QUARTERLY SYSTEM OPERATOR AND SYSTEM PERFORMANCE REPORT

FOR THE ELECTRICITY AUTHORITY

Transpower New Zealand Limited
April to June 2019

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 Q4 (April to June) 2019, 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 year to date, and actions taken in regard 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).

Table of Contents

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Commentary

This section provides an update for this quarter, any new initiatives that we have instigated, the current investigations we are progressing and areas of business that are under review. The remainder of the report provides supporting detail in two sections:

- System operator performance, and
- System performance.

Update (April to June 2019)

Compliance

- The overall average trend in breaches in our role as system operator continues to decline, however the 16 breaches reported in 2018/19 is up on the 10 breaches reported in the previous year.
- Work continues to strengthen our operational controls, improve processes and tools, and build our people capability with a goal to minimise future breaches.

Security of Supply

- Since the significant inflow event in late March, regular inflows have kept storage above average for this time of year, and consequently risk has remained low.
- We saw unusually low lake levels at Waikaremoana after little rainfall and a rapid decline in the last week of June. This issue was alleviated by a significant inflow in early July. Based on our analysis, regional network security is not under threat in the short term although we continue to monitor the situation closely and have planned mitigation measures in place.

Outage Planning

- The new consolidated Outage Planning Policy has been shared with industry.
- We held an Outage Planning Forum to update and discuss aspects of the Policy, and improvements to information provision around generation shortfalls for HVDC and other outages.

HVDC 2020 Outages

- The Grid Owner has scheduled major outages of the HVDC poles in January to April 2020. We are continuing to work on coordinating the system operator aspects of these outages.
- As system operator, we are ensuring relevant information is communicated to both the industry and the Grid Owner. An independent expert has been engaged to provide assurance around impartiality.
- We will be providing further information and the opportunity for participants to discuss the outages at a briefing in the last week of July.

Real Time Pricing (RTP)

- The project was approved by the Authority Board at its 27 June meeting.
- Transpower commenced work on the capital phase of the project on 1 July to prepare for increased IST support on project from October 2019.

Dispatch Service Enhancement (DSE)

- The project has been re-planned following an extended testing period.
- Work is on track to deliver to the original scope by 8 August.
- A change request has been submitted to the Authority to cover the forecast overspend, to be considered at the Authority Board's 8 August meeting.

SOSPA Deliverables

- We submitted all our end of financial year SOSPA deliverables to the Authority by 30 June.

Investigations

Battery Energy Storage Systems

- Our investigation into the impact on the operation of the New Zealand power system from the inclusion of large amounts of distributed solar PV and battery energy storage systems was published in late June.

Areas under review

Reserves Management Tool (RMT) modelling issue

- Deloitte has completed their review of the RMT change management process and will provide us with a final report and set of recommendations by end of July.

New Zealand Generation Balance

- A number of N-1-G shortfalls have been indicated over the early winter months.
- Sensitivity analysis to reflect gas shortage and peak winter load scenarios has also been provided.
- Scenario modelling underway to determine expected margins during the HVDC 2020 work.

System operator performance

1 Compliance

April

We reported two breaches in April. Neither breach had a market nor security impact:

- The first breach relates to the correction of inaccurate modelling of the reactive support at Whareroa.
- The second breach is due to the incorrect modelling of several SPS schemes in the market system and forward-looking schedules for a short period post-implementation of the SPS Automation project.

May

We reported one breach during May. This related to a delay in publishing the forward-looking schedules during the daylight-saving switch-over in April. A timestamp clash along with challenging system conditions meant a re-run of the long schedule did not complete in the time-frame required by the Code.

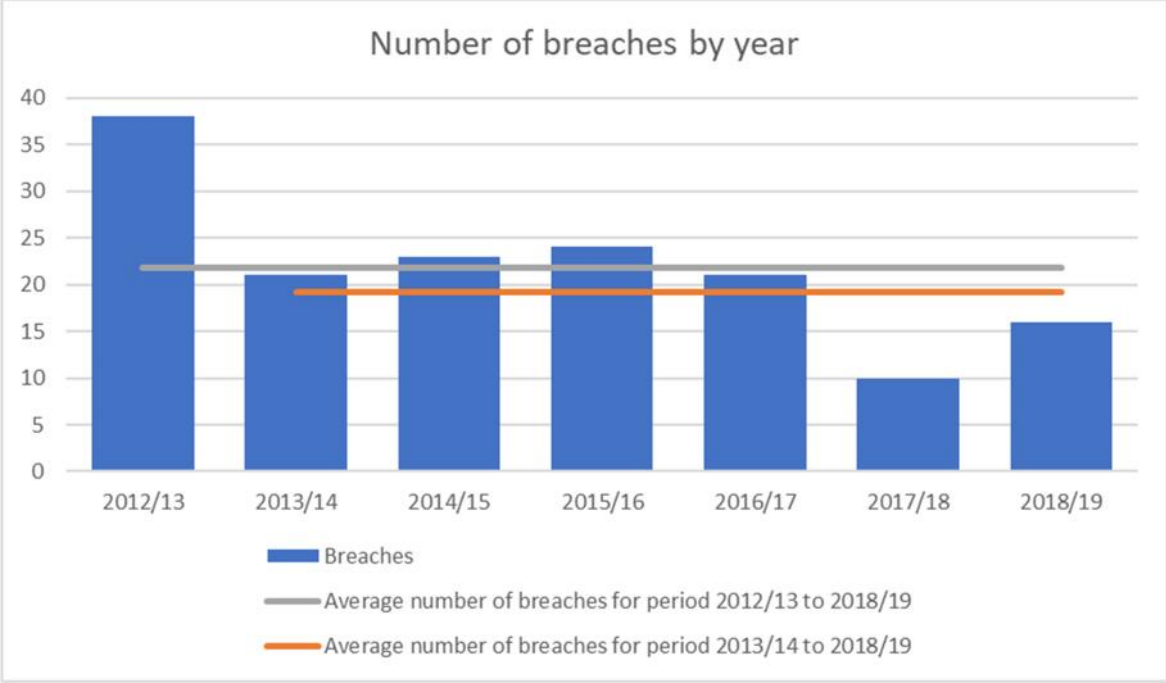
June

We reported two new system operator breaches to the Authority in June. Neither breach had a market nor security impact.

- The first breach related to a mismodelled circuit breaker (Maungatapere Circuit Breaker 252) required for an outage, identified and corrected before real-time.
- The second breach related to Oamaru-Waitaki circuits MW Limits for a Special Protection Scheme (SPS) incorrectly modelled during a long duration outage appearing in forward-looking schedules and real-time, when the outage was halted overnight. This breach had no market impact and an operational impact never eventuated as system conditions were unlikely to cause the operation of the SPS.

The overall average trend in breaches in our role as system operator continues to decline, however the 16 breaches reported in 2018/19 is up on the 10 breaches reported in the previous year.

We will continue to work to strengthen our operational controls, improve processes and tools, and build our people capability with a goal to minimise future breaches. We have initiatives underway to address trends and areas of identified weakness including control room communication and logging, change management for IST implementation of new tools, and investigations into improvements of operator behaviours.



