System Operator Reports
July 2014

Contents

SYSTEM OPERATOR

TRANSPOWER

Keeping the energy flowing

System Operator Operational and System Performance Report to the Electricity Authority

Period from 1 July – 31 July 2014

Purpose of Report

This report summarises the results of the System Operator's review of its performance for the period 1 July – 31 July 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

While a relatively quiet month operationally, a major, largely unseen system event occurred on the 13th when three of four 220kV circuits (along with other related assets) into Wellington tripped just after 7:00 am. Only controllable load was affected so customers were largely unaware of the event which, if further assets had tripped, would have resulted in a significant and widespread loss of supply.

Additional testing of new HVDC frequency sharing tool sets continued which, along with the recent introduction of roundpower trials, supports the Authority's progress towards developing national frequency keeping and reserves markets. MFK tests in the South island were carried out to support the expected go-live of MFK on 4th August.

Following procedural changes introduced during July there has been a fall in the number of grid emergencies declared to assist management of high voltages during periods of low demand. The changes have been introduced with assistance from Transpower Grid Owner.

1.1. Operational

- July was a quiet month operationally, although there were a couple of storm events which, at a grid level, passed relatively smoothly. Severe weather in the upper North Island around the 13th resulted in brief tripping of equipment (notably KOE_MPE_2) and minor damage, but no loss of supply events. A number of thunderstorms on the 30th, particularly in the South Island, resulted in some double circuit re-ratings, (for contingency event management) due to lightning in the area, with transfer restrictions during the relevant periods.
- A major system event, albeit one essentially unseen by customers, occurred on the 24th. At 07:10 a double HAY 220kV bus fault occurred during a winter morning load ramp up, during the course of a planned 220kV bus change. HAY 220kV bus zone protection initiated tripping of HVDC Pole 2, three out of four BPE HAY 220kV circuits, HAY T1 interconnecting transformer, HAY ST31 and HAY F4. The loss of this equipment initiated a runback of 100MW on the HVDC, an overload on the remaining HAY interconnectors, an overload on Pole 3, and a frequency disturbance in both islands (reaching 50.6Hz in the South Island).

- The first system co-ordinator action was to stabilise the power system, remove overloads, identify the cause and impact, and consider the safety of switching staff. A grid emergency was declared (at 07:12) and approximately 60MW of controllable load was disconnected to assist stabilisation (this load was able to be restored from 07:39). Following this initial response, power system security was assessed. It was evident that if only one of many possible additional events were to occur, a cascade failure of the greater Wellington power system would ensue. System restoration began at 07:35. The HAY 220kV bus was quickly reconfigured and N-1 security restored to the Wellington region. The grid emergency was ended at 08:54.

- Transpower system operator held an RMT workshop on the 14th, including three industry participant attendees. This workshop, initially established for system operator staff training, has been offered to external participants for several years and will be open again to participants when next scheduled.
- An emergency potline trip of 176MW on the 12th resulted in South Island frequency rising to 50.69Hz and North Island frequency rising to 59.7Hz.
- Further multiple frequency keeping (MFK) and frequency keeping controller (FKC) testing was carried out on the 7th and 8th. This testing is part of a progression towards the introduction of FKC into trial operations in the last quarter of 2014.

1.2. Market

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

2. Business Performance

Significant Project Update

	Status	Implementation date	Update
Dispatchable demand	On Track	**'Go Live' date of 15 May 2014**	• Opinion on Norske Skog's DCLS applications received from the EA and the Reconciliation Manager. Norske Skog is currently in discussions with EMS regarding commercial arrangements to help Norske Skog fulfil their DCLS metering requirements. • On track for project close in September. As there will be no approved DCLS in the systems after the warranty period has passed on 7 August, the SO will initiate discussions to determine whether the project can be closed earlier than planned.

3. Security of Supply Update

NZ aggregate storage levels are 134% 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 July.

There was one breach of the Electricity Industry Participation Code, due to a modelling error where the System Operator failed to use revised information from the Grid Owner in determining dispatch instructions.

