System Operator Reports
September 2014

Contents

SYSTEM OPERATOR

TRANSPOWER

Keeping the energy flowing

System Operator Operational and System Performance Report to the Electricity Authority

Period from 1 September – 30 September 2014

Purpose of Report

This report summarises the results of the System Operator's review of its performance for the period 1 September – 30 September 2014, 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 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

Further testing of Multiple Frequency Keeping (MFK), with the HVDC Frequency Keeping Control (FKC) functions enabled, was carried out during September. This was in preparation for a FKC trial operation, extending over several months, planned to commence on October 16. The tests were to further tune SO tools, and improve understanding of the frequency keeping, and market participant, impacts.

System Events

- On September 13, at 23:43, there was a loss of 51MW of industrial load at Kawerau substation as a result of a lightning strike reportedly striking the Kawerau mill. This resulted in the tripping of a 110kV Edgecumbe_Kawerau circuit. However, this in and of itself did not cause the disconnection of load.
- An electrical storm swept through the Waikato/Bay of Plenty on September 19 resulting in a loss of supply to Kopu (14MW for 144 minutes in the Thames/Coromandel area) and to Waiotahi and Te Kaha (4MW for 118 minutes in the Poverty Bay area).
- A controlled shutdown of supply to Horizon Energy at Edgecumbe was required on September 22, from 14:04 to 14:13, to allow isolation of a 33kV circuit breaker which was found to be inoperable. The shutdown was completed in consultation with the Transpower National Grid Operating Centre (NGOC) and Horizon, who either moved or (at some industrial sites) disconnected as much load as possible prior to the shutdown. Load pre shutdown was 40MW, but was reduced to 17MW by the time the shutdown commenced.

Black Start test

The planning for a 'black start' test at Maraetai Power Station on October 19 is well advanced. The test will involve Mighty River Power (MRP), Transpower's National Coordination Centre (NCC) and NGOC, and System Operations engineers leading the planning.

1.2. Market

There were no outages to the Market system exceeding two hours during September.

2. Business Performance

Significant Project Update

	Status	Implementation date	Update
Dispatchable demand	On Track	**'Go Live' date of 15 May 2014**	• Final PAT meeting was held. Project Closeout Report was presented. Lessons Learned presentation was given at same meeting. • F Status Form drafted and awaiting final signature. Final figures will be entered and forms submitted after FMIS runs September figures in early October

3. Security of Supply Update

NZ aggregate storage levels are 87% 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 by the System Operator during September.

There were two breaches of the Electricity Industry Participation Code (EIPC) reported to the Authority during the month of September. The two events were an instance of:

- incorrect application of a constraint during an emergency pot-line change at Tiwai; and
- incorrect modelling of HVDC capability in the market system.

5. Ancillary Services

The System Operator sent out tender documents for five Ancillary Services in September:

- Multiple Frequency Keeping;
- Back-up Single Frequency Keeping;
- Instantaneous Reserves;
- Over Frequency Arming; and
- Black Start (Two in the North Island, one in the South Island).

This tender round will close on 22 October, with the new service providers to be in place for 1 December 2014.