Refer to Appendix A for instances where the system operator has applied discretion under 13.70 of the Code.

1.1 Update on South Island AUFLS event (2 March 2017)

We are continuing to make progress on the 3 remaining actions from the 13 identified. The three outstanding actions are as follows:

- Action 7. Review procedures across Transpower regarding handover of tools and systems to ensure the tools and systems are able to be effectively operationalised
  - *Update*: We are trialling a new system in regards to tool and system handover into real time operation
- Action 12. Identify, review and address performance of risk management controls, specifically focused on high impact low probability event interactions
  - *Update*: Terms of reference have been agreed for a risk management review of high impact low probability events
- Action 13. Review Transpower's processes for reporting of major power system events, compliance breaches and material failures by Transpower to comply with its own standards and procedures
  - *Update*: A draft major events document is currently being finalised

The complaint raised by the Electricity Authority with the Rulings Panel concerning 12 alleged breaches relating to the 2 March 2017 event is progressing.

Refer to Appendix B for a detailed update of the actions at 30 June 2019.

2 Risk & Assurance

We agreed with the Authority 5 business processes for audit in 2019/20 as per the SOSPA. These processes link strongly with our critical risk controls.

Business Auditable Service	Proposed Completion Date
Planned Asset Testing while connected to the Power System	Q1
Manage a System Event (including a grid emergency)	Q2
Monitor and Adjust Medium Term Load Forecast	Q3
Outage Planning Policy	Q4
Conflict of Interest Management System Operator	Q4

Our annual business continuity planning (BCP) exercise was held on 29 May 2019. This year we held a joint exercise which involved 'standing-up' the Executive, Grid Service Delivery and Operations incident management teams. Several lessons have been captured to improve our future responses, including better access to communication equipment, and training in its use.

Reserve Management Tool (RMT) Change Management Review

Deloitte has completed their review of the RMT change management process and will provide us with a final report and set of recommendations by end of July 2019.

3 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.

Real Time Pricing (RTP)

The project was approved by the Authority Board at its 27 June 2019 meeting. Transpower commenced work on the capital phase of the project on 1 July 2019 to prepare for IST ramp-up on the project from October 2019. Authority Board approval of the initial business case is scheduled for the 8 August 2019 meeting. Transpower activity up to that date will be funded from the technical advisory service statement of work.

Dispatch Service Enhancement (DSE)

The project has been re-planned following an extended testing period. Work is on track for the project to deliver the original scope of the business case by 8 August 2019. However, the forecast cost to complete the project is over the approved business case budget. We are relying on the SOSPA provisions to allow work to continue to meet the 8 August 2019 commissioning date. We submitted change requests to the Authority to cover this overspend, as well as participant transition costs. These requests will be considered by the Authority Board at its 8 August 2019 meeting.

Wind Offer Arrangements

A change request to shift commissioning date of project to 5 September 2019 was approved by the Authority and the project is on track to deliver by this date.

4 Outage planning and coordination

New Zealand Generation Balance (NZGB)

Monthly NZGB reports in this quarter have indicated a number of N-1-G shortfalls over the early winter months. Sensitivity analysis to reflect gas shortage and peak winter load scenarios has also been provided. Sufficient generation balance margins were seen during the Pole 3 HVDC outage in May based on outage information ahead of time.

We are also analysing several scenarios to determine expected margins during the HVDC 2020 work.

Outage Planning

There was a 3-hour HVDC outage during the night on Monday 1 July 2019 in response to a short-notice outage request to enable the Grid Owner to replace some voltage measurement components, aimed at resolving the frequency oscillations seen in June 2019. If there are further oscillations, a further outage may be needed. We will continue to liaise with the HVDC team to ensure any outage is scheduled to avoid unnecessary market impact.

HVDC 2020 Outages

The Grid Owner has scheduled major outages of the HVDC poles in January to April 2020. We are continuing to work on co-ordinating the system operator aspects of the HVDC 2020 outages. This includes review of the test plans and continued monitoring of scenarios to estimate the generation balance margins during the outages. These scenarios include a gas shortage and minimal wind generation – particularly during the four bipole outages. We are meeting regularly with the HVDC team to discuss associated risks. To ensure impartiality as system operator in the work we do, any relevant information is communicated to both the industry and the Grid Owner. A webpage has been set up on the Transpower website to share information. An independent consultant from Canada is being engaged to review testing requirements to reinforce the impartiality aspect. We will be providing further information and the opportunity for participants to discuss the outages at a briefing in the last week of July 2019.

5 Power systems investigations

Battery Energy Storage Systems

In June 2019 we published our investigation into the impact on the operation of the New Zealand power system from the inclusion of large amounts of distributed solar PV and battery energy storage systems. The investigation looked at how these distributed energy resources could change the daily load profile and impact on voltage and frequency management.

Argentina, Uruguay and Paraguay blackout - 16 June 2019

The recent blackout across Argentina, Uruguay and parts of Paraguay impacted approximately 48 million people for up to 14 hours. Argentinian officials have stated that the cause was related to an automatic generation disconnection system not responding to an islanding event due to its configuration being out of date. In addition, 69 out of 74 distributors and big energy consumers did not disconnect sufficient demand to rebalance supply and demand as expected.

Like the Australian NEM separation, an event of this magnitude is an opportunity for us to learn and ensure our controls are effective in preventing a similar event occurring in New Zealand. We will be sharing any learnings for New Zealand via a report later this year.

6 Performance metrics

The following dashboard shows system operator performance against the performance metrics for the financial year 2018/19 as required by SOSPA 12.3 (a).

Our customers are informed and satisfied		Annual Target	Actual to Date
Improved annual participant survey result		80%	85%
Improved annual participant survey result response rate	Response rate to online survey	25%	16%
	Response rate from first tier stakeholders	80%	80%
On-time special event preliminary reports		90% ≤ 10 business days	N/A
Industry leadership and insights	Edge technology report	≥ 1	1
	Publicly available market insights	≥ 8	14

We maintain Code compliance and meet our SOSPA obligations		
Market breaches remain below threshold	≤ 3 @ ≥ $45k	1
Breaches creating a security risk remain below threshold/within acceptable range	≤3	0
On-time Code and SOSPA deliverables	100% (47)	100%

We deliver projects successfully			
Improved project delivery	Service Maintenance projects	≥ 60% achieved for approved time/budget	50%
	Market Design and Service Enhancement projects	≥ 60% achieved for approved time/budget	0%
Accurate capital planning		≥ 50%	66.67%

We are committed to optimal real time operation		
Sustained infeasibility resolution	100% ≤ 2 business days	100%
	80% ≤ 1 business day	98%
High spring washer resolution	100% ≤ Code obligations	100%
	80% ≤ 1 business day	100%

Our tools are fit for purpose		
Improved capability functional fit assessment score	74%	67.6%
Improved technical quality assessment score	60%	63%
Sustained SCADA availability	99.90%	99.97%
Maintained timeliness of schedule publication	99%	99.99%

7 SOSPA Deliverables

We submitted all our 2018/19 end of financial year SOSPA deliverables to the Authority by 30 June 2019. These included the Strategic Plan; Business Plan; Stakeholder Education and Engagement Plan; Statutory Objective Workplan; and Capex plans and roadmaps. We also submitted our Performance and Incentives Agreement, although the formal Authority approval of this is delayed until the System Operations Committee in August 2019.

