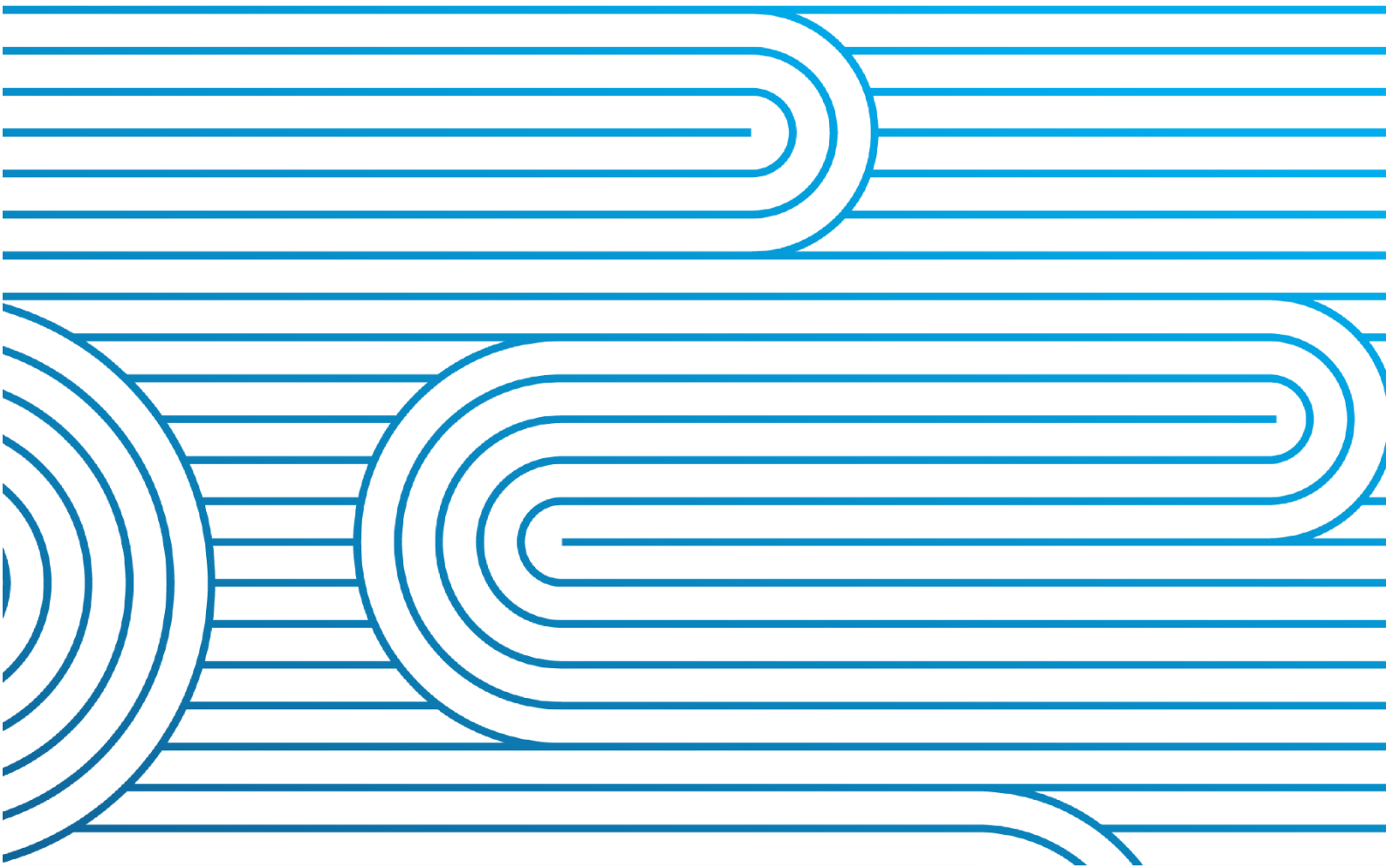
TRANSPOWER

Monthly System Operator and system performance report

for the Electricity Authority

October 2022



Report Purpose

This report is Transpower's review of its performance as System Operator for October 2022, in accordance with clause 3.14 of the Electricity Industry Participation Code 2010 (the Code).

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

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System Operator performance

1 Key points this month

- **RTP**: Phase 3 was successfully deployed into production on 18 October and was live in the market at midnight on 1 November. Phase 4 development and testing is now continuing in parallel.
- **Customer Portal Programme**: The new NZ Generation Balance (NZGB) application was successfully deployed in the Operations Customer Portal on 3 November.
- **7 October events**: We worked closely and well with the industry to minimise the effects of the HVDC filter outage, under-frequency event and grid emergency situation.
- **Operational Excellence**: We are well underway translating the output from the external consultant's review into an executable programme of work.
- **KPI Refresh Programme**: We have been working with Authority staff on pinpointing suitable metrics for external reporting. We are now nearing the end of the workshops and will be collating feedback during November.
- **Industry engagement**: We continue to inform, and be informed by, other industry players in New Zealand and overseas on adapting to the changing environment with more interruptible generation and distributed resources. This month these engagements included working closely with electricity distribution companies, considering resource adequacy, briefing the industry on a number of operational issues in New Zealand and attending the Association of Power Exchanges conference attended by other system operators from around the world.
- **Risk**: We have concluded the second of our business assurance audits for 2022/23 - Defects and Enhancements audit.
- **NZGB forecasting**: The NZGB tool is forecasting no shortfalls for the next 200 days. Looking ahead to spring and summer, margins are increasing, although there are some lower margin periods in mid-November and in February due to generation plant outages and the HVDC outages respectively.
- **System events**: One new 'moderate' significant incident occurred in early October when there was a loss of supply at Tauranga on 13 October 2022 due to bird activity. An investigation has commenced with an initial focus on capturing event data and building a timeline of the incident.
- **System Security Forecast**: This year's major SSF update includes a number of significant changes. The work is continuing, and a report will be published prior to the new year.
- **Security of Supply:** Currently hydro storage is 149% of average for the time of year. We are urgently investigating likely options for managing winter 2023, in anticipation of similar behaviour occurring next year as we saw this year due to the effect of the reduced thermal offers and higher peak loads.