Ancillary Service Costs

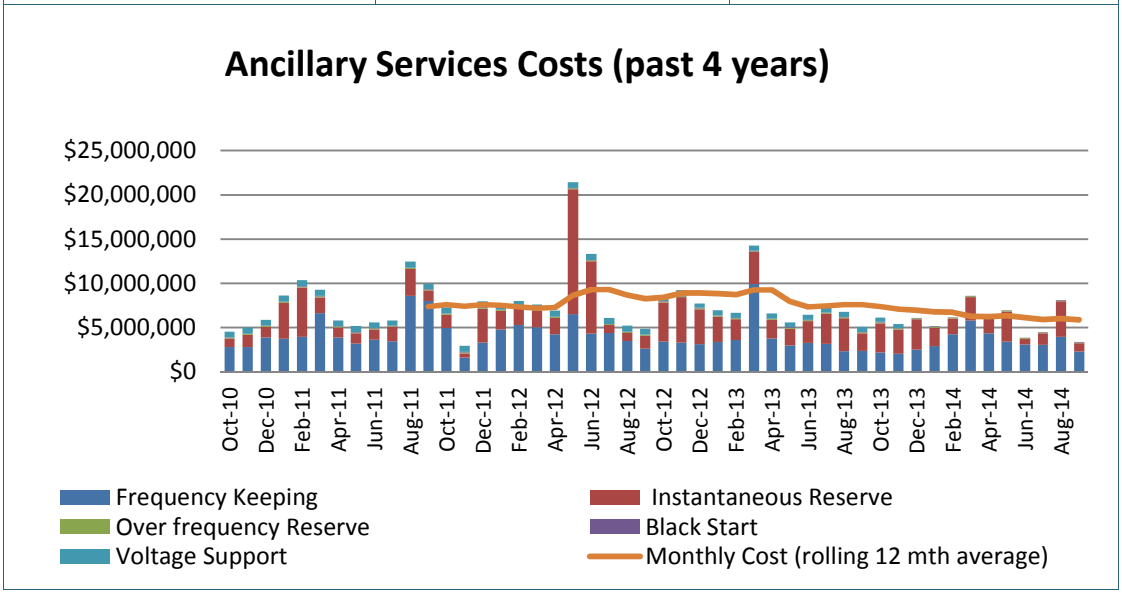
The costs of ancillary services for the month of September are set out in Appendix A (as required by clause 82.1 of the procurement plan).

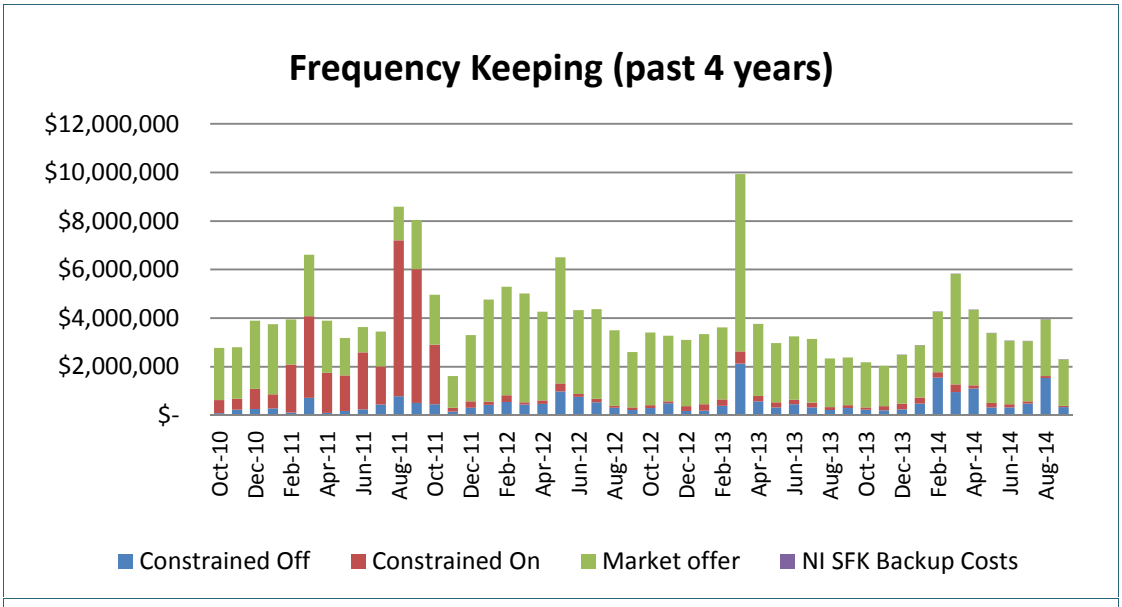
6. Code 7.10: Separation of Transpower Roles

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 September 2014

		Cost
Frequency Keeping	Constrained Off	$331,290
	Constrained On	$62,275
	Market offer	$1,907,223
	NI SFK Backup Costs	$1,666.67
	Total monthly Cost	**$2,302,455**
Instantaneous Reserve	Spinning reserve	$376,155
	Interruptible Load	$506,153
	Constrained On	$16,439
	Total monthly Cost	**$898,747**
Over Frequency Reserve	**Total monthly Cost**	**$97,417**
Black Start	**Total monthly Cost**	**$49,405**
Voltage Support	**Total monthly Cost**	**$-**
All Ancillary Services	**Total monthly Cost**	**$3,356,256**




