System Operator Reports
March 2016

Contents

SYSTEM OPERATOR

TRANSPOWER

Keeping the energy flowing

System Operator Operational and System Performance Report to the Electricity Authority for March 2016

Purpose of Report

This report is Transpower's review of its performance as system operator for March 2016, for clause 3.14 of the Electricity Industry Participation Code 2010 (the Code).

Operational issues are provided for the information of the Electricity Authority (Authority). A detailed System Performance report is separately provided to Authority staff.

1. Business Plan Progress Update

The System Operator Business Plan outlines key business initiatives to be undertaken in the 2015/16 financial year to enable us to meet the strategic goals set out in the System Operator Strategic Plan 2015-2020.

There are eight key business initiatives, each pertaining to one or more strategic goals, with a number of associated key performance indicators (KPIs). Performance to date is very good with just under 90% (34/38) of the measurable 2015/16 KPI's complete, or forecast to be complete. 2 KPIs have now been missed. Performance is summarised in Appendix A.

2. March Summary from an Operational and System Performance Perspective

Operational and System Performance

On 14 March, as a consequence of a filter being taken out of service by the Reactive Power Controller during a HVDC filter outage at Haywards, the HVDC ramped down quickly from 442 MW to 280 MW. This resulted in North Island frequency falling to 49.29 Hz, just above the level of a frequency event (49.25Hz). While interruptible load was not expected to trip for this event, some load was shed by one provider. A review of the event is focusing on planning for the filter outage and associated system operator situational awareness.

On 24 March, at 20:01, all circuits supplying the Southbank (SBK) bus tripped, removing SBK and Kaiapoi (KAI) from service. This resulted in a loss of supply to Mainpower of 43 MW's. The SBK bus was cleared by 21:00 in readiness for being made available for service, with the final stage authorised at 22:33. At 22:36, SBK and KAI load was lost again when SBK feeder 152 was closed. This second event helped establish the location of the initial fault, and restoration of all SBK and KAI load was completed by 23:06. The event remains under review, with the cause of the original trip not clearly established.

On 16 March Transpower commissioned a significantly upgraded SCADA system. The new SCADA, including different architecture, operating systems and application software, was commissioned with only minor interruption to ongoing operations, and minimal market impact. Upgraded SCADA tools include the system operator's suite of advanced contingency analysis tools, and inputs to the market system. In parallel, the system operator's Transient Security Assessment Tool was introduced into on-line operations. This will, following completion of co-ordinator training in mid-year, be used to improve contingency assessments and response to system events.

Market

No market systems outages exceeded two hours in duration in March.

3. Business Performance

Significant Project Update – Reserves and Frequency Management Programme

The Reserves and Frequency Management (RFM) programme continued to progress to schedule. The RFM programme forms part of key business initiative 4.

At present four RFM projects/initiatives are currently underway. The National Market for Instantaneous Reserves project is well into build phase and on track for delivery in October 2016. The RMT Study Tool project was deployed in March and is coming to a close. Investigations continue into the future strategy for frequency keeping and possible future instantaneous reserve products.

The National Market for Frequency Keeping project has been put on hold by the Authority. The future approach to frequency keeping is being reviewed in light of recent changes made by the system operator in this area, and pending the findings of the frequency keeping strategy investigation.

Significant Project Update – Efficient Procurement of Extended Reserves Implementation

During this period the system operator project team completed its first review of a draft procurement schedule created by the Extended Reserve Manager. The project team completed joint planning with the Authority and the Extended Reserve Manager and commenced development of material for the third industry workshop (scheduled for late April).

Significant Project Update – PRISM

Commissioning was successfully completed on Wednesday 16 March. Planning has been completed for decommissioning of the previous SCADA. The older servers will be powered off from 11 April, with physical removal starting on 18 April. 31 May is targeted for the completion of decommissioning. Project close-out and lessons learned reports will be completed in April. This will include a specific review, for the Transpower and Authority Boards, into the reasons for the time and cost extension required to successfully deliver the project.

SOSPA Transition Project Update

A SOSPA transition plan is in place and implementation underway. Four transitional provisions were delivered during the period to required due dates – the draft capex plan, draft capex roadmap, draft system operator strategic plan and draft SO ICT strategic roadmap all being made available to the Authority. A monthly meeting with Authority staff has been established to discuss progress.

