System Operator Reports
March 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 31 March 2015

Purpose of Report

This report summarises Transpower's review of its performance as system operator for the period 1 to 31 March 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

Cyclone Pam – We assisted Transpower's preparations for the arrival of Cyclone Pam (15 and 16 March 2015) by adding an additional co-ordinator to the night shift complement for these evenings to provide support and assistance in the event of significant (number or nature) transmission system outages. In retrospect, the additional support was not needed with relatively few asset trippings during the storm period.

Shoulder ratings – Transmission offers were changed to shoulder ratings at 07:00 on 15 March 2015.

Fernhill loss of supply – on 22 March 2015 Fernhill T1 tripped while T2 was on planned outage, resulting in a 17MW loss of supply for approximately 10 minutes.

Frequency keeping control operational trials

The system operator's trial of FKC (Frequency Keeping Control) operations came to an end on 31 March 2015. On 18 March 2015 the system operator advised participants it would continue with HVDC FKC operation on completion of the FKC trial period. This followed a determination that the system operator has experienced no adverse impact on its principal performance obligations (PPOs) from FKC operation since the trial started in mid-October 2014.

Work has commenced on a review of the FKC trial with a report due around the end of May 2015. With FKC operations commencing as the normal operational mode for frequency keeping, the system operator is purchasing 30 MW of MFK (Multiple Frequency Keeping) service across both islands and continues to add a modulation risk of 40 MW to the HVDC reserve risks.

For 24 hours, from 10:00 on 30 March 2015, a test of FKC with single frequency keeper (SFK) operations was carried out to demonstrate frequency management capability in abnormal conditions. During this time FKC and MFK operations were suspended. A similar South Island test was conducted in April 2015.

1.2. Market

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

2. Business Performance

Significant Project Update

The Reserves and Frequency Management programme is proceeding to the schedule agreed between the system operator and the Authority. At present the Security Tools project is scheduled to deploy after SCADA. Maintaining this approach would result in the Security Tools project being delayed, as deployment of the SCADA project will be later than planned. Implications and options are now being investigated with urgency. It should be noted that any delays to the Security Tools project delivery will also impact the dependent Inter-Island Reserve Sharing: SIR project.

The quantity of FK Procured by Island under the FKC project has been put on hold until the conclusion of TASC 049 (Normal Frequency Management Strategy), at which point a decision will be made on the project's future.

The remaining programme component projects are progressing at different stages which are described below:

- Efficient Procurement of Extended Reserves Implementation – The system operator and the Authority have signed a TASC statement of work to complete the planning phase for the remaining project work. Initial planning meetings are underway to determine a joint project approach.

- Inter-island Instantaneous Reserve Sharing Implementation – On 17 December 2014, the system operator successfully implemented interim reserve sharing. A scope change proposal was accepted by the EA to introduce SIR sharing to this interim project. This change is now actively moving forward, with requirements completed, and design work underway. SIR sharing is scheduled to be implemented in early September 2015 following the SO Tools project completion.

- National Market for Frequency Keeping – Work on this project is on hold pending the outcomes of TASC 049.

- National Market for Instantaneous Reserve – TASC 048 is on schedule with stakeholder requirements completed and approved in March. Solution options and development approach now to be commenced by the Information Services and Technology (IST) division.

- Reserves Management Tool TSAT Implementation – New version of the Reserve Management Tool engine is commissioned. Project closure is progressing.

- Review of Instantaneous Reserve Markets – Project is on time and budget. A new reserve product has been selected and presented to participants.

- RMT Study Tool – Stakeholder requirements workshops have been held and the stakeholder requirements completed. These are currently being reviewed by IST in preparation for the Solution Options.

- Security Tool Implementation for New HVDC Controls – The solution design, and build, is progressing with initial smoke testing planned from 20 April 2015. Training development is progressing as planned.

- South Island Multiple Frequency Keeping – MFK went live in the South Island on 4 August 2014. With all deliverables completed, and project closeout documentation prepared, this project will shortly be closed.

3. Security of Supply Update

Hydro storage is particularly low for this time of year at 64% of average; aggregate controlled storage is at a comparable level to that observed in 2008. However the hydro shortage risk the power system faces is also substantially lower than that observed in 2008.

As such the System Operator is closely monitoring the situation, but not, at this stage, initiating any of the procedures or processes designed for managing dry or shortage situations.

