19/02/15	15:54	A grid emergency was declared to allow for load management at Oamaru Substation following the tripping of one of the two supplying circuits.	S
23/02/15	15:07	A grid reconfiguration was required in Southland after the 110 kV Gore-Roxburgh Circuit was removed from service.	S
27/2/15	15:27	A grid emergency was declared to close the 110 kV Arapuni Bus split due to an electrical storm in the vicinity.	N

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

Island	Region	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Total
North Island	Northland	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Auckland	-	-	-	-	-	-	-	4	-	-	-	-	**4**
	Zone 1	3	7	8	6	3	1	-	-	-	-	-	-	**28**
	Waikato	1	1	-	-	-	-	2	2	2	4	1	2	**15**
	Bay of Plenty	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Hawkes Bay	-	1	-	-	-	-	-	-	-	-	-	-	**1**
	Taranaki	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Bunnythorpe	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Wellington	-	-	-	-	1	-	-	-	-	-	-	-	**1**
	North Island (all)	1	-	-	-	1	-	-	-	-	-	-	-	**2**
	Lower North Island	-	-	1	1	-	1	-	-	-	-	-	-	**3**
North & South Islands		-	-	-	1	1	1	-	1	-	-	-	-	**4**
South Island & HVDC	Nelson Marlborough	-	-	-	1	-	-	-	-	-	-	-	-	**1**
	West Coast	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Christchurch	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Canterbury	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Zone 3	-	5	9	3	-	1	1	-	1	-	-	-	**20**
	Otago	-	-	-	-	-	-	-	-	-	-	-	1	**1**
	Southland	-	-	-	-	-	-	-	-	-	-	-	1	**1**
	South Island (all)	-	-	-	-	-	-	-	-	-	1	-	-	**1**
	HVDC	-	-	-	-	-	-	-	-	-	-	-	-	**0**

3.3 Customer Advice Notices (CANs)

Twelve CANs (Customer Advice Notices) were issued in the reporting period:

- four related to temporary changes in HVDC capability due to HVDC Filter Bank outages;
- two advised of temporary changes to the HVDC risk subtractor due to planned Filter Bank outages;
- two related to Multiple Frequency Keeping tuning tests;
- one advised of the classification of Wairakei Power Station as a single contingent risk following a tripping on 23rd February;
- one related to the temporary re-rating of the 220 kV Islington – Livingstone Circuit 1 due to protection related issues;
- one advised the Roxburgh Import Overload Protection Scheme would no longer be enabled from 5th February; and
- one advised of a manual constraint being implemented during planned outages of 66 kV Coleridge-Otira 2 or Castle Hill-Coleridge 1.

3.4 Standby Residual Check (SRC) notices

No SRC notices were issued during the reporting period based on the SDS (system operator's own load forecasting tool).

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 in which operational measures (generation agreements, load management agreements or grid re-configurations) were required to allow the outage to proceed.

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. 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	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Total
North Island	Northland	8	4	8	6	-	1	2	5	3	3	3	7	**50**
	Auckland	5	-	12	5	2	3	6	4	3	1	1	6	**48**
	Waikato	12	12	12	6	3	5	10	10	9	3	4	10	**96**
	Bay of Plenty	7	5	6	5	5	5	-	6	7	6	3	4	**59**
	Hawkes Bay	6	12	5	-	1	-	-	5	2	2	2	4	**39**
	Taranaki	4	5	2	2	-	1	1	2	7	-	4	4	**32**
	Bunnythorpe	7	3	5	-	-	-	2	7	4	1	5	4	**38**
	Wellington	13	17	12	6	3	4	3	12	9	10	11	9	**109**
Total		62	58	62	30	14	19	24	51	44	26	33	48	**471**
South Island	Nelson Marlborough	7	5	4	7	5	2	4	10	14	8	7	6	**79**
	West Coast	11	6	7	7	10	6	4	10	11	8	8	8	**96**
	Christchurch	4	5	2	5	4	2	4	7	10	6	5	8	**62**
	Canterbury	4	3	2	5	4	4	2	6	7	4	4	5	**50**
	Otago	3	2	4	-	-	2	9	2	4	2	1	3	**32**
	Southland	6	2	8	6	5	5	2	1	3	3	1	2	**44**
Total		35	23	27	30	28	21	25	36	49	31	26	32	**363**