Frequency Keeping (past 4 years)
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$-
Oct-10
Dec-10
Feb-11
Apr-11
Jun-11
Aug-11
Oct-11
Dec-11
Feb-12
Apr-12
Jun-12
Aug-12
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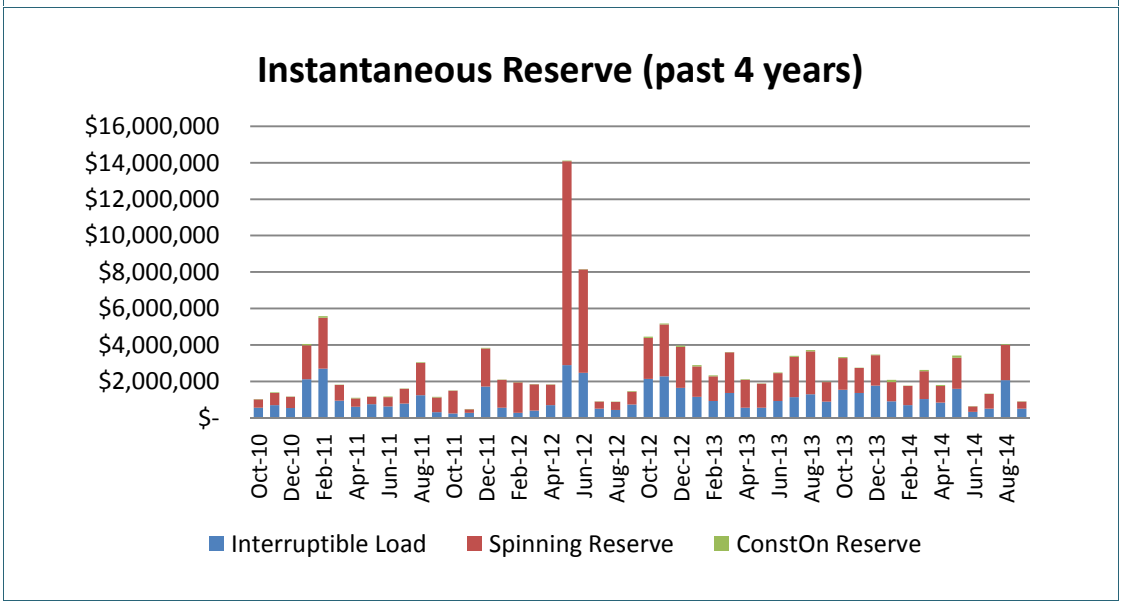
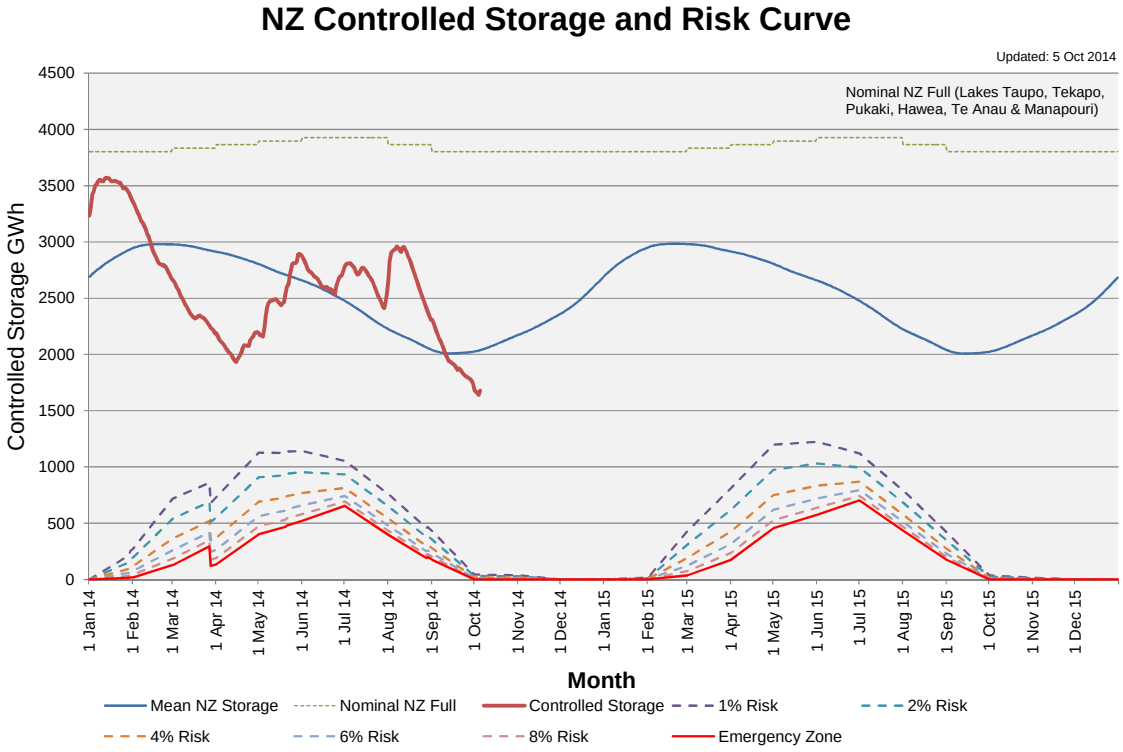
Aug-14
Constrained Off
Constrained On
Market offer
NI SFK Backup Costs