8 Actions taken

The following table contains a full list of actions taken during Q4 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**:	• As part of Transpower's efficiency programme, we have been progressing a situational intelligence toolset. The original scope of the investigation has been delivered ahead of schedule and under budget. The scope of the investigation has been extended to include an additional sprint to incorporate user feedback into the concept. • We have prepared a security of supply strategic workplan for the next 4 years as part of our development of the function. • We implemented improvements in the annual participant (customer) survey to make it shorter and the feedback more relevant and insightful. • We implemented the SOSFIP policy, including treatment of contingent storage. • We published a report on the potential for energy storage technologies. • We completed 5 of the 9 actions resulting from recommendations from the review of role impartiality between Transpower's grid owner and system operator roles. We are awaiting finalisation of Transpower conflict of interest policy to align the remaining four actions. • As part of our commitment to efficient energy market operation and reserves procurement, we have agreed a process to work with the Authority in 2019/20 to determine meaningful metrics for 2020/21.
(ii) To comply with the **statutory objective work plan**:	**Review of the Security of Supply Forecasting and Information Policy (SOSFIP)** • We completed the SOSFIP review in June. The new policy will take effect from 1 August 2019.
(iii) In response to participant responses to any **participant survey**:	The **two areas of growth identified in the May 2018 survey**: • *Communications around operations* – In April we held a teleconference outlining our planning and approach for May 2019 HVDC outage. • *Promotion and growth of education and information provision* During this quarter we completed our HRC 101 series of

Item of interest	Actions taken
	newsletters to increase understanding of our Security of Supply modelling. We also held industry workshops on the new SOSFIP implementation.
(iv) To comply with any **remedial plan** agreed by the parties under SOSPA 14.1	N/A – No remedial plan in place.

9 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 2017 and reporting will start in the 2019/20 year.

10 Technical advisory hours and services

The following table provides the technical advisory hours for Q4 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 Q4
TAS SOW 82 – Real Time Pricing	In progress	656.75
TAS SOW 83 - Provide ROM for system changes to support removal of constrained on payments for ramp-constrained generation	In progress	5.00
TAS SOW 84 - Deliver interim operational guideline for new connection of new generation technology in the wholesale market	In progress	146.00
Total hours		**807.75**

The maximum carry-over of 25% of unused base technical advisory hours (110 hours) was rolled over to Q4 (SOSPA 15.8). These hours were fully utilised during May.

11 Separation of Transpower roles

The entries below have been entered into the conflict of interest register in the last quarter. These issues are being handled in accordance with Transpower's policy for managing conflicts of interest.

April: We closed one entry in April; a plan to manage the conflict has been established and will be reviewed on a regular basis.

May: Two new issues were raised in the conflict of interest register in May:

- As system operator we provided a view on the need for Waikato and Upper North Island Voltage Management investment to resolve forecast transient

overvoltage risk. This has been closed now that the view has been shared with the grid owner;

- The Authority raised a concern regarding perceived favourable treatment of the grid owner in the system operator's recommendation of causer for the under-frequency event of 14 December 2018.

June: One issue was re-opened as additional management actions were put in place.

- A project has been initiated to co-ordinate the different activities Transpower as system operator is responsible for as part of the 2020 HVDC outages. This includes ensuring the right information is being communicated to all other industry participants and the system operator is acting prudently and impartially.

System Operator Open Conflict of Interest Issues		
ID	Title	Managed by
9	HVDC Outages 2019/20	Operations Planning Manager
18	Recommendations from Conflict of Interest Review	Compliance and Risk Manager
21	Staff interest in generator commissioning	GM Operations
22	Information Management – Data classification	SO Power Systems Group Manager
26	Response to 14 December UFE recommendation	SO Power Systems Group Manager

12 Customers

Teleconference on HVDC Outages

Transpower held a teleconference in April 2019 on the HVDC outage planned for 11 and 12 May 2019. At the teleconference, representatives from the system operator and grid owner explained to the industry the work involved, with the system operator providing a security overview. Given the anticipated conditions, we forecast there was sufficient generation margins during the outage but undertook additional analysis to test these margins with lower gas-fired generation, lower North Island hydro storage and no wind.

Planned Outage Co-ordination Process review

We provided a draft recommendation to the Authority regarding co-ordination of a review of the Planned Outage Coordination Process (POCP). The last review was carried out in 2013 and feedback from industry at our annual outage forum was supportive of a further review. The review will cover the functionality of the system, but we expect discussions around the mandatory use of POCP to disclose outages and inclusion of gas outages into POCP will be hot topics.

System performance

13 Operational and system events

April

Market and SCADA systems

In April the control rooms were impacted by intermittent loss and degraded performance of some of our critical tools. These were managed in line with existing business continuity processes, notably as a result of the dual control room operation. The issues were as follows:

- Just before midnight on 3 April 2019, there were major interruptions to multiple tools in the Hamilton control room. Responsibilities were managed from Wellington. Most of the impacted systems were restored before the morning peak with full restoration by 9am on 4 April 2019.
- On 20, 24, 26 April 2019 we experienced several brief disruptions to our SCADA tools that monitor and control systems.

As we were undertaking a lifecycle upgrade to part of our SCADA system at the time, following advice from the vendor (GE), we considered the most prudent course of action was to wait for our planned hardware upgrade to be implemented. As expected, this upgrade resolved the issues which have not recurred.

May

Black start testing - Maraetai

Black start testing was completed at Maraetai on Saturday 4 May. The last black start test of Maraetai was completed in 2015; this was the first black start test since the Maraetai bus coupler has been installed. The test itself went well, though there was an issue with voltage during restoration. The equipment involved was under outage and under test conditions. This issue is captured in the black start report which is close to being completed.

June

HVDC Oscillations:

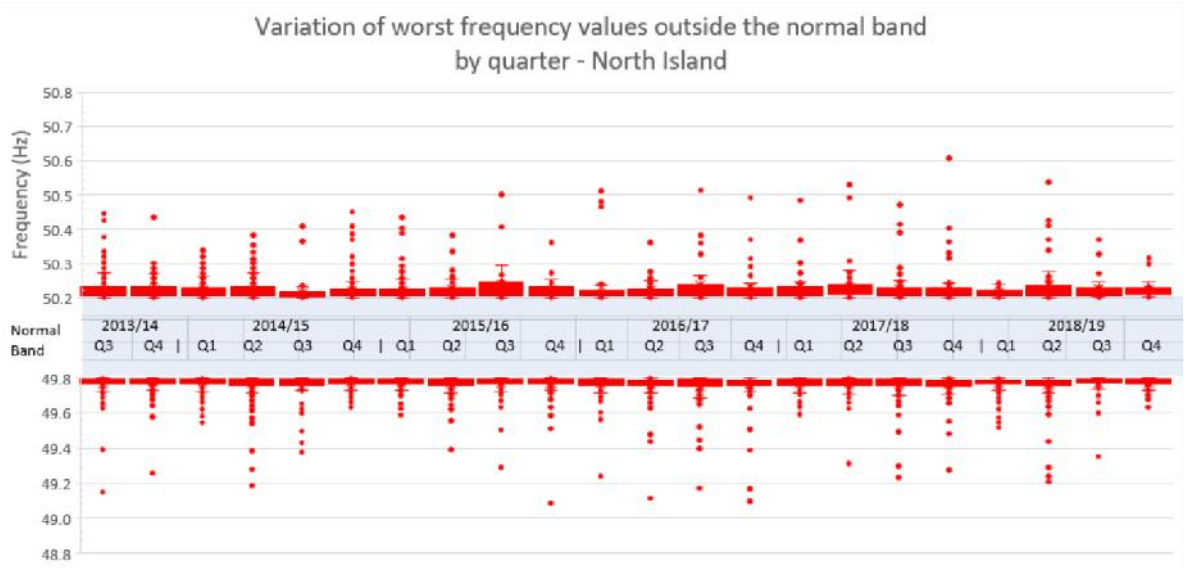
Light flicker in Wellington on 31 May 2019 led to the identification of oscillations occurring on the HVDC. A subsequent investigation showed there had been some previous occurrences over the previous three months. The voltage measurement device on Pole 2 at Haywards has been identified as a possible cause and the grid owner is taking steps to resolve this. In the meantime, the system operator has agreed mitigation measures should it reoccur in order to maintain system security. We communicated this information to industry via a teleconference on 10 June 2019.

14 Frequency fluctuations

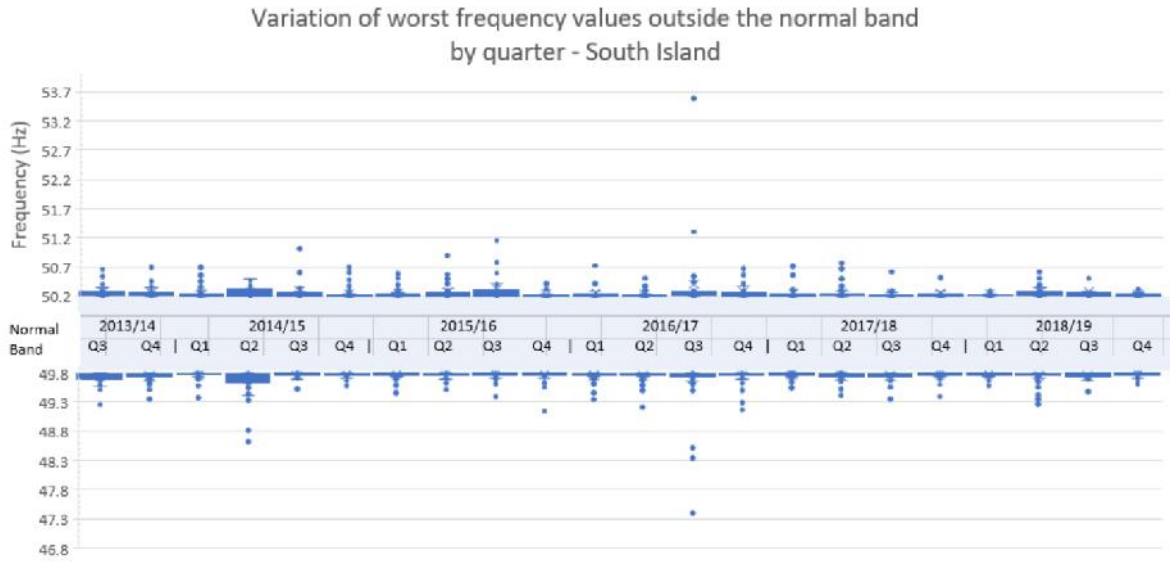
14.1 Maintain frequency in normal band (Frequency value)

The following charts show the distribution of the worst frequency excursion outside the normal band (49.8 to 50.2 Hz) by quarter since July 2014, including the reporting period.

North Island



South Island

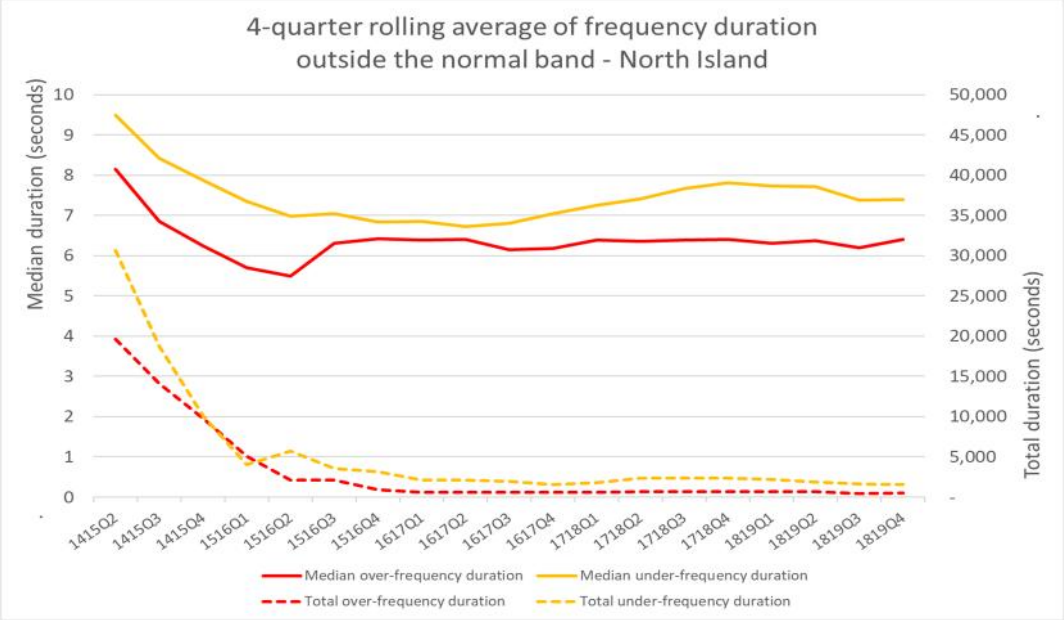


Note: These box and whisker charts show the distribution of data. The “box” represents the distribution of the middle 50% of the data, the “whiskers” indicate variability, and outliers are shown as single data points.