5. Ancillary Services

There were no issues arising in ancillary services during the month of July.

Ancillary Service Costs

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

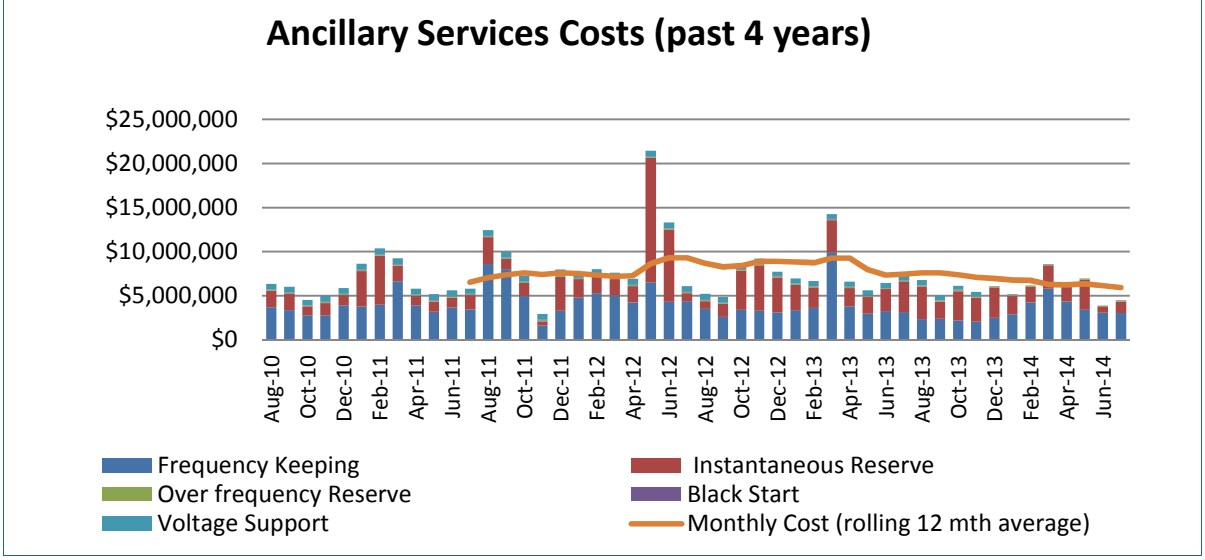
6. Code 7.10: Separation of Transpower Roles

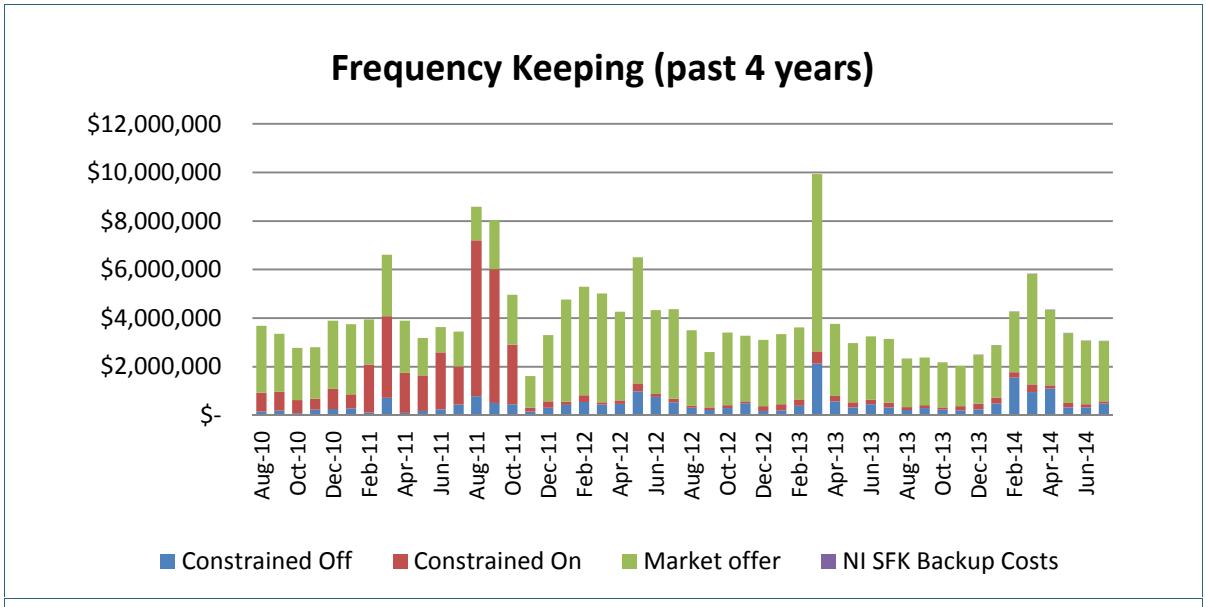
In performing its role as System Operator, Transpower has not been materially affected by any other role or capacity Transpower has under the Code or under any agreement.

