QUARTERLY SYSTEM OPERATOR AND SYSTEM PERFORMANCE REPORT

FOR THE ELECTRICITY AUTHORITY

Transpower New Zealand Limited
January to March 2018

Keeping the energy flowing




TRANSPOWER

Transpower New Zealand Limited The National Grid

Report Purpose

This report is Transpower's review of its performance as system operator for Q3 (January to March) 2018, 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.

A detailed system performance report (Code obligated) is provided for the information of the Electricity Authority (Authority).

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Commentary

This section highlights successful management of significant events and operational issues by the system operator. It provides additional commentary (not Code or SOSPA required) relating to aspects of system operator performance or system performance. The remainder of the report provides supporting detail (which is Code or SOSPA required) in two sections:

- System operator performance, and
- System performance.

Prices in the $150 and $250 range in December and January reflected the perceived hydrology risk going into winter. The HVDC was sending up to 500MW south overnight with low south transfer levels during the day leading to periods of price separation as reserve sharing became constrained.

Recent high inflows have alleviated the situation, although we had initiated studies analyse potential generation and load scenarios particularly in the lower South Island to identify any possible constraints and to determine mitigation options.

During February, Ex-cyclones Fehi and then Gita broke the spell of low inflows in southern hydro catchment areas. This saw a shift back to prices between $80 – $100. Prices climbed as inflows again started to slow, but as Gita approached prices dropped to $30 as hydro stations drew down water to allow inflows from Gita to be stored. These inflows resulted in higher South Island hydro generation, and a swing to HVDC north transfer.

A review of the March 2017 Transpower South Island AUFLS report is underway. This will likely result in a separate report focused on System Operator performance being provided to the EA's System Operator Committee.

In March a new organisation structure within Transpower was confirmed. This change establishes a new "Operations" division that brings together the grid operations and system operations functions. The purpose of this change is to enable Transpower to adapt to the changing environment and to work towards a more integrated operating environment in line with our real-time operating vision. There will be no immediate change to the way in which Transpower delivers its operating services and we remain committed to the delivery of the system operator service.

System operator performance

1 Compliance

January

No breaches were reported in January.

February

No breaches were reported in February.

March

No breaches were reported in March.

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

2 Market design and system enhancement project updates

Progress against high value 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

Following Authority Board direction in March work has commenced on refresh of Technical Requirements Schedule. This work will include an assessment of the AUFLS capability of each distribution company and a risk review around the implementation of the transition to the 4-block scheme.

System changes to the Reserves Management Tool were delivered in January to support the new four block extended reserves scheme. Discussion is ongoing with the Authority regarding the treatment of the remaining scope item and therefore the completion date from the Capex plan has not been met. The approved capital project underway deviates from the current Capex Plan with an increased approved capital cost (approved $525k against Capex Plan of $195k).

Real Time Pricing

Approval for the next phase of the project (to plan, implement governance and produce a business case) has been provided by the Authority and work is well underway. Additional workstreams associated with the market system outages and “lite” dispatch and generation options are also underway. This work is on track and planned to enter the capital phase in June. Time and cost of this work aligns with the current Capex Plan.

Dispatch Service Enhancement (formerly known as EDF Phase III)

The High-Level Design is currently under review and development of the delivery business case and has commenced. Delivery business case is planned for approval in May 2018. Time and cost of this work aligns with the current Capex Plan. Time and cost of this work aligns with the current Capex Plan.

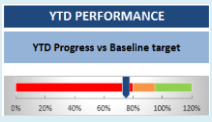
3 Performance metrics

The following dashboard shows system operator performance against the performance metrics for the financial year to date as required by SOSPA 12.3 (a). Overall the system operator are exceeding performance metric targets; taking into consideration the fact that some metrics are unable to be measured at this point in the year.