4. Security of Supply Update

Hydrology and Energy Margins – National controlled storage has been at, or above, average levels since late February. Inflows during March have been high, with NZ aggregate storage levels are 106% of average for this time of year. Current storage levels should be sufficient to manage winter demand barring major outages or unprecedented low inflows in upcoming months. The hydro risk meter is currently set at normal

Capacity Margins – The National Winter Group Report will be published in April. Initial results indicate that capacity margins have improved over last year, with the exception being one week in June due to an equipment outage that has been notified to the industry.

5. Compliance Report

No breaches of the principal performance obligations were reported during the period.

Two potential breaches of the Code were reported to the Authority. These related to an incorrect cost allocation and the “at risk transfer” definition for the HVDC.

6. Ancillary Services

We have commenced a review of the Procurement Plan. A draft of the new plan is expected to be sent for consultation with industry during May with a targeted final draft to the Authority by the end of June.

Ancillary Service Costs

The costs of ancillary services for the month are in Appendix B.

7. Code 7.10: Separation of Transpower Roles

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

Appendix A – Business Planning Update KPI Table

Key Business Initiative	# of KPIs	Complete	On track	At risk	NA	Missed	Comments
1. Assisting the Authority to meet its competition, reliability and efficiency objective (the CRE objective)	2	1	1	-	-	-	One KPI, relating to applying the CRE objective to 25% of our policies and procedures, has been completed ahead of schedule. However, we will continue to monitor progress. The other KPI, relating to releasing $1m of market benefits, is now on track, with further analysis underway.
2. Developing an efficient balance between risk, reliability and resilience	3	1	2	-	-	-	One KPI, relating to updating our risk management methodology to incorporate Bowtie, has been completed ahead of schedule. The remaining KPIs are presently on track.
3. Seeking opportunities to add value through the provision of information to support an efficient market	3	-	3	-	-	-	Work has commenced on all three KPIs with all presently on track.
4. Improvements to deliver a system operator service that meets or exceeds expectations and represents value for money	6	2	4	-	-	-	Two KPIs, relating to recognising and addressing the Authority's concerns about increasing capital spend, and identifying operational trends to determine five performance improvement areas, have been completed ahead of schedule. Work is ongoing on the remaining four KPIs, with all presently on track.
5. A transparent business and requirements roadmap for investments required to deliver the system operator service	2	2	-	-	-	-	Both KPIs, relating to aligning our capital investments, and delivering a strategic roadmap, are now complete. Completion was ahead of schedule.
6. Building capability, and promoting a professional, responsive service culture	5	2	3	-	-	-	Two KPIs, relating to implementing a study version of vSPD for analyst use, and assessing the feasibility of measuring dispatch performance against hypothetical optima, have been

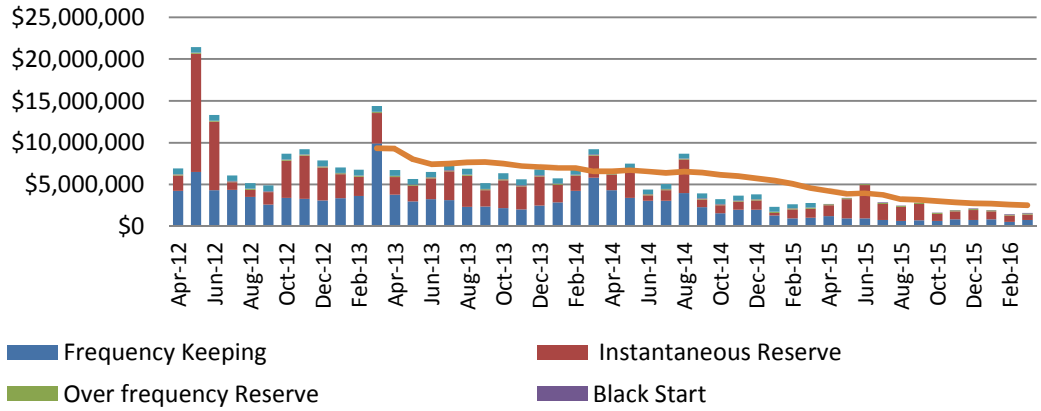
Key Business Initiative	# of KPIs	Complete	On track	At risk	NA	Missed	Comments
							completed ahead of schedule. Work continues on the remaining KPIs, with all on track at this stage.
7. Engaging with and understanding the Authority, market participants and consumers	5	1	4	-	-	-	One KPI, relating to completing a 'building connections' customer video, has now been completed ahead of schedule. The remaining KPIs are presently on track.
8. Maximising opportunities arising from being part of the wider Transpower business	12	4	4	2	-	2	Four KPIs, relating to an MOU for generator commissioning, developing a baseline for comparing future staff turnover, an engineering progression programme, and introducing an annual site visit safety assessment programme have been completed ahead of, or on, schedule. Two KPIs, relating to introducing a market analyst progression programme, and developing recruitment and retention guidelines, have now been missed, while a further two KPIs, relating to developing a common fatigue management policy, and investigating and implementing changes to reduce the quantity of reserves required to cover HVDC operation, are at risk. Work has commenced, or is shortly planned to commence, on the remaining KPIs, with these on track.
Totals	**38**	**13**	**21**	**2**	**0**	**2**	