Appendix A – Ancillary Service Costs for July 2014

Note: The Voltage Support graph is no longer included in this report as we no longer have Voltage Support contracts. The last Voltage Support contract was at the end of November 2013.

		Cost	
Frequency Keeping	Constrained Off	$	479,354
	Constrained On	$	87,931
	Market offer	$	2,480,157
	NI SFK Backup Costs	$	1,666.67
	Total monthly Cost	**$**	**3,049,109**
Instantaneous Reserve	Spinning reserve	$	801,877
	Interruptible Load	$	498,098
	Constrained On	$	5,867
	Total monthly Cost	**$**	**1,305,842**
Over Frequency Reserve	**Total monthly Cost**	**$**	**103,209**
Black Start	**Total monthly Cost**	**$**	**49,405**
Voltage Support	**Total monthly Cost**	**$**	**-**
All Ancillary Services	**Total monthly Cost**	**$**	**4,507,565**




Frequency Keeping (past 4 years)
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$-
Aug-10
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
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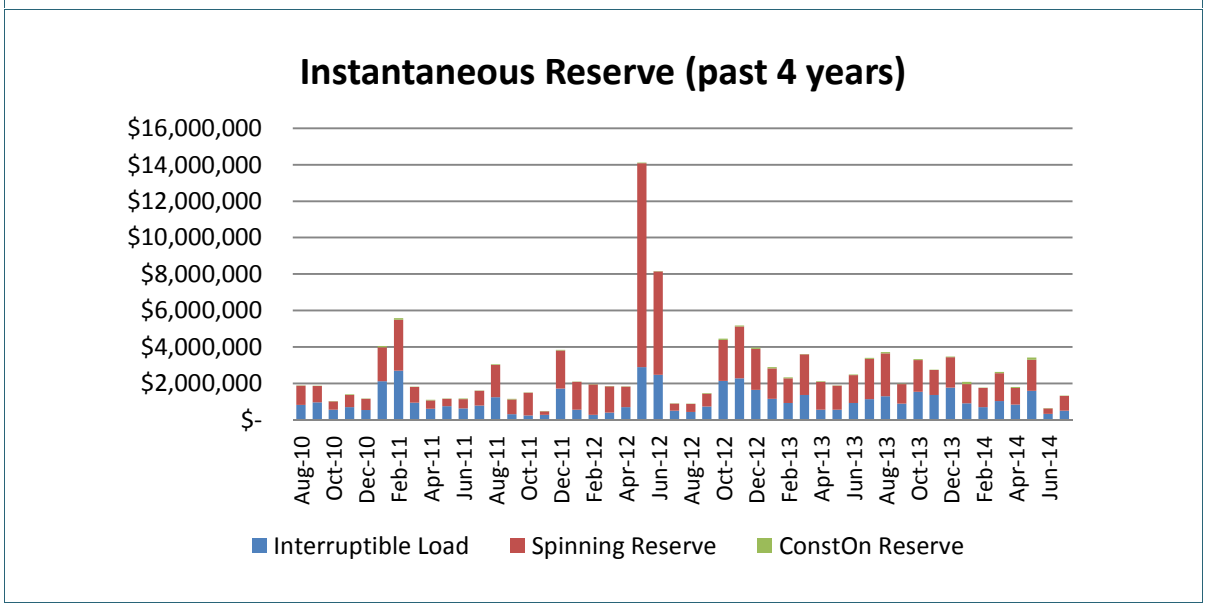
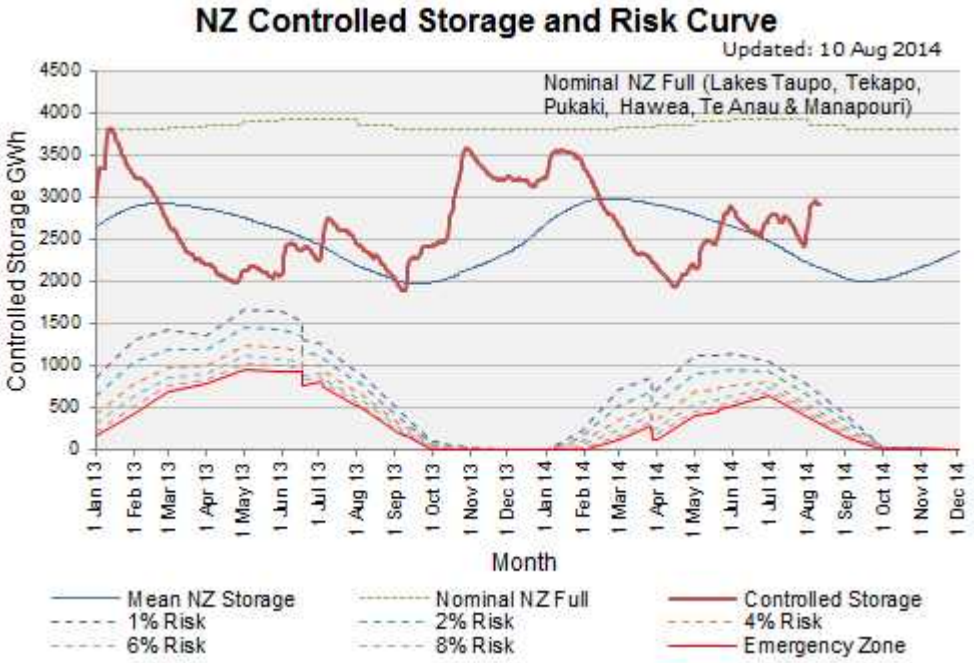
Aug-13
Oct-13
Dec-13
Feb-14
Apr-14
Jun-14
Constrained Off
Constrained On
Market offer
NI SFK Backup Costs


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
$-
Aug-10
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
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 134% 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 86% of average.
South Island Inflows over the last calendar month have been 144% of average.
Measurements are based on daily inflow values.

Over the last calendar month hydro generation has met 65% of demand.

System Performance Report

To the Electricity Authority

July 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

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1. Summary of System Performance

This system performance report covers the month of July 2014.

Principal Performance Obligations

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

System Events

On 12th July at 05:00 an emergency potline off-load at Tiwai Point Aluminium Smelter resulted in a momentary frequency rise in the South Island to 50.69 Hz.

Other noteworthy events occurring during the reporting period:

On 18th July at 04:18 both Greytown 110/33 kV supply transformers tripped resulting in a loss of supply to the Greytown grid exit point. Supply was restored after 11 minutes.

On 24th July at 07:10, Haywards 220 kV B & C busses, including HVDC Pole 2, tripped during planned switching. A significant voltage disturbance throughout the lower North Island resulted.

On 30th July at 18:37 110 kV Inangahua – Kikiwa Circuits 1 & 2 tripped and auto-reclosed.