TRANSPOWER **SO Service Dashboard** **Mar-18**

CRITICAL SUCCESS FACTORS	YTD PERFORMANCE YTD Progress vs. Baseline Target
Our customers are informed and satisfied	0% 20% 40% 60% 80% 100% 120% 2017/18 baseline target is 100%, 213% YTD
We maintain Code compliance and meet our contract obligations	0% 20% 40% 60% 80% 100% 120% 2017/18 baseline target is 100%, 110% YTD
We deliver projects successfully	0% 20% 40% 60% 80% 100% 120% 2017/18 baseline target is 100%, 111% YTD
We are committed to optimal real time operation	0% 20% 40% 60% 80% 100% 120% 2017/18 baseline target is 100%, 111% YTD
Our people are engaged and competent	0% 20% 40% 60% 80% 100% 120% 2017/18 baseline target is 100%, 100% YTD
Our tools and technologies are fit for purpose	0% 20% 40% 60% 80% 100% 120% 2017/18 baseline target is 100%, 101% YTD

How to read this dashboard:



- Shows year-to-date progress vs. baseline as %
- RAG criteria are the same for all metrics

4 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**:	• Modelling and initial analysis for Energy Storage Systems has been complete. • Review of the procurement plan is underway • Have establish project team and governance to support consultation and business case for Real Time Pricing
(ii) To comply with the **statutory objective work plan**:	**Policy and procedure alignment with CRE** • From the start of this financial year, 72 documents (18%) have been reviewed against CRE against a target of 25%. **Review of SOSFIP** • Analysis of treatment of contingent storage has been completed and a report on the changes to the SOSFIP was delivered by the 31st March. • Improvements to presentation of the annual assessment was completed by the 1st March. **Review of the Security Policy – Interconnecting transformers** • Commenced analysis in Quarter 2. On-track to meet target completion by June 2018. **Implement performance dashboard and review/propose performance metrics for 2018/19** • Implementation of the performance dashboard is complete and shown in section 3 of this report. • Review performance metrics (including placeholder metrics) and propose metrics for 2018/19 financial year is currently underway and planned for completion by the 1st May.
(iii) In response to participant responses to any **participant survey**:	Participant survey has been issued and we are waiting for responses to be provided.
(iv) To comply with any **remedial plan** agreed by the parties under SOSPA 14.1	N/A – No remedial plan in place.

5 Cost-of-services reporting

The feasibility study into implementing annual cost-of-services reporting to the Authority is required in financial year 2 (SOSPA 12.6). This was completed in September last year and a proposed approach submitted to the Authority for their feedback.

6 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 65 – Assessment of implementing the load aggregator participant type and block demand dispatch. Close out report in train.	Closed	41.00
TAS SOW 69 – RTP Consultation Support	In close out	112.25
TAS SOW 71 – Battery storage as a source of ancillary services	In progress	117.00
TAS SOW 72 – EPER Project Support Oct – Dec 2017	In close out	131.50
TAS SOW 73 – Evaluating Options to Improve System Operator Load Forecast	In progress	514.60
TAS SOW 75 – Market System outage impacts on Real Time Pricing	In progress	116.50
TAS SOW 76 – RTP Complete Develop Solution Approach	In progress	1345.75
TAS SOW 77 – Review Governor Response changes that have occurred to the normal frequency management	In progress	22.00
TAS SOW 78 – Gen-Lite and DD-Lite Investigation and ROM	In progress	85.00
Total hours		**2485.60**

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.

System performance

8 Operational and system events

January

Loss of supply events

During the morning peak on Thursday 25 January, a transformer at the Hamilton substation (T6) tripped while switching was being carried out for maintenance work on another transformer (T9). The cause of the tripping was identified as a fault with the protection relay on T6. This tripping resulted in a 160 MW loss of supply to most of the Waikato and Coromandel 110kV network. T9 was offered back into service immediately and the NCC and NGOC teams worked together to restore the network, with all load restored within 90 minutes of the tripping.

On the evening of Monday 22 January, a fire was reported in scrubland at Tiwai point. This fire threatened the four circuits supplying load at the Tiwai smelter. Coordinators studied the worst-case scenario of losing all four circuits, as loss of all Tiwai load would result in significant over frequency on the power system. All available over frequency reserves were armed to mitigate such an event were it to occur. We maintained open communication with the Power Supply Superintendent at Tiwai, who could relay valuable information about how close the fire was to our assets and how the firefighting effort was progressing. Ultimately, the fire did not require circuit de-energisation during the three-hour period during which the Fire Service was in action.

February

Loss of supply events:

Stratford Power generator (SPL) tripped twice in February. The first event on 9 February resulted in an under-frequency event, which saw some interruptible load trip. The second event three days later led to a smaller frequency drop above the underfrequency event threshold.

