Quarterly System Operator and system performance report

For the Electricity Authority

January to March 2023

Report Purpose

This report is Transpower's review of its performance as system operator for Q3 2022/23 (January to March 2023), 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).

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Commentary

This section provides a high-level update for this quarter. The remainder of the report provides supporting detail in two sections:

- System operator performance
- System performance

Update (January to March 2023)

Security of Supply and market information

- **Security of Supply:** High storage levels dropped average prices from the $200/MWh range to $120/MWh. Growth in wind generation, including the commissioning of the Turitea South wind farm, contributed to the renewable generation percentage lifting renewable generation from the 80–85% range to the 85–90% range.
- **Low residuals:** Three low residual notices were issued to the market in late March. While no grid emergency was issued, the residuals were close to expectations. The low residuals were caused by a combination of:
  - unseasonably cold weather lifting demand over the 99% percentile for the time of the year
  - high hydrology undermining economics for slow start thermal to commit to the market
  - an HVDC outage reducing the ability for the South Island hydro to supply the North Island demand.
- **2023 Security of Supply Assessment:** The annual assessment is currently underway and will be circulated for industry consultation in May.

Projects and TAS work

- **Real Time Pricing:** Phase 4 development was completed in March, with testing due for completion in April. The deliverables for this phase will now include publishing residual data via the wholesale information and trading system (WITS). The SPD audit opinion was completed, and the successful opinion delivered to the Authority. Deployment is on track for go-live on 27 April 2023.
- **Operational Excellence:** We are reassessing delivery options to identify and prioritise foundational changes in the areas identified by the external consultancy. In parallel the functions and skillsets required within the real time operations management team are being reviewed.

Risk and Assurance

- **Business assurance audits:** The system operator load forecast audit was sent to the Authority in early April. Overall, we achieved a good result (effective), with four recommendations for management action identified, one medium and three low risk, relating to: establishing an end-to-end process (medium); tidying up current process documentation (low); improving how we capture load forecast events (low); and updating the service provider contract to reflect current practice (low).
- **Preparations for Winter 2023:** The Authority requested the system operator investigate a number of options to alleviate some of the challenges identified for Winter 2023: 1) sensitivity analysis, 2) wind forecast, 3) changing frequency bands, and 4) controllable demand input as a market product. The TAS105 Phase 1 report assessing

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these four options was delivered on 31 January. We continue to hold discussions with Authority staff on the initiatives to manage an energy shortfall scenario.

- **Analysing future winter periods:** Alongside the work to prepare for winter 2023 , we have analysed winter peaks for winters 2024 and 2025 to consider the enduring suitability of the New Zealand frameworks. We continue to find that there is a high probability of winter peak capacity shortfalls if insufficient firm generation and/or demand response is offered into the market
- **Investigations:** We have assessed the performance of automatic under-frequency load shedding (AUFLS), for both the South and North Island schemes, based on data submitted for the 2021 year. This follows a request from the Authority and was submitted by 31 March 2023.

Customers and other relationships

- **Severe Auckland flooding:** We kept in close touch with all parties impacted by the Auckland flooding with a focus on minimising risk to end consumers.
- **HVDC outages:** We communicated with customers on the two HVDC outages this quarter.
- **Demand flexibility:** We have been working with the Flex Forum, a New Zealand collective of interested parties to create momentum in this area. We have also been discussing with National Grid ESO (the UK system operator) and Octopus Energy the innovative UK Demand Flexibility Service which was tested recently. We received six, generally supportive, submissions in response to our whitepaper on distribution-connected flexibility published in December. We have a system operator representative on the ENA Smart Tech Working Group workstream “Collaborative solutions”. An action on their 2023 workplan is to “Work with Transpower on the interface between the SO-DSO in a world of increasing DER penetration.” This workstream is directly relevant to the topics covered in our whitepaper.

System events

- **Cyclone Gabrielle:** We took proactive action ahead of the forecast cyclone, including identification of potential risks, and working with the grid operator to understand their risks. The impact of the cyclone required a considerable amount of system operator knowledge and commitment to ensure the grid returned to operation securely in as quick a time as possible. Our team used their experience and training to deliver electricity to the end consumers, working closely with distributors, gentailers and the grid owner.
- **Low Hydro Southland:** Low hydro storage in Southland presented challenges to manage voltage stability this quarter. We established a system operator working group to assess security risks and potential grid reconfigurations.
- **Upper North Island Voltage Management:** The system operator requested the grid owner’s Pakuranga-Whakamaru_1 circuit outage be extended until 7 February. This approach managed the risks of switching cable circuits over the Auckland Anniversary and Waitangi weekends. The Pakuranga-Whakamaru_1 circuit is now in service. With increased generation from Huntly and contributions from the newly commissioned Otahuhu reactor, we expect to be able to manage voltage with overhead switching over

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low demand periods through the rest of the summer. Arrangements are in place with the grid owner should switching of cables be required.

- **9 August event:** On 31 March, the Authority and system operator filed a joint statement of facts and joint penalty submission with the Rulings Panel. On 11 April, the Rulings Panel issued a Minute noting that no other party has filed a submission or sought a hearing and the Rulings Panel will now determine the matter on the papers.

Outages

- **Outage Planning:** We continued to have very high outage volumes over the summer months which are forecast to continue into April. Some weeks there have been around 150 to 180 transmission outages a week, with additional generation outages.
- **NZGB:** As of March, the tool is forecasting no shortfalls for the next 200 days. There are some low margin periods in May due to generation plant, HVDC equipment and circuit outages. We are monitoring a low margin day on 1 May closely, as it may require a CAN to be issued if the margin drops lower.

SOSPA deliverables

- **Draft SO Strategic Plan, Draft SO ICT Strategic Roadmap, Draft Capex Roadmap, Draft Capex Plan:** We delivered these to the Authority on 24 February. The final version of these reports will be delivered on 30 June, following Authority feedback.
- **The Strategic Objective Workplan (SOWP) deliverable: Proposal of 23/24 Performance Metrics & Incentives Agreement:** We delivered this on 31 March and are expecting Authority feedback by 12 May. The final version of this report will be delivered on 30 June.
- **Software Audit:** We delivered the annual audit on 31 March.

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System Operator performance

1 Customers and other relationships

Cyclone Gabrielle

On 14 February, we declared a Grid Emergency following the loss of electricity supply to Hawkes Bay and Gisborne. We led the initial response to the event, which included restoration of supply and coordination of with market participants, distribution companies and customers. Transpower as grid owner led the response for the restoration of grid assets once the initial restoration was completed. During and after the event, we updated customers and the general public through our website and social media channels as the situation became clearer. Significant new developments are placed on our dedicated webpage - Hawke's Bay and Gisborne power outage.

FlexForum

In January, we attended the Flex Forum monthly meeting and have been reviewing and informing publications around flexibility contracting, risk management, communications, and connectivity. We also hosted a Flex Forum workshop on 22 February which discussed flexibility needs for winter 2023 and are supporting market participants who are keen to investigate potential small-scale pilots which may meet these needs during winter 2023.

National Grid ESO and Octopus Energy

This quarter, we met with peers from National Grid ESO (the UK system operator) and Octopus Energy to discuss the innovative UK Demand Flexibility Service which was tested recently. This discussion highlighted the potential for a new ancillary service to meet winter peak demand. The recording was shared with Flex Forum and wider industry to share the learnings with those interested in solutions for New Zealand winter peak challenges.

Black Start simulation

On 22 February, we hosted NZAS, Meridian, and Contact Energy in a black start simulation for the lower South Island. This regular exercise was put on hold over COVID-19 and is an important part of ensuring the industry participants are aligned and well prepared around the contingency plan. All the participants were pleased with how the exercise went, there was lots of shared learning, and some improvements were identified which will be incorporated into processes.

Distribution-connected flexibility

We received six submissions in response to our whitepaper on distribution-connected flexibility published in December. Feedback is generally supportive of the positions taken in our paper. We will continue to try and solicit more responses.

The Energy Networks Association has recast its Smart Tech Working Group into three distinct workstreams under a Future Networks Forum. One of those workstreams, "Collaborative solutions", has on its 2023 workplan "Work with Transpower on the interface between the SO-DSO in a world of increasing DER penetration." This workstream is directly relevant to the topics covered in our whitepaper on distribution-connected flexibility. We have a representative on this workstream.

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Longer market insights

The final longer market insight was published on the Transpower website early in April, Winter 2024-25 analysis. Greater detail on this analysis is contained in section 2.

The four insights published this financial year are:

Winter Review 2022	Nov 2022
Enabling distributed flexibility to support whole system reliability and efficiency: a system operator view	Dec 2022
2023 Security of Supply Outlook	Jan 2023
Winter Peak Analysis 2024-25	Apr 2023

Previous years insights can be found on the Transpower website – Market Insights.

SOSPA deliverables to the Authority

Draft SO Strategic Plan, Draft SO ICT Strategic Roadmap, Draft Capex Roadmap, Draft Capex Plan – We delivered these to the Authority on 24 February. The final version of these reports will be delivered on 30 June, following Authority feedback.

The Strategic Objective Workplan (SOWP) deliverable: Proposal of 23/24 Performance Metrics & Incentives Agreement – We delivered this on 31 March and are expecting Authority feedback by 12 May. The final version of this report will be delivered on 30 June.

Software Audit – We delivered the annual audit on 31 March.

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2 Risk & Assurance

Risk Management Framework

We developed and presented a paper on how the system operator models and responds to changes in demand for the Security and Reliability Council in March. The paper was well received.

We presented a deep dive risk paper to present at the Authority system operator committee in April covering the threat of “not having power system assets available to manage the system” with a winter 2023 lens.

We started planning for our next round of risk control self-assessment which will assess five critical controls: Change Management; Connected Asset Monitoring; Monitor & Evaluate Potential Operating Environment; People Management and Stakeholder Management.

Business assurance audits

System operator load forecast: We finalised the system operator load forecast audit and shared it with the Authority; the scope included the system operator’s management of the Tesla contract (monitoring and performance management), and our internal processes for managing the load forecast including event and issues management. Overall, we achieved a good result (effective), with four recommendations for management action identified, one medium and three low risk, relating to: establishing an end-to-end process (medium); tidying up current process documentation (low); improving how we capture load forecast events (low); and updating the service provider contract to reflect current practice (low).

Remaining audits: The three remaining audits for 2022/23 are in progress:

- Voltage Stability Assessment Tool (VSAT) change management audit fieldwork has been completed with a draft report being prepared.
- Ancillary Service contract management audit has started with fieldwork scheduled for completion during April.
- Audit on Simultaneous Feasibility Test (SFT) constraints is being planned.

Preparations for Winter 2023

Preparations for Winter 2023 have included a number of discussions with Authority staff on the initiatives to manage an energy shortfall scenario. We are working with the Authority to advance the priority initiatives published in March in the Authority’s decision paper following consultation feedback. These being, (1) progress Option B: Provide forecast spot prices under demand sensitivity cases and (2) progress Option D: System operator review of wind offers based on external forecast.

In addition, we are running a simulation exercise alongside the Electricity Authority on 24 May to test the industry’s response to a situation where available supply is insufficient to meet winter peak demand. The exercise will provide an opportunity to practice new processes being developed by the Authority with our support to help manage these peaks ahead of winter 2023.

A working group has been established to ensure we are well prepared for winter. This includes capturing what we have learned from previous years, codifying actions that worked well such as tight focus on the impact of weather and wind on forecasts, proactive

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communications including standardising how material is presented to help build familiarity. We are also considering other tactical options such as increasing the frequency of industry briefings through winter and use of templated operational and informational communications. This planning will be completed by 1 May 2023.

Analysing future winter periods
We are looking at the winter 2023 capacity issues with a wider lens, this includes analysis of winter peaks for winters 2024 and 2025 which was presented as part of the fortnightly SO Industry Forum on 4 April. A summary of the analysis findings is as follows:

- There is a high probability of winter peak capacity shortfalls without sufficient firm generation and/or demand response being offered into the market. These winter peak capacity risks continue into 2024 and 2025.
- The size and shape of the capacity risk depends on the timeliness of new projects coming online (and their respective firm capacity), and potential thermal generation retirements.
- The capacity risk is most apparent during peak load days. Unavailability of existing inflexible thermal plant (due to retirement/commitment) results in large "step" reductions in the quantity of available supply offered into the market to balance demand which increase the capacity risk.
- With increasing quantities of intermittent generation expected to come online over the coming years, this will require more firming/flexible resources offered into the market to help balance supply and demand.
- Although more intermittent generation will reduce the average spot prices, it will also increase price volatility, potentially reducing the incentive for running inflexible thermal units against the spot price.

The recording of the session and the slide pack are published on the Transpower website 2023 section. .

3 Compliance

We reported two system operator self-breach in this quarter.