2. Principal Performance Obligations

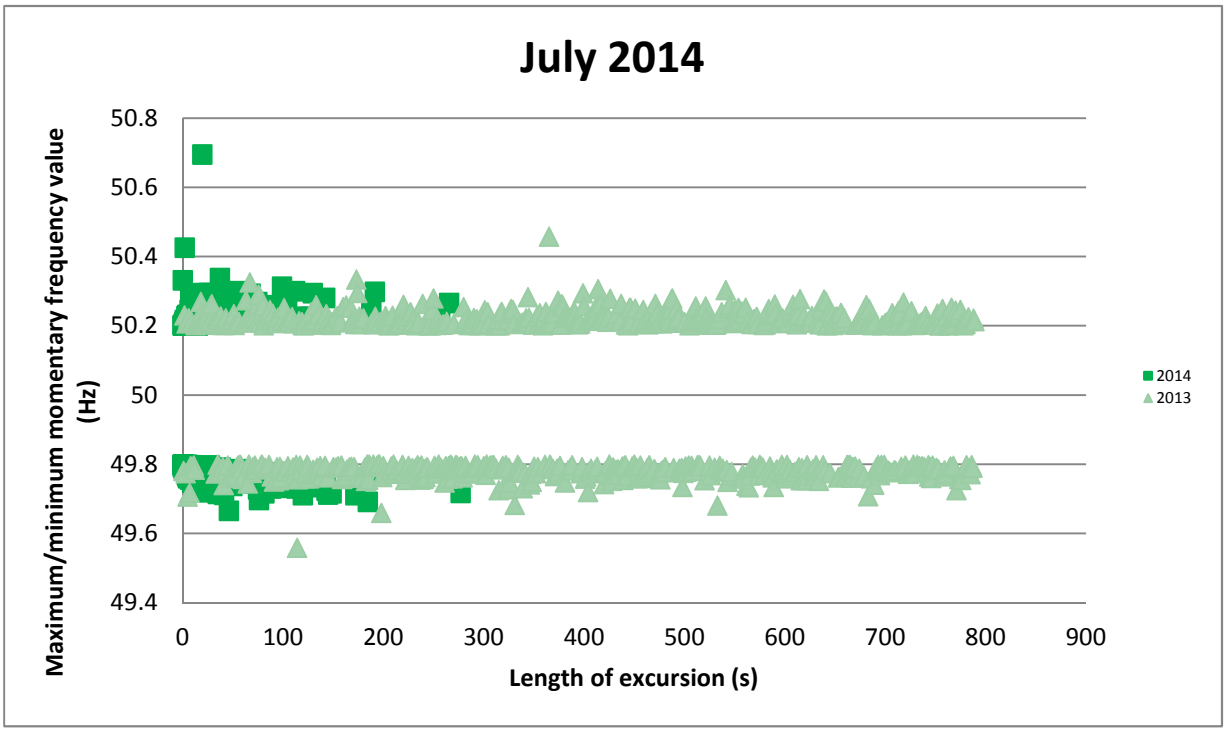
2.1 Avoid Cascade Failure

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	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-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	1	4	4	9	1	2		1	0	1	1	1	**25**	**50**
50.50 > Freq >= 50.20	656	709	797	582	267	364	333	398	545	430	206	336	**5623**	
50.20 > Freq > 49.80														
49.80 >= Freq > 49.50	652	692	789	605	396	450	386	610	639	485	208	452	**6364**	
49.50 >= Freq > 48.75		2	7	7	3		3	1	2				**25**	**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		Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-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	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14
emand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	1	2	1	12	8	22	9	5	14	19	12	5
Warning Notice	1	-	-	2	-	-	-	-	-	1	-	8
Customer Advice Notice	15	31	63	86	48	18	12	18	24	17	4	33

3.2 Grid Emergencies

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

Date	Time	Summary Details	Island
05/07/14	00:38	A grid emergency was declared to allow a 220 kV Pakuranga – Whakamaru Circuit to be removed from service to assist with managing high voltages.	N
12/07/14	23:52		
21/07/14	00:15		
15/07/14	00:51	A grid emergency was declared to allow a 220 kV Bunnythorpe - Haywards Circuit to be removed from service to assist with managing high voltages.	N
24/07/14	07:12	A grid emergency was declared to assist with system restoration after the tripping of Haywards 220 kV B & C buses.	S