2 Customers and other relationships

Industry briefing – tight residuals

In response to observing unusually high peak demand and tight residuals during the week 3-7 October, as a cold snap moved across New Zealand, we published a low residual Customer Advice Notice (CAN) for the morning peak on Tuesday 4 October, and a subsequent CAN for the morning peak on Friday 7 October. This was followed by an industry briefing on the afternoon of Thursday 6 October.

Industry forum

We presented the timeline of the events of the week 3-7 October, including the HVDC tripping, under-frequency event and the issuing of a generation emergency notice, from a System Operator perspective at our fortnightly industry forum with participants on Tuesday 11 October.

Energy Systems Integration Group (ESIG)

We attended an ESIG event on redefining resource adequacy for modern power systems. This event covered a recent report written by the Redefining Resource Adequacy Task Force, and provided an overview of key drivers changing the way resource adequacy needs to be evaluated, identifies shortcomings of conventional approaches, and outlines first principles for practitioners to consider as they adapt their approaches. The central message was “what got us here won’t get us there”.

Real Time Pricing (RTP)

We supported the Authority in the webinar that prepared the industry for the launch of phase 3 of the project on 18 November.

Electricity distribution company cooperation

We have been working with an electricity distribution company and the Authority throughout October to understand growth in peak demand at a more granular, regional level. This analysis has been shared with industry to build a common view on this issue.

FlexForum

We have joined FlexForum as a member, a cross industry group formed to identify a set of actions to integrate distributed energy resources (DER) into the electricity system and markets to maximise the benefits for New Zealand. We informed the Flexibility Plan 1.0 with system operations perspectives.

Annual APEx conference (Association of Power Exchanges)

Dr Jay attended this year’s conference in Dubrovnik where he moderated a session on “New Technologies and Emerging Energy Forums”. The other themes at this conference were “Decentralisation”, “Decarbonisation”, “Flexibility and Resilience” and a session on the regulator’s perspective.

3 Risk & Assurance

Risk Management Framework

We presented a paper at the Authority's November System Operator Committee (SOC) on the System Operator's role and risks around "failing to maintain service levels for consumers". In this paper we acknowledge that our role in ensuring supply meets demand and recovering from unplanned outages is important to consumers but identify no Code requirement for direct service obligations to consumers.

We have begun workshops for the November Risk Control Self-Assessment. We are assessing five critical risk controls: 24 hour real-time; business support functions; incident preparedness & response; power system planning; and support of critical tools & systems.

Business assurance audits

The Defects and Enhancements audit has concluded, it is currently being reviewed internally and will be shared with the Authority once a management response is finalised. The System Operator Load Forecast audit has started. The three remaining System Operator Audits (Voltage stability assessment tool (VSAT) change management, ancillary service contract management, real-time management of simultaneous feasibility test (SFT) constraints) are now planned.

4 Compliance

We did not self-report any System Operator breaches in this reporting period.

9 August event

The directions conference has been rescheduled for 25 November. The Authority and System Operator are continuing discussions around submissions.

5 Impartiality of Transpower roles

We have three open items in the Conflict of Interest Register (below). These are being actively managed in accordance with our Conflict of Interest Procedure.

System Operator Open Conflict of Interest Issues		
ID	Title	Managed by
29	**Preparing the Net Benefit test – System Operator involvement:** The System Operator is reviewing how it can provide information for use by the grid owner undertaking a Net Benefit Test.	Operations Planning Manager
40	**General System Operator/Grid Owner dual roles:** This is a general item that will remain permanently open to cover all employees with a dual System Operator/grid owner role. The item documents the actions necessary to ensure impartiality in these circumstances; these items will be monitored to ensure their continue effectiveness.	SO Compliance & Impartiality Manager
41	**General relationship situation:** This is a general item that will remain permanently open to cover all potential conflicts of interest arising under a relationship situation. This item documents the actions necessary to prevent an actual conflict arising and will be monitored by the SO Compliance & Impartiality Manager to ensure their continued effectiveness.	SO Compliance & Impartiality Manager

6 Project updates

6.1 Market design and service enhancement project updates

Progress against high value, in-flight market design, service enhancement and service maintenance projects are included below along with details of any variances from the current capex plan.

Real-Time Pricing (RTP)
Phase 3 was successfully deployed into production on 18 October and was live in the market at midnight on 1 November. A small number of minor defects have been identified which are planned to be resolved through a patch release on 1 December. Phase 4 development and testing is continuing in parallel.

A change request (CR009) to re-baseline the project for changes to budget was submitted to the Authority on 6 October following agreement through previous change approval to defer budget request until actuals were closer to current budget. The Authority approved the change request following the Board-to-Board meeting on 8 November. Phase 4 procedure and training development will commence in November.

Operational Excellence
We are well underway translating the output from the external consultant's review into an executable programme of work. Planning prioritisation, approach to resourcing the workstreams and initiatives, and development of targeted benefit streams in a format that can be tracked by Transpower's Portfolio Management group, are underway. Checkpoints have been booked with the governance group to ensure the plan meets expectations as we work towards a target of pre-Christmas for delivery of the plan. From the new year, as we progress towards execution, we will move to monthly progress updates.

There is foundational work underway already which is building momentum around procedural assurance, resource planning, backlog grooming, and new start training.

Customer Portal Programme
The new NZ Generation Balance (NZGB) application was successfully deployed in the Operations Customer Portal on 3 November. We have developed a suite of NZGB instruction videos and a NZGB user guide; these are available on the Transpower website.