Appendix B – Ancillary Service Costs for March 2016

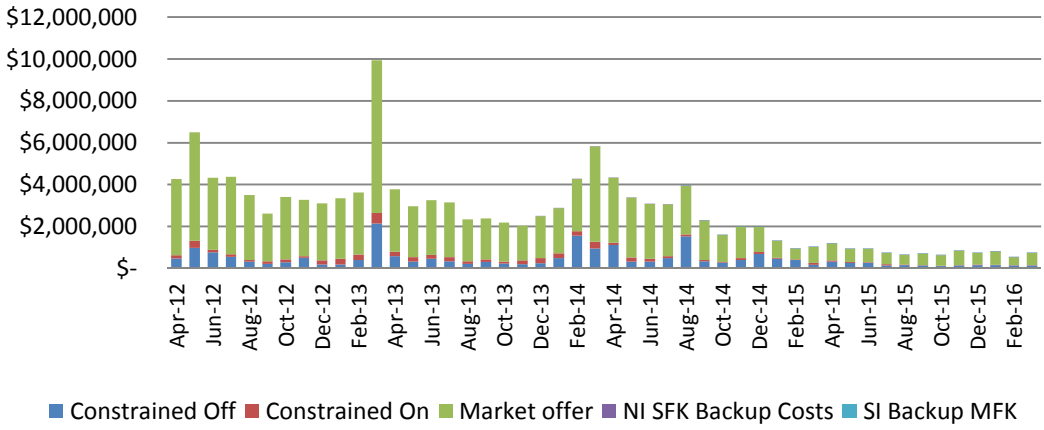
Note: The scale for the Instantaneous Reserve (Past 4 Years) graph has been reduced to clarify detail. Two months data, May and June 2012, overly influenced the graph scale.

		Cost	
Frequency Keeping	Constrained Off	$	122,691
	Constrained On	$	24,781
	Market offer	$	591,274
	NI SFK Backup Costs	$	2,916.67
	SI Backup MFK	$	3,832.00
	Total monthly Cost	**$**	**745,495**
Instantaneous Reserve	Spinning reserve	$	286,119
	Interruptible Load	$	403,674
	Constrained On	$	3,714
	Total monthly Cost	**$**	**693,507**
Over Frequency Reserve	**Total monthly Cost**	**$**	**123,349**
Black Start	**Total monthly Cost**	**$**	**55,285**
Voltage Support	**Total monthly Cost**	**$**	**-**
All Ancillary Services	**Total monthly Cost**	**$**	**1,617,636**

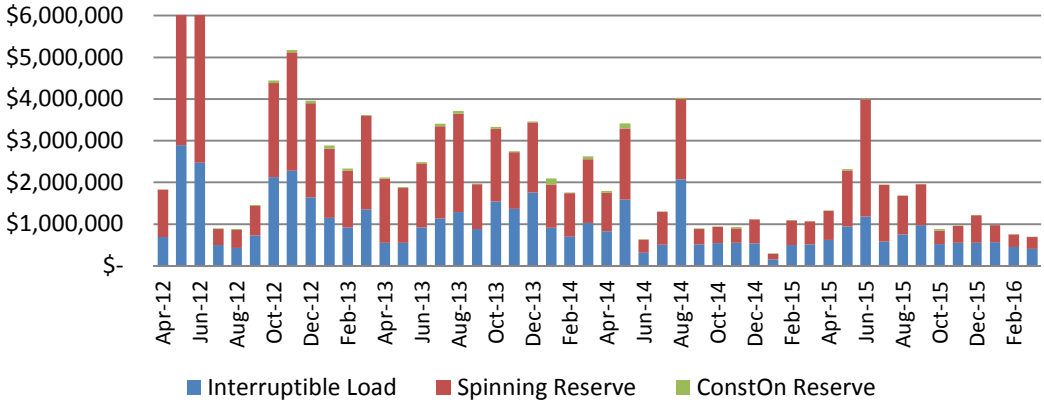
Ancillary Services Costs (past 4 years)