Instantaneous Reserve (past 4 years)
$16,000,000
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$-
Oct-10
Dec-10
Feb-11
Apr-11
Jun-11
Aug-11
Oct-11
Dec-11
Feb-12
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
Apr-14
Jun-14
Aug-14
Interruptible Load
Spinning Reserve
ConstOn Reserve

Appendix B – Security of Supply

New Zealand Hydro Storage and Hydro Risk Curves

Aggregate primary New Zealand storage is 87% of average for this time of year.
The graph below compares New Zealand hydro storage to the hydro risk curves.



Hydro Storage and Generation

North Island Inflows over the last calendar month have been 79% of average.
South Island Inflows over the last calendar month have been 62% of average.
Measurements are based on daily inflow values.

Over the last calendar month hydro generation has met 58% of demand.

System Performance Report
To the Electricity Authority
September 2014

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 September 2014.

Principal Performance Obligations

The System Operator met the Principal Performance Obligations during the reporting period.

System Events

- On 6th September at 20:41 an emergency potline off-load at Tiwai Point Aluminium Smelter resulted in a momentary frequency rise in the South Island to 50.56 Hz.
- On 19th September at 03:49 the Kopu 66 kV supply bus tripped, resulting in a loss of supply to Kopu Substation. Supply was restored after 145 minutes.

Other noteworthy events occurring during the reporting period:

- On 19th September at 05:09 110 kV Edgecumbe – Waiotahi Circuit 2 tripped resulting in a loss of supply to Waiotahi and Te Kaha Substations. Supply was restored after 114 minutes.
- On 22nd September at 13:08 Naseby Supply Transformer T1 tripped during a planned outage on the parallel transformer resulting in a loss of supply to Naseby Substation. Supply was restored after 14 minutes.