We will be hosting several NZGB webinars, starting the week of 7 November. These one-hour sessions will give further insight into NGZB and its purpose in the New Zealand electricity market. We will provide an overview of the new application, and the session will provide an opportunity to discuss any questions.

KPI Refresh Programme
Work is underway on the next stage of the KPI refresh programme, which will roll out performance metrics reporting with an external focus, based on External Outcomes discussed with the Authority. We have held four of six sessions with both Operations

and the Authority participation, and the remaining sessions will run through to mid-November. These sessions will develop metrics which will be tracked to provide assurance of System Operator activities. Metrics developed will inform a revised incentives agreement with the Authority for 2023/24.

Future Security and Resilience (FSR) Programme
We continue to support ongoing discussions with the Authority and provide inputs to their issues paper on common quality.

7 Technical advisory hours and services

Technical advisory hours and a summary of all technical advisory services (TAS) to which those hours related (SOSPA 12.3 (d) refers) will be provided in the next quarterly report.

8 Outage planning and coordination

Outage planning – near real time
Outage numbers are approaching the highest of the year with around 170 transmission outages in one week alone, as the weather improves. (Outages tend to peak around mid-November and February-March when we have very high outage assessment workloads.)

New Zealand Generation Balance (NZGB) analysis
The NZGB tool is forecasting no shortfalls for the next 200 days. Looking ahead to spring and summer, margins are increasing, although there are some lower margin periods in mid-November and in February due to generation plant outages and the HVDC outages respectively. We are monitoring these periods.

9 Power systems investigations and reporting

Since July this year the Operations team have been performing analysis to support the delivery of this year's System Security Forecast (SSF). This year's major update will include updated load forecasts, several recently commissioned and committed renewable generation projects, and impending commissioning of several grid upgrades. A few of the more significant changes studied in this review are:

- New GXP at Norwood
- New Reactive Equipment to support high voltage management
- Turitea wind generation
- Harapaki wind farm
- Kaitaia Solar farm
- Tauhara B geothermal generation
- New Statcom at Hamilton

The project team are aiming to deliver the SSF prior to the new year.

10 Performance metrics and monitoring

System Operator performance against the performance metrics for the financial year as required by SOSPA 12.3 (a) will be provided in the next quarterly report.

11 Cost-of-services reporting

The next cost of services reporting, for 2021/22 will be delivered to the Authority before the end of 2022.

12 Actions taken

A full list of actions taken regarding the System Operator business plan, statutory objective work plan, participant survey responses and any remedial plan, as required by SOSPA 12.3 (b) will be provided in the next quarterly report.

System performance

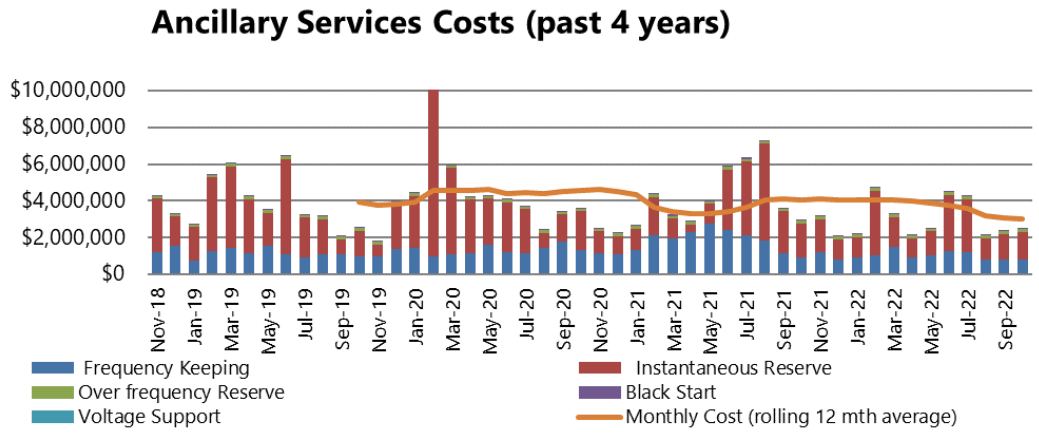
13 Security of supply

Hydro storage had decreased from its high level in August/September. The decrease was attributable to lower inflows and to high levels hydro generation which reflect the high levels of storage. However at the time of writing the southern lakes have received a material inflow event which begun to be visible in the storage: we expect this to elevate lake levels to the high storage quantities seen during early September. Hydro storage is currently 149% of average for the time of year.

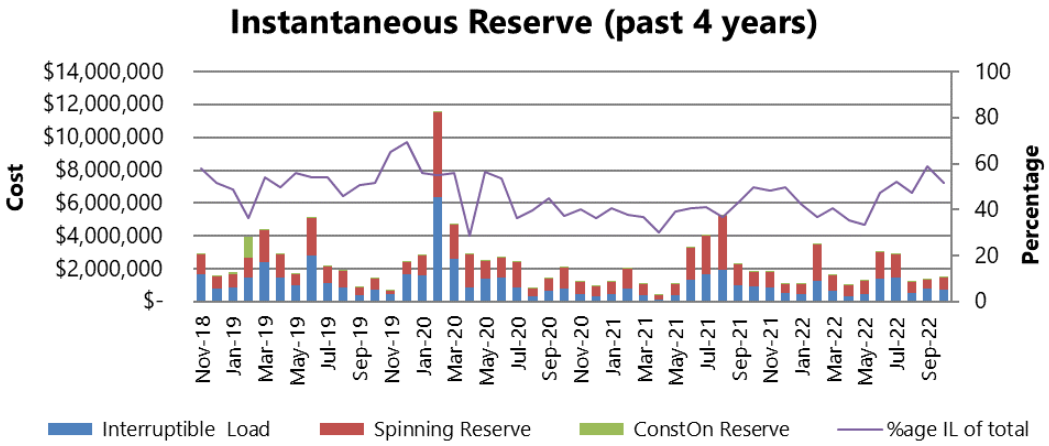
The high hydro generation is keeping prices low, typically around $50/MWh, but price volatility is common during periods of high demand and/or low wind generation. Due to a cold snap on 6 and 7 October, residuals were dropped below 200 MW across several peak demand periods and prices rose above $1,000/MWh. A grid emergency was issued over the morning peak of 7 October due to an unplanned reduction in HVDC transfer. Controllable load was managed, and prices peaked at $2,299/MWh.

