System Operator Reports
April 2016

Contents

SYSTEM OPERATOR

TRANSPOWER

Keeping the energy flowing

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

Purpose of Report

This report is Transpower's review of its performance as system operator for April 2016, in accordance with 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 over 85% (33/38) of the measurable 2015/16 KPI's complete, or forecast to be complete on, or ahead of, time. Two KPIs have been missed. Performance is summarised in Appendix A.

2. April Summary from an Operational and System Performance Perspective

Two loss of supply events occurred during April, while no market systems outages exceeded two hours in duration. On 2 April 14.6MW of load was lost at Cromwell, and on 12 April 1.5MW of load was lost at Ongarue.

As part of a continuing program of work, the system operator is undertaking analysis to determine the impacts decommissioning of thermal units will have on operation of the power system. As part of this work the upper North Island operational limits report was published to industry on 27 April. The report outlined the potential operational impact of the Huntly Rankine retirements, with a particular focus on changes to upper North Island power system limits until 2020. However, following this work, on 28 April, Genesis announced the Rankine units would stay in the market until 2022, which is a positive result for the industry.

The reserve management tool was amended to add 14.5 MW of lower South Island generation at the Flat Hill and Mt Stuart wind farms into the system model. This change reflects expected tripping response to an under-frequency event. Consequently, additional FIR and SIR may be purchased from time to time.

The upgrade of the system operator's market tools suite continued with a new enterprise service bus (ESB) going live on 14 April. Implementation went smoothly, with limited market impact. The first market system site switch[1], on 24 April, following the new ESB implementation was both quicker and more easily accomplished than with the previous ESB.

Site switch overs require coordination centre operations to be maintained using stand-alone dispatch (an emergency dispatch tool), which temporarily disrupts market bids and offers. The new ESB enabled a reduced switchover time (by around 25%), to the benefit of participants.

[1] The market system is duplicated and operates in two sites, at Wellington and Hamilton. The server at one site operates on line while the other is being updated. However, the server being updated is in fully capable, 'stand-by mode', and is ready if the need arises. Site switch overs have generally taken over 60 minutes to accomplish.

On 5 April the system operator notified participants of a week-long HVDC Haywards filter outage during June. Coincident generation outages could lower system security levels at peak periods during certain times in the outage window. The notification called for participants to maximise generation during the period of the outage and appeared inconsistent with advice (presented in February) from Transpower's National Winter Group regarding the overall 2016 winter period.

However, this advice was presented prior to completion of a detailed assessment of the filter outage. Subsequent National Winter Group work shows the filter outage does not impact the overall winter assessment of low security of supply risk (assuming all assets in service). The system operator's notification resulted in excellent participant response, which, in planning time, has eliminated the supply risk.

Transpower's Hall Road (Hamilton) site is in the course of major refurbishment. Key objectives are to accommodate Transpower's modelling team (bringing operational efficiencies to system operator use of SCADA and market tools) and to upgrade the building interior to a modern standard while addressing some structural deficiencies. The first half of the refurbishment was completed with staff able to reoccupy space previously vacated to facilitate the upgrade work.

Remaining work (now in progress) will refurbish the immediate co-ordination centre space, the balance of the office space and meeting areas and exterior car parking.

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.

Of the four RFM projects/initiatives currently underway, the national market for instantaneous reserves project is the most active and is at the halfway point of the build phase. Testing is due to commence in early June. The project remains on track for delivery in October 2016.

Investigations continue into the future strategy for frequency keeping and possible future instantaneous reserve products. Both initiatives are progressing to next stage investigation.

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 findings of the frequency keeping strategy investigation.

Significant project update – Efficient Procurement of Extended Reserves implementation

The project reached a major milestone in April, completing a third industry workshop. Transpower presented a high level overview of the implementation phase, and facilitated an information gathering exercise to identify industry needs and timeframes relating to implementation. Participants provided valuable information during the workshop that will assist Transpower plan remaining works. The joint project team is now undertaking a re-planning exercise to scope remaining work.