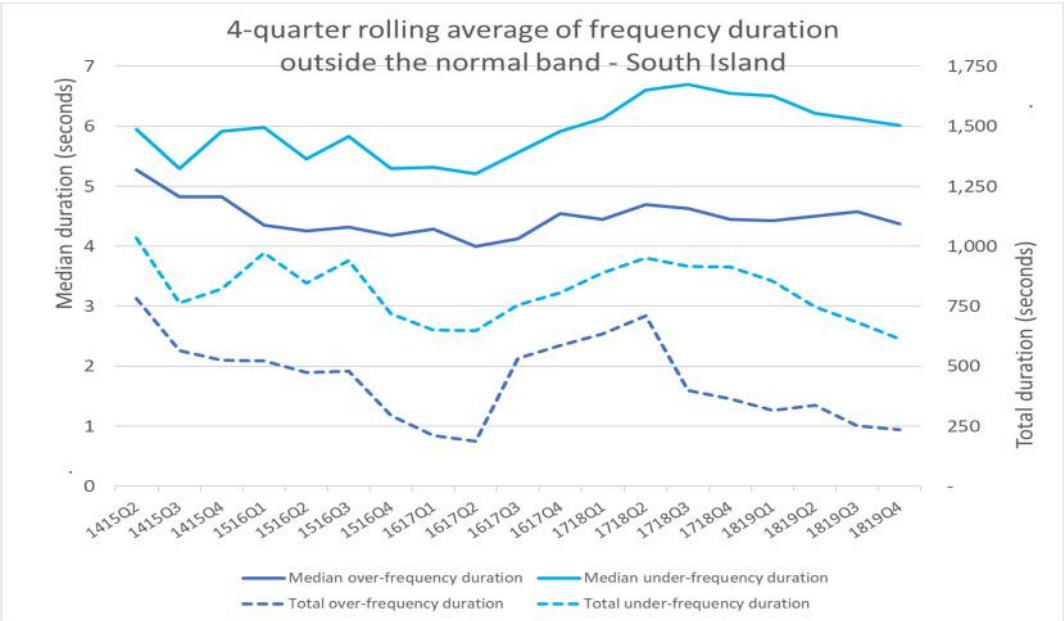
14.2 Recover quickly from a fluctuation (Time)

The following charts show the median and total duration of all the momentary fluctuations above and below the normal band for each island. The information is shown as a 4-quarter rolling average to illustrate trends in the data.

North Island



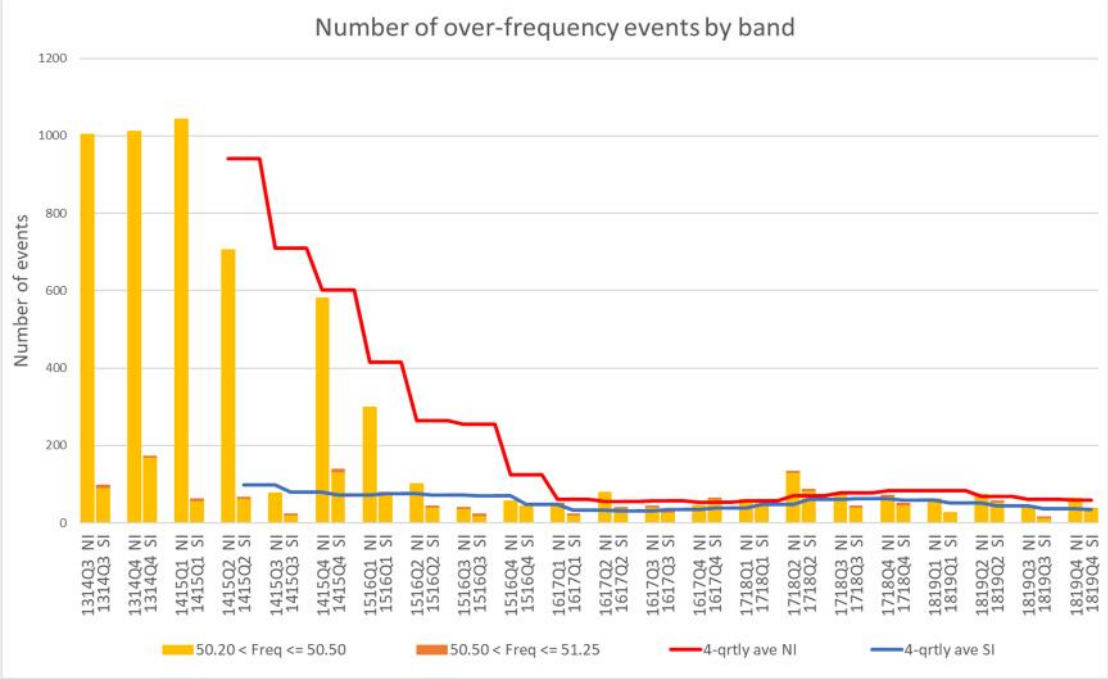
South Island



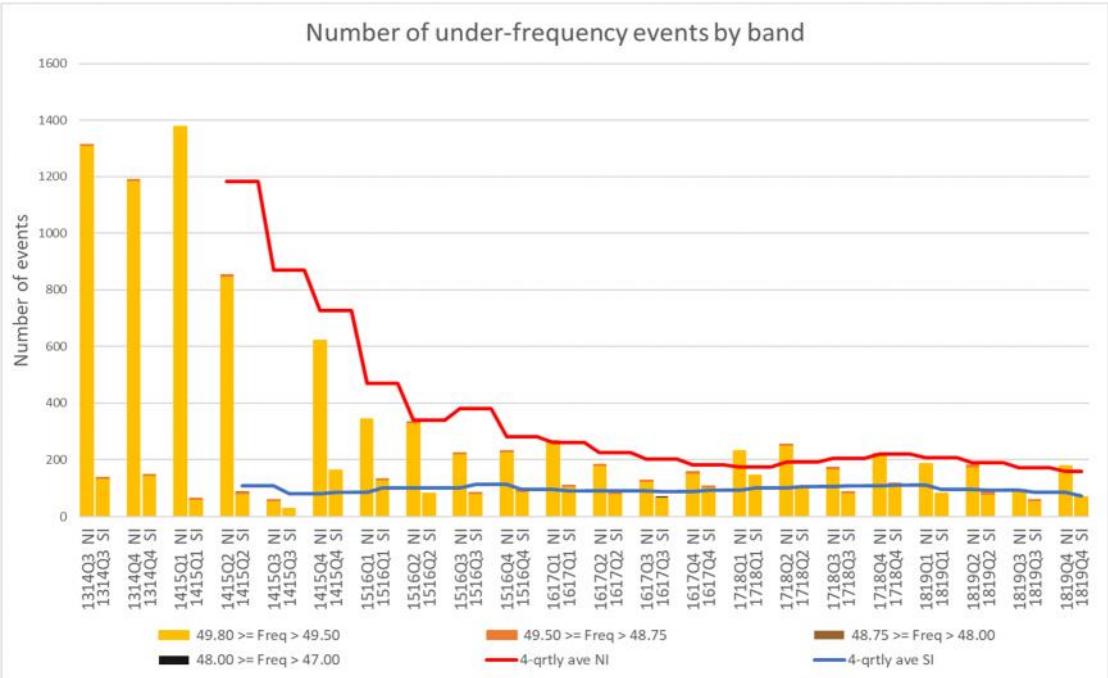
14.3 Manage frequency and limit rate of occurrences during momentary fluctuations (Number)

The following charts show the number of momentary fluctuations outside the frequency normal band, grouped by frequency band, for each quarter since 2014. The information is shown by island, including a 4-quarter rolling average to show the prevailing trend.

Over-frequency events



Under-frequency events



14.4 Manage time error and eliminate time error once per day

There were no time error violations in the reporting period.

15 Voltage management

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

16 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	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19
Demand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	-	1	-	-	-	-	-	-	1	-	-	-
Warning Notice	1	-	-	-	1	-	-	-	-	-	-	1
Customer Advice Notice	2	9	9	6	20	20	16	6	7	4	8	17

17 Grid emergencies

The following table shows grid emergencies declared by Transpower as system operator from April to June.