2. Principal Performance Obligations

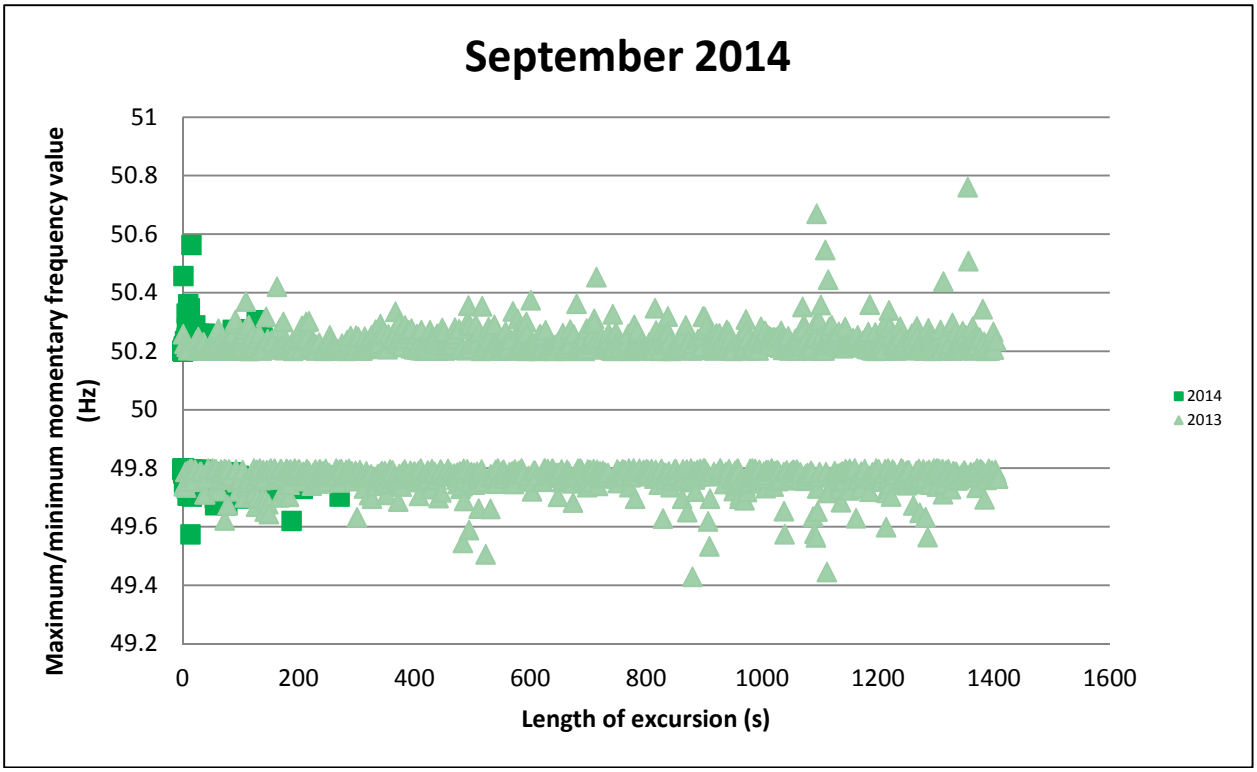
2.1 Avoid Cascade Failure

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	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Annual rate	PPO target
55.00 > Freq >= 53.75														**0.2***
53.75 > Freq >= 52.00		2											**2**	**2***
52.00 > Freq >= 51.25	2				3								**5**	**7**
51.25 > Freq >= 50.50	4	9	1	2		1	0	1	1	1	1	1	**22**	**50**
50.50 > Freq >= 50.20	797	582	267	364	333	398	545	430	206	336	345	420	**5023**	
50.20 > Freq > 49.80														
49.80 >= Freq > 49.50	789	605	396	450	386	610	639	485	208	452	401	585	**6006**	
49.50 >= Freq > 48.75	7	7	3		3	1	2				1		**24**	**60**
48.75 >= Freq > 48.00														**6**
48.00 >= Freq > 47.00		1											**1**	**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		Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
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	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
Demand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	1	12	8	22	9	5	14	19	12	5	4	3
Warning Notice	-	2	-	-	-	-	-	1	-	8	21	7
Customer Advice Notice	63	86	48	18	12	18	24	17	4	33	16	10

3.2 GRID EMERGENCIES

The following table shows grid emergencies declared by the System Operator in the reporting period.