Alongside this course of action the System Operator is preparing additional reporting material specific to dry situations to display on the SO website, and reviewing internal procedures and processes to ensure they are fit for purpose and ready to go in the unlikely event the system faces a shortage situation.

The hydro risk meter is currently set at “normal”.

4. Compliance Report

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

There was one breach of the Code reported to the Authority during March 2015 relating to a modelling error for failing to update the dispatch schedule using information provided by an asset owner.

5. Ancillary Services

Black Start

The system operator and Meridian have commenced planning for a black start test at Manapouri to be held later this year. A date will be confirmed once a test plan has been agreed.

Frequency Keeping

The existing contractual performance measure for frequency keeping has been producing erroneous results for some sites (particularly in the South Island), which we do not believe appropriately reflects provider performance. This appears to be related to the suitability of the metric while the HVDC link is operating in FKC mode. We intend to review the measure following completion of the current work looking at options for the future management of frequency later this year. We have suspended application of the measure in the meantime and will rely upon real-time logging of performance issues by co-ordinators.

During the FKC tests with SFK operations held during March and April, high frequency keeping offers were observed (particularly during the North Island test). While there were theoretically three providers available to provide SFK during this period (which should have ensured a competitive market), there were unanticipated issues with two of the providers during the test which meant that only a single provider was offering and clearing at some points during the test. High prices were notified to the Authority’s Market Monitoring team for potential follow-up.

Allocable Costs

The system operator discovered that some AOPO dispensation costs for the North Island had been incorrectly calculated due to a modelling error made in late November. While the total allocable cost was correct, the amounts allocated to dispensation holders and/or instantaneous reserve payers were incorrect. We advised affected participants as soon as we became aware of this issue. The error was rectified for March, but November, December and February costs are likely to have been impacted and will be corrected via the Clearing Manager's usual wash-up process. At this stage, we do not have a full picture of the quantum of the error. However, as a rough order of magnitude, the total dispensation costs for all parties for February were approximately $200,000. Some, or all, of this may have been incorrectly charged.

Ancillary Service Costs

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

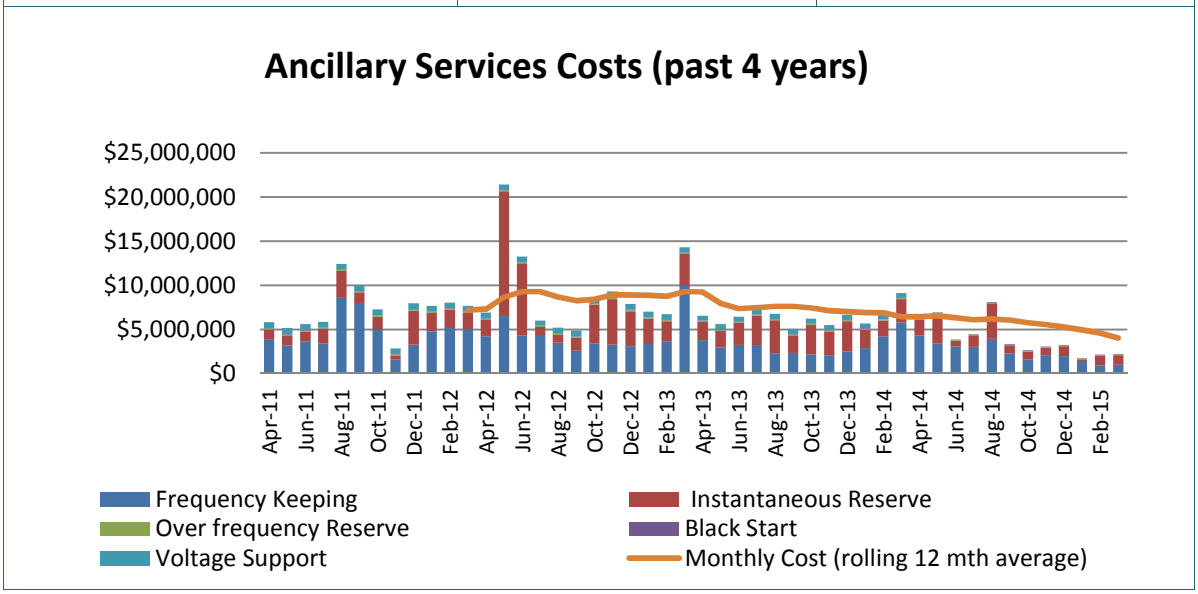
6. Code 7.10: Separation of Transpower Roles