Date	Time	Summary Details	Island
Apr-19		None	
May-19		None	
Jun-19		None	

18 Security of supply

Since the significant inflow event in late March, regular inflows have kept storage above average for this time of year, and consequently risk has remained low. National controlled storage at the end of April was 107% of average, however, North Island storage was particularly low (66% of average).

National storage remained steady throughout most of May, and North Island storage continued to decline, until a major rainfall event occurred across the country at the end of May. This caused even further increases to the already high South Island storage levels (reaching 135% of average at its peak), while North Island storage received a much-needed boost. This increased storage supported high levels of hydro generation, particularly from the South Island, and with this consumption national storage dropped to a still healthy level of 117% of average. With the return to service of the Kupe and Pohokura gas fields at the end of May, the amount of gas

available for electricity generation was restored to normal. This was the first time since September that both hydrology and gas had been in healthy supply at the same time.

In late June we saw unusually low lake levels at Waikaremoana after little rainfall and a rapid decline in the last week of June. A significant inflow in early July helped alleviate the issue and based on our analysis regional network security is not under threat in the short term although we are continuing to monitor the situation closely and have planned mitigation measures in place.

Security of Supply Forecasting and Information Policy

The review of our Security of Supply Forecasting and Information Policy (SoSFIP) has been completed, and the new version will come into effect on 1 August 2019. The policy relates to the operational management of Security of Supply and the key change is the inclusion of contingent storage for risk analysis. We are currently adapting our internal processes in preparation for this new policy, and we hosted an industry workshop on 4 July 2019 to discuss and explain the changes.

19 Ancillary services

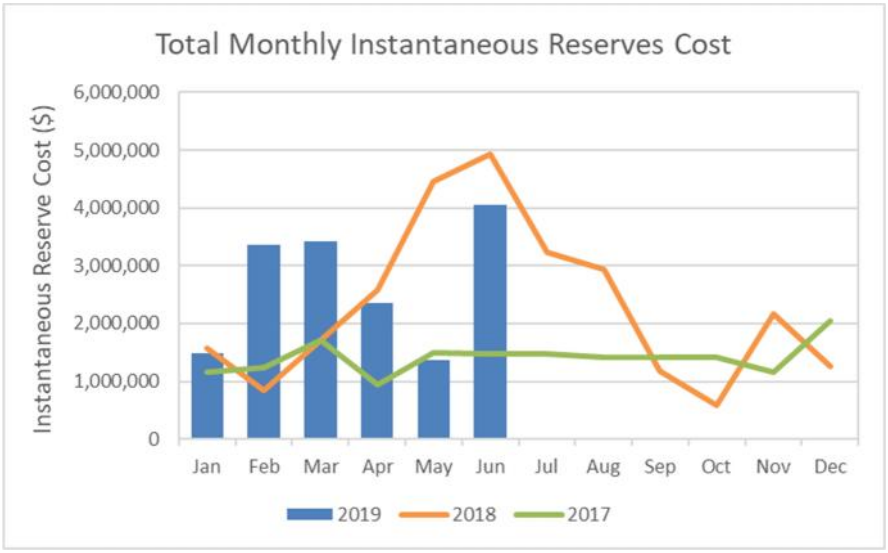
Ancillary service costs decreased by 27% in April to $3.73 million, a decrease of $1.36 million from March. In both February and March, the ancillary service costs had been in the order of $5 million.

In April, the largest decrease was for Instantaneous Reserve costs which decreased by $1.07 million (31%) to $2.35 million. This likely reflects the re-valuation of fuel following the increase in hydro storage in late March and resolution of the gas supply issues in February/March. In addition, April demand was low for a period of two weeks due to Easter and Anzac public holidays and school holidays.

In May, costs decreased by 18% down $577k from April.

In June, the largest decrease was for Instantaneous Reserve costs which decreased by $981k (72%) to $1.37 million, reflecting continued decline in the cost of fuel following the increase in hydro storage and resolution of the gas supply issues in February through April.

As we enter winter, higher loads create a tighter power system over the peaks pushing up the price of energy and reserve. This was very apparent in June as 44% of the monthly reserve costs ($1.7M) accumulated over 7 days when the system was tight and temperatures cold. This was in stark contrast to May which was a warmer than average month with few cold snaps.



April's frequency keeping costs decreased by $294k (20%) to $1.167 million. Although the procurement of Frequency Keeping increased slightly (+$200k), the overall decrease was a result of decreases in the constrained on (-$1.642k) and constrained off (-$492k) costs.

May's frequency keeping costs increased by $401k (26%) to $1.568 million. This included an increase in the procurement of Frequency Keeping (+$421k), as well as a small increase for constrained on (+52k), offset by a decrease in constrained off (-$72k) costs.

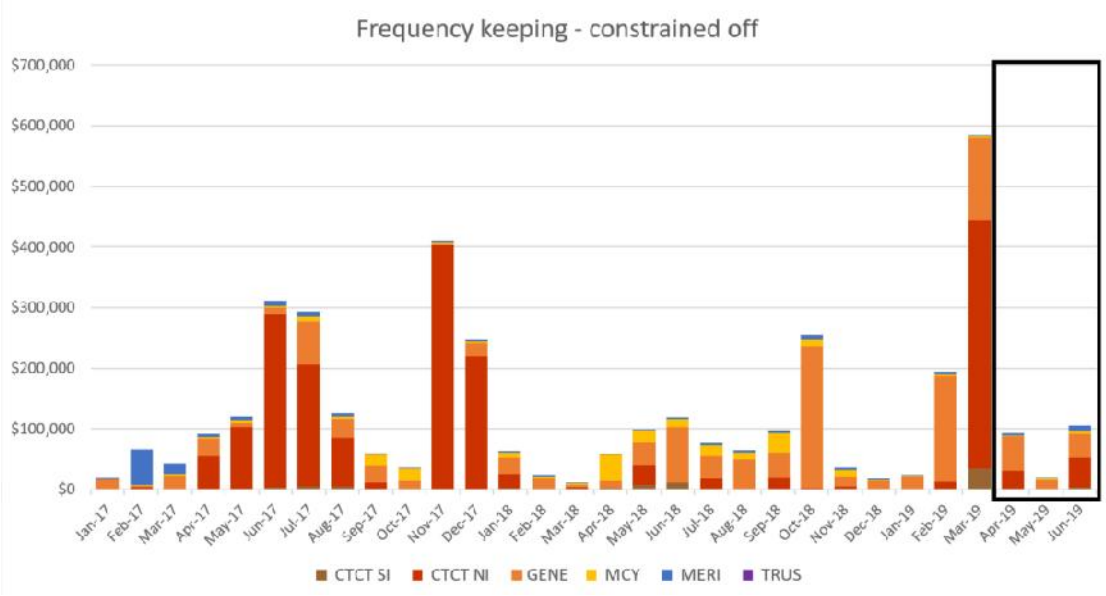
In June frequency keeping costs decreased by $466k (29.7%) to $1.101 million. This includes a decrease in the procurement of Frequency Keeping (-$500k), as well as a small decrease for constrained on (+52k), offset by an increase in constrained off ($86k) costs.