Frequency Keeping (past 4 years)



Instantaneous Reserve (past 4 years)



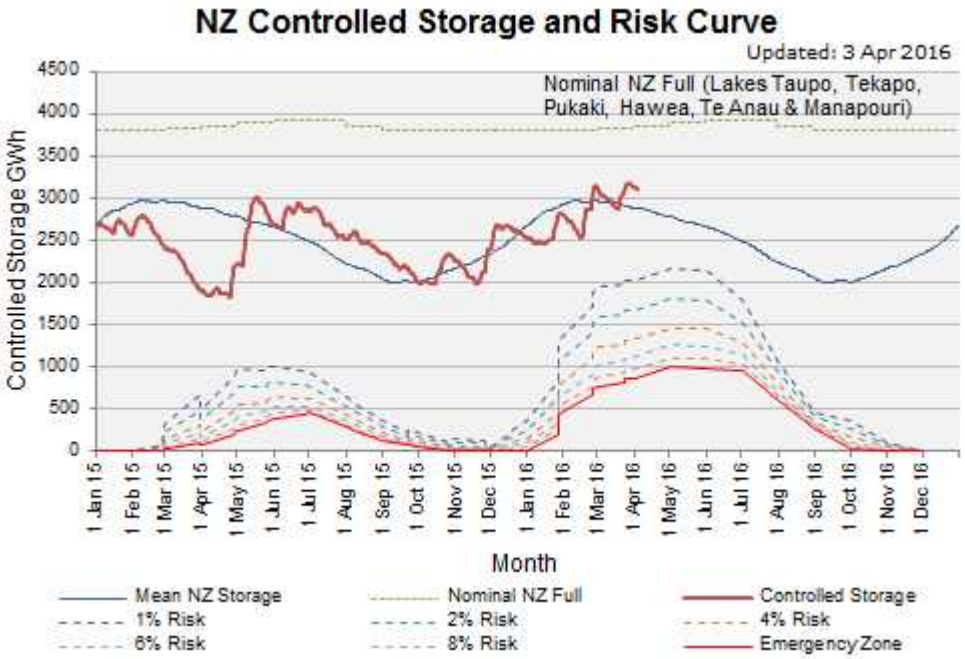
Note: IR Cost May 2012 = 14.129M, IR Cost Jun 2012 = 8.164M

Appendix C – Security of Supply

New Zealand Hydro Storage and Hydro Risk Curves

As at 7 April 2016, aggregate primary New Zealand storage was 106% of average.

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



Hydro Storage and Generation in March

North Island inflows were 77% of average.

South Island inflows were 121% of average.

Measurements are based on daily inflow values.

Hydro generation met 63% of demand.

System Performance Report

To the Electricity Authority

March 2016

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 March 2016.

Principal Performance Obligations

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

System Events

- On 14 March an HVDC runback was initiated, resulting in a momentary drop of North Island frequency to 49.29 Hz, and a momentary rise in South Island frequency to 51.15 Hz.
- On 15 March, at 00:51, an emergency potline off-load at Tiwai Point aluminium smelter resulted in a momentary rise in frequency in both islands – North Island to 50.50 Hz and South Island to 50.78 Hz.
- On 24 March, at 20.02, the four 66 kV circuits connecting Kaiapoi and Southbrook substations tripped, resulting in a loss of supply to both stations. Restoration of supply was in progress when the circuits tripped again at 22:36. Supply was completely restored by 23:28.

Other noteworthy events that occurred during the reporting period are as follows.