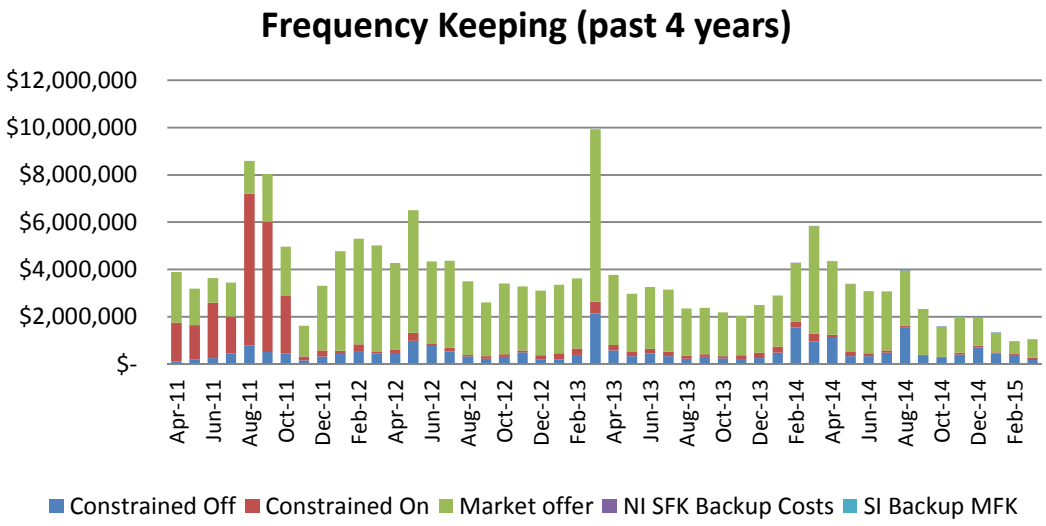
In performing its role as system operator, Transpower has not been materially affected by any other role or capacity Transpower has under the Code or under any agreement.

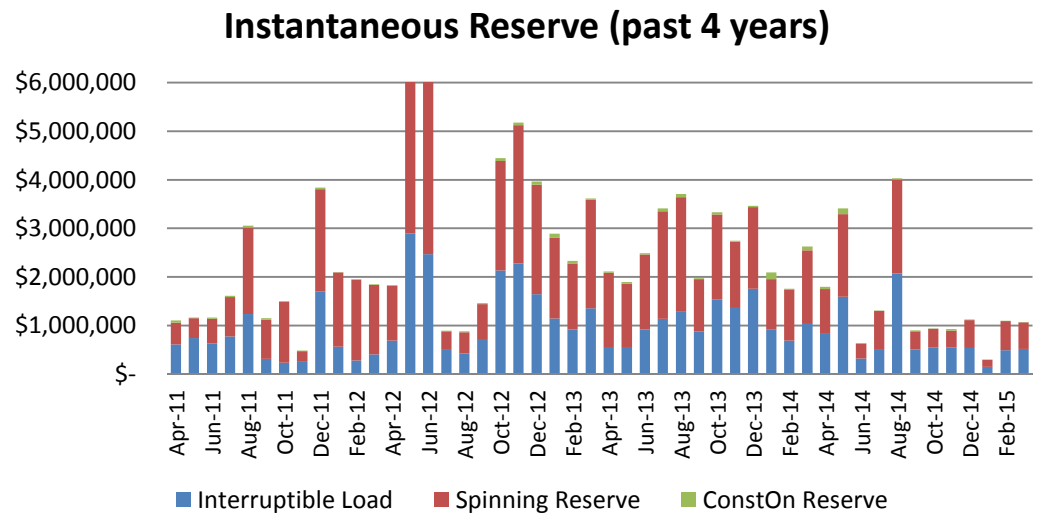
Appendix A – Ancillary Service Costs for March 2015

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	$	169,481
	Constrained On	$	83,485
	Market offer	$	769,571
	NI SFK Backup Costs	$	2,716.67
	SI Backup MFK	$	2,232.00
	Total monthly Cost	**$**	**1,027,486**
Instantaneous Reserve	Spinning reserve	$	550,940
	Interruptible Load	$	515,373
	Constrained On	$	6,781
	Total monthly Cost	**$**	**1,073,094**
Over Frequency Reserve	**Total monthly Cost**	**$**	**115,229**
Black Start	**Total monthly Cost**	**$**	**52,487**
Voltage Support	**Total monthly Cost**	**$**	**-**
All Ancillary Services	**Total monthly Cost**	**$**	**2,268,296**