Significant project update – PRISM

Commissioning was successfully completed on 16 March. All old servers have been shut down and decommissioned. Remaining decommissioning activities are due for completion by mid-June. Project close-out and lessons learned reports will be completed in May. In addition a specific review, for the Transpower and Authority boards, is underway on the reasons for the time and cost extension required to deliver the project

SOSPA Transition Project update

A letter was sent from the system operator to the third party licensor of the simultaneous feasibility test (SFT) software, GE Grid Solutions, on 1 March 2016 requesting permission to publish the SFT software specification on the Transpower System Operator website. GE Grid Solutions responded on the 4 April 2016, declining our request in order to protect its intellectual property. However, this response was still sufficient to satisfy transitional provision (e) within the new SOSPA.

The system operator business continuity plan was provided to the Authority in April and will be tested in May. Discussions with the Authority have continued regarding performance metrics and incentives, and the statutory objective work plan.

4. Security of Supply update

National controlled storage has been near average levels since late February. While inflows during April were below average, high inflows in quarter one of 2016 leave storage in a healthy position; national controlled storage is currently 97% of average. 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 at normal.

The National Winter Group report was issued to members for comment on 22 April, with the final report published on 4 May. Results indicate the capacity margin for 2016 will be double that of 2015, the exception being one week in early June. Capacity margins during this week are reduced, due to the equipment outage discussed in section 2, and specifically addressed in the report.

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 the incorrect application of a constraint and a failed schedule.

6. Ancillary services

The system operator has completed its internal review of the Procurement Plan. A draft for comment will be issued to participants in May.

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 on track pending approval of the report. Analysis indicates this KPI will be met.
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 now 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	4	2	-	-	-	Four KPIs, relating to recognising and addressing the Authority's concerns about increasing capital spend, identifying operational trends to determine five performance improvement areas, documenting an operating model between the SO and IST divisions, and determining additional economic capability, have been completed ahead of schedule. The remaining two KPIs are 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 complete.

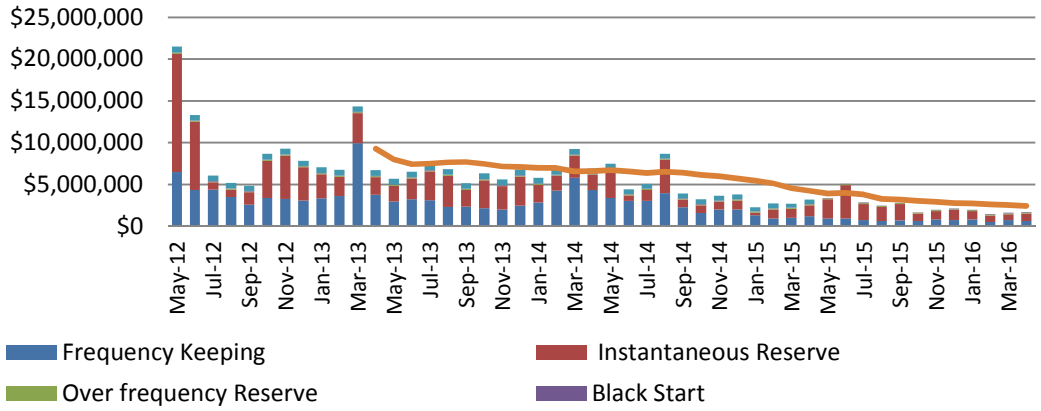
Key Business Initiative	# of KPIs	Complete	On track	At risk	NA	Missed	Comments
6. Building capability, and promoting a professional, responsive service culture	5	2	3	-	-	-	Two KPIs, relating to implementing a study version of vSPD for analyst use, and assessing the feasibility of measuring dispatch performance against hypothetical optima, have been 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	3	3	-	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. Three KPIs, relating to developing a common fatigue management policy, investigating and implementing changes to reduce the quantity of reserves required to cover HVDC operation, and reducing offload times from 15 to 10 minutes, are now at risk. Two KPIs, relating to introducing a market analyst progression programme, and developing recruitment and retention guidelines, have been missed. The remaining KPIs are on track.
Totals	**38**	**15**	**18**	**3**	**0**	**2**	