In February, we reported a breach related to mis-modelling the night ratings for two transformers at Redclyffe (RDF T3 and T4) from 10 May – 3 June 2022. The error occurred due to a non-standard grid owner offer for the two transformers (different to every other transformer). The error was corrected on 3 June 2022. There was no market or operational impact during the affected period.

In March, we reported a breach related to incorrect constraints produced for the Clyde-Twizel 1 & 2 circuits in two forward schedules on 10 August 2022. The incorrect constraints were produced due to misaligned models caused by a SCADA update. The constraints were corrected before real time and a permanent fix has been deployed.

9 August event: On 31 March, the Authority and system operator filed a joint statement of facts and joint penalty submission with the Rulings Panel. On 11 April, the Rulings Panel issued a Minute noting that no other party has filed a submission or sought a hearing and the Rulings Panel will now determine the matter on the papers.

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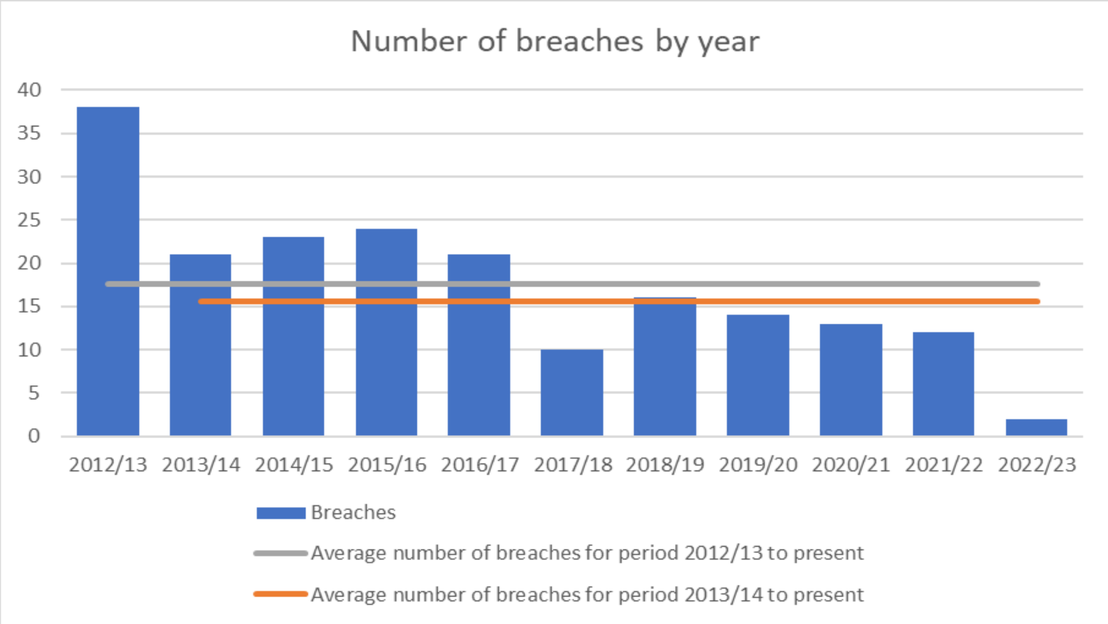

4 Impartiality of Transpower roles

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		
FID	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

4.1 System Operator independence audit

In February, Deloitte issued its final report for the 2022 outage planning independence audit. The report noted that overall there are processes and controls in place to maintain system operator independence within outage planning. The report made several priority 3 (continuous improvement) recommendations around formalising management oversight of dual roles and clarifying role separation on the Transpower website. These recommendations have been addressed. The report also noted that interviews with industry participants did not identify any perceptions of system operator partiality towards the grid owner in outage planning.

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Deloitte has completed its fieldwork for the 2023 security of supply independence audit and in March it presented its initial summary of findings to the system operator, which did not identify any independence concerns. We expect Deloitte to finalise its report by late April/early May.

5 Project updates

5.1 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 4 development completed in March which includes the dispatch notified products and dispatchable demand product. Testing is due for completion in mid-April.

The dispatch notified products open up a low-cost path for small-scale providers of distributed energy resource such as aggregated residential solar and battery systems to bid and offer their resources into the wholesale market.

Enhancements to dispatchable demand will allow large industrial consumers to use load control to limit their exposure to high spot prices by bidding controllable load into the wholesale market when prices are high and/or offering this interruptible load as instantaneous reserves.

The change request (CR009) to re-baseline the project for changes to budget was approved by the Authority in November. Monthly drawdown requests have been approved in December, January, February and March. No additional drawdown was requested in April.

The SPD audit opinion was completed, and the successful opinion delivered to the Authority.

We continue to support the Authorities communications with industry regarding the changes being released under phase 4.

Operational Excellence
This programme has now moved to implementation and will run for 18 months, accelerating improvement across our real time operational processes. Initiatives underway include a review of procedure documentation, assurance processes to support the delivery of agreed KPIs, and enhancements in resource planning.

Wherever possible delivery will be undertaken from existing business resources with the required skill sets. In parallel the functions and skillsets required within the real time operations management team are being reviewed against the current structure and position descriptions.

Customer Portal Programme
Work to incorporate a new Dispensations and Equivalences Arrangements (D&E) application is underway. We expect the new D&E application to be available later this year.

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We will be getting in touch with affected asset owners to provide more information about the changes and roll-out.

KPI Refresh Programme

As part of rolling out performance metrics reporting with an external focus, based on the high-level outcomes discussed with the Authority, teams from the Authority and the system operator have agreed a draft set of metrics which are now being refined as an input to the incentives calculation for FY23-24.

The draft Performance metrics and incentives agreement was delivered to the Authority on 31 March for comment. The Authority provided verbal feedback at the April SOC meeting (17 April) and formal feedback from the Authority is due in writing on 12 May. In parallel, we have been working with the Authority staff to develop the scoring scales and weightings used to calculate the incentive payment. Progress is on target to enable the metrics and incentive payment to go live on 1 July.

Future Security and Resilience (FSR) Programme

The issues paper on common quality (Part 8 of the Code) that the system operator contributed to has been published for consultation. We are now progressing no regret analysis work to support the development of the next paper, detailing options to address the seven issues raised.

The FSR tracking indicators to help guide the speed/course of the roadmap delivery have been agreed. We are working with the Authority to identify the data sources, data communication methods and our role in providing the data.

6 Technical advisory hours and services

The system operator and the Authority are finalising the TAS 104 statement of work to publish residual MW information from forecast schedules. The scope for TAS 104 includes the addition of the calculated residual data for both the North and South Island in the data transfer to NZX. The residual data will be provided for forecast market schedules (RTD, NRS PRS and WDS) for all forecast trading periods.

The following table provides the technical advisory hours for Q3 2022/23 and a summary of technical advisory services to which those hours related (SOSPA 12.3 (d) refers).

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TAS Statement of Work (SOW)	Status	Hours worked during Q3
TAS SOW 102 – Reviewing Part 8 of the Code – Common Quality	In progress	177.5
TAS SOW 103 - Extended Reserve Implementation FY22/23 - Planning for Transition	In progress	399.5
TAS SOW 104 - Publish residual MW information from forecast schedules	In progress	172.0
TAS SOW 105 - Winter 2023 option investigation and implementation	In progress	620.5
Total hours		**1,369.5**

7 Outage planning and coordination

Outage planning – near real time

We continue to have very high outage volumes which are forecast to continue until April at least. Some weeks there are around 150 to 180 transmission outages a week, with additional generation outages. We have been coordinating with the grid owner on changes to outages as a result of Cyclone Gabrielle and risks to outages as a result of low Southland generation and will continue to do so in the event Southland Lake levels drop into low operating ranges again.

The grid owner published its draft annual outage plan at the end of January, and we will be assessing security impacts from this plan after the grid owner has completed its customer consultations.

We communicated the security and generation margin impacts to participants ahead of this year's HVDC outage which completed in the second half of February. We also worked with the grid owner to assess implications of a second HVDC Pole 2 outage rescheduled for the end of March. This second outage was needed as resources from the February outage were redeployed to restoration work in Hawke's Bay. The HDVC outages were successfully completed.

New Zealand Generation Balance (NZGB) analysis

The NZGB tool is forecasting no shortfalls for the next 200 days. There are some low margin periods in May due to generation plant, HVDC equipment and circuit outages. We are monitoring a low margin day on 1 May closely, as it may require a CAN to be issued if the margin drops lower.

During the quarter, there were lower margin periods in March coinciding with the second HVDC outage. Industry response alleviated the low margins prior to real time.

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8 Power systems investigations and reporting

Automatic under-frequency load shedding (AUFLS) transition / compliance

We have received 12 out of 14 AUFLS transition plans during March, with the team following up with the remaining two. The system operator will now start to analysis the implications to security of the proposed transition plan.

The system operator was asked by the Authority to assess the performance of AUFLS based on data submitted for the 2021 year. The assessment included both the South and North Island scheme. The assessment report was submitted to the Authority by 31 March 2023 and showed that while the system remained secure for extended contingent events, a majority of AUFLS providers did not meet their obligations at all times. It has also highlighted that many providers have not recently submitted any relay test data. All providers have been issued with a letter outlining the system operator's findings and reminding them of their obligations.

The 2022 AUFLS data submission from North Island connected asset owners was due as of the end of March. Only 11 out of 15 connected asset owners have submitted data. The system operator will be issuing each party, who has yet to submit, a letter reminding them of their obligations and suggesting they self-breach.

9 Performance metrics and monitoring

The following dashboard shows system operator performance against the performance metrics for the financial year to date as required by SOSPA 12.3 (a). Only those metrics with a weighting are used in the calculation of the System Operator score and incentive payment.

<table>
<tr><th colspan="2"></th><th>Annual Target</th><th>Actual to date</th><th>Pts</th></tr>
<tr><td colspan="5">Smart about money</td></tr>
<tr><td colspan="2">Perception of added value by participants</td><td>80%</td><td>N/A</td><td></td></tr>
<tr><td colspan="5">Customers are informed and satisfied</td></tr>
<tr><td colspan="2">Annual participant survey result</td><td>83%</td><td>N/A</td><td>5</td></tr>
<tr><td colspan="2">Annual participant survey result response rate - First tier stakeholders</td><td>80%</td><td>N/A</td><td></td></tr>
<tr><td rowspan="3">Future thinking and insights</td><td>Future thinking report</td><td>≥ 1</td><td>0</td><td>5</td></tr>
<tr><td>Longer Market Insight reports</td><td>≥ 4</td><td>4</td><td rowspan="2">5</td></tr>
<tr><td>Bite-sized Market Insights</td><td>≥ 45</td><td>36</td></tr>
<tr><td colspan="2">Quality of written reports</td><td>100% of standard</td><td>100%</td><td></td></tr>
<tr><td colspan="2">Role impartiality</td><td>80%</td><td>N/A</td><td>5</td></tr>
<tr><td colspan="2">Responding to requests for information from the Authority</td><td>100% by agreed deadline</td><td>N/A</td><td></td></tr>
<tr><td colspan="5">Code compliance maintained and SOSPA obligations met</td></tr>
<tr><td colspan="2">Market breaches remain below threshold</td><td>≤ 3 @ ≥ $40k</td><td>0</td><td>10</td></tr>
<tr><td colspan="2">Breaches creating a security risk - below threshold/within acceptable range</td><td>≤2</td><td>0</td><td>10</td></tr>
<tr><td colspan="2">On-time SOSPA deliverables</td><td>100% (49)</td><td>100% (23)</td><td>10</td></tr>
</table>

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		Annual Target	Actual to date	Pts
Successful project delivery				
Project delivery	Service Maintenance projects	≥ 70% on time	50%	
		≥ 70% on budget	0 to date	
	Market Design and Service Enhancement projects	≥ 70% on time	0 to date	
		≥ 70% on budget	0 to date	
Accurate capital planning		≥ 50%	N/A	10
Commitment to optimal real time operation				
Sustained infeasibility resolution		80% ≤ 10am or equiv	87%	5
High spring washer resolution		80% ≤ 10am or equiv	0 to date	
Fit-for-purpose tools				
Capability functional fit assessment score		76.00%	N/A	
Technical quality assessment score		70.00%	N/A	
Sustained SCADA availability		99.90%	99.99%	10
Maintained timeliness of schedule publication		99.00%	99.99%	10

We prepare for, manage & review events*		Q1	Q2	Q3	Q4	Pts
Event preparedness	Procedures overdue	4 (5.3%)	7 (9.3%)	5 (6.7%)		12
	Industry exercises	0	0	0	Planned	
	Control rm simulations	0	12 (100%)	12 (100%)		
Event management	Sig event mgt & comms audit scores	N/A	Good	*In progress*		13
Event review and improvements	Sig event actions due	N/A	0	*In progress*		12
	Deliv time-major evt rept	N/A	N/A	<10 days		

* Score determined on an annual basis, with system operator and Authority staff assessment on a quarterly basis.

9.1 Dispatch accuracy dashboard

We produce two dispatch accuracy dashboards:

- An energy dashboard as a means of monitoring overall industry performance.
- A reserves dashboard to identify trends and patterns in reserve management.