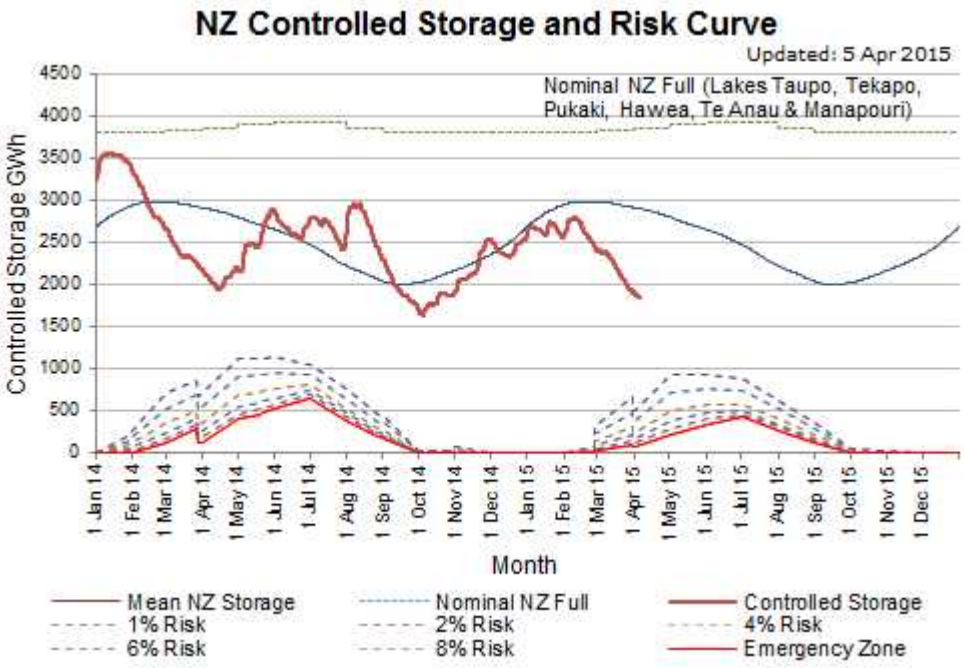
Note: IR Cost May 2012 = 14.129M, IR Cost Jun 2012 = 8.164M

Appendix B – Security of Supply

New Zealand Hydro Storage and Hydro Risk Curves

As at 10th April 2015, aggregate primary New Zealand storage is 64% of average.

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



Hydro Storage and Generation

North Island inflows during March 2015 were 52% of average.

South Island inflows during March 2015 were 59% of average.

Measurements are based on daily inflow values.

Hydro generation met 52% of demand during March 2015.

System Performance Report

To the Electricity Authority

March 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

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1. Summary of System Performance

This system performance report covers the month of March 2015.

Principal Performance Obligations

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

System Events

- On 3 March at 13:31 filter switching at Haywards caused an HVDC runback operation. This resulted in a momentary drop in North Island frequency to 49.38 Hz and a corresponding momentary rise in South Island frequency to 51.01 Hz.
- On 24 March at 18:36 an emergency potline off-load at Tiwai Point Aluminium Smelter resulted in a momentary frequency rise in the South Island to 50.63 Hz.

Other noteworthy events occurring during the reporting period:

- On 11 March at 17:00 a double circuit fault occurred on Islington – Waipara – Culverden – Kikiwa Circuits 2 & 3. This resulted in the disconnection of the Culverden grid exit point and the loss of additional upper South Island load due to the associated voltage disturbance. Supply to Culverden was re-established after 10 minutes.
- On 12 March three 220 kV circuit faults occurred during a lightning storm that resulted in simultaneous commutation failures on HVDC Poles 2 & 3 causing widespread voltage disturbances in the lower North Island. The circuit faults occurred on Huntly – Stratford Circuit 1 at 15:04, Bunnythorpe – Brunswick Circuit 1 at 17:15, and Bunnythorpe – Paraparaumu – Haywards Circuit 2 at 17:38.
- On 22 March at 12:46 Fernhill supply transformer T1 tripped during a planned outage on T2 causing a loss of supply to Fernhill Substation. Supply was restored after 19 minutes.