Appendix B – Ancillary Service Costs for April 2016

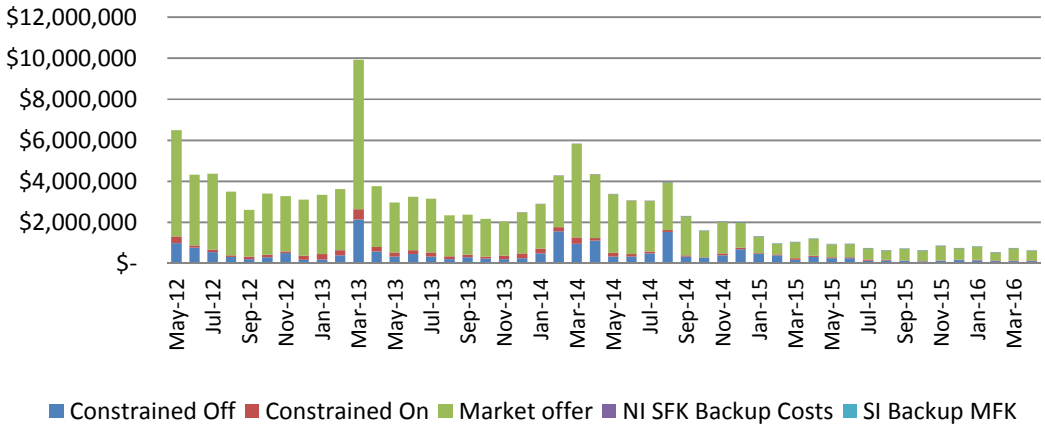
Note: The scale for the Instantaneous Reserve (Past 4 Years) graph has been reduced to clarify detail. Two months data, May and June 2012, overly influenced the graph scale.

		Cost	
Frequency Keeping	Constrained Off	$	114,370
	Constrained On	$	24,952
	Market offer	$	478,298
	NI SFK Backup Costs	$	2,916.67
	SI Backup MFK	$	3,832.00
	Total monthly Cost	$	624,369
Instantaneous Reserve	Spinning reserve	$	366,863
	Interruptible Load	$	511,315
	Constrained On	$	5,459
	Total monthly Cost	**$**	**883,637**
Over Frequency Reserve	**Total monthly Cost**	**$**	**123,349**
Black Start	**Total monthly Cost**	**$**	**55,285**
Voltage Support	**Total monthly Cost**	**$**	**-**
All Ancillary Services	**Total monthly Cost**	**$**	**1,686,640**

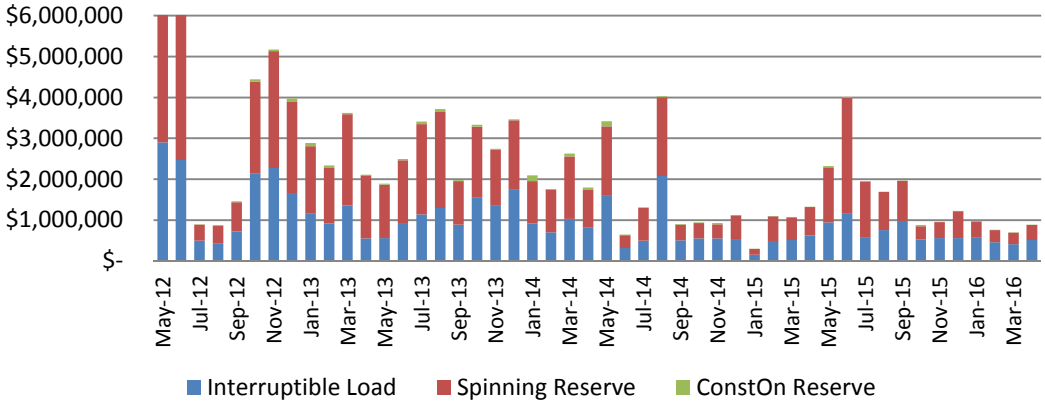
Ancillary Services Costs (past 4 years)