Both dashboards are contained in Appendix B, along with an explanation of the methodology we used to create the dashboards.

The dashboards continue to evolve and provide a good mechanism to see how changes to the power system, such as how the introduction of more wind generation, affect performance.

Below are instances of variations we have observed this quarter.

Energy

Overall industry performance this quarter – January to March 2023

Application of discretion under 13.70 (since July)

- This quarter the number of instances where discretion was applied to manage generators on minimum MW values overnight, occurred primarily in February when Manapouri was kept on for operational reasons during periods of low-priced generation.

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Frequency excursions (January and March)

- The majority of frequency excursions in the January were a result of a Tiwai line tripping.
- The March frequency excursions were due to the HVDC pole 3 tripping, Kawarau generation tripping and Tiwai potlines 1 and 2 emergency shut downs.

Optimal dispatch this quarter

These figures are currently unavailable; we will provide an updated version of this report in early May which will contain this data and a corresponding commentary.

Reserves

It should be noted, the variability in the way the system responds could be a result of many factors, not just the efficiency of the system operator actions. These factors include:

- The amount of interruptible load armed, as opposed to that offered and used as an input into RMT (and then dispatched by SPD).
- The influence of the type of generation on the amount of net free reserves (NFR) available.

Observations this quarter – January to March 2022

The “Reserve sharing” and “IL vs Spinning reserve percentages” are currently unavailable, following the transition to RTP. These figures will be included when the Q3 report is re-issued in early May.

A contributor to the variation to the figures this quarter is the two HVDC outages in February and March. For each of these periods, while on single pole outage, as expected the quantity of reserves required (and hence cost) were higher than the usual values. Reserves required for the DC CE risk by their nature cannot be shared from the sending island which can impact the cost.

This quantity increase is also a reflection of the higher than usual northward transfer on the HVDC while the system was in single pole operation. The typical MW risk for the bipole during a pole outage is 300 MW, but as the transfer was peaking above 400 MW over periods of the outage, the quantity of North Island reserves required was higher.

During the outages the DC CE was often the binding risk, particularly in March.

This quarter, the FIR procured as a proportion of risk when the AC CE (Contingent Event) was the binding risk has returned to the more typical values of 60-80%, which is mainly attributable to Huntly unit 5 coming back into the market following outage. The increase in the MW risk for AC CE prevents any very low reserve solutions.

There was no noticeable impact to the reserves requirements as a result of Cyclone Gabrielle.

10 Cost of services reporting

The cost of services reporting, for 2021/22 will be delivered to the Authority in Q4.

11 Actions taken

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The following table contains a full list of actions taken during Q3 2022/23 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**:	• **Progress code changes for new technology (Part 8 code update – new technology)** *We reviewed the Authority issues paper on changes required to Part 8 common quality requirements (part of the FSR work). The consultation went out to the industry in early April.* • **Roll out the revised performance metrics, targets and incentive payment calculation for FY 2023/24 (SOWP)** *We delivered the proposal to the Authority on 1 April that details the work being progresses in this area with Authority staff.* • **Start to investigate appropriate pathways for information sharing around DER (data and model)** *We have been working closely with the Flex Forum to share ideas and information that enables closer working together*
(ii) To comply with the **statutory objective work plan**:	• **Develop and agree the revised performance metrics, targets and incentive payment calculation for FY 2023/24** *During quarter 3, we have:* *been working with the Authority to develop relative weighting and incentive payment mechanisms*
(iii) In response to participant responses to any **participant survey**:	**Feedback from the 2021-22 survey** • **"More guidance and resources regarding the expectations of a system operator with large scale solar connections would be beneficial to EDBs"** *We are having conversations with EDBs and other potential large scale solar provider on matters concerning generator commissioning, power requirements and Code compliance. We attend ENA meetings to provide input where required.* • **"There seems to more industry participation & communication across companies than in the past."** *This was illustrated during the close industry collaboration required to minimise the effects of Cyclone Gabriel. There was good feedback from the industry and from government ministers on the communications and actions.*
(iv) To comply with any **remedial plan** agreed by the parties under SOSPA 14.1	N/A – No remedial plan in place.

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System performance

12 Security of supply

After a dry start to the year, the South Island hydro catchments continued to rise following strong inflows through February and March. Lake Pukaki and Tekapo, which account of 70% of national storage, are very close to their maximum operating range indicating spilling is close. All other hydro lakes are also healthy, above 80% of full.

Due to high storage levels, average prices have dropped from the $200/MWh range to $120/MWh, and renewable generation percentage has lifted from low 80 - 85% range to 85% - 90% range. Ongoing growth in wind generation, including the partially commissioned Turitea South windfarm, is contributing to the low prices and high renewable percentage.

Further details in the weekly market update report: [Weekly Summary and Security of Supply Reporting | Transpower]

Winter peak capacity challenges
Three low residual notices were issued to the market in March. While no grid emergency was issued, the residuals were close to expectations.

By comparing wind offers against the system operator's independent forecast and reviewing temperature sensitivity of load, a high degree of confidence was assumed in the residual being accurate, with a GEN situation being expected if a unit failed or load increased substantially beyond that forecast.

The low residual was caused by a combination of:

- unseasonably cold weather lifting demand over the 99% percentile for the time of year.
- high hydrology undermining economics for slow start thermal to commit to the market.
- an HVDC outage reducing the ability for the South Island hydro to supply the North Island demand.

Annual Security of Supply Assessment
The 2023 security of supply assessment is underway. The consultation on reference case assumptions and sensitivities is complete, and the draft report is being prepared based on feedback. The draft 2023 security of supply assessment is expected to be go out for consultation in early May.

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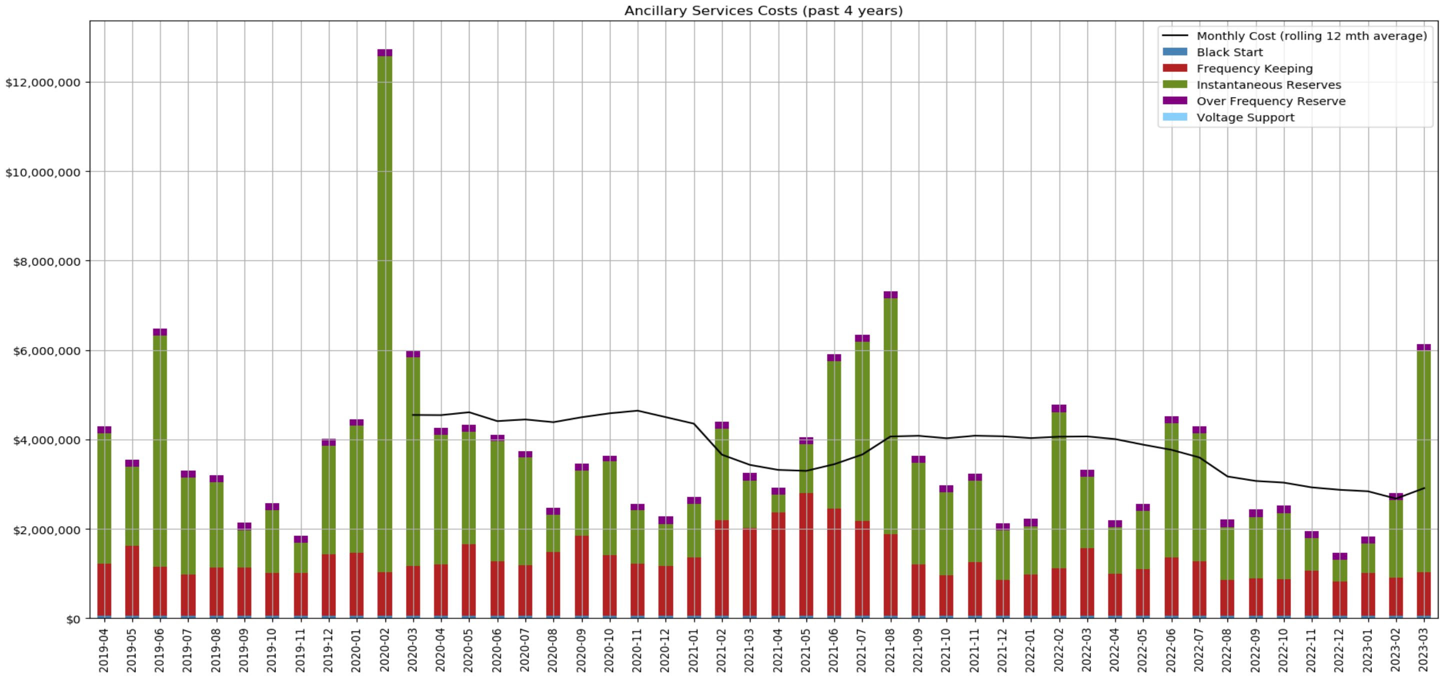
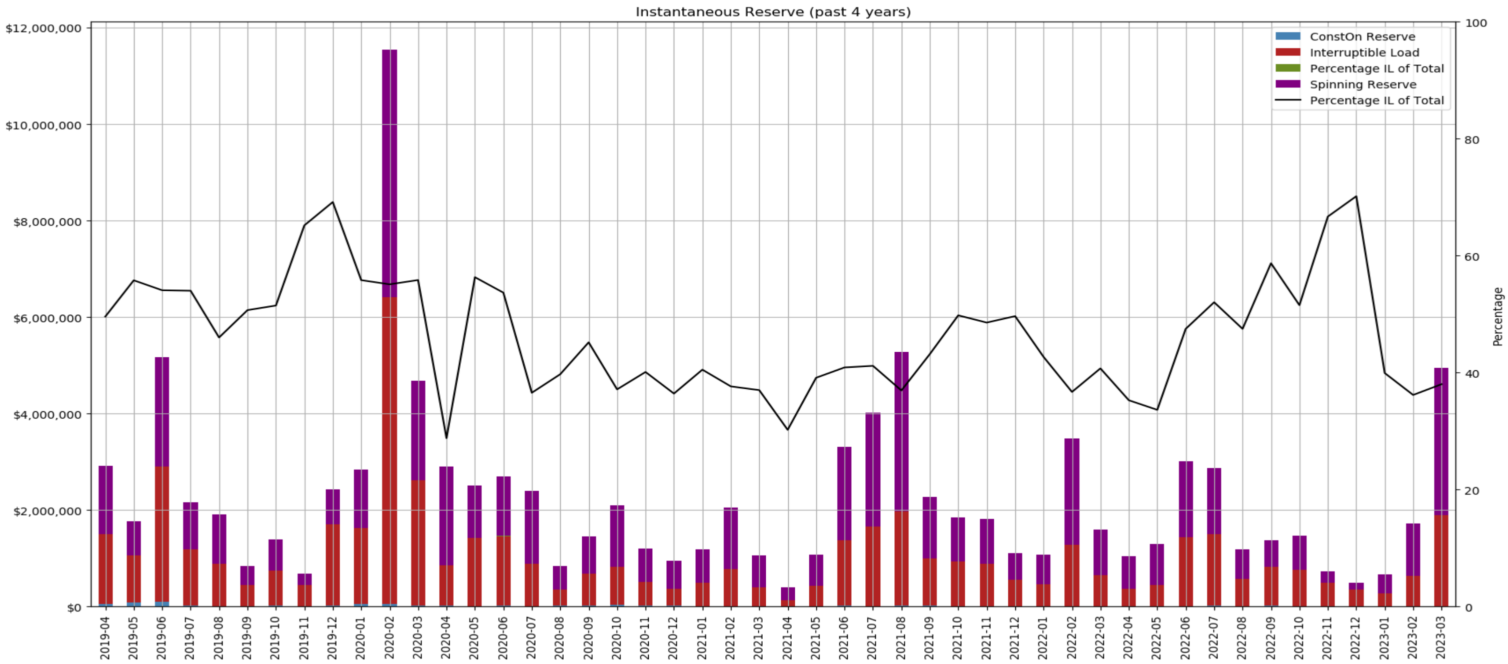
13 Ancillary services

Ancillary services costs (past 4 years)



The higher ancillary services costs this quarter were mainly due to higher instantaneous reserve costs. These were partially attributable to higher relative prices and reduced reserve sharing during the HVDC single pole and bipole outages at the end of the February and in March.