2. Principal Performance Obligations

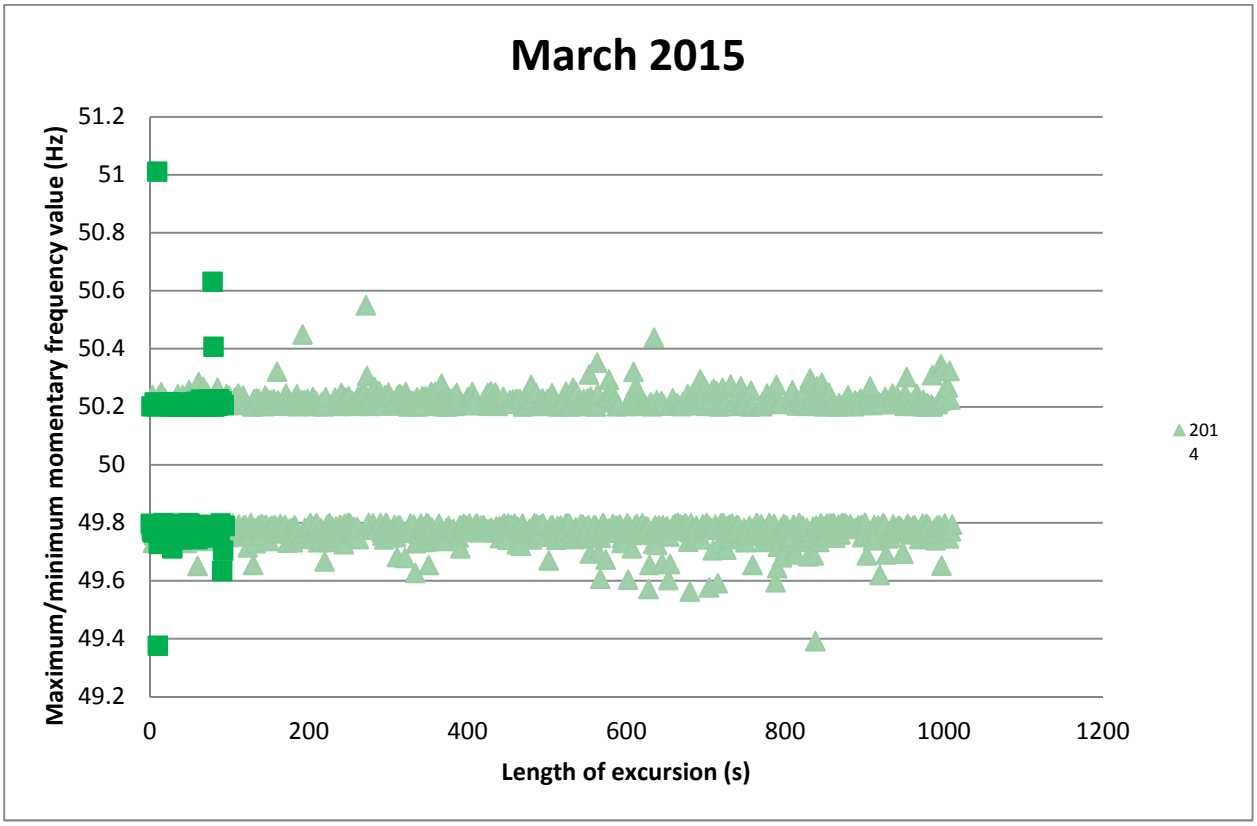
2.1 Avoid Cascade Failure

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	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-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	1		2			1	2	**10**	**50**
50.50 > Freq >= 50.20	545	430	206	336	345	420	244	360	165	26	25	47	**3149**	
50.20 > Freq > 49.80														
49.80 >= Freq > 49.50	639	485	208	452	401	585	351	375	204	24	15	44	**3783**	
49.50 >= Freq > 48.75	2				1		2	5	2	1	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		Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-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	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15
Demand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	14	19	12	5	4	3	7	3	5	1	4	-
Warning Notice	-	1	-	8	21	7	8	11	23	29	27	31
Customer Advice Notice	24	17	4	33	16	10	28	22	20	11	12	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**
		None	