Frequency Keeping (past 4 years)



Instantaneous Reserve (past 4 years)



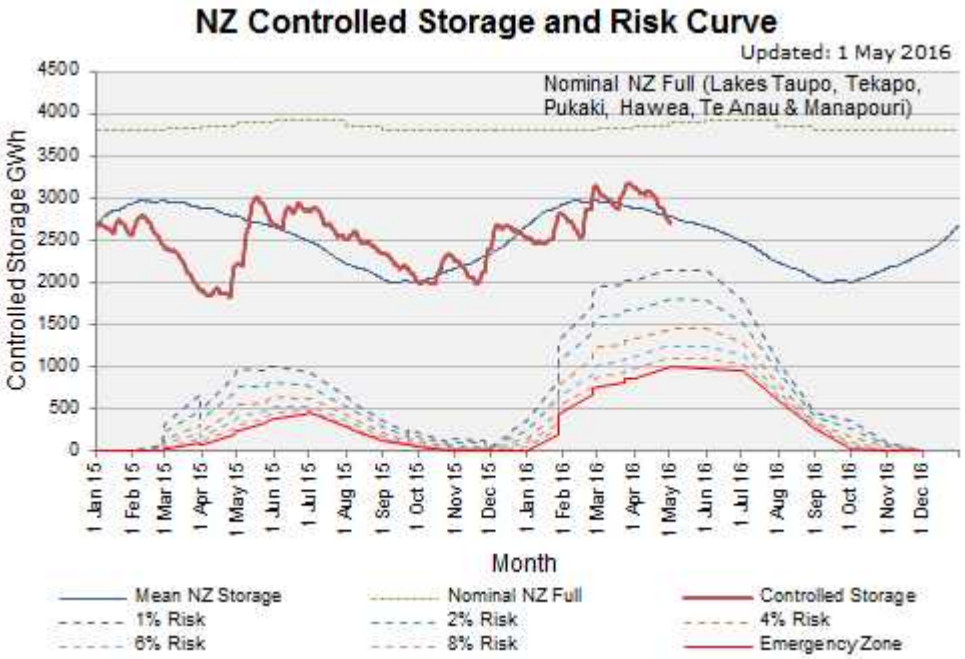
Note: IR Cost May 2012 = 14.129M, IR Cost Jun 2012 = 8.164M

Appendix C – Security of Supply

New Zealand Hydro Storage and Hydro Risk Curves

As at 4 May 2016, aggregate primary New Zealand storage was 97% of average.

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



Hydro Storage and Generation in April

North Island inflows were 68% of average.

South Island inflows were 81% of average.

Measurements are based on daily inflow values.

Hydro generation met 62% of demand.

System Performance Report

To the Electricity Authority

April 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

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1. Summary of System Performance

This system performance report covers the month of April 2016.

Principal Performance Obligations

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

System Events

- On 2 April, at 08:14, a fault on the 33kV bus at Cromwell substation resulted in a loss of supply to the 33 kV grid exit point. Supply was restored after 107 minutes.
- On 12 April, at 11:34, Ongarue supply transformer T1 tripped, resulting in a loss of supply to Ongarue substation. Supply was restored after 545 minutes.