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	Auckland	BOB_OTA2.2__BOB_OTA1.2__BOB_OTA1__OTA__LN	This is an SFT generated constraint. Its purpose is to protect Bombay-Otahuhu 2 for a tripping of Bombay-Otahuhu 1.	1
	Hamilton	KIN_TRK1.2__KIN_TRK2.2__KIN_TRK2__TRK__LN	This is an SFT generated constraint. Its purpose is to protect Kinleith -Tarukenga 1 for a tripping of Kinleith -Tarukenga 2.	1
	Hawkes Bay	RDF_T3&T4_S_P_1	The effect of this constraint is to manage flows through Redclyffe T3 and T4 for a contingency of Redclyffe T4 or T3 during low Tuai generation.	41
South Island & HVDC	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.	29

		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.	13
		LIV_WTK.1__CYD_ROX2.1__CYD_ROX2__WTK__LN	This is an SFT generated constraint. Its purpose is to protect Livingston-Waitaki 1 for a tripping of Clyde-Roxburgh 2.	3
		STU_TIM.1__CYD_ROX2.1__CYD_ROX2__TIM__LN	This is an SFT generated constraint. Its purpose is to protect Studholme-Timaru 1 for a tripping of Clyde-Roxburgh 2.	6
		AVI_WTK.1__CYD_ROX1.1__CYD_ROX1__AVI__LN	This is an SFT generated constraint. Its purpose is to protect Aviemore-Waitaki 1 for a tripping of Clyde-Roxburgh 1.	1
	West Coast	HOR_KBY_ISL1.2__HOR_KBY_ISL2.2__:S__HOR_ISL2__ISL__LN	This is an SFT generated constraint. Its purpose is to protect Hororata-Kimberley-Islington 1 for a tripping of Hororata-Kimberley-Islington 2.	128
		HOR_KBY_ISL2.2__HOR_KBY_ISL1.2__:S__HOR_ISL1__ISL__LN	This is an SFT generated constraint. Its purpose is to protect Hororata-Kimberley-Islington 2 for a tripping of Hororata-Kimberley-Islington 1.	27
Grand Total				**250**

Constraints binding during last 12 months

The following table shows all binding constraints during the reporting period, which were binding for a duration of more than 4 trading periods and any constraints 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_S_P_1	41	3.05%	17	0.10%
South Island & HVDC	West Coast	COL_HOR2.1__COL_HOR3.1__COL_HOR3__COL__LN	0	0.00%	50	0.29%
		COL_HOR3.1__COL_HOR2.1__COL_HOR2__COL__LN	0	0.00%	54	0.31%
		HOR_KBY_ISL1.2__HOR_KBY_ISL2.2__:S__HOR_ISL2__ISL__LN	128	9.52%	0	0.00%
		HOR_KBY_ISL2.2__HOR_KBY_ISL1.2__:S__HOR_ISL1__ISL__LN	27	2.01%	0	0.00%
	Otago	NSY_ROX.1__CYD_TWZ1.1__CYD_TWZ1__ROX__LN	13	0.97%	4	0.02%
		NSY_ROX.1__CYD_TWZ2.1__CYD_TWZ2__ROX__LN	29	2.16%	0	0.00%
		LIV_NSY.1__CYD_ROX1.1__CYDROX1#__NSY__LN	0	0.00%	59	0.34%
		STU_TIM.1__CYD_ROX2.1__CYD_ROX2__TIM__LN	6	0.45%	0	0.00%