Further details can be found in the weekly market update reports: [Weekly Summary and Security of Supply Reporting | Transpower]

14 Ancillary services

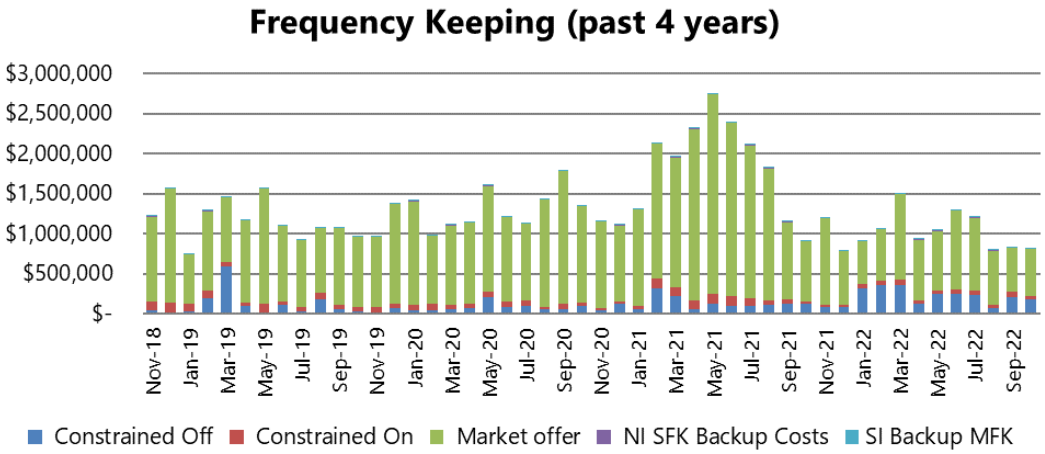


This month's ancillary services costs were $2.52 million, an increase of $86k (3.5% increase) from the previous month and is of the same magnitude as was seen in August and September. Instantaneous reserve costs have increased compared to the previous month while frequency keeping costs decreased; instantaneous reserve costs increased by $97k (7% increase) while frequency keeping costs decreased by $19k (2% decrease).



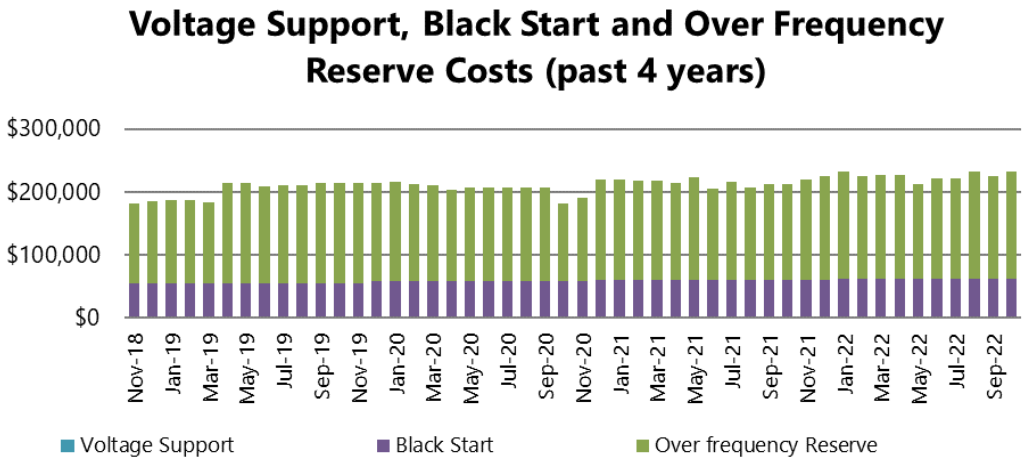
This month's instantaneous reserve costs were $1.47 million, an increase of $97k (7% increase). Spinning reserves were $706k, an increase of $152k (28% increase), in contrast to decreases in both interruptible load and constrained on payments which were $760k, a decrease of $49k (6% decrease) and $8.5k, a decrease of $6.7k (44% decrease), respectively.

Overall quantities of both fast and sustained reserves were higher than the previous month as a result of higher quantities of South Island reserves. Quantities of fast reserves increased in the South Island while in the North Island quantities were similar to last month. Quantities of sustained reserves decreased in the North Island but increased by over 20% in the South Island. The average prices per megawatt of sustained reserves decreased in both the North and South Islands; South Island fast reserves prices per megawatt were the same as last month while North Island fast reserve MW prices more than quadrupled.



This month's frequency keeping costs were $813k, a decrease of $19k on the previous month (2% decrease). North Island frequency keeping costs increased this month by $30k (9% increase) while in the South Island frequency keeping costs decreased by $49k (10% decrease).

Constrained off costs decreased by $26k (12% decrease) while the constrained on costs decreased by $30k (47% decrease).



Over frequency costs rose slightly this month to $171k as a result of higher availability this month. Black start costs remained at $62k this month. There are currently no voltage support costs.

15 Commissioning and Testing

No new items to report this period.

16 Operational and system events

7 October events (HVDC filter, under-frequency event and grid emergency)
During the early morning on 7 October, an HVDC filter tripped. This resulted in the HVDC running back leading to an under-frequency event and a subsequent response from interruptible load. HVDC transfer was then reduced by about 300 MW. With an unseasonal cold morning and high peak, we declared a grid emergency notice (GEN) for 07:15 to 09:30 for the morning peak and began instructing distribution businesses to remove controllable load. The GEN ended and controllable load restoration commenced at 08:00 as the filter was returned to service.