- A series of seventeen HVDC line faults resulting in voltage disturbances in the lower North Island. The faults occurred at:
  - 06/03/16 - 06:16, 07:00, 07:05, 07:20
  - 07/03/16 - 06:07, 06:21, 06:30, 07:08, 07:45
  - 13/03/16 - 22:55, 23:09, 23:21, 23:44, 00:07 (on 14/03)
  - 15/03/16 - 18:59, 19:41, 19:44
- On 31 March, at 03:10, Cobb power station tripped.

2. Principal Performance Obligations

2.1 Avoid Cascade Failure

No instances of cascade failure occurred during the reporting period.

2.2 Frequency

Maintain frequency in normal band and recover quickly from a fluctuation

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

Maintain Frequency and limit rate occurrences during momentary fluctuations

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

Frequency Band	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	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	4	2	2		1	1	3		1	3	**19**	**50**
50.50 > Freq >= 50.20	153	252	308	104	131	146	52	52	37	10	18	31	**1294**	
50.20 > Freq > 49.80														
49.80 >= Freq > 49.50	174	315	295	141	170	172	128	173	111	84	101	118	**1982**	
49.50 >= Freq > 48.75					1				1	1		1	**4**	**60**
48.75 >= Freq > 48.00														**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-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
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-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
Demand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	2	3	1	-	-	-	1	2	1	4	2	2
Warning Notice	10	12	-	-	1	-	3	-	-	-	-	-
Customer Advice Notice	13	32	11	5	6	10	7	9	16	3	7	19

3.2 Grid Emergencies

The following table shows grid emergencies declared by the system 0perator in the reporting period.

Date	**Time**	**Summary Details**	**Island**
24/03/16	20:44	A grid emergency was declared to assist with restoration following the loss of supply at Southbrook and Kaiapoi.	S
25/03/16	01:21	A grid emergency was declared to close the 110 kV Arapuni Bus split after the tripping of generation on the Arapuni South bus.	N

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

Island	Region	Apr-15	May-15	Jun-15	July-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Total
North Island	Northland	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Auckland	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Zone 1	1	-	-	-	-	-	-	-	-	-	-	-	**1**
	Waikato	-	3	-	-	-	-	1	1	1	4	2	1	**13**
	Bay of Plenty	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Hawkes Bay	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Taranaki	-	-	-	-	-	-	-	--	-	-	-	-	**0**
	Bunnythorpe	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Wellington	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	North Island (all)	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Lower North Island	-	-	-	-	-	-	-	-	-	-	-	-	**0**
North & South Islands		-	1	-	-	-	-	-	-	-	-	-	-	**1**
South Island & HVDC	Nelson Marlborough	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	West Coast	-	-	-	-	-	-	-	1	-	-	-	-	**1**
	Christchurch	-	-	-	-	-	-	-	-	-	-	-	1	**1**
	Canterbury	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Zone 3	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Otago	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Southland	1	-	1	-	-	-	-	-	-	-	-	-	**2**
	South Island (all)	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	HVDC	-	-	-	-	-	-	-	-	-	-	-	-	**0**

3.3 Customer Advice Notices

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

- six related to the temporary reclassification of the Clyde – Twizel 220 kV double circuit lines as a single contingent risk due to electrical storms in the vicinity
- two related to the system operator dispatching from back-up tools on 22 March
- two related to an issue being experienced with schedules on 30 March
- two related to a change being made to the Reserve Management Tool (RMT) regarding the calculation of reserves necessary for the South Island
- two advising that commissioning of Transpower's new SCADA system would impact Multiple Frequency Keeping (MFK) capability on 15 and 16 March
- one advising that HVDC Pole 2 was being switched to reduced voltage mode, limiting its capacity, on 14 March following a series of line faults
- one advising of prospective interruptions to ICCP data on 15 March, due to the commissioning of Transpower's new SCADA system
- one related to the impact of planned Harmonic Filter outages from 14 – 17 March on HVDC transmission limits
- one advising of constraint information being published in POCP on 30 March relating to the 220 kV Livingstone – Waitaki Circuit 1 outage
- one advising of the commencement of the 'shoulder' rating period on 15 March.

3.4 Forecast Standby Reserve Shortfall (SRS) notices

Five SRS notices were issued during the reporting period based on the SDS (the system operator's own load forecasting tool). These SRS notices were in respect of trading periods on 21 and 30 March. Three additional SRS notices, sent for 29 February and 1 March, were identified as being invalid.

