SO QUARTERLY OPERATIONAL AND SYSTEM PERFORMANCE REPORT

FOR THE ELECTRICITY AUTHORITY

Transpower New Zealand Limited
January to March 2017

Keeping the energy flowing




TRANSPOWER

Transpower New Zealand Limited The National Grid

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Report Purpose

This report is Transpower's review of its performance as system operator for Q3 (January to March) 2017, in accordance with clause 3.14 of the Electricity Industry Participation Code 2010 (the Code).

As this is the final self-review report of the quarter, additional information is included as per SOSPA clause 12.3. This includes performance against the performance metrics in the year to date, and actions taken in regards to the system operator business plan, statutory objective work plan, participant survey responses, and any remedial plan agreed under clause 14.1 (i). A summary of technical advisory services for the quarter is also provided.

Operational issues and a detailed system performance report (Code obligated) are provided for the information of the Electricity Authority (Authority).

Monthly Report – March

1 Operational and system performance update

AUFLS event

On 2 March 2017 at 11:20 the two Clyde-Cromwell-Twizel 220 kV circuits connecting the lower and upper South Island disconnected from the grid in quick succession. The third circuit normally connecting the upper and lower South Island generation was out of service for planned maintenance. The disconnection created two electrical systems in the South Island:

1. the Otago/Southland region, including generation at Manapouri, Clyde and Roxburgh and the Tiwai Point smelter load
2. the remainder of the South Island, from the Waitaki Valley northwards including generation in the Waitaki Valley, the HVDC connection to the North Island and Canterbury, Nelson and the West Coast.

On disconnection, there was a loss of 410 MW of transfer into the upper South Island from the lower South Island. As a result, in the lower South Island, system frequency reached 53.6Hz before operation of over frequency protection and generator governor action reduced frequency to a manageable level. In the upper South Island system frequency fell to 47.4Hz, tripping the first tranche of automatic under frequency load shedding (AUFLS) relays and reducing load by around 16% (approximately 120MW across the upper South Island).

The HVDC Frequency Keeping Control resulted in an automatic 250 MW reduction in HVDC transfer resulting in North Island frequency falling to 49.2 Hz, tripping approximately 396MW of contracted interruptible load.

The two South Island electrical systems were re-connected at 11:44. However, the two islands were re-connected when the difference in voltage phase angle across the closing breaker was approximately 60 degrees at the time of closing (rather than at approximately equal angles).

Load restoration instructions to South Island distributors were progressively given and completed by 12:32, 72 minutes after the event occurred. Restoration of North Island interruptible load commenced at 11:52.

The event markedly impacted wholesale energy prices across the country due to the drop in load as prices fell in response. Prices returned to normal levels after load was restored.

On 3 March 2017, generators were advised to check plant in light of the synchronisation undertaken (on 2 March) at a 60 degree voltage phase angle. No reports of damaged equipment have been advised to date.

Transpower is completing a full review of the event and will produce a public report in due course.

Market system outage

On 23 March 2017, a scheduled market system outage which commenced at 11:09 (to implement Oracle database changes in the security work programme) was abandoned at 14:20 when it became apparent that the planned migration could not be completed satisfactorily. The work had been planned to occur within a 1hr 30 min window; when problems became apparent during the migration and those could not be resolved a decision was taken to roll back the migration and return the database to its prior operative state. During the extended market system outage, the ability for participants to submit offer changes, and Transpower's ability to produce market schedules, was impacted. Dispatch was unaffected as our backup systems provided continuity of service.

Key market observations

Accuracy of System Operations load forecast continues to be monitored with findings published on the Transpower website. We have observed a higher forecast error in the South Island at conforming nodes over the summer months in comparison to the North Island. This is likely related to the heavy weighting of irrigation load (80%) toward the South Island and will be monitored as we move into the winter months.

We have observed a rise in the price of North Island reserves since implementation of NMIR. NMIR increases the reserve costs per unit paid by generators masking some of the benefits of NMIR and elevates the level of price separation when the HVDC is the binding risk.