Ahead of the events on Friday 7 October, we saw unusually high peak demand and tight residuals during the week as a cold snap moved across New Zealand. We published a low residual Customer Advice Notice (CAN) for the morning peak on Tuesday 4 October, and a subsequent CAN for the morning peak on Friday 7 October followed by an industry brief in the afternoon of Thursday 6 October.

We presented the timeline of these events from a System Operator perspective at our fortnightly industry forum with participants on Tuesday 11 October.

Significant incident investigations
One new 'moderate' significant incident occurred in early October (as outlined in the list below) in addition to one other active significant event investigation:

- Event 4317 – loss of supply at Tauranga on 13 October 2022 at 21:42 (bird activity). Initial indication is that 68 MWh were lost over a 204-minute period, resulting in a 'moderate' classification. Investigation has commenced with an initial focus on capturing event data and building a timeline of the incident.

- Event 4284 - (multiple lightning strikes in June). We submitted a final report to the Authority, with no breaches or underperformance of the System Operator service identified.

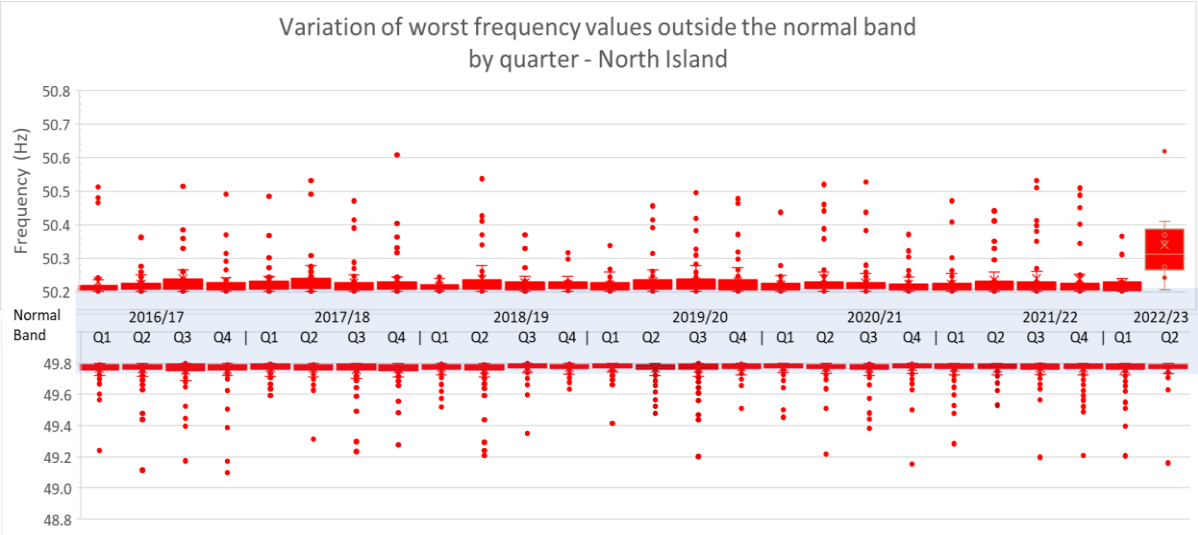
We are awaiting feedback from the Authority on our proposal to change the significant incident criteria to ensure we are reporting on the right level of incidents considering associated consequences.

17 Frequency fluctuations

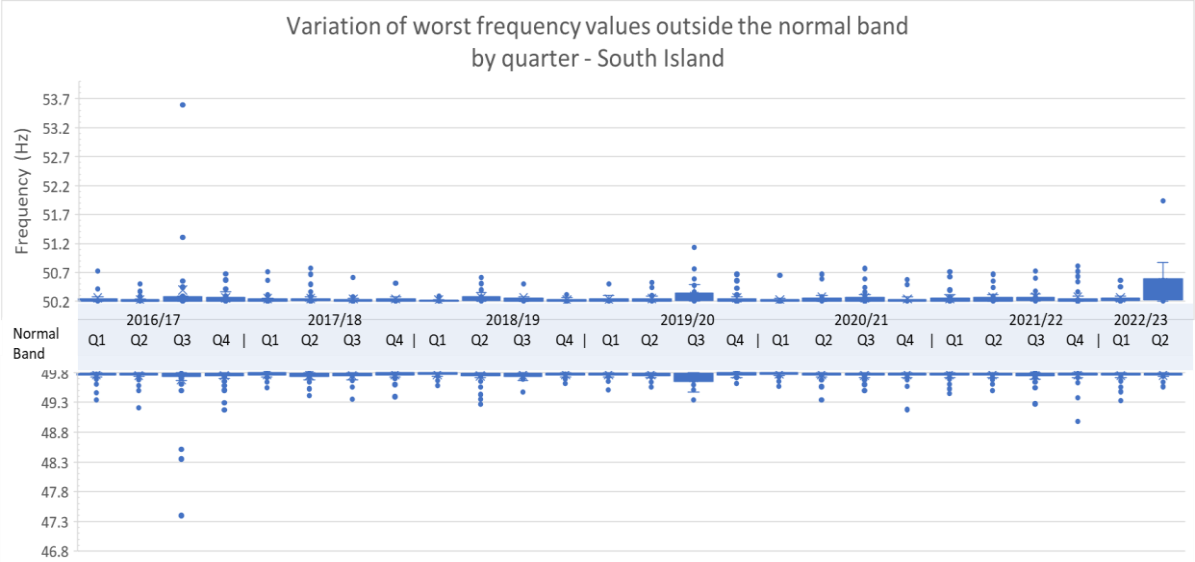
17.1 Maintain frequency in normal band (Frequency value)

The following charts show the distribution of the worst frequency excursion outside the normal band (49.8 to 50.2 Hz) during the reporting period.