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 a distributor to manage load at one or more grid exit points. Generation agreements are required to ensure 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-15	May-15	Jun-15	July-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Total
North Island	Northland	12	8	7	-	3	3	5	6	3	-	3	4	**54**
	Auckland	8	11	5	3	7	9	5	8	2	6	3	5	**72**
	Waikato	8	11	7	4	6	9	5	4	1	3	6	5	**69**
	Bay of Plenty	6	4	4	3	2	5	2	4	-	3	3	7	**43**
	Hawkes Bay	6	7	3	-	-	3	2	2	1	1	2	8	**35**
	Taranaki	2	5	2	-	-	2	2	3	2	-	4	4	**26**
	Bunnythorpe	8	7	4	2	2	-	5	4	-	4	7	10	**53**
	Wellington	9	6	7	-	3	4	5	6	3	3	6	6	**58**
Total		59	59	39	12	23	35	31	37	12	20	34	49	**410**
South Island	Nelson Marlborough	6	8	3	2	2	4	4	7	2	7	2	5	**52**
	West Coast	5	10	7	6	3	3	5	9	3	7	5	7	**70**
	Christchurch	7	7	6	6	4	3	2	7	3	6	2	6	**59**
	Canterbury	2	6	1	2	2	3	1	5	2	6	2	5	**37**
	Otago	3	5	-	-	2	2	3	2	-	-	-	2	**19**
	Southland	5	3	1	4	2	1	4	-	2	1	1	3	**27**
Total		28	39	18	20	15	16	19	30	12	27	12	28	**264**

3.7 CONSTRAINTS

SUMMARY: Security constraints binding during the month

The following table shows binding constraints during the month.

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

Island	Region	Branch	Description	Total
North Island	Hawkes Bay	FHL_RDF1.1__FHL_RDF2.1__FHL_RDF2__RDF__LN	This is an SFT generated constraint. Its purpose is to protect Fernhill-Redclyffe 1 for a tripping of Fernhill-Redclyffe 2.	27
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
	Otago	NSY_ROX.1__CYD_TWZ2.1__:S__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.	23
		NSY_ROX.1__CYD_TWZ1.1__:S__CYD_TWZ1__ROX__LN	This is an SFT generated constraint. Its purpose is to protect Naseby-Roxburgh 1	30

			for a tripping of Clyde-Twizel 1.	
		STU_TIM.1__ASB_ISL1.1__ASB_ISL1__TIM__LN	This is an SFT generated constraint. Its purpose is to protect Studholme-Timaru 1 for a tripping of Ashburton-Islington 1.	2
	Southland	EDN_INV.1__GOR_ROX.1__GOR_ROX1__INV__LN	This is an SFT generated constraint. Its purpose is to protect Edendale-Invercargill 1 for a tripping of Gore-Roxburgh 1.	36
		EDN_INV.1__GOR_ROX.1__:S__GOR_ROX1__INV__LN	This is an SFT generated constraint. Its purpose is to protect Edendale-Invercargill 1 for a tripping of Gore-Roxburgh 1.	1
		CYD_TWZ_TEMP_STABILITY_1	This constraint was applied to assist with managing flows after CYD_TWZ 1 & 2 were declared a double circuit risk due to a lightning storm.	5
Grand Total				**125**

Constraints binding during last 12 months

The following table shows constraints which bound for four or more trading periods, and those binding for more than 48 trading periods during the year.

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	FHL_RDF1.1__FHL_RDF2.1__FHL_RDF2__RDF__LN	27	1.81%	23	0.13%
South Island & HVDC	West Coast	COL_HOR2.1__COL_HOR3.1__COL_HOR3__COL__LN	0	0.00%	48	0.27%
		COL_HOR3.1__COL_HOR2.1__COL_HOR2__COL__LN	0	0.00%	48	0.27%
	Otago	NSY_ROX.1__CYD_TWZ2.1__CYD_TWZ2__ROX__LN	0	0.00%	77	0.44%
		NSY_ROX.1__CYD_TWZ1.1__:S__CYD_TWZ1__ROX__LN	30	2.02%	53	0.30%
		NSY_ROX.1__CYD_TWZ2.1__:S__CYD_TWZ2__ROX__LN	23	1.55%	27	0.15%
	Southland	EDN_INV.1__GOR_ROX.1__GOR_ROX1__INV__LN	36	2.42%	9	0.05%
		CYD_TWZ_TEMP_STABILITY_1	5	0.34%	0	0.00%