Date	Time	Summary Details	Island
03/09/14	01:38	A grid emergency was declared to allow a 220 kV Islington – Kikiwa Circuit to be removed from service to assist with managing high voltages.	S
19/09/14	02:41	A grid emergency was declared to close the 110 kV Arapuni Bus split due to an electrical storm in the vicinity.	N
19/09/14	18:00	A grid emergency was declared to close the 110 kV Arapuni Bus split following the tripping of 110 kV Arapuni-Bombay Circuit 1.	N

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

Island	Region	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Total
North Island	Northland	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Auckland	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Zone 1	-	4	5	15	8	3	7	8	6	3	1	-	**60**
	Waikato	-	6	2	3	-	1	1	-	-	-	-	2	**15**
	Bay of Plenty	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Hawkes Bay	-	-	-	-	-	-	1	-	-	-	-	-	**1**
	Taranaki	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Bunnythorpe	1	-	-	1	-	-	-	-	-	-	-	-	**2**
	Wellington	-	-	-	-	-	-	-	-	-	1	-	-	**1**
	North Island (all)	-	2	1	1	1	1	-	-	-	1	-	-	**7**
	Lower North Island	-	-	-	-	-	-	-	1	1	-	1	-	**3**
North & South Islands		-	-	-	-	-	-	-	-	1	1	1	-	**3**
South Island & HVDC	Nelson Marlborough	-	-	-	-	-	-	-	-	1	-	-	-	**1**
	West Coast	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Christchurch	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Canterbury	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Zone 3	-	-	-	1	-	-	5	9	3	-	1	1	**20**
	Otago	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Southland	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	South Island (all)	-	-	1	-	-	-	-	-	-	-	-	-	**1**
	HVDC	-	-	-	-	-	-	-	-	-	-	-	-	**0**

3.3 Customer Advice Notices (CANs)

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

- Four related to planned Multiple Frequency Keeper (MFK) tuning with the HVDC Frequency Controller;
- Two related to an unplanned outage of HVDC Pole 2;
- Two related to a planned outage of Benmore Filter Bank F6 and its impact on HVDC risk;
- One advised of the planned trial operation of HVDC frequency keeping control from 6th October;
- And one related to compliance with energy dispatch during HVDC frequency keeping control testing.

3.4 Standby Residual Check (SRC) notices

A total of one hundred and seventy 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 1st – 5th, 7th – 12th, 15th – 16th September.

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. 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	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Total
North Island	Northland	5	7	4	9	7	8	4	8	6	-	1	2	**61**
	Auckland	9	6	1	-	1	5	-	12	5	2	3	6	**50**
	Waikato	11	7	5	9	9	12	12	12	6	3	5	10	**101**
	Bay of Plenty	8	8	7	2	2	7	5	6	5	5	5	-	**60**
	Hawkes Bay	5	7	2	5	4	6	12	5	-	1	-	-	**47**
	Taranaki	3	2	3	5	5	4	5	2	2	-	1	1	**33**
	Bunnythorpe	5	6	6	7	6	7	3	5	-	-	-	2	**47**
	Wellington	8	9	4	10	13	13	17	12	6	3	4	3	**102**
Total		54	52	32	47	47	62	58	62	30	14	19	24	**501**
South Island	Nelson Marlborough	8	11	7	8	3	7	5	4	7	5	2	4	**71**
	West Coast	7	12	6	8	2	11	6	7	7	10	6	4	**86**
	Christchurch	8	7	3	7	3	4	5	2	5	4	2	4	**54**
	Canterbury	4	4	3	4	2	4	3	2	5	4	4	2	**41**
	Otago	2	1	-	-	-	3	2	4	-	-	2	9	**23**
	Southland	3	-	1	4	2	6	2	8	6	5	5	2	**44**
Total		32	35	20	31	12	35	23	27	30	28	21	25	**319**

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.	2
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.	1
	Nelson	COB_UTK1.1__COB_STK2.2__:S__COB_STK2__COB__LN	This is an SFT generated constraint. Its purpose is to protect Cobb-Upper Takaka 1 for a tripping of Cobb-Stoke 2.	1
Grand Total				**4**