Instantaneous reserve costs (past 4 years)



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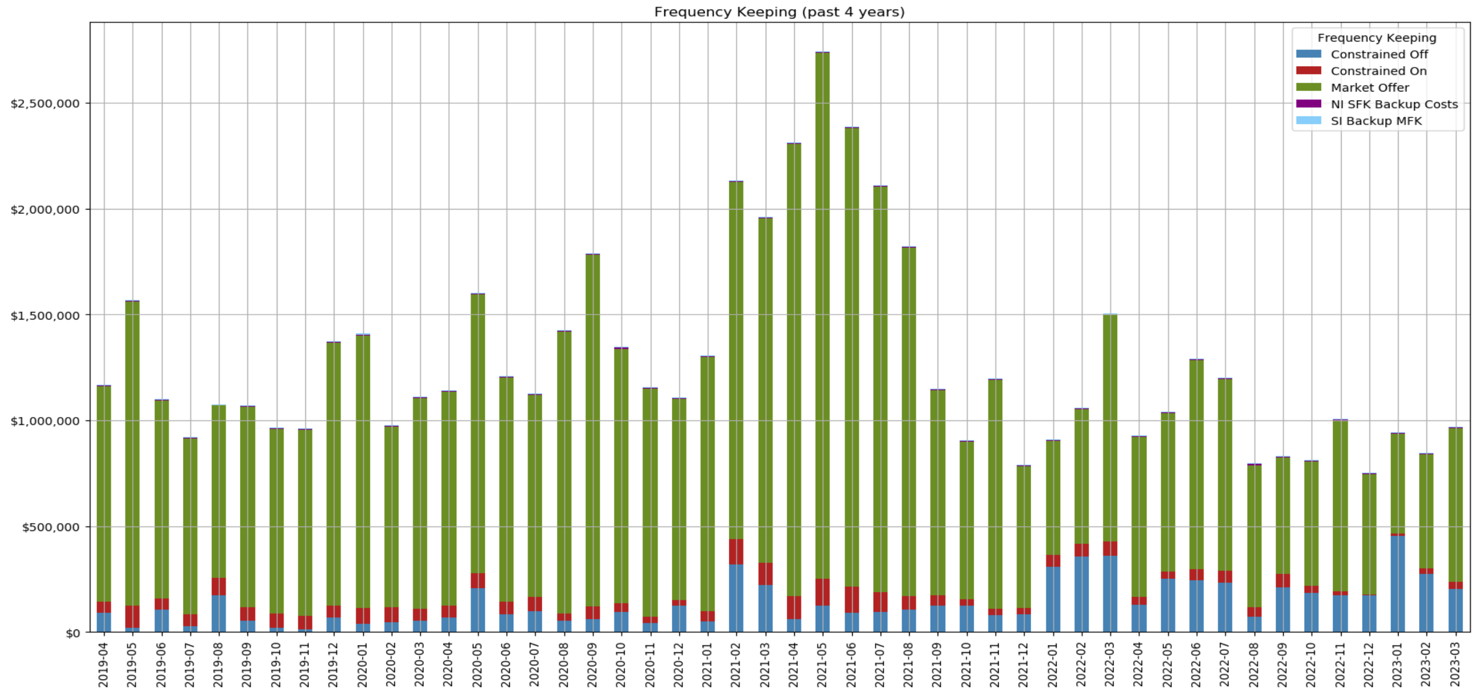
Both interruptible load and spinning reserves costs increased this quarter. This was partially attributable to the impact of the HVDC pole outages.

The overall quarterly effect was:

- Procured quantities of North Island reserve (both fast and sustained reserve) steadily increased since Q2 to reach nearly double what they were at the close of last quarter (88% increase in fast reserve and 54% increase in sustained reserve over the quarter).
- Procured quantities of both fast and sustained reserves in the South Island also effectively doubled since the end of last quarter; reserves increased marginally in the middle of the quarter and then fell back to levels at the beginning of the quarter.

The average price per MW for North Island sustained reserve tripled in March superimposed over a quarter of steadily increased prices for fast and sustained reserves in both islands.

Frequency keeping costs (past 4 years)



Although, there are no major changes to overall frequency keeping costs this quarter, the amount attributable to constrained off costs in January was significantly higher. More details on this are shown in section 13.1.

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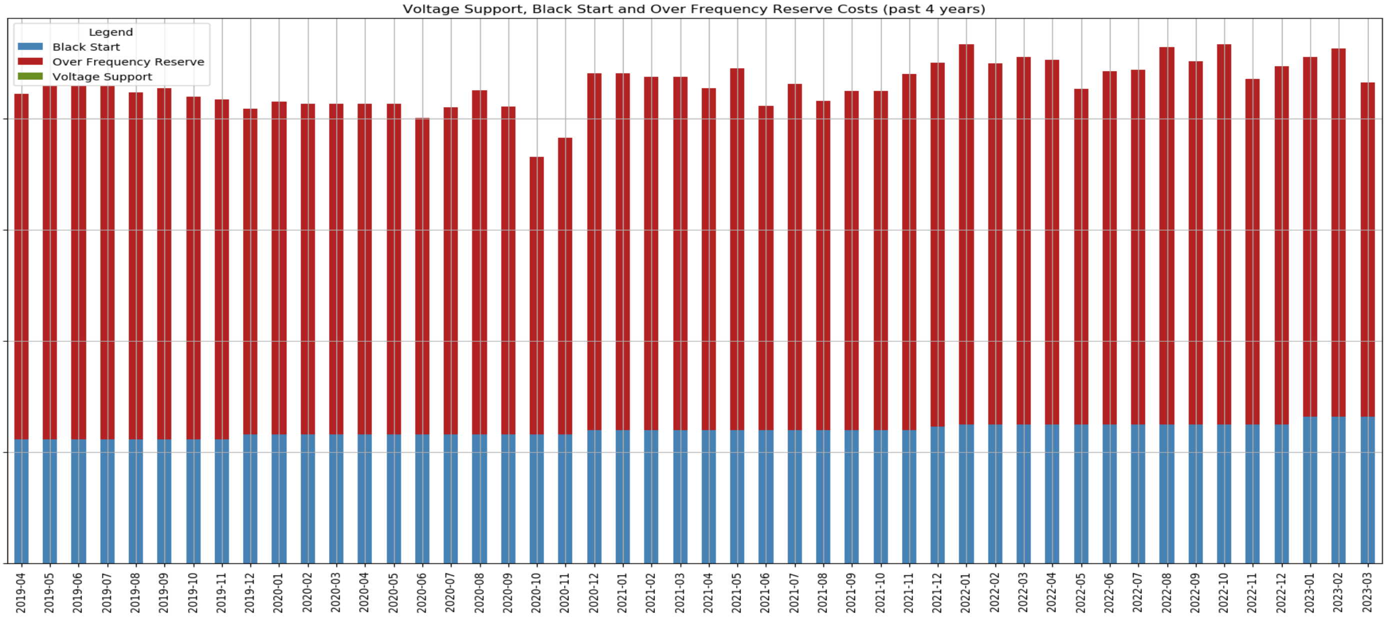
Voltage support, Black start and over-frequency reserve costs (past 4 years)

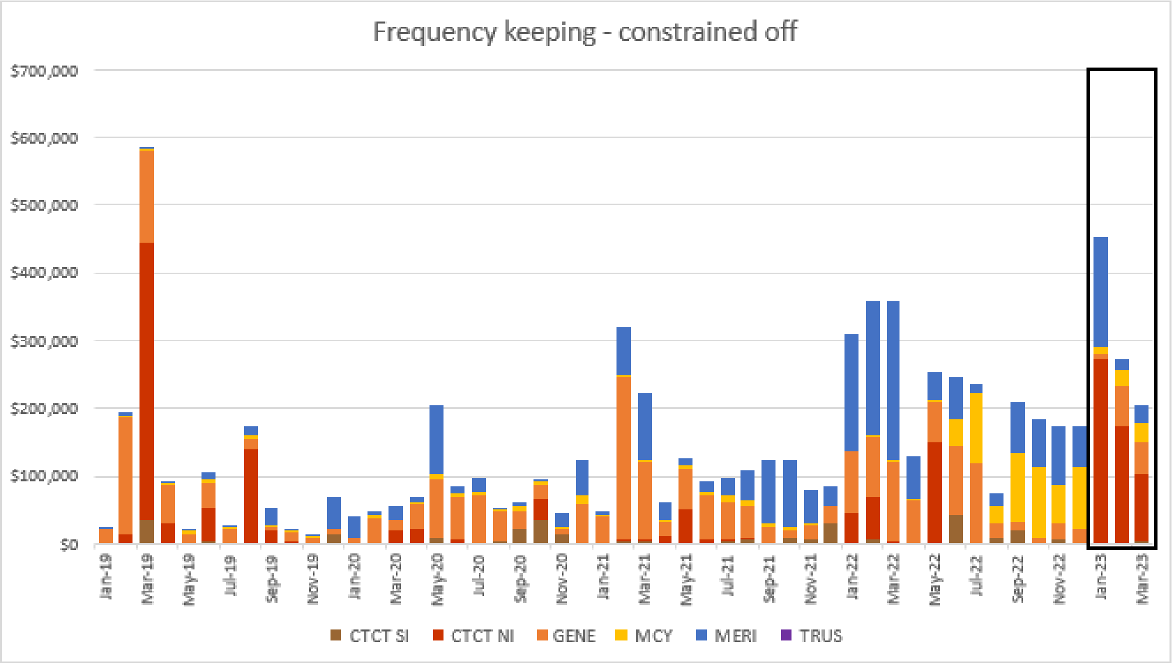


Over frequency reserve costs decreased slightly this quarter to $477k (2% decrease) in line with decreased provider availability. Black start costs increased to $66k in each month ($11k increase) since last quarter because of increased fees. There are no voltage support costs as there is no need to procure this ancillary service at this time.

13.1 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



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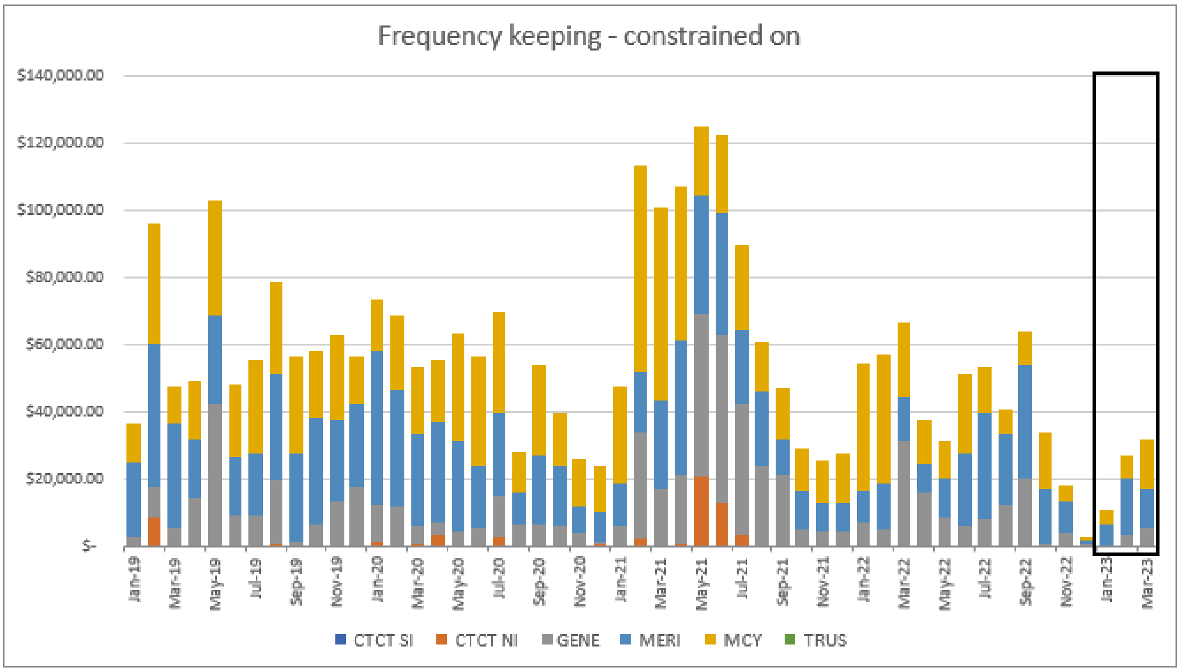
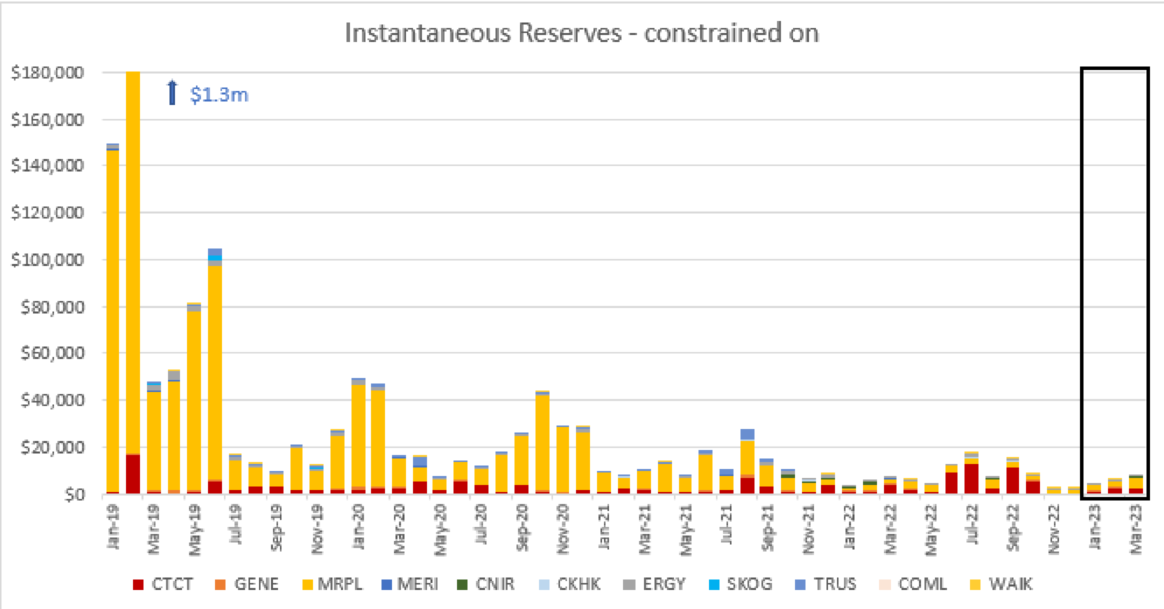
For Q3 2022/23, the frequency keeping constrained off costs increased by 75% to $931k. The North Island constrained off costs increased by 137% over this period; conversely the South Island constrained off costs decreased by 8%. Constrained off costs reflect the price of the energy during the period in which the frequency was constrained down.