4. System Events

4.1 Significant System Events

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

Significant frequency excursions

Date	Time	Summary Details	Island	Freq (Hz)
14/03/16	12:42	An HVDC runback operation resulted in a momentary drop in frequency in the North Island and rise in frequency in the South Island.	N S	49.29 51.15
15/03/16	00:51	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in both the North and South Islands.	N S	50.50 50.78

Connection point events

Date	Time	Summary Details	Generation / Load interrupted (MW)	Restoration time (minutes)
24/03/16	20:02	66 kV Ashley-Southbrook 1, Islington-Southbrook 1 & 2, and Southbrook-Waipara 1 tripped resulting in a loss of supply to Kaiapoi and Southbrook substations.	SBK 28 KAI 16	121 142
24/03/16	22:36	66 kV Ashley-Southbrook 1, Islington-Southbrook 1 & 2, and Southbrook-Waipara 1 tripped resulting in a loss of supply to Kaiapoi and Southbrook substations.	SBK 19 KAI 19	14 22

4.2 System Events during reporting period

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

Contingent events

Event	Number	Summary
Loss of single AC transmission circuit	8	These related to tripping's of: • Coleridge-Otira 2 (2 x auto reclose) • Henderson-Hepburn 3 • Kawerau-Matahina 2 • Kinleith-Tarukenga 2 (auto reclose) • Mangamaire-Woodville 1 • Otahuhu-Whakamaru 1 (auto reclose) • Pakuranga-Penrose 3
HVDC Start/Stop	18	This related to tripping of: • HVDC Pole 2 Line Protection Operation, trip and restart at full voltage (17 x) • HVDC Runback operation
Supply Transformer	0	
Loss of grid reactive plant	6	These related to tripping's of: • Kikiwa Static Synchronous Compensator STC2B (4 x) • Marsden Static Synchronous Compensator STC6 (2 x)
Loss of single generation units	17	These related to tripping's of: • Arapuni G7 • Aviemore G1, G4 (2 x planned tests) • Branch River (Argyle) generation • Coleridge G3 • Kinleith Co-generation (3 x) • Kaimai generation • Kapuni GT2 (2 x) • Manapouri G4 • McKee U21 • Rotokawa OEC11 (2 x) • Wheao generation
Total during reporting period	**49**	

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	2	These related to: • 66 kV Ashley-Southbrook Circuit 1, Islington-Southbrook Circuits 1 & 2, & Southbrook-Waipara Circuit 1 tripped (2 x)
Demand change	1	These related to: • Tiwai NZAS Standby Potline Emergency off-load
Generation	3	This related the tripping of: • Arapuni Generation Runback scheme operation • Cobb G1, G2, G5, & G6 • McKee G61 & G62
Total during reporting period	**6**	

Other disturbances

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

4.3 System Events – Trend

	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Total	Average Events per month
Contingent Event – transmission	13	8	26	11	7	8	6	20	14	17	8	8	**146**	12.2
Contingent Event – generation	6	11	11	13	6	16	19	27	16	12	19	17	**173**	14.4
Contingent Event – Supply transformer	3	3	4	0	1	2	1	2	9	1	4	0	**30**	2.5
Contingent Event – Reactive plant	3	6	4	3	2	5	1	2	4	2	3	6	**41**	3.4
Contingent Event - HVDC	0	0	0	0	0	1	0	0	0	3	0	18	**22**	1.8
Extended Contingent Event HVDC	0	0	0	0	0	0	0	0	1	0	0	0	**1**	0.1
Extended Contingent Event Inter-connecting Transformers	0	2	0	0	0	0	0	0	0	0	0	0	**2**	0.2
Extended Contingent Event Busbar	2	1	2	0	1	0	1	0	0	0	0	0	**7**	0.6
Other Event – AC transmission	0	1	8	0	0	3	2	1	0	3	2	2	**22**	1.8
Other Event – Demand	1	2	5	2	3	0	3	3	3	3	3	1	**29**	2.4
Other Event – Generation	0	1	0	0	1	3	0	0	0	1	2	3	**11**	0.9