Refer to Appendix C for more detailed Ancillary Services graphs.

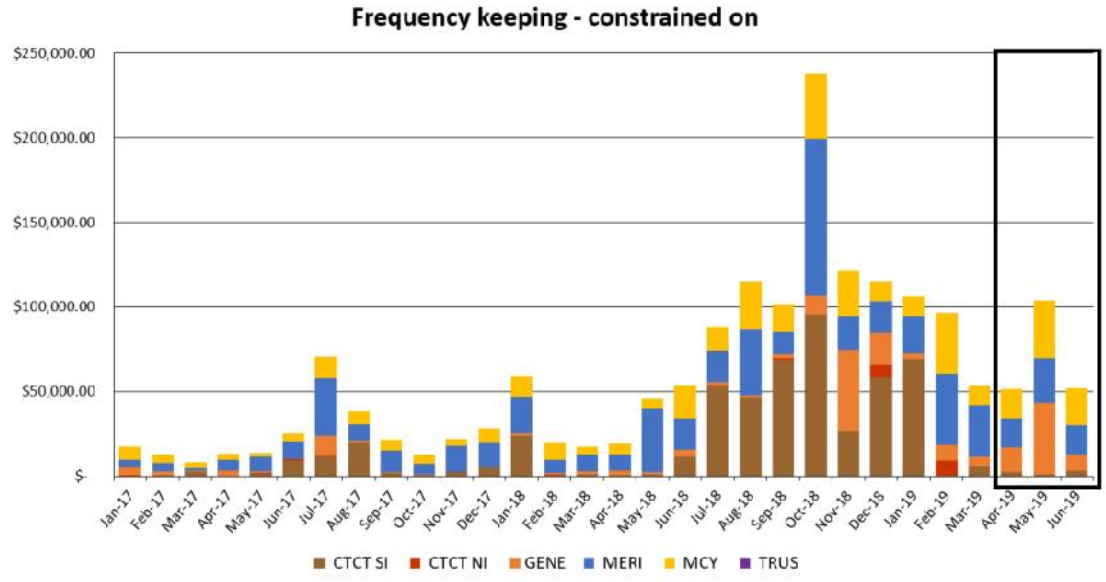
19.1 Constrained on/off costs

Note: Where there is a high payment, as opposed to in increasing/decreasing trend, it will often relate to payments over a small number of trading periods.

Frequency Keeping

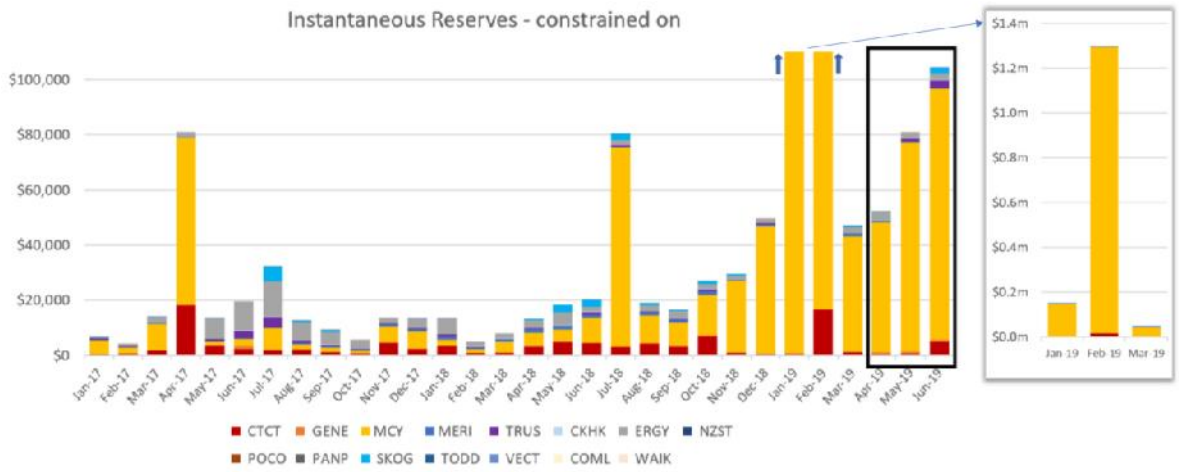


Frequency Keeping constrained-off costs for the quarter returned to their normal winter range.



Constrained-on costs for frequency keeping were higher in May due to low HVDC transfer during the monopole outage on 12 May 2019. This required us to switch off the HVDC's Frequency Keeping Control, requiring additional procurement of frequency keeping reserve.

Instantaneous Reserves



Constrained-on reserve costs for June were $100,000. $41,000 of this occurred over four trading periods on 5 and 9 June 2019. These costs were paid to Mercury as a result of Maraetai being constrained on for reserve to support high HVDC transfer during the morning peaks.

Note: The graph shows the costs for the January to March on a different axis as they are considerably higher than constrained on amounts for Instantaneous Reserves for any other period.

Appendix A: Discretion

April

Event Date & Time	Event Description
	There were no applications of discretion during April 2019

May

Event Date & Time	Event Description
01-May-2019 18:00:57	HLY2201 HLY5 : Required for offload violations due to TKU_WKM_1 outage and slow ramping plant.
01-May-2019 18:27:20	HLY2201 HLY5 : Required for offload violations due to TKU_WKM_1 outage and slow ramping plant
01-May-2019 18:52:33	HLY2201 HLY5 : Required for offload violations due to TKU_WKM_1 outage and slow ramping plant
03-May-2019 14:00:08	ARG1101 BRR0 : Return to Service ARG_KIK_1
20-May-2019 06:28:05	ARG1101 BRR0 : Power System Operation on BLN_KIK cct
24-May-2019 15:29:28	ARG1101 BRR0 : To allow return of ARG_BLN circuit.
31-May-2019 13:01:59	ARG1101 BRR0 : Discretion to allow ARG_BLN cct return.

June

Event Date and Time	Description
04-Jun-2019 08:55:25	RPO2201 RPO0 : Planned switching
04-Jun-2019 09:13:29	ARI1102 ARI0 : Security issues with HTI_TMU_1 contingency violating ARI_BOB-1 at 07:30
14-Jun-2019 13:00:10	ARG1101 BRR0 : Required for switching to restore ARG_BLN CCT
17-Jun-2019 06:12:59	ARG1101 BRR0 : Required off for planned switching on the ARG BLN circuits
21-Jun-2019 13:32:57	ARG1101 BRR0 : Discretion ARG to 0MW in preparation for ARG_KIK 1 cct return to service

Appendix B: Update on South Island AUFLS event (2 March 2017)