2 Market design and system enhancement project updates

Progress against in-flight market design and service enhancement projects is included below along with details of any variances from the current Capex Plan.

Efficient Procurement of Extended Reserves – The Technical Requirements Schedule was published in February. Planning for the implementation phase is now underway including changes required to tools to support the change in block allocations.

Gate Closure – Gate Closure project will reduce the market system gate closure from 2 hours to 1 hour. Development, testing and training are all progressing, and industry readiness planning is being undertaken with the Authority. The project is to go-live on 29 June.

Real Time Pricing – Design input into the Authority's consultation paper due for release in May has been completed. We will continue to work with the Authority through this consultation period, providing support and advice. Requirements and design work are expected to recommence in October 2017.

EDF Phase III – This project will refresh dispatch functionality within the market system, reducing barriers to entry and enable future dispatch products to be implemented. The investigation project was completed with an initial business case and associated consultation paper delivered to the Authority. The appropriation approval process is now underway. The capital phase of the project is planned to commence in 2017/18.

3 Security of Supply update

Inflows remain high in the North Island but have dropped below average in the South Island. Storage levels were at 73% of total at the end of the month. The hydro risk meter is set to normal.

For the month of March:

- North Island inflows were 158% of average[1]
- South Island inflows were 50% of average[2]
- Hydro generation met 62% of demand.

As at 1 April, aggregate primary New Zealand storage was 98% of average.

An update to Simulated Storage Trajectories was published on 29 March.
The Winter Capacity Margin report (formerly the National Winter Group report) was published on 6 April.

[1] Measurements are based on daily inflow values.
[2] Measurements are based on daily inflow values.

4 Compliance update

Transpower (as system operator) reported three breaches of the Code in March:

1. Late in 2016 an error occurred in real time when reconfiguring the market system following an outage. This caused the grid owner's offer to be incorrectly used in the market system.
2. In January 2017, a modelling error caused Glenbrook generation to be incorrectly dispatched for a period of 45 minutes.
3. A deployment error with the Reserve Management Tool (RMT) in February 2017 caused a defect in the calculation of required instantaneous reserve quantities. When the defect was discovered a fix was tested and applied expediently.

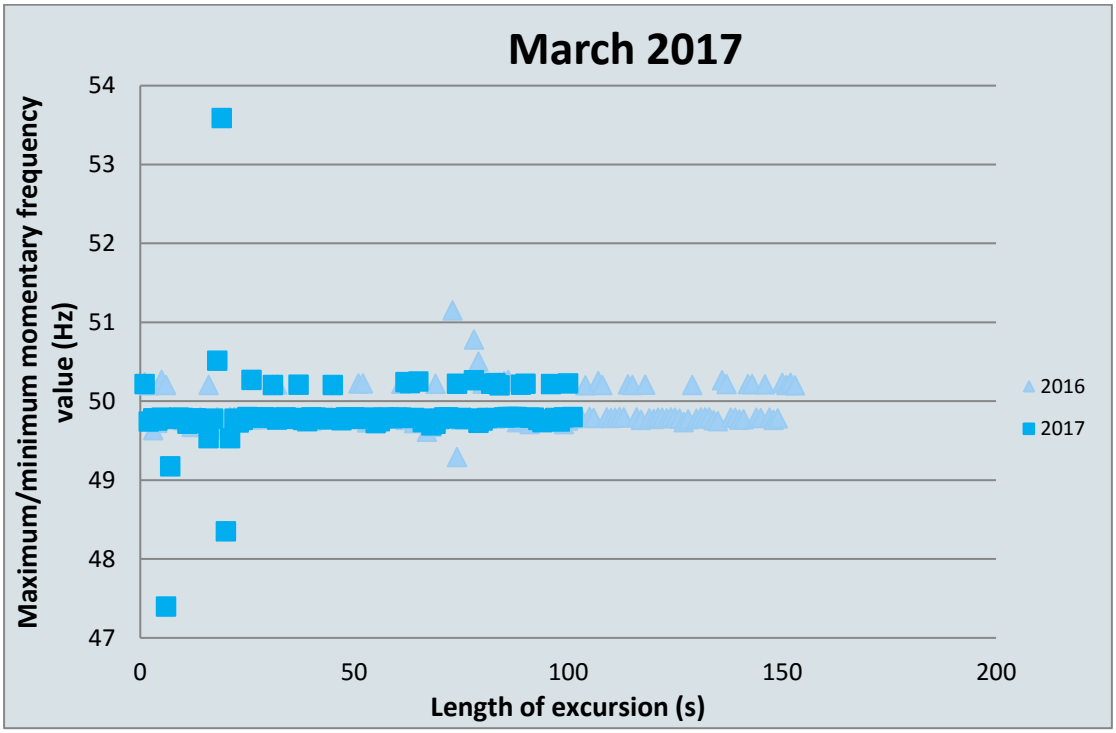
Appendix B shows instances where the system operator has applied discretion under 13.70 of the Code.