North Island



South Island



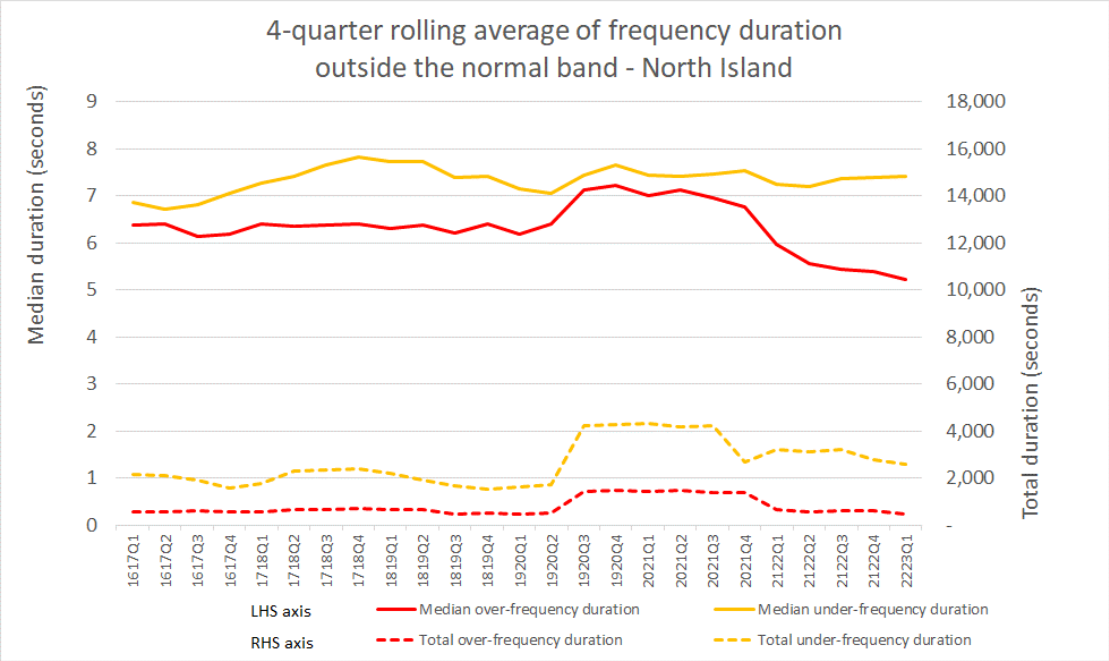
*2022/23 Q2 contains data for October only

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.

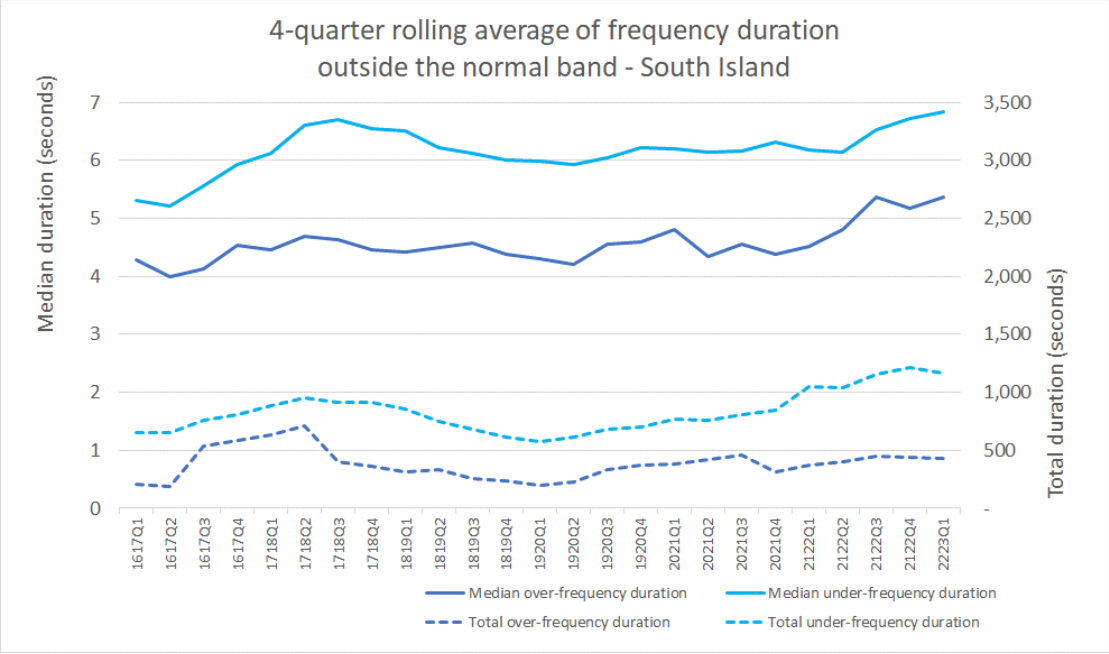
17.2 Recover quickly from a fluctuation (Time)