Cyclone Gita brought high winds and heavy rain to the South Island and parts of the lower North Island on 20 February. Transpower teams prepared for the storm with a pre-event Coordinated Incident Management System (CIMS) group watching the weather, recalling critical circuits from outages and inspecting circuits and substations in the forecast cyclone path. Aside from many feeder trippings in the Taranaki area, Transpower's high voltage network was unaffected.

Grid Emergency

A grid emergency was declared on the 18th of February to allow the system operator to move to single frequency keeping. This was due to a system issue with one of the market system communication protocols. The issue was resolved by following normal support procedures, returning service to full functionality within 30 mins. An assessment of the cause has been completed and was identified as a misconfiguration which has now been corrected.

March

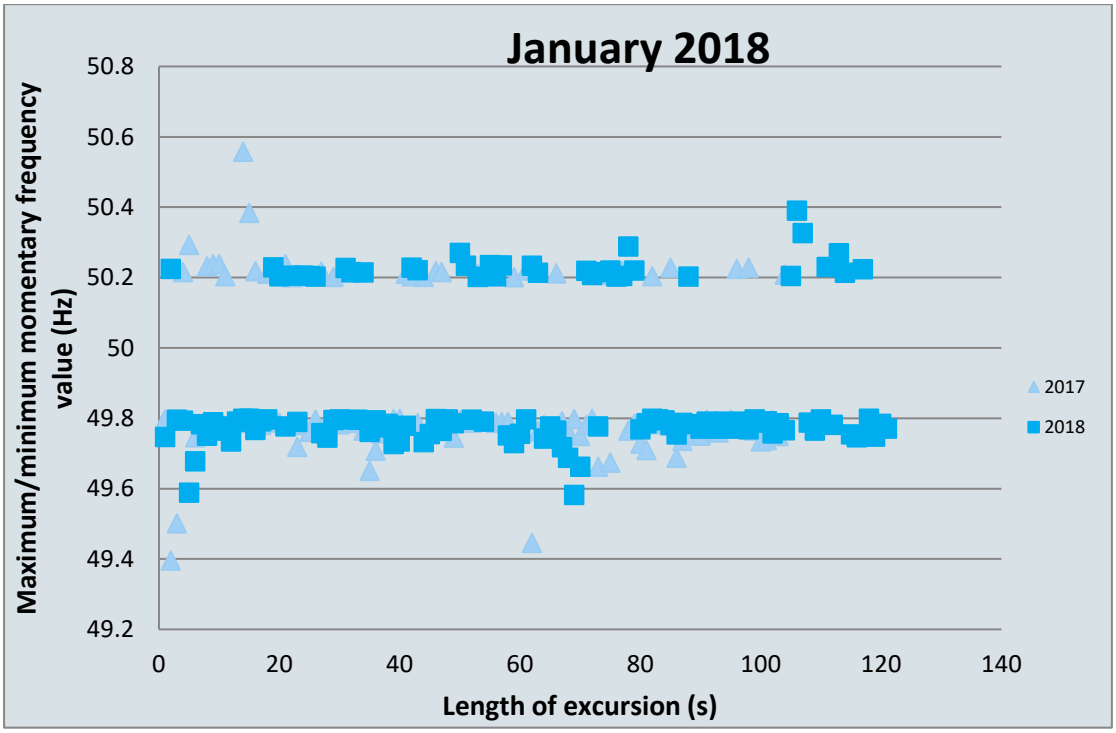
Loss of supply events:

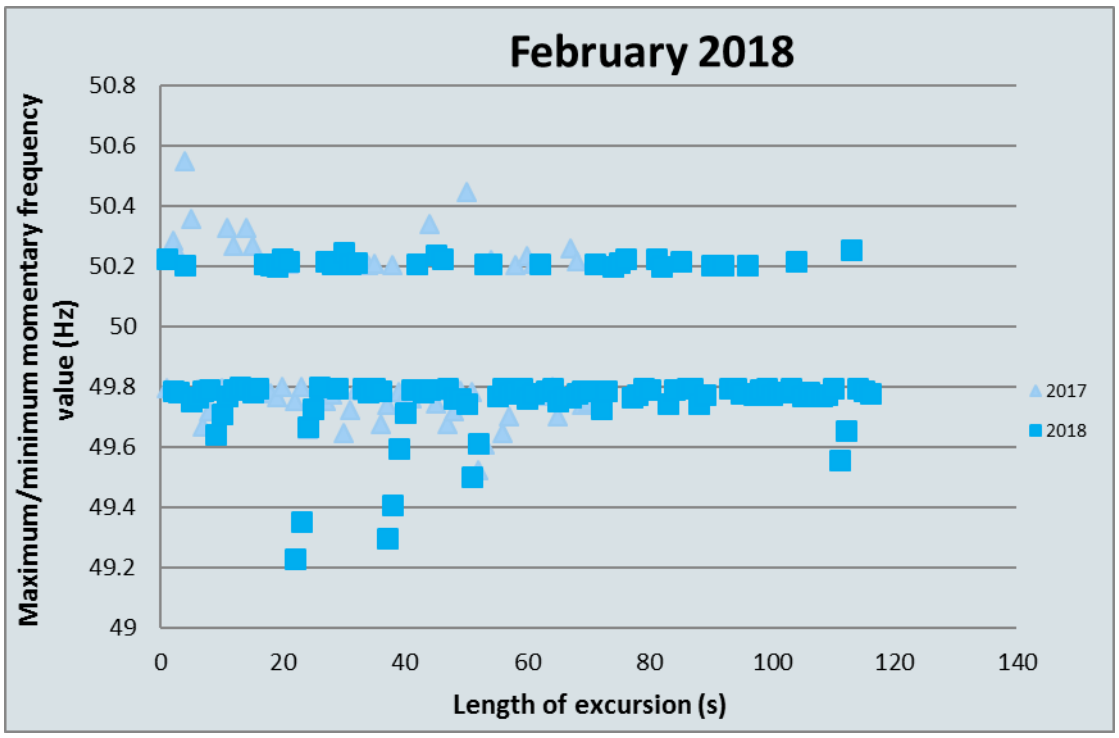
On 9 March, Southbrook T1 and T2 tripped simultaneously causing a 14 MW loss of supply to Southbrook. The tripping was caused by a switchgear fault within the Mainpower network. After confirming that the failed equipment was isolated, NGOC made the transformers available for service, and supply was restored 26 minutes after the event. Following the event, Transpower protection engineers investigated the T1 and T2 protection relays and found that settings were incorrect, and transformers should not have tripped. This has been rectified for T1, and the T2 relay will be corrected in April.