5 Operational management

5.1 Frequency fluctuations

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.



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, for each month over the last 12 months and the 12 month cumulative totals, grouped by frequency band.

Frequency Band	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Annual rate
55.00 > Freq >= 53.75													
53.75 > Freq >= 52.00												1	**1**
52.00 > Freq >= 51.25													
51.25 > Freq >= 50.50						2			1	1	1	1	**6**
50.50 > Freq >= 50.20	30	42	29	25	13	32	39	45	32	34	20	17	**358**
50.20 > Freq > 49.80													
49.80 >= Freq > 49.50	125	106	89	128	102	153	101	101	59	67	49	79	**1159**
49.50 >= Freq > 48.75		2		1		2	2	3	1	2		1	**14**
48.75 >= Freq > 48.00												1	**1**
48.00 >= Freq > 47.00												1	**1**
47.00 >= Freq > 45.00													

Note the frequency excursions for March include simultaneous over-frequencies and under-frequencies that occurred when the South Island was split into two electrical islands on 2 March.

Manage time error and eliminate time error once per day

There were no time error violations in the reporting period.

5.2 Voltage management

Grid voltages did not exceed the Code voltage ranges during the reporting period.

5.3 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-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17
Demand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	2	5	2	3	2	1	2	-	-	-	4	1
Warning Notice	-	3	2	2	5	1	-	-	-	-	-	-
Customer Advice Notice	11	12	3	8	7	5	12	26	7	11	7	24

5.4 Grid emergencies

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

Date	Time	Summary Details	Island
02-Mar-17	11:28	A grid emergency was declared to reconfigure South Island grid to allow resynchronising & restoration of South Island AUFLS after the tripping of the 220 kV Clyde-Twizel circuits resulted in the formation of two separate electrical islands.	S

6 Ancillary services

We are conducting our usual review of the performance of North Island interruptible load providers following the 2 March 2017 South Island AUFLS event/North Island under frequency event. Feedback from some providers was that restoration times after that event were extended and caused inconvenience for providers. As part of the wider Transpower investigation, we are reviewing the issue of restoration timeframes.

Refer Appendix A for Ancillary Services Graphs.

7 Separation of Transpower roles

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

Quarterly Report – Q3 (January to March)

1 Performance metrics

The following table shows system operator performance against the performance metrics for the financial year during Q3 as required by SOSPA 12.3 (a).

Performance Metric	Q3 Progress
Released at least $1 million of market benefits through the application of the CRE objective and/or implementing new capital investments:	• Analysis underway. On track for 30 April completion.
77.5% of the participants responding to the annual participant survey rate the system operator's performance as 'good' or better:	• Result was 81%.

2 Actions taken

The following table contains a full list of actions taken during Q3 regarding the system operator business plan, statutory objective work plan, participant survey responses and any remedial plan, as required by SOSPA 12.3 (b).