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

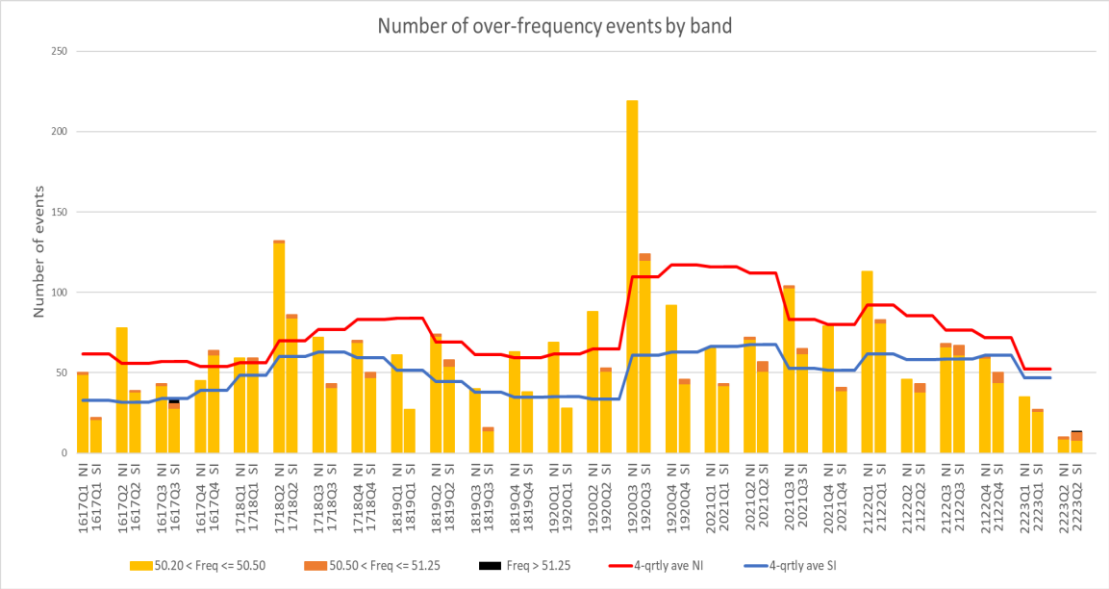


*These graphs have not been updated since 2022/23 Q1; they will only be updated at the end of each quarter

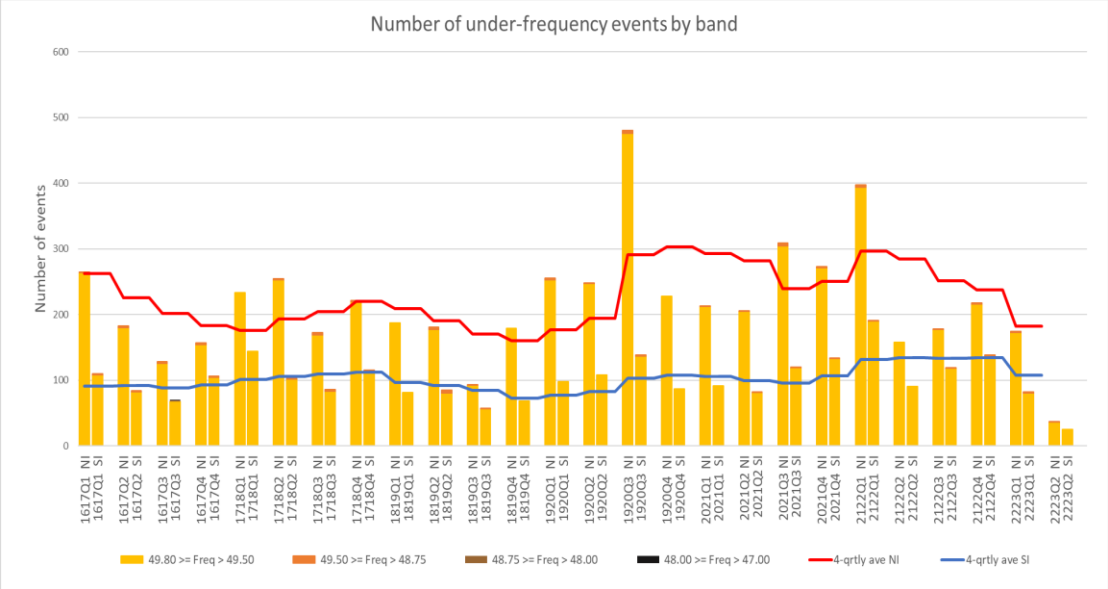
17.3 Manage frequency and limit rate of occurrences during momentary fluctuations (Number)

The following charts show the number of momentary fluctuations outside the frequency normal band, grouped by frequency band, for each quarter since Q1 2015/16. The information is shown by island, including a 4-quarter rolling average to show the prevailing trend.

Over-frequency events



Under-frequency events



* 4-quarterly rolling averages for NI and SI are only updated at the end of each quarter.

2022/23 Q2 contains data for October only

17.4 Manage time error and eliminate time error once per day

There were no time error violations in the reporting period.

18 Voltage management

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

19 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	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22
Demand Allocation Notice	--	--	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	--	2	-	-	-	-	-	-	1	-	-	1	1
Warning Notice	--	--	-	-	-	-	-	1	-	-	-	-	1
Customer Advice Notice	9	7	5	7	9	15	14	15	28	24	25	35	33

20 Grid emergencies

Date	Time	Summary Details	Island
07/10/22	07:15	A grid emergency was declared due to insufficient generation offers in the North Island following a reduction in HVDC capacity.	N