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

Island	Region	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Total
North Island	Northland	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Auckland	-	-	-	-	-	-	4	-	-	-	-	-	**4**
	Zone 1	7	8	6	3	1	-	-	-	-	-	-	-	**35**
	Waikato	1	-	-	-	-	2	2	2	4	1	2	-	**14**
	Bay of Plenty	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Hawkes Bay	1	-	-	-	-	-	-	-	-	-	-	-	**1**
	Taranaki	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Bunnythorpe	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Wellington	-	-	-	1	-	-	-	-	-	-	-	-	**1**
	North Island (all)	-	-	-	1	-	-	-	-	-	-	-	-	**1**
	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:

- three related to the planned and unplanned deactivation of HVDC Frequency Keeping Control;
- two related to HVDC Frequency Keeping Control operation;
- two advised of temporary changes to the HVDC risk subtractor due to planned Filter Bank outages;
- one advised of constraint information being published in POCP for a planned outage of 220 kV Aviemore-Waitaki Circuit 1;
- one advised of a change to South Island AC Contingent and Extended-Contingent Event risks;
- one related to the change in timing of a planned Market Systems Outage;
- one related to the change in Transmission Loss Modelling being implemented on 1 April; and
- one advised of the change to shoulder rating period on 15 March.

3.4 Standby Residual Check (SRC) notices

No SRC notices were issued during the reporting period based on the SDS (the 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 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	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Total
North Island	Northland	4	8	6	-	1	2	5	3	3	3	7	6	**48**
	Auckland	-	12	5	2	3	6	4	3	1	1	6	4	**47**
	Waikato	12	12	6	3	5	10	10	9	3	4	10	9	**93**
	Bay of Plenty	5	6	5	5	5	-	6	7	6	3	4	4	**56**
	Hawkes Bay	12	5	-	1	-	-	5	2	2	2	4	6	**39**
	Taranaki	5	2	2	-	1	1	2	7	-	4	4	3	**31**
	Bunnythorpe	3	5	-	-	-	2	7	4	1	5	4	4	**35**
	Wellington	17	12	6	3	4	3	12	9	10	11	9	8	**104**
Total		58	62	30	14	19	24	51	44	26	33	48	44	**453**
South Island	Nelson Marlborough	5	4	7	5	2	4	10	14	8	7	6	4	**76**
	West Coast	6	7	7	10	6	4	10	11	8	8	8	6	**91**
	Christchurch	5	2	5	4	2	4	7	10	6	5	8	7	**65**
	Canterbury	3	2	5	4	4	2	6	7	4	4	5	2	**48**
	Otago	2	4	-	-	2	9	2	4	2	1	3	2	**31**
	Southland	2	8	6	5	5	2	1	3	3	1	2	4	**42**
Total		23	27	30	28	21	25	36	49	31	26	32	25	**353**

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	Edgecumbe	EDG_KAW1.1__EDG_KAW3.1__EDG_KAW3__KAW__LN	This is an SFT generated constraint. Its purpose is to protect Edgecumbe-Kawerau 1 for a tripping of Edgecumbe-Kawerau 3.	4
	Hawkes Bay	RDF_T3&T4_M_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.	14
		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.	29
	Taranaki	SFD__M10__110KV__NPL_SFD2.1__NPL_SFD2__XF	This is an SFT generated constraint. Its purpose is to protect Stratford interconnecting transformer T10 for a tripping of New Plymouth-Stratford 2.	1

South Island & HVDC	Southland	EDN_INV.1__GOR_ROX.1__GOR_ROX__INV__LN	This is an SFT generated constraint. Its purpose is to protect Edendale-Invercargill 1 for a tripping of Gore-Roxburgh 1.	8
		BDE_GOR.1__INV_ROX1.1__INV_ROX1__GOR__LN	This is an SFT generated constraint. Its purpose is to protect Brydone-Gore 1 for a tripping of Invercargill-Roxburgh 1.	10
Grand Total				**66**