Item of interest	Actions taken
(i) To give effect to the **system operator business plan**:	• three business assurance audits have been completed and fourth and fifth audits are underway • five capital projects from the Capex Plan have been commissioned on time and within budget • a final capex plan and roadmap is on track for delivery by 30 June 2017 • work on the market design investigation proposal for 2017/18 continues in conjunction with final capex plan and roadmap (previous bullet point) • a second round of industry workshops planned in Q3 were held in April • ongoing identification and record of trends to predict and reduce overall number of events • education and engagement plan for 2017/18 is underway • statutory objective work plan for 2017/18 is underway • a tool to measure planned versus actual resource utilisation has been implemented

	• a benefits register has been implemented • incorporated SOSPA changes, learnings from 2016 BCP exercise and November earthquake into the business continuity plan and back-up procedures, and next BCP exercise is scheduled for May 2017.
(ii) To comply with the **statutory objective work plan**:	**Policy and procedure alignment with CRE** Ongoing checks being undertaken for CRE as part of document review process. **Review of Contingent Storage under SOSFIP** Scoping ongoing. **Review of the Security Policy – busbars** Revised classification methodology has been finalised. A review of each busbar according to the revised methodology is underway. Review results will be published for industry comment by 30 June 2017. **Develop a suite of performance metrics** KPIs and metrics have been identified and supporting metric profiles are underway.
(iii) In response to participant responses to any **participant survey**:	Participant survey responses were analysed. Areas for improvement were communications, responsiveness, and knowing the customer. System operator industry workshops have been changed to a more interactive format and informal ad-hoc meetings with participants are being held.
(iv) To comply with any **remedial plan** agreed by the parties under SOSPA 14.1 (i):	N/A – No remedial plan in place.

3 Cost-of-services reporting

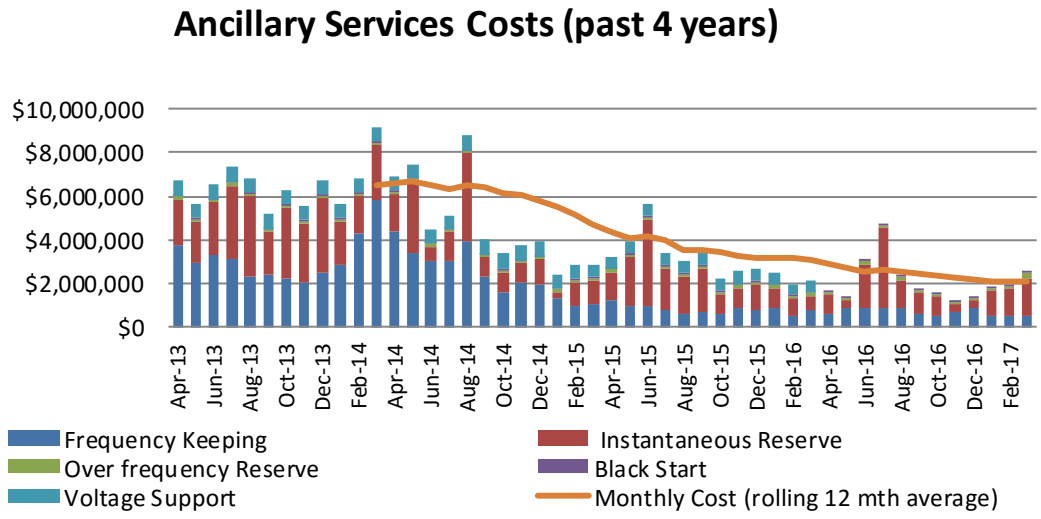
The feasibility study into implementing annual cost-of-services reporting to the Authority is not required until financial year 2 (SOSPA 12.6 refers). Planning continues.