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

Island	Region	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Total
North Island	Northland	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Auckland	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Zone 1	-	-	-	4	5	15	8	3	7	8	6	3	**56**
	Waikato	1	2	-	6	2	3	-	1	1	-	-	-	**16**
	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	-	**2**
North & South Islands		-	-	-	-	-	-	-	-	-	1	1	-	**2**
South Island & HVDC	Nelson Marlborough	-	-	-	-	-	-	-	-	-	-	1	-	**1**
	West Coast	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Christchurch	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Canterbury	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Zone 3	-	-	-	-	-	1	-	-	5	9	3	-	**18**
	Otago	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Southland	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	South Island (all)	-	-	-	-	1	-	-	-	-	-	-	-	**1**
	HVDC	-	-	-	-	-	-	-	-	-	-	-	-	**0**

3.3 Customer Advice Notices (CANs)

Thirty-three CANs (Customer Advice Notices) were issued in the reporting period:

- Nine advised of a temporary change to HVDC capability due to planned and unplanned outages of Haywards Filter Bank F4;
- Nine related to planned and unplanned outages of HVDC Pole 2;
- Four related to planned Multiple Frequency Keeper (MFK) testing on 7th July;
- Four advised that a tripping of 220 kV Clyde – Twizel Circuits 1 and 2 was being managed as a single contingency due to an electrical storm in the vicinity;
- Three related to South Island Multiple Frequency Keeping being implemented;
- One advised of the commissioning of the new 220 kV Whakamaru – Wairakei C Line;
- One advised the postponement of a planned Market Systems outage;
- One advised of the implementation of the Remedial Action Scheme (RAS) tool in the Market Systems on 24th July;
- And one advised in a change to HVDC risk classification during bus switching resulting from the July 24th tripping.

3.4 Standby Residual Check (SRC) notices

A total of three hundred and thirty 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 – 3rd, 7th, 13th – 14th, 16th, 17th, 19th, 21st – 22nd, and 24th July.

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	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Total
North Island	Northland	3	7	5	7	4	9	7	8	4	8	6	-	**68**
	Auckland	3	5	9	6	1	-	1	5	-	12	5	2	**49**
	Waikato	6	8	11	7	5	9	9	12	12	12	6	3	**100**
	Bay of Plenty	5	4	8	8	7	2	2	7	5	6	5	5	**64**
	Hawkes Bay	1	-	5	7	2	5	4	6	12	5	-	1	**48**
	Taranaki	-	-	3	2	3	5	5	4	5	2	2	-	**31**
	Bunnythorpe	3	3	5	6	6	7	6	7	3	5	-	-	**51**
	Wellington	4	9	8	9	4	10	13	13	17	12	6	3	**108**
Total		25	36	54	52	32	47	47	62	58	62	30	14	**519**
South Island	Nelson Marlborough	4	3	8	11	7	8	3	7	5	4	7	5	**72**
	West Coast	3	3	7	12	6	8	2	11	6	7	7	10	**82**
	Christchurch	2	4	8	7	3	7	3	4	5	2	5	4	**54**
	Canterbury	3	3	4	4	3	4	2	4	3	2	5	4	**41**
	Otago	4	5	2	1	-	-	-	3	2	4	-	-	**21**
	Southland	5	5	3	-	1	4	2	6	2	8	6	5	**47**
Total		21	23	32	35	20	31	12	35	23	27	30	28	**317**

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
	Edgecumbe	ATI_WKM.1__WKM_WRK1.1__:S__WKM_WRK1__ATI__LN	This is an SFT generated constraint. Its purpose is to protect Atiamuri-Whakamaru 1 for a tripping of Wairakei-Whakamaru 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.	2
	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.	18
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.	12

	Otago	NSY_ROX.1__CYD_TWZ2.1__CYDTWZ12__ROX__LN	This is an SFT generated constraint. Its purpose is to protect Naseby-Roxburgh 1 for a tripping of Clyde-Twizel 2.	3
	West Coast	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	28
		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	28
			Grand Total	**93**