Appendices

Appendix A: Discretion

34 instances

Event Date and Time	Description
1/10/2022 1:46	NAP scheduled below 135 MW (min run) from 05:00 to 06:00 (2nd Oct) since todays 08:00 NRSL. Should NAP be dispatched off, it will take 48hrs to reconnect.134 MW has been applied to NI Optional Island AC CE risk from 00:00 to 07:00 (2nd Oct). Keeping NAP on is the least cost solution, plus required for voltage support and over frequency reserves. Note: Low price forecast starting midnight and HLY U1 ramps below 100MW overnight with high wind forecast.
1/10/2022 16:13	TUI1101 PRI0 Will breach resource consent. They have heavy lake inflows Last Dispatched MW: 23
1/10/2022 16:14	TUI1101 KTW0 Due to plant capability Last Dispatched MW: 25.35
1/10/2022 16:14	TUI1101 TUI0 Will breach resource consent. They have heavy lake inflows. Last Dispatched MW: 40
1/10/2022 16:17	Genesis Operator called SC to query why WKA was being dispatched below their current offer (KTW 35MW at $0.01, PRI 23 MW at $0.00, TUI 40 MW at $0.00). SC explained that this was due to the low pricing (currently $0.01) and they mentioned that they could not go lower than the amounts offered due to plant capability/ resource consent and subsequently claimed rule exemption 13.82 2a.
1/10/2022 16:28	TKU2201 TKU0 Will breach resource consent. They have heavy lake inflows. Last Dispatched MW: 94.99
2/10/2022 19:51	SFD2201 SFD21 Held SFD21 on at minimum run of 4MW at $660 as next generator in price stack is WHI at $4,996 - load forecast is tracking approx. 100 MW under actual load, actual wind is 38 MW nationally (schedule shows 82 MW wind). SFD21 also being dispatched reserves.
5/10/2022 6:43	JRD1101 JRD0 Low residual situation, evening peak with lighting load coming on. Residual less than 200MW Last Dispatched MW: 29.22
5/10/2022 7:08	JRD1101 JRD0 Low residual situation, evening peak with lighting load coming on. Residual less than 200MW Last Dispatched MW: 29.2
5/10/2022 7:09	JRD1101 JRD0 Low residual, require JRD on Last Dispatched MW: 29.2
5/10/2022 7:10	JRD1101 JRD0 Low residual, require JRD on Last Dispatched MW: 29.2
5/10/2022 17:36	TUI1101 TUI0 Tripping of RDF_TUI_1. Discretion applied to avoid overloading remaining RDF_TUI_2 Circuit Last Dispatched MW: 40
5/10/2022 17:36	TUI1101 PRI0 Tripping of RDF_TUI_1. Discretion applied to avoid overloading remaining RDF_TUI_2 Circuit Last Dispatched MW: 40
5/10/2022 17:37	TUI1101 PRI0 Tripping of RDF_TUI_1. Discretion applied to avoid overloading remaining RDF_TUI_2 Circuit Last Dispatched MW: 40

Event Date and Time	Description
5/10/2022 17:37	TUI1101 KTW0 Tripping of RDF_TUI_1. Discretion applied to avoid overloading remaining RDF_TUI_2 Circuit Last Dispatched MW: 30.46
5/10/2022 17:38	TUI1101 KTW0 Tripping of RDF_TUI_1. Discretion applied to avoid overloading remaining RDF_TUI_2 Circuit Last Dispatched MW: 30.46
5/10/2022 17:45	TUI1101 KTW0 Tripping of RDF_TUI_1. Discretion applied to avoid overloading remaining RDF_TUI_2 Circuit. to Last Dispatched MW: 35
5/10/2022 17:45	TUI1101 TUI0 Tripping of RDF_TUI_1. Discretion applied to avoid overloading remaining RDF_TUI_2 Circuit Last Dispatched MW: 40
5/10/2022 17:45	TUI1101 PRI0 Tripping of RDF_TUI_1. Discretion applied to avoid overloading remaining RDF_TUI_2 Circuit Last Dispatched MW: 25
6/10/2022 6:42	WHI2201 WHI0 Required for security, - low residual over evening peak. Last Dispatched MW: 13.93
6/10/2022 6:56	JRD1101 JRD0 Required for security, - low residual over evening peak Last Dispatched MW: 51.14
6/10/2022 7:13	WHI2201 WHI0 Required for security, - low residual over evening peak. WHI advised 20 MW is their minimum run. Last Dispatched MW: 13
6/10/2022 16:30	SFD2201 SFD21 Discretioned on for security over the morning peak. Last Dispatched MW: 16.13
6/10/2022 18:47	WHI2201 WHI0 GEN due to energy shortfall resulting from low national residual and reduced HVDC capability. WHI discretioned to be held at min to ensure they were not dispatched off during controllable load shedding. Last Dispatched MW: 27.3
6/10/2022 18:48	WHI2201 WHI0 GEN due to energy shortfall resulting from low national residual and reduced HVDC capability. WHI discretioned to be held at min of two machines to ensure they were not dispatched off during controllable load shedding. Last Dispatched MW: 27.3
6/10/2022 19:06	WHI2201 WHI0 GEN due to energy shortfall resulting from low national residual and reduced HVDC capability. WHI discretioned to be held at min to ensure they were not dispatched off during controllable load restoration. Last Dispatched MW: 40
10/10/2022 9:02	NAP scheduled below 140 MW (min run) from 03:30 to 05:00 (11 Oct) in 20:00 NRSL. Mercury trader confirmed Rule 13.82(a) will be claimed for these periods if dispatched to scheduled values. Should NAP be dispatched off, it will take min 48hrs to reconnect. 139 MW has been applied to NI Optional Island AC CE risk from 00:00 to 05:30 (11 Oct). Keeping NAP on is the least cost solution, plus required for voltage support and over frequency reserves. Note: Low price forecast starting midnight with HLY U5 offline coupled with high wind forecast.
10/10/2022 23:14	MAN2201 MAN0 MEL have confirmed they will remain off economic dispatch for the duration of the extended potline. Estimated end TP26 Last Dispatched MW: 590
10/10/2022 23:16	MAN2201 MAN0 MEL have confirmed they will remain off economic dispatch for the duration of the extended potline. Estimated end TP26 Last Dispatched MW: 405
13/10/2022 8:46	TGA0331 KMI0 TGA bus fault Last Dispatched MW: 26

Event Date and Time	Description
13/10/2022 23:41	MAN2201 MAN0 MAN reduced by 190MW for the return of extended potline 1. Last Dispatched MW: 660
16/10/2022 23:12	MAN2201 MAN0 TWI extended potline management Last Dispatched MW: 497
24/10/2022 23:42	MAN2201 MAN0 To make room for return of TWI L1. Last Dispatched MW: 589
26/10/2022 23:09	MAN2201 MAN0 To manage TWI line 1 extended potline. MCC have chosen to not return to economic dispatch. Last Dispatched MW: 589