For Q3 2022/23, the frequency keeping constrained on costs increased by $15k (27% increase). Both the North and South Island frequency keeping constrained on costs increased, by 32% in the South Island and by 22% in the North Island since the previous quarter.

Instantaneous Reserves



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Instantaneous reserve constrained on costs increased steadily over the quarter to settle marginally higher than the previous quarter at $18k (39% increase).

14 Commissioning and Testing

Generator Commissioning and testing

Turitea South windfarm commissioning is progressing well, with 50 MW of its 100 MW capacity already online. This has allowed for the removal of the secondary contingent event risk classification with only the secondary extended contingent event risk classification remaining in place for the remaining duration of commissioning. Full commissioning is expected by end of June.

Two new embedded solar farms have notified the system operator of their intention to connect, another 68 MW in total.

15 Operational and system events

Southland dry hydro

The Southland region experienced a prolonged dry period through December and January. This impacted inflows into Lakes Manapouri and Te Anau. As a result, hydro-storage levels at both lakes dropped into their low operating range. In early February, a material inflow event lifted storage at both lakes back into their main operating range, removing security risks. Studies continue and will be shared with the market once completed.

Significant incident investigations

One ‘major’ significant incident was notified to the Authority in February and continues to be investigated:

- Event 4355 – On Tuesday 14 February, supply was lost to the grid owner’s Redclyffe (RDF) 220kV and 110kV buses, impacting Unison and Eastland lines companies and consumers in Hawke’s Bay region. Other grid exit points availability and SCADA indications were also impacted by extreme flooding associated with Cyclone Gabrielle. A grid emergency was declared at 08:17 on the day and remained in place while restoration was ongoing. The grid emergency was closed on 10 March.

<u>Significant incident criteria</u>

We are still 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. During this quarter, we sent a recent example of a loss of supply event at Tekapo which was just over one hour in length and impacted 2.4 MWh of load. Under existing criteria, it would be deemed ‘moderate’ and need reporting on (requirement is for an outage to be either over an hour or greater than 100 MWh). Our proposal is to combine the criteria i.e. outage over an hour <u>and</u> resulting in more than 100 MWh of impact. For the Tekapo example, the Authority has confirmed they are happy for this to be treated as a minor incident, with no reporting.

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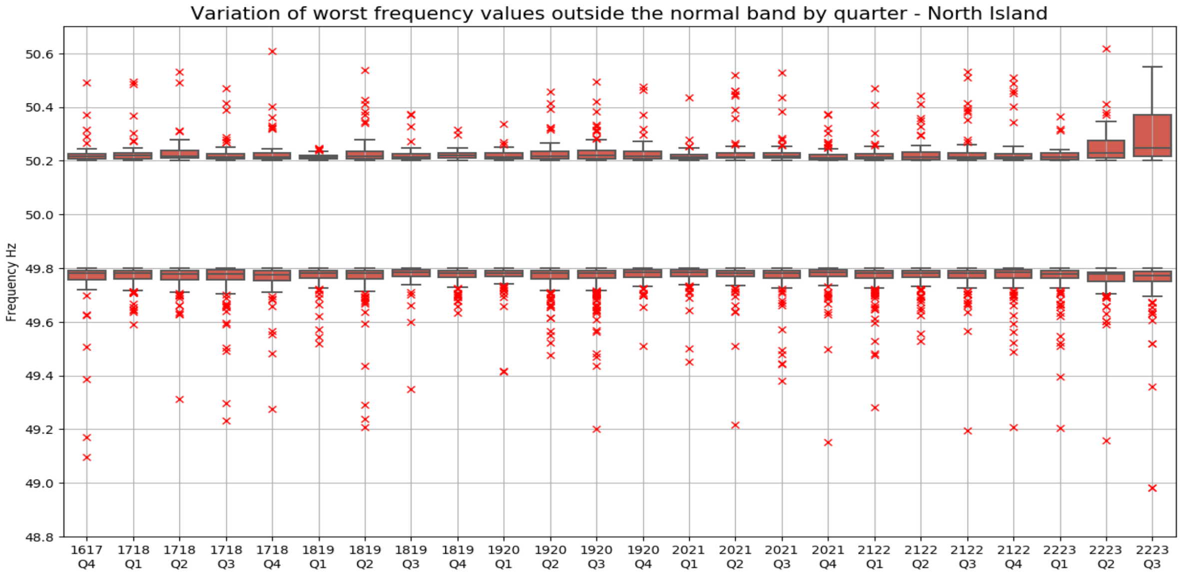
16 Frequency fluctuations

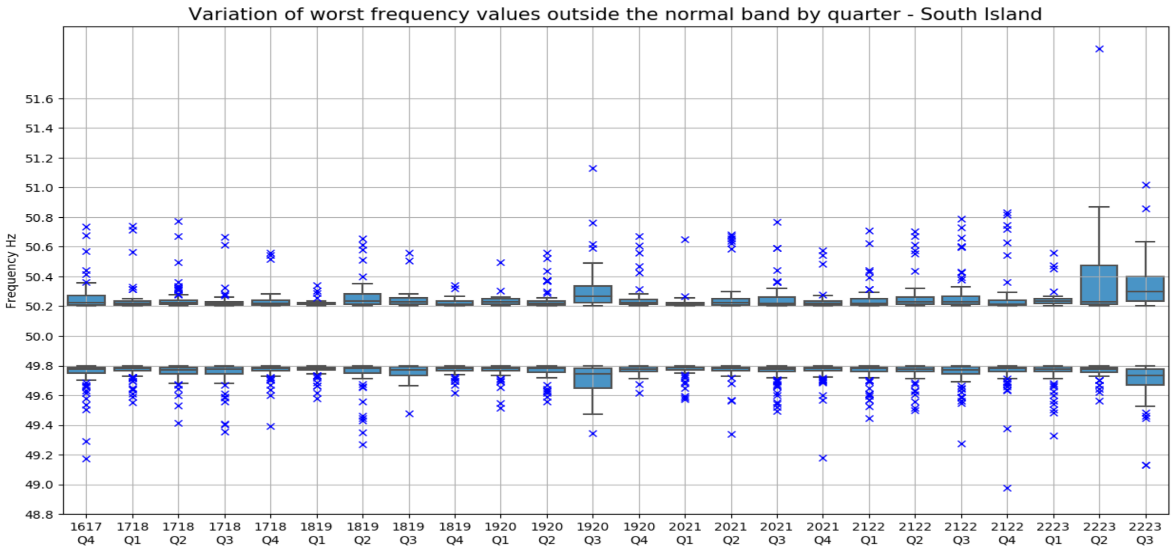
16.1 Maintain frequency in normal band (Frequency value)

The following charts show the distribution of the worst frequency excursion outside the normal band (49.8 to 50.2 Hz) by quarter since Q4 2016/17, including the reporting period.

North Island



South Island



Note1: 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.

Note2: The “box” for Q2 2022/23 above the normal band is a reflection of more Tiwai excursions than average and the HVDC runback in October. The wider “boxes” for Q3 2022/23 cover the periods of the HVDC outages and Cyclone Gabrielle.

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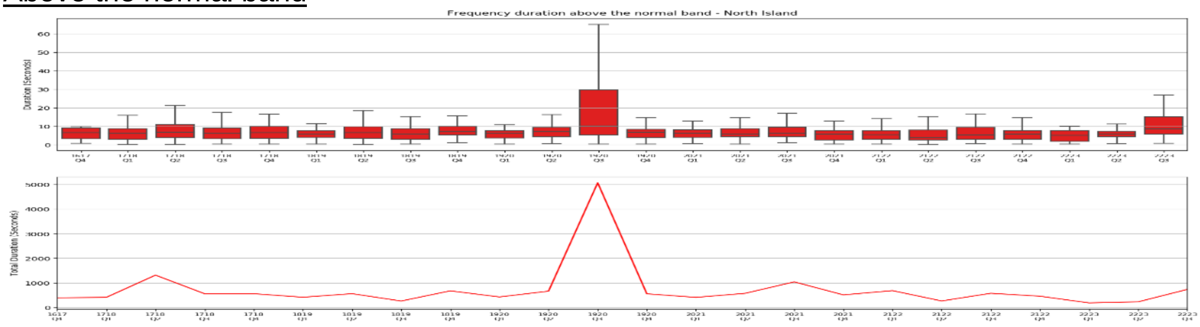
16.2 Recover quickly from a fluctuation (Time)

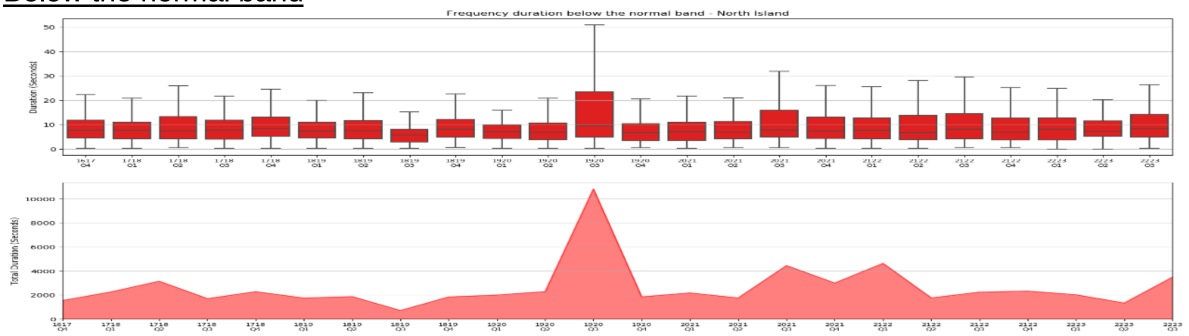
The following charts show the median and total duration of all the momentary fluctuations above and below the normal band for each island.