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

- On 4 April, at 18:10, 50kV Te Kaha – Waiotahi circuit 1 tripped, resulting in a loss of supply to Te Kaha Substation. Supply was restored after 6 minutes.
- On 23 April, at 07:25, 110kV Oamaru – Blackpoint – Waitaki circuit 1 tripped, resulting in a loss of supply to Blackpoint Substation. Supply was restored after 215 minutes.
- On 28 April, at 06:47, 110kV Motunui – McKee – Stratford circuit 1 tripped and auto-reclosed. This resulted in McKee generation tripping, causing a momentary drop in frequency in the North Island to 49.51 Hz and the South Island to 49.62 Hz.

2. Principal Performance Obligations

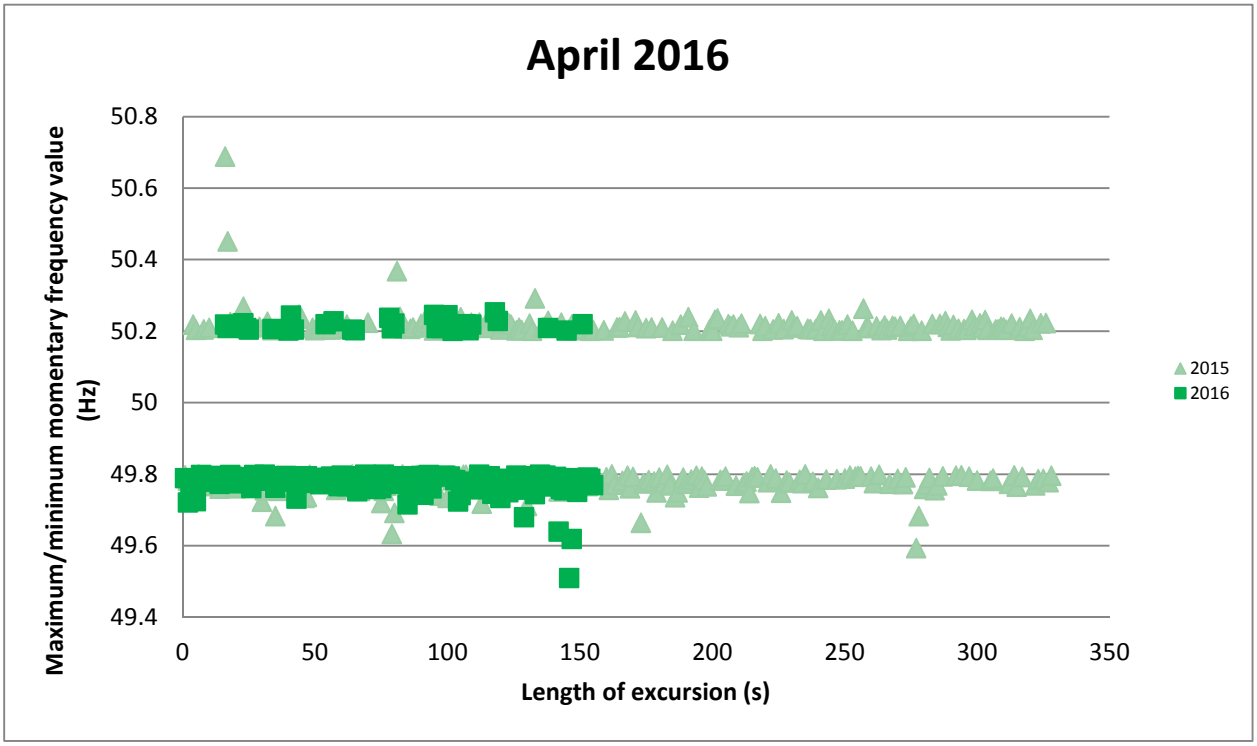
2.1 Avoid Cascade Failure

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	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-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	4	2	2		1	1	3		1	3		**18**	**50**
50.50 > Freq >= 50.20	252	308	104	131	146	52	52	37	10	18	31	30	**1171**	
50.20 > Freq > 49.80														
49.80 >= Freq > 49.50	315	295	141	170	172	128	173	111	84	101	118	125	**1933**	
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

Performance criteria are that time error must be:

- managed within +/- 5 seconds; and
- eliminated at least once every day.