	HVDC	BEN_HAYP2max	0	0.00%	120	0.68%

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)
23/02/15	01:51	Generation at Wairakei Power Station tripped resulting in a momentary drop in frequency in the North island.	N	49.50
27/02/15	17:44	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.61

Connection point events

Date	Time	Summary Details	Generation / Load interrupted (MW)	Restoration time (minutes)
06/02/15	06:24	Supply was lost to Mangahao Substation when 110 kV Bunnythorpe-Mangahao Circuit 1 and the connecting transformer on the other circuit both tripped.	21 gen 15 load	48
16/02/15	08:39	110 kV Oamaru-Bells Pond-Studholme-Waitaki Circuit 2 tripped resulting in a loss of connection to Bells Pond Substation.	7	96

4.2 System Events during reporting period

System events that occurred during the reporting period are summarised below:

Contingent events

Event	Number	Summary
Loss of single AC transmission circuit	10	These related to trippings of • Arapuni-Hangatiki-Ongarue 1 • Arapuni-Kinleith 1 (auto reclose) • Balclutha-Halfway Bush 1 (auto reclose) • Clyde-Cromwell-Twizel 2 / Cromwell-Frankton 2* • Henderson-Maungatapere 1 • Huntly-Stratford 1 (auto reclose) • Inangahua-Kikiwa 1 (auto reclose) • Kinleith-Tarukenga 1 (auto reclose) • Maraetai-Whakamaru 1 • Oamaru-Bells Pond-Studholme-Waitaki 2 * Note due to the system configuration this is a single contingency.
HVDC Start/Stop	0	
Supply Transformer	3	These related to trippings of • Bunnythorpe T10 • Hamilton T4 • Tuai T15

Event	Number	Summary
Loss of grid reactive plant	4	This related to tripping of • Benmore Filter Bank F4 • Gisborne C1 (2 x) • Haywards Synchronous SC7
Loss of single generation units	10	These related to trippings of • Aviemore G1 (2 x) • Coleridge G2 • Kapuni generation (3 x) • Matahina G2 (2 x) • Mokai generation • Ohaaki G2
Total during reporting period	**27**	

Extended contingent events

Event	Number	Summary
Loss of both HVDC poles	0	
Loss of interconnecting transformer	0	
Loss of bus bar section	0	
Total during reporting period	**0**	

Other events

Event	Number	Summary
Loss of multiple AC transmission circuits	1	These related to • Bunnythorpe-Mangahao 1 & Mangahao T4 (Bunnythorpe-Mangahao 2)
Demand change	2	This related to • Islington multiple feeder trippings • Tiwai NZAS Potline 1 Emergency off-load
Generation	1	These related to trippings of • Wairakei G4, G7, G9, G10, & G11
Total during reporting period	**4**	

Other disturbances

Event	Number	Summary
Feeder trippings	52	Various locations
Total during reporting period	**52**	

4.3 SYSTEM EVENTS – TREND

	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Total	Average Events per month
Contingent Event – transmission	8	34	19	9	16	8	14	19	9	11	13	10	**170**	14.2
Contingent Event – generation	11	12	5	7	23	12	12	1	16	12	19	10	**140**	11.7
Contingent Event – Supply transformer	0	3	4	3	0	2	4	4	1	1	2	3	**27**	2.3
Contingent Event – Reactive plant	2	2	5	2	0	1	9	1	2	1	7	4	**36**	3.0
Contingent Event - HVDC	1	1	1	0	0	0	2	2	7	0	1	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	0	0	1	1	0	0	0	1	0	0	0	0	**3**	0.3
Extended Contingent Event Busbar	1	0	0	1	1	0	0	2	0	1	0	0	**6**	0.5
Other Event – AC transmission	0	6	2	1	1	1	0	2	3	0	2	1	**19**	1.6
Other Event – Demand	1	0	1	1	1	1	2	1	5	0	1	2	**16**	1.3
Other Event – Generation	0	0	0	0	0	1	2	1	1	0	3	1	**9**	0.8