North Island

Above the normal band

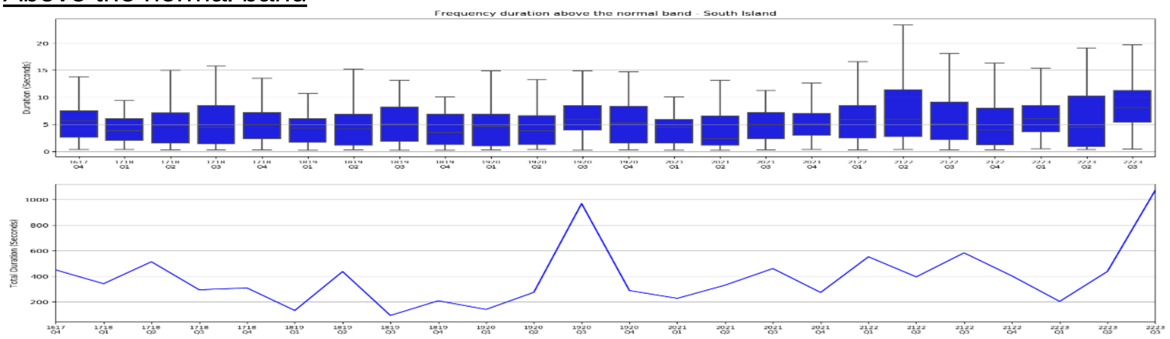


Below the normal band

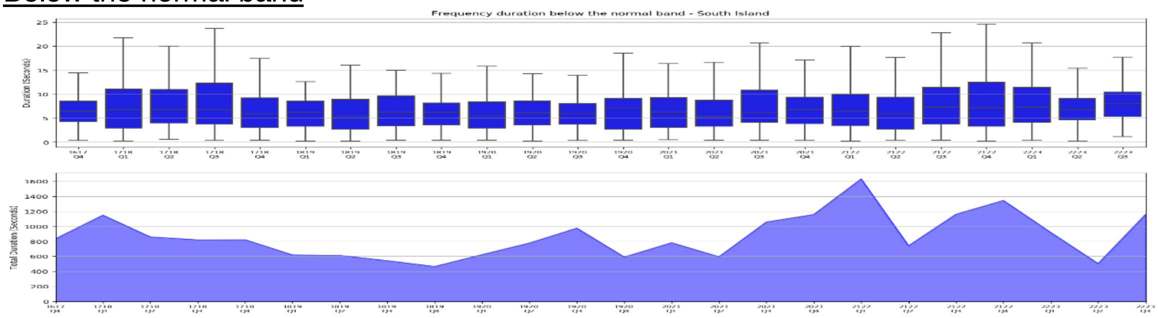


South Island

Above the normal band



Below the normal band



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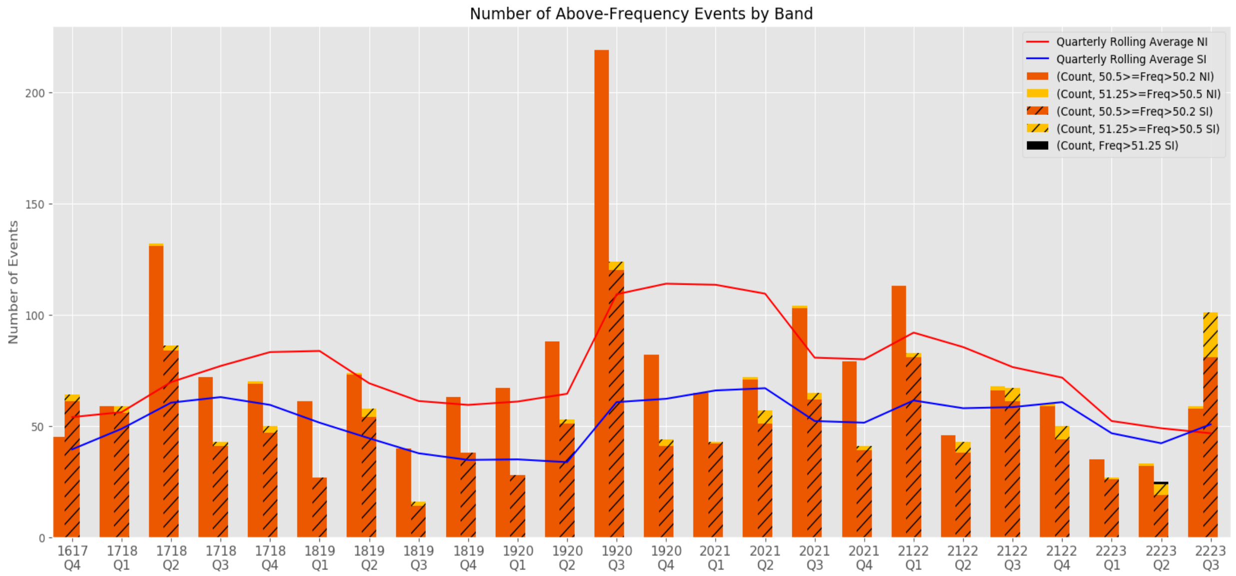
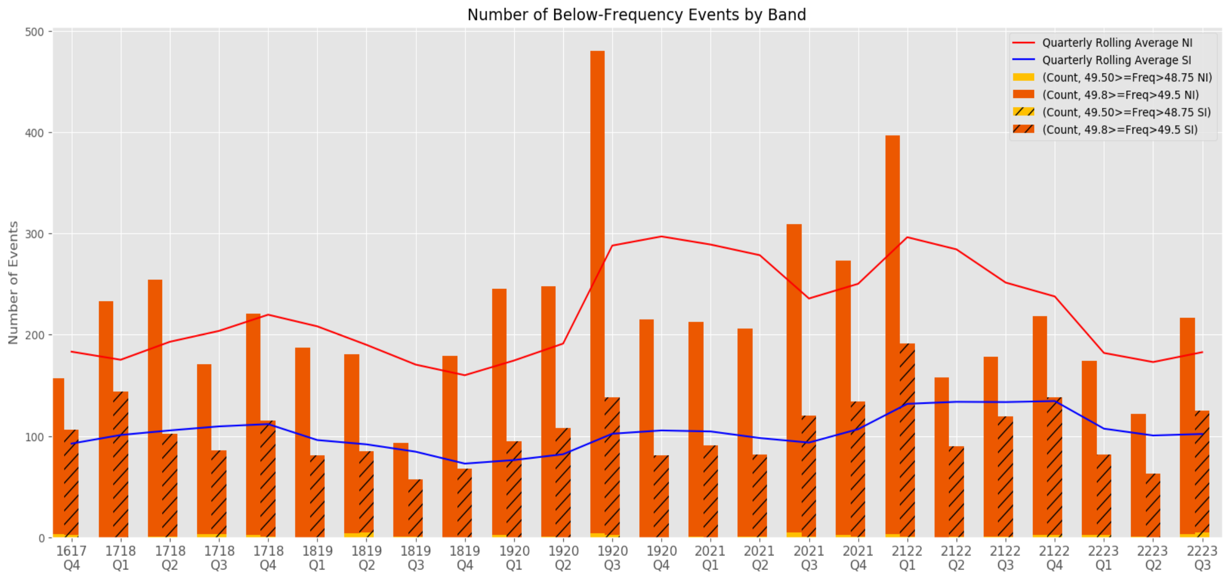
16.3 Manage frequency and limit rate of occurrences during momentary fluctuations (Number)

The following charts show the number of momentary fluctuations outside the frequency normal band, grouped by frequency band, for each quarter since Q4 2016/17. Information is shown by island, including a 4-quarter rolling average to show the prevailing trend.

Over-frequency events



Under-frequency events



16.4 Manage time error and eliminate time error once per day

There were no time error violations in the reporting period.

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17 Security notices

The following table shows the number of Warning Notices, Grid Emergency Notices and Customer Advice Notices issued over the last 13 months.

Notices issued	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23
Demand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	-	-	-	1	-	-	1	1	1	-	-	1	-
Warning Notice	-	-	1	-	-	-	-	1	-	-	-	-	-
Customer Advice Notice	15	14	15	28	24	25	35	33	30	17	11	4	14

18 Grid emergencies

Date	Time	Summary Details	Island
14/02/23	08:00	A grid emergency was declared following the loss of supply to Hawke's Bay caused by Cyclone Gabrielle. The grid emergency closed at 16:30 on 10 March; several revisions to the original notice were issued as the situation changed.	N

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Appendices

Appendix A: Discretion

In recent months, discretion has been reclassified to include the process to manage generators on minimum MW values overnight. As a result, the list of discretions in this report is much larger than recorded in previous months.

January – 16 instances

Event Date and Time	Description
1/01/2023 9:35	TKA0111 TKA1 Discretion Clause 13.70, Part 13 ENR Max : 0 Start: 01-Jan-2023 09:35 End: 01-Jan-2023 10:00 ABY-TKA trip Last Dispatched MW: 25
1/01/2023 18:49	NAP scheduled below their minimum operating run of 133 MW in various trading periods in 18:00 NRSL. SC called MRG Trader, who advised they would claim Rule 13.82A citing min run of 133 MW for plant safety. NI manual CE risk set to 132 MW from 23:00 to 07:00. Keeping NAP on at its minimum run is the least cost solution. Required for voltage support and over frequency reserves as well.
8/01/2023 18:31	NAP scheduled below their minimum operating run of 133 MW. Trader claimed Rule 13.82(a) citing minimum run of 133 MW for plant safety. NI manual CE risk set to 132 MW from 02:30 to 06:00 9 Jan. Keeping NAP on at its minimum run is the least cost solution. Required for voltage support and over frequency reserves as well.
9/01/2023 3:36	CYD2201 CYD0 Discretion Clause 13.70, Part 13 ENR Max : 0 Start: 09-Jan-2023 03:36 End: 09-Jan-2023 04:00 Discretion applied to 0 MW as dispatched to 13 MW, trader advised unable to meet this and minimum is 70 MW for 1 unit. Last Dispatched MW: 13.41
18/01/2023 16:07	MAN2201 MAN0 Discretion Clause 13.70, Part 13 EN Max : 230 Start: 18-Jan-2023 16:07 End: 18-Jan-2023 17:30 TWI 1 extended potline, MCC does not want to come back to economic dispatch, discretioned down to current value Last Dispatched MW: 407
19/01/2023 13:08	MAN2201 MAN0 Discretion Clause 13.70, Part 13 EN Max : 155 Start: 19-Jan-2023 13:08 End: 19-Jan-2023 13:30 TWI Line 1 extended offload. Last Dispatched MW: 328.94
25/01/2023 13:07	MAN2201 MAN0 Discretion Clause 13.70, Part 13 EN Max : 186 Start: 25-Jan-2023 13:07 End: 25-Jan-2023 14:30 ext. Potline Last Dispatched MW: 360
25/01/2023 14:26	MAN2201 MAN0 Discretion Clause 13.70, Part 13 EN Max : 186 Start: 25-Jan-2023 14:26 End: 25-Jan-2023 15:30 ext potline Last Dispatched MW: 186
25/01/2023 22:38	MAN2201 MAN0 Discretion Clause 13.70, Part 13 EN Max : 0 Start: 25-Jan-2023 22:39 End: 25-Jan-2023 23:00 MAN Dispatched below safe running range (49.8 MW) MAN has a min of 80MW. Claimed 13.82A. SC decided to apply Energy only discretion to 0 to bring them off until end of TP and then re assess. Still being used for reserves. Last Dispatched MW: 49.81
25/01/2023 23:01	MAN2201 MAN0 Discretion Clause 13.70, Part 13 EN Max : 0 Start: 25-Jan-2023 23:01 End: 26-Jan-2023 00:30 MAN Dispatched below safe running range at start of new TP (49.4 MW) MAN has a min of 80 MW. Earlier claimed 13.82A. Energy only discretion to 0 MW re applied until 01:00. Still being used for reserves. Last Dispatched MW: 0

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Event Date and Time	Description
26/01/2023 1:36	MAN2201 MAN0 Discretion Clause 13.70, Part 13 EN Max : 0 Start: 26-Jan-2023 01:36 End: 26-Jan-2023 02:00 Applied discretion for energy to 0 MW as dispatched 1.3 MW, rough running range is under 80 MW. Needed for reserves so discretioned energy only. Last Dispatched MW: 1.29
27/01/2023 11:14	MAN2201 MAN0 Discretion Clause 13.70, Part 13 EN Max : 240 Start: 27-Jan-2023 11:14 End: 27-Jan-2023 11:30 line 3 extended off load Last Dispatched MW: 300
27/01/2023 11:15	OHC2201 OHC0 Discretion Clause 13.70, Part 13 EN Max : 153 Start: 27-Jan-2023 11:15 End: 27-Jan-2023 12:00 line 3 extended off load Last Dispatched MW: 183.27
27/01/2023 11:15	OHB2201 OHB0 Discretion Clause 13.70, Part 13 EN Max : 153 Start: 27-Jan-2023 11:15 End: 27-Jan-2023 12:00 line 3 extended off load Last Dispatched MW: 183.27
27/01/2023 11:16	BEN2202 BEN0 Discretion Clause 13.70, Part 13 EN Max : 398 Start: 27-Jan-2023 11:16 End: 27-Jan-2023 12:00 line 3 extended off load Last Dispatched MW: 458.29
28/01/2023 21:15	HLY_5 scheduled below their minimum operating run of 182 MW in the NRSS and NRSL for the morning trough of 29 JAN. Genesis Trader advised they would claim Rule 13.82A citing min run of 182 MW for plant safety. NI manual CE risk set to 181 MW from 23:30 to 07:00. OPS case indicated MW price would increase by between $160 - $220 MW/h and HLY 5 required for voltage support during the morning trough.