Time Error Compliance Table		May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-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	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16
Demand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	3	1	-	-	-	1	2	1	4	2	2	2
Warning Notice	12	-	-	1	-	3	-	-	-	-	-	-
Customer Advice Notice	32	11	5	6	10	7	9	16	3	7	19	11

3.2 GRID EMERGENCIES

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

Date	Time	Summary Details	Island
02/04/16	16:37	A grid emergency was declared to close the 110 kV Arapuni Bus due to lightning in the vicinity.	N
12/04/16	22:58		

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

Island	Region	May-15	Jun-15	July-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	Total
North Island	Northland	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Auckland	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Zone 1	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Waikato	3	-	-	-	-	1	1	1	4	2	1	2	**15**
	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**
	South Island (all)	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	HVDC	-	-	-	-	-	-	-	-	-	-	-	-	**0**

3.3 Customer Advice Notices

11 customer advice notices (CANs) were issued in the reporting period including:

- two related to the temporary reclassification of the 220kV Huntly 'B' bus on 7 April, resulting from an AC extended contingent event (ECE) during an outage of the 220kV 'A' bus;
- two related to problems issuing the non-response schedule long on 13 April;
- one related to the impact of planned harmonic filter outages from 7 – 13 June;
- one related to a new date for reserve management tool (RMT) changes, which were advised by CAN on 30 March;
- one advising a report was published to the planned outage co-ordination process on 22 April regarding the proposed 220kV Manapouri – North Makarewa double circuit outage;
- one advising of changes to frequency keeping that will be effective from 1 May;
- one advising of an outage of multiple frequency keeping (MFK) on 27 April;
- one advising of proposed testing of the MFK application from 11 May to 1 June; and
- one related to the planned 220 kV Atiamuri – Whakamaru circuit 1 outage from 2 – 5 May.

3.4 Forecast Standby Reserve Shortfall (SRS) notices

A total of one hundred and seventeen SRS notices were issued during the reporting period based on the SDS (the system operator's own load forecasting tool). SRS notices were in respect of trading periods on 4 – 6, 15, 18 – 22, and 26 – 27 April.

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	May-15	Jun-15	July-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	Total
North Island	Northland	8	7	-	3	3	5	6	3	-	3	4	3	**45**
	Auckland	11	5	3	7	9	5	8	2	6	3	5	6	**70**
	Waikato	11	7	4	6	9	5	4	1	3	6	5	9	**70**
	Bay of Plenty	4	4	3	2	5	2	4	-	3	3	7	5	**42**
	Hawkes Bay	7	3	-	-	3	2	2	1	1	2	8	4	**33**
	Taranaki	5	2	-	-	2	2	3	2	-	4	4	2	**26**
	Bunnythorpe	7	4	2	2	-	5	4	-	4	7	10	6	**51**
	Wellington	6	7	-	3	4	5	6	3	3	6	6	7	**56**
Total		59	39	12	23	35	31	37	12	20	34	49	42	**393**
South Island	Nelson Marlborough	8	3	2	2	4	4	7	2	7	2	5	5	**51**
	West Coast	10	7	6	3	3	5	9	3	7	5	7	9	**74**
	Christchurch	7	6	6	4	3	2	7	3	6	2	6	2	**54**
	Canterbury	6	1	2	2	3	1	5	2	6	2	5	2	**37**
	Otago	5	-	-	2	2	3	2	-	-	-	2	2	**18**
	Southland	3	1	4	2	1	4	-	2	1	1	3	3	**25**
Total		39	18	20	15	16	19	30	12	27	12	28	23	**259**