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	Edgecumbe	EDG_KAW1.1__EDG_KAW3.1__EDG_KAW3__KAW__LN	4	0.27%	0	0.00%
	Hawkes Bay	RDF_T3&T4_M_P_1	14	0.94%	2	0.01%
		RDF_T3&T4_S_P_1	29	1.95%	58	0.33%
South Island & HVDC	West Coast	COL_HOR2.1__COL_HOR3.1__COL_HOR3__COL__LN	0	0.00%	50	0.29%
		HOR_KBY_ISL1.2__HOR_KBY_ISL2.2__:S__HOR_ISL2__ISL__LN	0	0.00%	128	0.73%
	Southland	EDN_INV.1__GOR_ROX.1__GOR_ROX__INV__LN	8	0.54%	13	0.07%
		BDE_GOR.1__INV_ROX1.1__INV_ROX1__GOR__LN	10	0.67%	2	0.01%
	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)
03/03/15	13:31	An HVDC Runback occurred resulting in a momentary rise in frequency in the South Island and a momentary drop in frequency in the North Island.	S N	51.01 49.38
24/03/15	18:36	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)
		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	8	These related to trippings of • Arapuni-Hangatiki-Ongarue 1 • Blenheim-Kikiwa 1 • Bunnythorpe-Mataroa 1 (auto reclose) • Inangahua-Robertson St-Westport 1 (auto reclose) • Inangahua-Robertson St-Westport 2 (2 x auto reclose) • North Makarewa-Three Mile Hill 2 (auto reclose) • Te Kaha-Waiotahi 1
HVDC Start/Stop	3	These related to • HVDC runback • HVDC Pole 3 trip • HVDC Pole 2 trip and restart (full voltage).
Supply Transformer	2	These related to trippings of • Fernhill T1 • Penrose T22
Loss of grid reactive plant	2	This related to tripping of • Albany Static Var Compensator SVC7 • Marsden Static Synchronous Compensator STC6
Loss of single generation units	14	These related to trippings of • Mangahao G1 • Kinleith Co-generation • Kapuni generation (4 x) • Manapouri G3 • Matahina G2 (2 x) • Mill Creek Windfarm • Mokai generation • Ngatamariki G1 • Onepu TA2 • Wairakei G15 & 16
Total during reporting period	**29**	

Extended contingent events

Event	Number	Summary
Loss of both HVDC poles	0	
Loss of interconnecting transformer	1	This related to tripping of • Edgecumbe T5 * Edgecumbe T5 is operated energised only and is open on the MV side.

Event	Number	Summary
Loss of bus bar section	1	This related to tripping of • Stratford 220 kV 'B' Bus.
Total during reporting period	**2**	

Other events

Event	Number	Summary
Loss of multiple AC transmission circuits	4	These related to • Bunnythorpe-Paraparaumu-Haywards 2 (auto reclose), resulting voltage disturbance caused commutation failures on HVDC P2 & P3. • Huntly-Stratford 1 (auto reclose), resulting voltage disturbance caused commutation failures on HVDC P2 & P3. • Bunnythorpe-Brunswick 1 (auto reclose), resulting voltage disturbance caused commutation failures on HVDC P2 & P3. • Islington-Kikiwa 2 (auto reclose) & Islington-Kikiwa 3 (trip)
Demand change	1	This related to • Tiwai NZAS Potline 1 Emergency off-load
Generation	4	These related to trippings of • Wairakei G4, G7, G9, G10, & G11 • Cobb G5 & G6 (2 x); G1, G2, & G4
Total during reporting period	**9**	

Other disturbances

Event	Number	Summary
Feeder trippings	30	Various locations
Total during reporting period	**30**	

4.3 SYSTEM EVENTS – TREND

	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Total	Average Events per month
Contingent Event – transmission	34	19	9	16	8	14	19	9	11	13	10	8	**170**	14.2
Contingent Event – generation	12	5	7	23	12	12	1	16	12	19	10	14	**143**	11.7
Contingent Event – Supply transformer	3	4	3	0	2	4	4	1	1	2	3	2	**29**	2.4
Contingent Event – Reactive plant	2	5	2	0	1	9	1	2	1	7	4	2	**36**	3.0
Contingent Event - HVDC	1	1	0	0	0	2	2	7	0	1	0	3	**17**	1.4
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	1	1	0	0	0	1	0	0	0	0	1	**4**	0.3
Extended Contingent Event Busbar	0	0	1	1	0	0	2	0	1	0	0	1	**6**	0.5
Other Event – AC transmission	6	2	1	1	1	0	2	3	0	2	1	4	**23**	1.9
Other Event – Demand	0	1	1	1	1	2	1	5	0	1	2	1	**16**	1.3
Other Event – Generation	0	0	0	0	1	2	1	1	0	3	1	4	**13**	1.1