February – 24 instances

Event Date and Time	Description
1/02/2023 6:46	ROT1101 WHE0 Discretion Max: 0 Start: 01-Feb-2023 07:00 End: 01-Feb-2023 08:30 Required for switching purposes for ROT bus outage. Last Dispatched MW: 23.5
1/02/2023 22:23	MAN2201 MAN0 Discretion Max: 0 Start: 01-Feb-2023 22:23 End: 01-Feb-2023 22:30 GC claimed 13.82.2a due to plant safety - minimum output is 80MW (dispatch is 60.9MW) Last Dispatched MW: 60.9 Was scheduled to 0MW this TP anyway but due to poor wind offers (250MW vs 82MW actual) MAN is marginal.
1/02/2023 22:25	MAN2201 MAN0 Discretion Max: 0 Start: 01-Feb-2023 22:25 End: 01-Feb-2023 22:30 GC claimed 13.82.2a due to plant safety - minimum output is 80MW (dispatch is 60.9MW) Last Dispatched MW: 60.9 Was scheduled to 0MW this TP anyway but due to poor wind offers (250MW vs 82MW actual) MAN is marginal. Last Dispatched MW: 60.9

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1/02/2023 22:33	MAN2201 MAN0 Discretion Max: 0 Start: 01-Feb-2023 22:33 End: 01-Feb-2023 23:00 GC claimed 13.82.2a due to plant safety - minimum output is 80MW (dispatch is 72MW) Was scheduled to 0MW last TP anyway but due to poor wind offers (250MW vs 82MW actual) MAN is marginal. Last Dispatched MW: 0
1/02/2023 23:03	MAN2201 MAN0 Discretion Max: 0 Start: 01-Feb-2023 23:03 End: 01-Feb-2023 23:30 GC claimed 13.82.2a due to plant safety - minimum output is 80MW (dispatch is 17MW) Last Dispatched MW: 0
2/02/2023 19:52	TKA0111 TKA1 Discretion Max: 0 Start: 02-Feb-2023 19:52 End: 02-Feb-2023 20:00 Albury Tekapo A tripped, Loss of connection to Tekapo A Last Dispatched MW: 13
2/02/2023 23:38	MAN2201 MAN0 Discretion Max: 0 Start: 02-Feb-2023 23:38 End: 03-Feb-2023 01:00 GC claimed 13.82.2a due to plant safety - minimum output is 80MW (dispatch is 3.2MW) Was scheduled to 0MW this TP but due to inaccurate IG offers (170MW vs 92MW actual) MAN is marginal. Last Dispatched MW: 3.27
3/02/2023 14:55	ROT1101 WHE0 Max: 0 Start: 03-Feb-2023 14:55 End: 03-Feb-2023 15:30 Required to be dispatched off for Outage Return. Last Dispatched MW: 23.5
3/02/2023 22:02	MAN2201 MAN0 Discretion Max: 0 Start: 03-Feb-2023 22:02 End: 04-Feb-2023 00:00 Claimed Rule 13.82a. Last Dispatched MW: 22.92 Rule 13.82(2)(a) claimed for a MAN dispatch of 22.9MW. MAN minimum run 80MW. Discussed with SC who determined MAN not required on and producing MWs, though still should be available for reserves.
4/02/2023 21:40	MAN2201 MAN0 Discretion Max: 0 Start: 04-Feb-2023 21:40 End: 04-Feb-2023 22:30 Claimed Rule 13.82(2)(a). SC advises MAN energy not required, but to ensure MAN reserves still available. Last Dispatched MW: 48.75
5/02/2023 0:01	MAN2201 MAN0 Discretion Max: 0 Start: 05-Feb-2023 00:01 End: 05-Feb-2023 00:30 Claimed Rule 13.82(2)(a). SC advises MAN energy not required, but to ensure MAN reserves still available. Last Dispatched MW: 0
8/02/2023 19:31	HLY5 scheduled below their minimum operating run of 182MW. Trader would claim Rule 13.82(a) citing minimum run of 182MW for plant safety. NI manual CE risk set to 181MW from 23:00 to 06:30. Studies show keeping HLY5 on at its minimum run is the least cost solution. Note, helps manage risk of EDG_KAW_3 risk as well, scheduling ~200MW export on single circuit. Using the KAW_110 risk group for this outage is inaccurate, the total of the generators in the area is not the same as the risk if the circuit tripped (due to lost load). Consideration needs to be given to how to manage this given the flows are changing all the time.
9/02/2023 13:19	MAN2201 MAN0 Discretion Max: 309 Start: 09-Feb-2023 13:19 End: 09-Feb-2023 15:00 Remaining off economic dispatch after line 1 offload Last Dispatched MW: 490
13/02/2023 10:40	MAN2201 MAN0 Discretion Max: 158 Start: 13-Feb-2023 10:40 End: 13-Feb-2023 12:00 TWI extended potline reduction. MAN not returning to economic dispatch. Last Dispatched MW: 326
13/02/2023 21:31	KPA1101 KPI1 Discretion Max: 0 Start: 13-Feb-2023 21:31 End: 13-Feb-2023 22:00 OPK_KPI_SFD_2 and OPK T4 tripped. Last Dispatched MW: 13
14/02/2023 7:42	TUI1101 TUI0 Discretion Max: 0 Start: 14-Feb-2023 07:42 End: 14-Feb-2023 09:00 RDF substation tripped Last Dispatched MW: 12

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21/02/2023 4:10	SFD2201 SFD22 Discretion Min: 10 Start: 21-Feb-2023 04:10 End: 21-Feb-2023 04:30 Discretioned on for voltage support- High steady state volts at TWH. Check SC MOL entries for details. Last Dispatched MW: 0
21/02/2023 4:13	SFD2201 SFD22 Discretion Min: 16 Start: 21-Feb-2023 04:13 End: 21-Feb-2023 05:30 CCC advised that SFD22 unit rough running range is 16MW. So discretion is amended to reflect that. Last Dispatched MW: 10
24/02/2023 3:00	TUI1101 TUI0 Discretion Min: 44 Start: 24-Feb-2023 03:00 End: 24-Feb-2023 04:00 Required for security in Hawkes Bay . Last Dispatched MW: 43.85
24/02/2023 3:01	TUI1101 KTW0 Discretion Min: 36 Start: 24-Feb-2023 03:01 End: 24-Feb-2023 04:00 Required for security in Hawkes Bay. Last Dispatched MW: 24.13
25/02/2023 1:52	HLY5 scheduled below their minimum operating run of 182MW. HLY operator advised they would claim Rule 13.82(a) citing minimum run of 182MW for plant safety. Studies show keeping HLY5 on at its minimum run is the least cost solution and they are also required for North Island voltage support. NI Optional Island Manual CE risk set to 181MW from 02:00 to 06:00.
25/02/2023 4:26	TUI1101 TUI0 Discretion Min: 44 Start: 25-Feb-2023 04:26 End: 25-Feb-2023 05:30 Required for Hawkes Bay security Last Dispatched MW: 43.87
25/02/2023 4:27	TUI1101 KTW0 Discretion Min: 36 Start: 25-Feb-2023 04:27 End: 25-Feb-2023 05:30 Required for Hawkes Bay security Last Dispatched MW: 22.17
25/02/2023 4:36	MAT1101 MAT0 Discretion Min: 19 Start: 25-Feb-2023 04:36 End: 25-Feb-2023 05:30 Rule 13.82a claimed due to resource consent Last Dispatched MW: 17.53

March – 15 instances

Event Date and Time	Description
3/03/2023 14:21	RPO2201 RPO0 Max : 0 Start: 03-Mar-2023 14:21 End: 03-Mar-2023 15:00 RPO WRK and RPO TNG tripped. Last Dispatched MW: 60
18/03/2023 8:59	KAW0111 TAM0 Max : 0 Start: 18-Mar-2023 08:59 End: 18-Mar-2023 09:30 Possible tripping due to earthquake. Last Dispatched MW: 21
18/03/2023 9:00	KAW1101 KAG0 Max : 0 Start: 18-Mar-2023 09:00 End: 18-Mar-2023 09:30 Possible tripping due to earthquake. Discretion removed after offers were electronically updated to 0. Last Dispatched MW: 105
18/03/2023 17:19	MAN2201 MAN0 Max : 25 Start: 18-Mar-2023 17:19 End: 18-Mar-2023 20:00 Reducing MAN generation in order to get MAN G4 RFS - Bus coupler 238 in mid-pos. Last Dispatched MW: 326
18/03/2023 17:19	MAN2201 MAN0 Max : 20 Start: 18-Mar-2023 17:19 End: 18-Mar-2023 20:00 Reducing MAN generation in order to get MAN G4 RFS - Bus coupler 238 in mid-pos. Last Dispatched MW: 326

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Event Date and Time	Description
18/03/2023 17:19	MAN2201 MAN0 Max : 220 Start: 18-Mar-2023 17:19 End: 18-Mar-2023 20:00 Reducing MAN generation in order to get MAN G4 RFS - Bus coupler 238 in mid-pos. Last Dispatched MW: 326
18/03/2023 18:19	MAN2201 MAN0 Max : 246 Start: 18-Mar-2023 18:19 End: 18-Mar-2023 18:30 . Reducing MAN generation in order to get MAN G4 RFS - Bus coupler 238 in mid-pos. Last Dispatched MW: 220
24/03/2023 8:18	WHI2201 WHI0 Min : 20 Start: 24-Mar-2023 08:18 End: 24-Mar-2023 09:00 Low residual in the North Island with a Pole 2 outage. Last Dispatched MW: 0
24/03/2023 8:30	WHI2201 WHI0 Min : 46 Start: 24-Mar-2023 08:30 End: 24-Mar-2023 09:00 Low residual in the North Island with a Pole 2 outage. Last Dispatched MW: 20
24/03/2023 8:31	WHI2201 WHI0 Min : 44 Start: 24-Mar-2023 08:31 End: 24-Mar-2023 09:00 Low residual in the North Island with a Pole 2 outage. Last Dispatched MW: 20
24/03/2023 8:36	WHI2201 WHI0 Min : 52 Start: 24-Mar-2023 08:36 End: 24-Mar-2023 09:00 Low residual in the North Island with a Pole 2 outage. Last Dispatched MW: 44
24/03/2023 8:55	WHI2201 WHI0 Min : 20 Start: 24-Mar-2023 08:55 End: 24-Mar-2023 10:00 Low residual in the North Island with a Pole 2 outage. Last Dispatched MW: 52
24/03/2023 9:44	WHI2201 WHI0 Min : 10 Start: 24-Mar-2023 09:44 End: 24-Mar-2023 10:00 Low residual in the North Island with a Pole 2 outage. Decreasing the discretioned MW to allow one end to be available next trading period if need be. Last Dispatched MW: 20
27/03/2023 0:43	Due to OKI_WRK_1 outage starting early Sunday evening, NAP NTM OKI risk binding and scheduling OKI varying values down to 0.2MW. Operator claims this would be a risk to plant and if shutdown unsure if it could be restarted. Schedules run with a manual NI CE risk of 257MW show negligible price difference. Already have 8 ccts out for voltage in NI so NAP NTM OKI additionally required to manage volts.NI CE risk modelled 257MW 01:00-03:00, 258MW 03:00-04:00 & 256MW 04:00-06:00.
27/03/2023 19:11	With an OKI_WRK_1 outage in place, the NAP NTM OKI Optional AC Risk risk is binding and scheduling OKI down by varying values (as low as 0.2MW). Contact Operator claims this would be a risk to plant and if shutdown they are unsure if it could be restarted. NTM is also being scheduled down and Mercury Trader indicated that they would claim a 13.82 (a) exemption if dispatched below their expected generation level. Schedules run with a manual NI CE risk of 257MW show negligible price difference. NI CE risk modelled at 257MW from 23:30 - 05:30.

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Appendix B: Dispatch Accuracy Dashboards