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	Hawkes Bay	RDF_T4_M_O_1A	The effect of this constraint is to manage flows through Redclyffe-T3 during an outage of Redclyffe_T4 with low Tuai generation.	2
South Island & HVDC	Southland	EDN_INV.1__GOR_ROX.1__GOR_ROX 1__INV__LN	This is an SFT generated constraint. Its purpose is to protect Edendale-Invercargill 1 for a tripping of Gore-Roxburgh 1.	67
Grand Total				**69**

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	0	0.00%	50	0.29%
South Island & HVDC	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	0	0.00%	83	0.47%
		NSY_ROX.1__CYD_TWZ2.1_ _:S__CYD_TWZ2__ROX__LN	0	0.00%	50	0.29%
	Southland	EDN_INV.1__GOR_ROX.1__G OR_ROX1__INV__LN	67	4.65%	45	0.26%

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)
		None.		

Connection point events

Date	Time	Summary Details	Generation / Load interrupted (MW)	Restoration time (minutes)
02/04/16	08:14	Cromwell T5 & T8 33 kV circuit-breakers tripped resulting in a loss of supply to Cromwell Substation.	15	107
12/04/15	11:34	Ongarue T1 tripped resulting in a loss of supply to Ongarue Substation.	1.5	545

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	9	These related to trippings of: • Arapuni-Kinleith 1 (auto reclose) • Bunnythorpe-Mataroa 1 (auto reclose) • Edgecumbe-Kawerau 1 • Islington-Livingstone 1 (auto reclose) • Motunui-Stratford 1 (auto reclose) • Oamaru-Blackpoint-Waitaki 1 • Ohau A-Twizel 1 • Te Kaha-Waiotahi 1 • Woodville-Dannevirke-Waipawa 2
HVDC Start/Stop	0	
Supply Transformer	2	These related to trippings of: • Halfway Bush T1 • Ongarue T1
Loss of grid reactive plant	2	These related to trippings of: • Kikiwa Static Synchronous Compensator STC2A, STC2B
Loss of single generation units	11	These related to trippings of: • Cobb G1 • Kapuni GT2 • Kinleith Co-generation • McKee U22 • Poihippi G1 • Roxburgh G6 (2 x planned tests) • Te Rapa Combined Cycle • Wairakei G13 (2 x) • Wheao generation
Total during reporting period	**24**	

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	These related to: • Cromwell 33 kV supply bus trip • Trippings in the connected party's network fed from Maungatapere Substation
Generation	4	This related the tripping of: • Arapuni Generation Runback scheme operation • Cobb G1, G5, & G6 • Te Apiti Generation fluctuations (2 x)
Total during reporting period	**6**	

Other disturbances

Event	Number	Summary
Feeder trippings	47	Various locations
Total during reporting period	**47**	

4.3 System Events – Trend

	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	Total	Average Events per month
Contingent Event – transmission	8	26	11	7	8	6	20	14	17	8	8	9	**142**	11.8
Contingent Event – generation	11	11	13	6	16	19	27	16	12	19	17	11	**178**	14.8
Contingent Event – Supply transformer	3	4	0	1	2	1	2	9	1	4	0	2	**29**	2.4
Contingent Event – Reactive plant	6	4	3	2	5	1	2	4	2	3	6	2	**40**	3.3
Contingent Event - HVDC	0	0	0	0	1	0	0	0	3	0	18	0	**22**	1.8
Extended Contingent Event HVDC	0	0	0	0	0	0	0	1	0	0	0	0	**1**	0.1
Extended Contingent Event Inter-connecting Transformers	2	0	0	0	0	0	0	0	0	0	0	0	**2**	0.2
Extended Contingent Event Busbar	1	2	0	1	0	1	0	0	0	0	0	0	**5**	0.4
Other Event – AC transmission	1	8	0	0	3	2	1	0	3	2	2	0	**22**	1.8
Other Event – Demand	2	5	2	3	0	3	3	3	3	3	1	2	**30**	2.5
Other Event – Generation	1	0	0	1	3	0	0	0	1	2	3	4	**15**	1.3