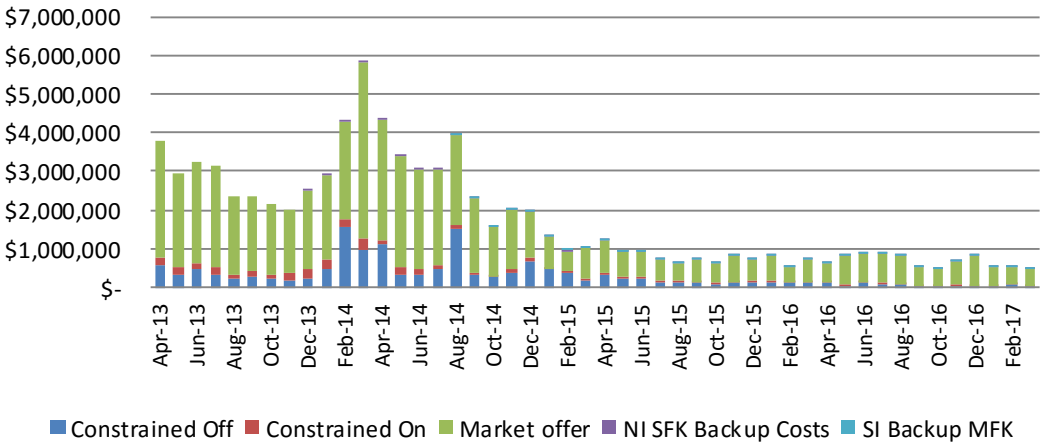
4 Technical advisory hours and services

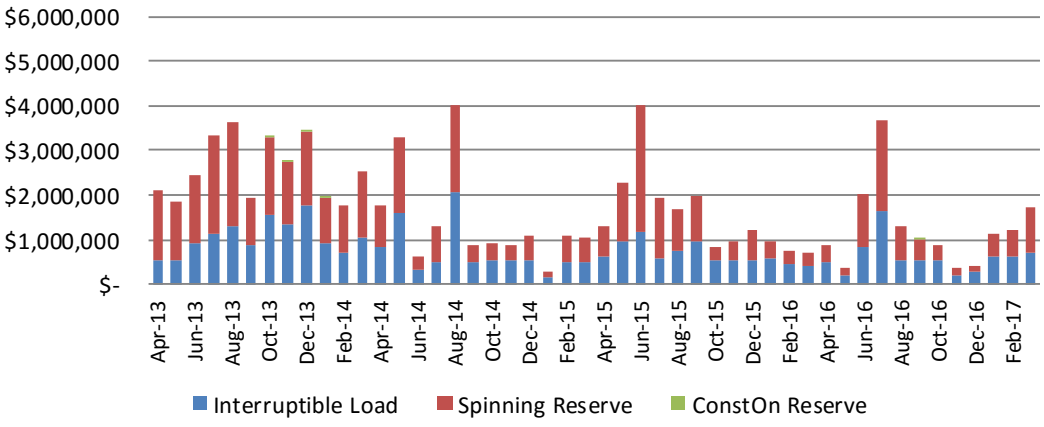
The following table provides the technical advisory hours for Q3 and a summary of technical advisory services to which those hours related (SOSPA 12.3 (d) refers).

TAS Statement of Work (SOW)	Status	Hours worked during Q3
TAS SOW 60 – Real Time Pricing	Closed	401.75
TAS SOW 62 – Wind Generation Offers	In Progress	10.00
TAS SOW 63 – Establishing Amendment to Code for RTP	Closed	16.00
TAS SOW 64 – ESB for NZX	In Progress	441.75
TAS SOW 65 – Assessment of implementing the load aggregator participant type and block demand dispatch	In Progress	90.00
Total hours		**959.50**

Appendix A: Ancillary Services Graphs







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

Appendix B: Discretion

Event Date & Time	Subject	Event Description
23/3/2017 8:46:58 PM	DISCRETION	WGN0331 Discretion Clause 13.70, Part 13 FIR Max : 95.2 Start: 23-Mar-2017 20:46 End: 23-Mar-2017 21:00 Notes: Last Dispatched: IntF: 100.73 IntS: 111.58
27/3/2017 5:58:30 AM	DISCRETION	RPO2201 RPO0 Discretion Clause 13.70, Part 13 ENR Max : 0 Start: 27-Mar-2017 05:58 End: 27-Mar-2017 06:30 Notes: Done to allow RPO PSO to be carried out in preparation for RPO bus work. Last Dispatched Mw: 63
31/3/2017 2:28:20 PM	DISCRETION	ARG1101 BRR0 Discretion Clause 13.70, Part 13 ENR Max : 0 Start: 31-Mar-2017 14:30 End: 31-Mar-2017 15:00 Notes: Restoration of ARG_BLN_1 Last Dispatched Mw: 9