Energy

Same quarter in 2021/22

This quarter 2022/23

Measure	Description		2022 January	February	March	April	May	June	July	August	September	October	November	December	2023 January	February	March
Operator discretion applied	Total number of instances (5-minute dispatches) where operator interventions depart from the dispatch schedule to ensure the dispatch objective is met.	100% binding	355	422	445	292	501	529	457	517	565	406	418	329	395	554	501
	Instances where the system operator has applied discretion under 13.70 of the Code to meet dispatch objective		2	9	5	1	10	5	32	67	47	34	73	34	16	24	15
Frequency keeper (MW)	Average absolute deviation (MW) from frequency keeper dispatch point. A movement of frequency keeping units away from their setpoint suggests greater variability in the system, but can also indicate the need for additional dispatches	NI	7.32	6.41	7.11	7.23	6.95	6.82	6.81	7.06	7.03	6.99	6.96	7.16	7.10	6.46	7.05
		SI	6.76	6.32	6.69	7.10	6.46	6.62	6.66	6.82	6.86	6.88	6.89	6.87	7.00	6.32	6.70
Time error (s)	Average absolute daily time error (s) indicates imbalance between generation and load, a reflection of imperfect dispatch	NI	0.2087	0.2261	0.1901	0.2056	0.2071	0.2142	0.2347	0.2141	0.2208	0.2190	0.1722	0.1751	0.1900	0.1900	0.1900
		SI	0.1707	0.2258	0.1799	0.2120	0.1995	0.2142	0.2222	0.2138	0.2357	0.2140	0.1638	0.1583	0.1600	0.1600	0.1700
Frequency excursions	Number of frequency excursions (>0.5Hz from 50Hz)		2	6	2	3	4	4	3	-	2	8	-	-	11	1	6
FK within 1% of band limit	% of time frequency keepers spend near to or exceeding their regulation limits indicates the need to redispatch.	NI	2.68%	3.54%	2.58%	3.16%	2.58%	2.42%	2.47%	2.52%	2.67%	2.63%	2.18%	2.56%	2.56%	2.01%	1.99%
		SI	2.72%	3.55%	2.31%	3.13%	2.57%	2.44%	2.50%	2.53%	2.67%	2.62%	2.18%	2.57%	2.57%	1.79%	1.55%
FK outside of band limit	% of time frequency keepers spend outside their regulation limits	NI	0.01%	0.08%	0.05%	0.03%	0.04%	0.01%	0.03%	0.01%	0.04%	0.02%	0.01%	0.00%	0.01%	0.03%	0.04%
		SI	0.00%	0.03%	0.01%	0.01%	0.01%	0.00%	0.01%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.10%	0.04%
HVDC modulation beyond 30MW band	% of minutes where the maximum HVDC modulation exceeds 30MW away from its dispatch setpoint. This indicates greater variability in the system, but can also indicate the need for redispatch.		9.09%	10.37%	7.38%	8.38%	9.13%	10.89%	13.55%	11.16%	10.78%	7.72%	8.89%	7.20%	5.59%	6.44%	6.79%
Constrained on energy- Total	Total Monthly Generation	MWh	3,423,033	3,102,676	3,300,548	3,303,156	3,612,262	3,598,421	4,004,136	3,954,180	3,681,478	3,643,313	3,375,791	3,370,563	3,390,399	3,092,089	3,363,675
	Total constrained on - All sources	MWh	27,518	25,195	25,071	17,302	21,182	24,421	32,151	30,377	29,256	26,824	1,381	16,084	18,259	18,537	19,179
		% of all generation	0.80%	0.81%	0.76%	0.52%	0.59%	0.68%	0.80%	0.77%	0.79%	0.74%	0.04%	0.48%	0.54%	0.60%	0.57%
Constrained on energy ($) - Frequency keeping	Total constrained on $ due to frequency keeping (within band is attributable to SO)	$ Constrained On Energy	264,827	351,930	1,048,490	1,034,695	273,109	765,655	721,155	434,805	579,448	575,841	1,544,639	328,958	388,506	397,311	461,017
		$ Grid Constrained On Energy	41,297	57,475	66,726	38,151	31,680	53,162	54,655	42,003	64,386	34,066	811	4,758	11,001	27,896	28,005
Optimal Dispatch (%)	Compares the average impact of a perfect foresight case against dispatch solutions. Indicates impact of wind offer, load forecast and PSD accuracy.	%	93.910%	92.050%	94.100%	95.730%	94.830%	91.160%	90.310%	92.020%	88.960%	91.590%	93.470%	80.920%			
Dispatch load accuracy error (%)	Average absolute difference between forecast generation (load plus losses, including PSD) and actual generation relative to the average actual generation	%	99.600%	99.570%	99.600%	99.610%	99.600%	99.620%	99.610%	99.620%	99.610%	99.610%	99.590%	99.600%	Data currently unavailable		
Wind offer accuracy (%)	Average absolute difference between persistence wind offer (based on 5mins prior) and the actual wind output relative to the average wind output	%	97.410%	97.340%	97.260%	97.440%	97.420%	97.510%	97.510%	97.310%	97.090%	97.820%	97.500%	96.960%			

Scale for measures:

Variation of up to 0.25 std devs from standard	... up to 1 std dev from standard	... up to 2 std devs from standard	... over 2 std devs from standard

NOTE 1: Commentary on the current quarter's data is included in section 9.1 of this report

NOTE 2: The Optimal dispatch data is currently unavailable; we will provide an updated version of this report in early May which will contain this data and a corresponding commentary.

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Understanding the energy dashboard

The purpose of this dashboard is to identify trends and outliers for measures that represent overall industry performance in energy dispatch. The System Operator actions are only one of the influences in this performance. Three of the measures in which the System Operator has some influence in the performance are converted into a metric.

Measures selected

We have selected measures that cover the following key areas of dispatch performance:

- When operator discretion is required
- Variations in frequency
- When generators are required to be constrained on/off to meet the dispatch objective
- Variation in output and inputs to the Optimum dispatch tool, which compares what happened in real time to what would have happened if there had been perfect foresight

Colour scale

The dashboard uses coloured shading to make it easy to highlight interesting cells or ranges of cells and emphasise unusual values. In this case we have used a colour scale from green (good performance) through to orange (outliers). Each of the cells sits on a colour gradient within this scale.

The colour scales used in the dashboard reflect performance against a standard. A standard that represents good performance has been applied to each of the measures. Variance from this standard identifies outliers which we comment on in section 9.1 of the report. The current standard is the average of the data since January 2019.

Variation of up to 0.25 std devs from standard	... up to 1 std dev from standard	... up to 2 std devs from standard	... over 2 std devs from standard

[1]

Metric[2]

The measures that contribute towards the metric are:

- FK outside of band limit [3]
- Constrained on energy- Total
- Optimal Dispatch (%)

There are three stages to calculating the metric

1. **Determine a standard**
   This is based on what represents good performance
2. **Rate the comparison on a scale of 1 to 3**
   The monthly performance is compared to the standard against a predefined scale. There are two scales used in this calculation - FK outside of the band limit and Constrained on energy - Total; and Optimal Dispatch (%). These are shown in the tables below:

[4]

Score	Outcome	Measure is:
3	Good performance	Up to 0.25 std devs above the standard
2	OK performance	Between 0.25 and 1 std dev above the standard
1	Weak performance	Over 1 std devs above the standard

Score	Outcome	Optimal dispatch is:
3	Good performance	Up to 0.25 std devs below the standard
2	OK performance	Between 0.25 and 1 std dev below the standard
1	Weak performance	Over 1 std devs below the standard

3. **Calculate an overall metric score**
   The overall metric is the average of the three individual scores.

Example:

			Month	Standard
FK outside of band limit	% of time frequency keepers spend outside their regulation limits	NI	0.20%	0.08%
		SI	0.02%	0.01%
Constrained on energy- Total	Total constrained on - All sources	MWh	23,649	28,417
		% of all generation	0.59%	0.80%
Optimal Dispatch (%)	Compares the average impact of a perfect foresight case against dispatch solutions. Indicates impact of wind offer, load forecast and PSD accuracy.	%	93.2%	92.37%
	Metric calculation rows	FK outside band	2	
		Constrained on	3	
		Optimal Dispatch	3	
Dispatch accuracy %	Metric out of 3 (3 is best possible result)		2.7	

FK outside of band limit = (0.2+ 0.02)/2 = 1.1 -> 2 (as a result of the distribution for this measure)
Constrained on energy- Total = 0.59 -> 3 (as a result of the distribution for this measure)
Optimal Dispatch (%) = 93.20% -> 3 (as a result of the distribution for this measure)
Overall metric = (2+3+3)/3 = **2.7**

[1] Since last quarterly report we have changed the way in which we measure variation, to make it in terms of standard deviations (instead of percentage variations) for both the conditional formula shading and the metric calculation
[2] This metric is for analysis purposes and is not part of the performance metrics report to the Authority
[3] Last quarterly report used the measure FK within 5% of band limit, we have updated this as variation outside of band limit was felt to be more meaningful
[4] The score was changed during the year from a five point (1-5) to a three point (1-3) scale.

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Reserves

Same quarter in 2021/22

This quarter 2022/23

			2022 January	February	March	April	May	June	July	August	September	October	November	December	January	February	March
FIR procured vs Risk	NI+SI Fast Instantanous Reserve (FIR) procured divided by the estimate of FIR risk. A greater proportion suggests over procurement of reserves in the relevant island. Monthly average per trading period.	ACCE	**0.74**	**0.82**	**0.76**	**0.73**	**0.79**	**0.70**	**0.59**	**0.47**	**0.48**	**0.54**	**0.47**	**0.45**	**0.60**	**0.71**	**0.78**
		DCCE	**NIL**	**0.88**	**NIL**	**NIL**	**NIL**	**NIL**	**0.54**	**0.58**	**0.45**	**0.55**	**0.50**	**0.41**	**NIL**	**0.66**	**0.75**
FIR procured (MW)	Average FIR MW procured per trading period	FIR	217	268	244	246	256	213	176	113	107	123	76	73	151	225	235
SIR procured (MW)	Average SIR MW procured per trading period	SIR	307	357	337	343	339	318	306	255	239	243	171	165	244	338	347
FIR procured ($)	Total monthly cost ($) of FIR procured	FIR	648,275	2,668,483	1,026,829	773,471	1,016,826	1,289,642	654,500	350,087	60,030	418,165	181,568	16,936	467,409	1,199,166	3,661,739
SIR procured ($)	Total monthly cost ($) of SIR procured	SIR	425,975	819,488	565,559	272,183	275,921	1,676,320	2,203,944	858,185	1,286,853	1,207,130	550,071	474,674	188,940	519,073	1,284,391
Net free reserves (NFRs)	Average national Net free reserves (NFRs) for a trading period where the risk type is binding, averaged over a month	AC	97	88	96	106	90	111	140	152	145	142	120	131	123	118	99
		DC	**NIL**	82	**NIL**	**NIL**	**NIL**	**NIL**	**115.55**	**126.76**	**124.29**	**117.33**	**115.15**	**118.71**	**NIL**	**109.91**	**98.34**
Reserve sharing	Average percentage of FIR procured that is shared between islands. FIR shared NI+SI / FIR MW Procured NI+SI (Average per trading period).		51%	33%	42%	46%	43%	47%	50%	57%	64%	Data currently unavailable					
IL vs Spinning Reserve	Percentage of IR procured as interuptable load.	FIR	34%	35%	34%	28%	27%	34%	36%	25%	24%						
		SIR	39%	36%	34%	27%	26%	36%	43%	37%	36%						
Risk setter	Most common risk setter (highest number of trading periods)	NI	HLY5CE	HLY5CE	HLY5CE	HLY5CE	HLY5CE	HLY5CE	HLY5CE+15	HLY5CE	HLY5CE	HLY5CE	OtherIslandCE	OtherIslandCE	HLY5CE	HLY5CE	HLY5CE
		SI	ManualCE;OtherIslandCE	OtherIslandCE	ManualCE;OtherIslandCE	ManualCE;OtherIslandCE	ManualCE;OtherIslandCE	ManualCE;OtherIslandCE	ManualCE;OtherIslandCE	ManualCE;OtherIslandCE	ManualCE;OtherIslandCE	ManualCE	ManualCE	ManualCE	ManualCE;OtherIslandCE	OtherIslandCE	OtherIslandCE
Proportion of time risk setter	Proportion of time each type of risk was FIR risk setter	ACCE	99.93%	89.43%	100.00%	100.00%	100.00%	100.00%	99.26%	96.10%	94.99%	97.38%	76.53%	84.54%	99.87%	97.25%	80.65%
		DCCE	0.00%	10.57%	0.00%	0.00%	0.00%	0.00%	0.34%	3.09%	2.78%	1.68%	19.58%	15.05%	0.00%	2.75%	19.35%
		DCECE	0.07%	0.07%	0.00%	0.00%	0.00%	0.00%	0.40%	0.81%	2.23%	0.94%	3.89%	0.40%	0.07%	0.00%	0.00%
Average MW risk when risk setter	Average risk MW for each risk type when they are the FIR risk setter	ACCE	294	313	319	337	326	305	300	239	227	227	141	142	250	306	295
		DCCE	0	420	0	0	0	0	253	302	228	261	232	203	NIL	322	367
		DCECE	149	0	0	0	0	0	39	59	45	46	82	145	111	NIL	NIL

NOTE 3: “Reserve sharing” and “IL vs Spinning reserve percentages” are currently unavailable, following the transition to RTP. These figures will be included when the Q3 report is re-issued in early May..

Understanding the reserves dashboard

The purpose of this dashboard is to provide greater visibility of statistics on fast instantaneous reserve (FIR) and sustained instantaneous reserves (SIR) which enable us to look at trends in reserve procurement.

Measures selected

We have selected a number of measures that identify trends in instantaneous reserves procurement. The one which we believe is the key one to focus on is:

> Monthly average of [FIR MW procured as a percentage of the FIR risk] per trading period (%)
> across the whole of New Zealand[5] for AC contingent events (ACCE)

This is because it reports on System Operator efficiency in procuring the lowest quantity of FIR to ensure system stability following an event. It also provides an insight into the output of the key System Operator tool – RMT. We consider this provides useful information and trends that can be analysed further. Note, this measure is focused on FIR quantities rather than costs which are largely a result of reserve offer prices than optimal procurement.

Colour scale

The dashboard uses coloured shading to highlight patterns in the data. In this case the shading identifies the variability of the results in the dashboard; it does not compare the results against a standard.

The variation in the shading should not be interpreted as good/bad – but used to identify where there is variation.

All results for a measure may be extremely good, but if there is any variation, the shading simply shows the most desirable values in darker green and the least desirable values in orange; colours from pale green, through pale orange illustrate the relative values between these two extreme points.

The blue shading is used for measures where the concept of least desirable and most desirable does not exist.

[5] The introduction of the national IR market has resulted in reserves being shared across the islands.

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