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	Bunnythorpe	RPO_TNG1.1__THI_WKM1.1__THI_WKM1__RPO__LN	0	0.00%	133	0.76%
	Edgecumbe	THI_WKM1.1__OHK_WRK.1__OHK_WRK__WKM__LN	0	0.00%	59	0.34%
	Hawkes Bay	RDF_T3&T4_W_P_1	18	1.21%	5	0.03%
South Island & HVDC	West Coast	COL_HOR2.1__COL_HOR3.1__COL_HOR3__COL__LN	28	1.88%	26	0.15%
		COL_HOR3.1__COL_HOR2.1__COL_HOR2__COL__LN	28	1.88%	39	0.22%
	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	12	0.81%	137	0.78%
		BEN_HAYmax	0	0.00%	249	1.42%
		BEN_HAYP3max	0	0.00%	173	0.99%

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)
12/07/14	05:00	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.69 Hz

Connection point events

Date	Time	Summary Details	Generation / Load interrupted (MW)	Restoration time (minutes)
		None.		

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	16	These related to trippings of • Balclutha-Berwick-Halfway Bush 1 (auto reclose) • Bream Bay-Huapai 1 (auto reclose) • Henderson-Maungatapere 2 (1 x auto reclose, 3 x trip) • Halfway Bush-Roxburgh 2 • Invercargill-Roxburgh 2 (auto reclose) • Kinleith-Tarukenga 1 (auto reclose) • Kaikohe-Maungatapere 1 (auto reclose) • Kaikohe-Maungatapere 2 (auto reclose) • Kumara-Otira 1 • Masterton-Upper Hutt 2 (auto reclose) • Otahuhu-Whakamaru 1 (auto reclose) • Otahuhu-Whakamaru 2 (auto reclose) • Timaru-Temuka 2 (auto reclose)
HVDC Start/ Stop	0	
Supply Transformer	0	
Loss of grid reactive plant	0	
Loss of single generation units	23	These related to trippings of • Huntly U2 • Kawerau TA3 • Kinleith Co-generation • Ngatamariki G2, G3 (6 x), G4 (3 x) • Ohau A G5 • Onepu TOPP1 • Roxburgh G1, G3, G5 • Southdown GE101, STG103 (4 x)
Total during reporting period	**39**	

Extended contingent events

Event	Number	Summary
Loss of both HVDC poles	0	
Loss of interconnecting transformer	0	
Loss of bus bar section	1	This related to tripping of • Haywards 220 kV Buses B & C
Total during reporting period	**1**	

Other events

Event	Number	Summary
Loss of multiple AC transmission circuits	1	These related to trippings of • Inangahua-Kikiwa 1 & 2 auto reclose.
Demand change	1	This related to tripping of • Tiwai NZAS Potline 3
Generation	0	
Total during reporting period	**2**	

Other disturbances

Event	Number	Summary
Feeder trippings	41	Various locations
Total during reporting period	**41**	

4.3 System Events – Trend

	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Total	Average Events per month
Contingent Event – transmission	16	64	24	39	30	4	6	8	34	19	9	16	**269**	22.4
Contingent Event – generation	17	10	12	10	12	11	8	11	12	5	7	23	**138**	11.5
Contingent Event – Supply transformer	3	5	1	3	5	3	3	0	3	4	3	0	**33**	2.8
Contingent Event – Reactive plant	6	7	8	8	7	0	5	2	2	5	2	0	**52**	4.3
Contingent Event - HVDC	0	4	18	22	6	1	2	1	1	1	0	0	**56**	4.7
Extended Contingent Event HVDC	0	1	0	1	0	0	0	0	0	0	0	0	**2**	0.2
Extended Contingent Event Inter-connecting Transformers	0	0	0	1	1	1	0	0	0	1	1	0	**5**	0.4
Extended Contingent Event Busbar	0	3	0	0	1	1	1	1	0	0	1	1	**9**	0.8
Other Event – AC transmission	1	5	3	4	2	3	1	0	6	2	1	1	**29**	2.4
Other Event – Demand	1	1	1	1	0	2	2	1	0	1	1	1	**12**	1.0
Other Event – Generation	0	2	0	0	0	1	0	0	0	0	0	0	**3**	0.3