Constraints binding during last 12 months

The following table shows binding constraints, during the reporting period, with 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	Edgecumbe	THI_WKM1.1__OHK_WRK.1__OHK_WRK__WKM__LN	0	0.00%	59	0.34%
South Island & HVDC	West Coast	COL_HOR2.1__COL_HOR3.1__COL_HOR3__COL__LN	0	0.00%	52	0.30%
		COL_HOR3.1__COL_HOR2.1__COL_HOR2__COL__LN	0	0.00%	65	0.37%
	Otago	NSY_ROX.1__CYD_TWZ2.1__CYD_TWZ2__ROX__LN	0	0.00%	161	0.92%
		LIV_NSY.1__CYD_ROX1.1__CYDROX1!__NSY__LN	0	0.00%	61	0.35%
		LIV_NSY.1__CYD_ROX1.1__CYDROX1#__NSY__LN	0	0.00%	69	0.39%
	HVDC	BEN_HAYP2max	1	0.07%	214	1.22%
		BEN_HAYmax	0	0.00%	245	1.40%
		BEN_HAYP3max	0	0.00%	170	0.97%

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)
06/09/14	20:41	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.56 Hz

Connection point events

Date	Time	Summary Details	Generation / Load interrupted (MW)	Restoration time (minutes)
19/09/14	03:49	The Kopu 66 kV bus tripped resulting in a loss of supply to Kopu Substation.	14	145

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	14	These related to trippings of • Arapuni-Bombay 1 (2 x) • Cobb-Stoke 2 (2 x) • Edgecumbe-Kawerau 1 • Edgecumbe-Waiotahi 2 • Halfway Bush-Roxburgh 2 • Inangahua-Robertson St-Westport 1 (auto reclose) • Islington-Livingstone 1 (auto reclose) • Kikiwa-Stoke 3 • Kopu-Waikino 2 (auto reclose) • Motunui-McKee-Stratford 1 (auto reclose) • Opunake-Kapuni-Stratford 2 • Otahuhu-Whakamaru 2 (auto reclose)
HVDC Trip	2	These related to trippings of • HVDC Pole 2 • HVDC Pole 3
Supply Transformer	4	These related to trippings of • Bream Bay T3 • Naseby T1 • Te Kowhai T1 • Tuai T15
Loss of grid reactive plant	9	This related to tripping of • Benmore Filter Bank F6 • Haywards Synchronous Condensers SC1, SC4, SC10 • Hokitika Capacitor Banks C7 – C9 (2 x) • Islington Static Var Compensator SVC9 (3 x)

Event	Number	Summary
Loss of single generation units	12	These related to trippings of • Kinleith Co-generation (4 x) • Manapouri G6 • Matahina G1 • Ngatamariki G4 • Onepu TA3 • Paerau generation • Te Mihi G2 • Tokaanu G4 • Whaeo generation
Total during reporting period	**41**	

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	0	
Demand change	2	This related to tripping of • Tangiwai Demand • Tiwai NZAS Potline 3
Generation	2	This related to tripping of • Tauhara G1 & G2 • Matahina G1 & G2
Total during reporting period	**4**	

Other disturbances

Event	Number	Summary
Feeder trippings	45	Various locations
Total during reporting period	**45**	

4.3 SYSTEM EVENTS – TREND

	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Total	Average Events per month
Contingent Event – transmission	24	39	30	4	6	8	34	19	9	16	8	14	**211**	17.6
Contingent Event – generation	12	10	12	11	8	11	12	5	7	23	12	12	**135**	11.3
Contingent Event – Supply transformer	1	3	5	3	3	0	3	4	3	0	2	4	**31**	2.6
Contingent Event – Reactive plant	8	8	7	0	5	2	2	5	2	0	1	9	**49**	4.1
Contingent Event - HVDC	18	22	6	1	2	1	1	1	0	0	0	2	**54**	4.5
Extended Contingent Event HVDC	0	1	0	0	0	0	0	0	0	0	0	0	**1**	0.1
Extended Contingent Event Inter-connecting Transformers	0	1	1	1	0	0	0	1	1	0	0	0	**5**	0.4
Extended Contingent Event Busbar	0	0	1	1	1	1	0	0	1	1	0	0	**6**	0.5
Other Event – AC transmission	3	4	2	3	1	0	6	2	1	1	1	0	**24**	2.0
Other Event – Demand	1	1	0	2	2	1	0	1	1	1	1	2	**13**	1.1
Other Event – Generation	0	0	0	1	0	0	0	0	0	0	1	2	**4**	0.3