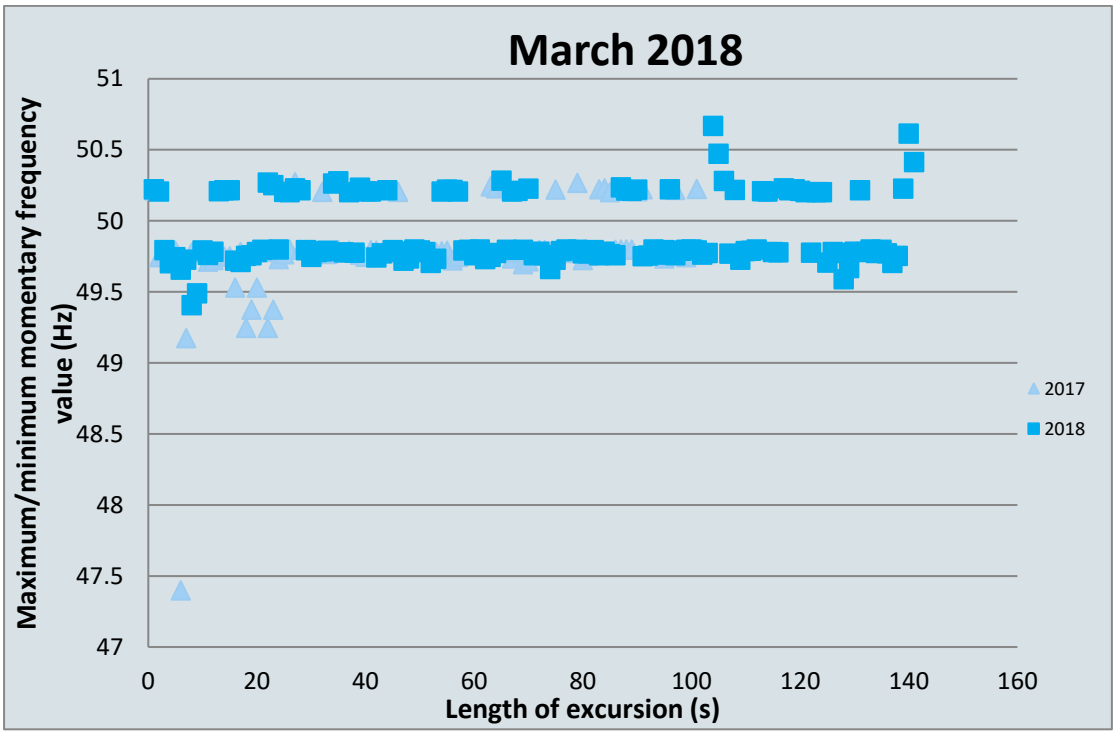
9 Frequency fluctuations

9.1 Maintain frequency in normal band and recover quickly from a fluctuation

The following charts show 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.







9.2 Maintain frequency and limit rate occurrences during momentary fluctuations

The tables below show the total number of momentary fluctuations outside the frequency normal band, recorded in each island, for each month over the last 12 months and the 12-month cumulative totals, grouped by frequency band.

North Island

Frequency Band	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Annual rate
55.00 > Freq >= 53.75													
53.75 > Freq >= 52.00													
52.00 > Freq >= 51.25													
51.25 > Freq >= 50.50									1				**1**
50.50 > Freq >= 50.20	8	16	22	6	22	31	41	85	5	23	19	30	**308**
50.20 > Freq > 49.80													
49.80 >= Freq > 49.50	55	59	42	52	92	89	91	135	27	53	57	62	**814**
49.50 >= Freq > 48.75			3						1		2	1	**7**
48.75 >= Freq > 48.00													
48.00 >= Freq > 47.00													
47.00 >= Freq > 45.00													

South Island

Frequency Band	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Annual rate
55.00 > Freq >= 53.75													
53.75 > Freq >= 52.00													
52.00 > Freq >= 51.25													
51.25 > Freq >= 50.50	1	1	1		2	1	1		1			2	**10**
50.50 > Freq >= 50.20	16	18	28	11	17	28	29	47	8	13	12	16	**243**
50.20 > Freq > 49.80													
49.80 >= Freq > 49.50	29	33	45	36	50	58	46	42	13	32	24	29	**437**
49.50 >= Freq > 48.75			2						1		2	1	**6**
48.75 >= Freq > 48.00													
48.00 >= Freq > 47.00													
47.00 >= Freq > 45.00													

9.3 Manage time error and eliminate time error once per day

There were no time error violations in the reporting period.

10 Voltage management

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

11 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-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18
Demand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	1	1	-	-	1	-	-	1	-	3	1	-
Warning Notice	-	-	-	-	-	2	-	-	1	-	-	-
Customer Advice Notice	10	16	23	2	6	6	1	8	1	3	6	4

12 Grid emergencies

The following table shows grid emergencies declared by the system operator from October to December.

Date	Time	Summary Details	Island
12-Jan-18	18:33	A grid emergency was declared to assist with restoration following the tripping of both 110 kV Woodville-Dannevirke-Waipawa and subsequent loss of supply to Dannevirke and Waipawa Substations.	N
25-Jan-18	07:56	A grid emergency was declared to assist with restoration following the tripping of Hamilton 220 / 110 kV inter-connecting transformer T6 and the subsequent loss of supply to the Coromandel and Waikato regions.	N
31-Jan-18	18:07	A grid emergency was declared to allow the reconfiguration of the Southland 110 kV network following the tripping of 110 kV Edendale-Invercargill Circuit 1.	S
18-Feb-18	00:27	A grid emergency was declared due to an unplanned communications failure affecting the Multiple Frequency Keeping (MFK) application. The System Operator reverted to Single Frequency Keeping during this time.	N+S
Mar		None	

13 Security of supply

The quarter saw above average inflows. The following table shows monthly inflows for both islands as a percentage of average for the time of year.