Action	Accountable	Due	Status
1.Agree an approach, to be used in future, by protection designers and technicians, to enable access to site-specific information on protection schemes • Confirm the purpose of existing and newly required documentation and how it fits into a wider documentation structure, identifying linkages to existing systems and processes. • Workshop a solution with impacted stakeholders including designers, technicians, operators, the SO, and the NGOCs, developing a set of templates for site specific information based on learnings. (Workshops 24 May, 7 June) • Investigate methods for Service Providers to review site specific queries and information added by designers. • Agree ownership of agreed system and information (including the maintenance of information), confirming roles and responsibilities. • Create a change and implementation plan.	Grid Development	June 2018	Complete
2.Develop a process that supports protection designers in gaining clarity on isolation, testing and maintenance requirements for future protection schemes early in the design process - allowing for appropriate consultation with protection technicians who will be undertaking the work • Work with designers and service providers to define an agreed list of minimum interface requirements for new protection schemes. (Workshops 24 May, 7 June) • Develop a set of design principles for the validation/accreditation of the design and construction of new schemes. • Confirm a method of displaying the technical aspects of protection systems being installed (Linked to Action 1). • Compile a document that describes the proposed process and present at a forum for designers and service provider technicians. • Develop changes and create an implementation plan.	Grid Development	June 2018	Complete

Action	Accountable	Due	Status
3.Consider providing real-time SCADA data to technicians - Consider providing near real-time SCADA data to technicians (Sept 2018) - Investigate options to meet the need of technicians for better on-site visibility of the real-time system (including access to near-real time SCADA) - (Additional step added Nov 2018) Develop business case for a preferred solution (June 2019)	Operations	Dec 2018	Complete
4.Improve current outage planning processes to include a risk-based approach that assesses requests for outages of protection equipment to identify maintenance activities that have a high system impact (including the impact of other concurrent planned outages) - Confirm plan for improving current outage planning process (31 Jan) - Review effectiveness of regular SO/GO meetings for identifying major protection outage concurrencies and protection issues, and protection group's involvement in Annual Outage Plan review. (28 Feb) - Identify protection outages which involve increased risk and significant impact, update IONS with information for the relevant outage blocks (29 March) - Agree processes and responsibilities for using this information - Develop process for updating information - On-going related work continuing in parallel determine which outage blocks require protection advice - Implement Communication Plan on changes, core teams by end of April, wider communication by end of May	Operations	June 2018	Complete
5. Review the existing Autosync tool and procedures to support NGOC grid asset controllers and NCC system co-ordinators working under pressure - Discussions with NCC facilitated to find a clear outcome that is technically and operationally fit for purpose - Tool Interface solution being developed by NCC. Options provided for business case completion - Implementation of tool interface changes - Technical Protection changes proposed	Operations	June 2018	Complete

Action	Accountable	Due	Status
) Sync-check functionality on the relay to be discussed with TP Protection Functions meeting			
6. Re-emphasise and embed through regular training of NGOC and NCC staff the importance of compliance with policies and use of procedures during restoration after rare events) Develop and refine single shared Autosync operational documentation and checklist) Role clarifications for NCC and NGOC coordination centres) Create simulator experiences for Autosync operation) Complete training of all NCC and NGOC teams through Autosync operations) Capture feedback from all NCC and NGOC staff post simulation to refine documentation) Align training schedules for NCC and NGOC teams to allow for integrated training exercises) Increase monitoring of operational communications by senior NCC staff during normal operations and during simulator training, to build core competency and ensure Code-compliant communications are being used.) Implement 'human factors' e-learning training material to NCC and NGOC staff.) Review policy to ensure clear guidance is provided for changes to Grid Owner offers following asset trips) Reiterate compliance with Manual Reclose Policy (which requires identification of trip causation)) Implement HILP-style events into future real-time training simulations. Current NGOC and NCC operator training sessions each have major (HILP) simulation events. Planning for the next sessions is underway and includes similar-style major event simulations.) Include in training reinforcement of policies and procedures used during event management	Operations	Dec 2018	Complete
7. Review procedures across Transpower regarding handover of tools and systems to ensure the tools and systems are able to be effectively operationalized) Review procedures across Transpower regarding handover of tools and systems to ensure tools and systems are able to be effectively operationalised) Service Delivery Lifecycle (SDL) and Project Delivery Framework (SDF) processes are reviewed for compatibility with grid asset project deliveries	Operations	Dec 2018	Missed

Action	Accountable	Due	Status
• Ensure Transpower's policy and processes for asset developments reflect similar handover principles to those found in the SDL and SDF. • The process solution is tested for suitability and implemented across Transpower *Update: Action 7 has missed the deadline. A process solution is nearing completion and its suitability is being tested for application across Transpower. The Operations, Process and Technology Improvement (OPTI) Team has revised its structure to ensure the effective delivery of its functions across the entire business. A system is currently being trialed in regards to tool and system handover into real time operation.*			
8. Investigate improvements in the design and use of the market model and market system to assist in the management of large scale system restoration events • Investigate improvements in the design and the processes for using the market model and market system to assist management of significant system restoration events • Investigate having the market model being at all times reflective of the real time SCADA model (allowing SPD to support system restorations without having to manually update the market model).	Operations	Dec 2018	Complete
9.Work with industry and real-time teams within Transpower to address issues with operational communications • Ensure real-time operations demonstrate Code-mandated inter-control room communications requirements and require interactions with industry control rooms to reflect compliance with the same Code standard. • Work with industry and real-time teams within Transpower to address issues with inter-control room communications (to meet requirements of Part 8 Tech Code 3 of the Code)	Operations	Dec 2018	Complete
10.Work with generators to assess what real-time information could assist them with visibility of the system during events and investigate the practicability of providing this • Work with generators to assess what real-time information could assist them with visibility of the system during events and investigate the practicability of providing this information.	Operations	Dec 2018	Complete

Action	Accountable	Due	Status
• Include in September workshop (see Action 9) an investigation with Industry of options for improving communications during major events. • Consider options for providing industry with up to date information during complex, busy events. • (Additional step added Nov 2018) A interim solution in place via email, will continue to investigate other options			
11.Require technicians testing and maintaining protection schemes to document in their Work Method Statement how, at each stage of their testing process, they will affirm no adverse outcomes have occurred as a result of their work. • Review internal AUFLS Reports and Electrix work method statements (22 Jan) • Assess these reviews against recent issue (17 Sept 2017) of work statements requirement documentation (22 Jan) • Determine if changes if necessary post review and assessment (12 Feb) • Develop changes and implementation plan as required (end of May)	Grid Projects	May 2018	Complete
12.Identify, review and address performance of risk management controls, specifically focused on high impact low probability event interactions. • Identify, determine how to review (including with use of an external reviewer) and address performance of risk management controls, specifically focused on high impact low probability event interactions. • Utilisation of internal Audit process to focus on controls and a scheduled internal audit (Dec 2018-Feb 2019) of control room communications • Carry out review, as determined in the first component, of Transpower's risk management of controls including high impact low probability events (June 2019) *Update: Action 12 has missed the deadline. This action relates to our risk management and as part of the action an enterprise level review of our risk management framework was proposed. The terms of reference have been agreed for a risk management review of high impact low probability events.*	Operations	Dec 2018	Missed

Action	Accountable	Due	Status
13. Review Transpower's processes for reporting of major power system events, compliance breaches and material failures by Transpower to comply with its own standards and procedures. • Agree with the Electricity Authority the scope of this process • Prepare documented event reporting process with input from the Electricity Authority as required • Implement processes changes for managing compliance and internal failures to follow operational process as identified *Update: Action 13 has missed the deadline. The draft major events document is currently being finalised.*	Operations	Dec 2018	Missed

Appendix C: Ancillary Services Graphs