	January	February	March
North Island	122%	166%	111%
South Island	69%	146%	112%

National hydro storage increased from 82% to 113% of average for the time of year between 1 January and 31 March.

This quarter has seen a lot of work in the area of Security of Supply. During January through March we published the 2018 Annual Security of Supply Assessment, reviewed and updated a number of key assumptions in the hydro risk curves (HRCs) and subsequently published the new HRCs – including an ongoing review of the treatment of thermal generation fuel limitations, completed the revision of many of our Security of Supply event planning activities (including process development, procurement planning, and communications planning), and have delivered a draft consultation document to the Authority that covers likely changes to the Security of Supply Forecasting and Information Policy (as part of the Statutory Objective Work Plan).

14 Ancillary services

An Under-Frequency Event on the 9th of February saw the North Island frequency dip and spinning reserve came on to arrest the frequency drop. As per normal process we analysed the reserve providers' response.

A further analysis is being done to better understand the settings of the different IL providers and to help model the response better in the Reserve Management Tool.

Refer Appendix B for Ancillary Services Graphs.

Appendix A: Discretion

January

Event Date & Time	Event Description
9/1/2018 12:00:18 PM	MAN2201 MAN0. Return of extended potline.
16/1/2018 2:35:21 PM	HWA1101 PTA2. Bona-fide change to offer claimed
18/1/2018 9:00:03 AM	MAT1101 MAT0. Late return of KAW_MAT 1 outage
25/1/2018 7:55:43 AM	KPO1101 KPO0. Required for restoration of Waikato region following HAM_T6 tripping
28/1/2018 5:48:36 PM	ROT1101 WHE0. ROT_WHE tripped

February

Event Date & Time	Event Description
01-02-2018 01:09 p.m.	TUI1101 PRI0 Discretion ended for return of RDF WRK 1
01-02-2018 01:09 p.m.	TUI1101 PRI0 Discretion ended for return of RDF WRK 1
01-02-2018 01:12 p.m.	TUI1101 PRI0 Discretion ended for return of RDF WRK 1
09-02-2018 05:06 a.m.	SFD2201 SPL0 Bona-fide change to offer claimed
14-02-2018 06:21 a.m.	ARG1101 BRR0 Required off for switching ARG_BLN
15-02-2018 02:00 p.m.	ARG1101 BRR0 Required off for switching ARG_BLN
19-02-2018 06:18 a.m.	ARG1101 BRR0 Required off for switching ARG-KIK-1
19-02-2018 03:58 p.m.	ARG1101 BRR0 Required off for switching ARG-KIK-1
20-02-2018 04:16 p.m.	KPA1101 KPI1 KPI islanded upon OPK_KPI_SFD_2 tripping
21-02-2018 02:24 a.m.	COL0661 COL0 Discretion on to provide upper south island MVAr support
21-02-2018 02:27 a.m.	COL0661 COL0 Discretion on to provide upper south island MVAr support

21-02-2018 03:42 a.m.	COL0661 COL0 Discretion on to provide upper south island MVAr support
26-02-2018 07:29 a.m.	ARG1101 BRR0 Required off for switching ARG-KIK-1
27-02-2018 09:55 p.m.	MAN2201 MAN0 Required for extension of emergency potline

March

Event Date & Time	Event Description
1/03/2018 04:50 p.m.	ARG1101 BRR0 Generation required to be of for planned switching.
6/03/2018 06:25 a.m.	SFD2201 SFD21 Constrained to previous dispatch (16MW) until SFD21 unit can generate.
12/03/2018 11:49 a.m.	MAN2201 MAN0 Pot Line 2 Restoration
15/03/2018 05:56 a.m.	RPO2201 RPO0 Generation required to be of for planned switching
15/03/2018 11:46 a.m.	MAN2201 MAN0 Extended potline offload
19/03/2018 11:43 a.m.	MAN2201 MAN0 Extended Potline
19/03/2018 11:30 p.m.	SFD2201 SFD21 Required for voltage support
22/03/2018 11:33 a.m.	MAN2201 MAN0 Potline extended outage
28/03/2018 11:47 a.m.	MAN2201 MAN0 Restoration of pot Line

Appendix B: Ancillary Services Graphs