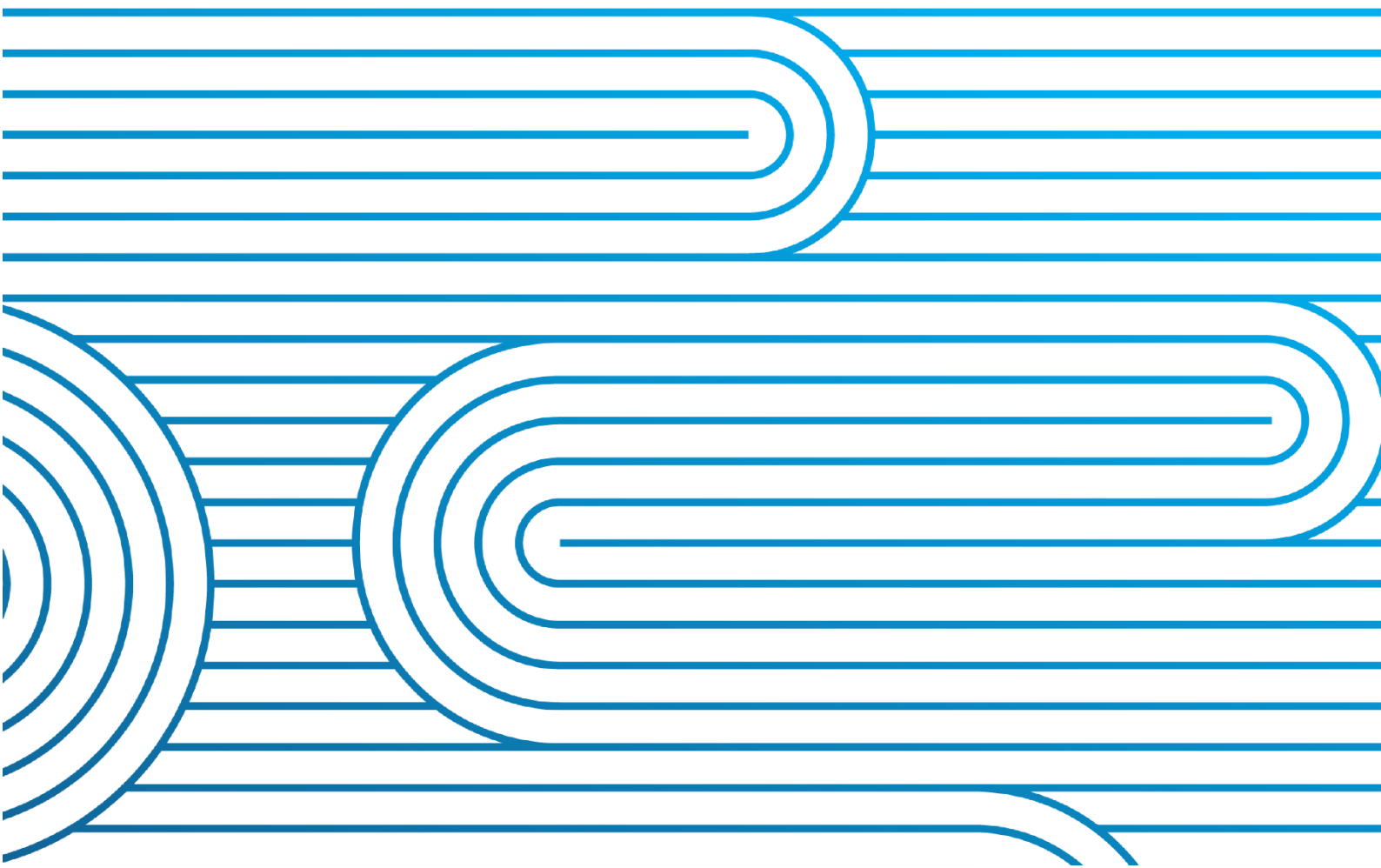


Quarterly System Operator and system performance report

For the Electricity Authority

July to September 2023



Report Purpose

This report is Transpower's review of its performance as system operator for Q1 2023/24 (July to September 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.

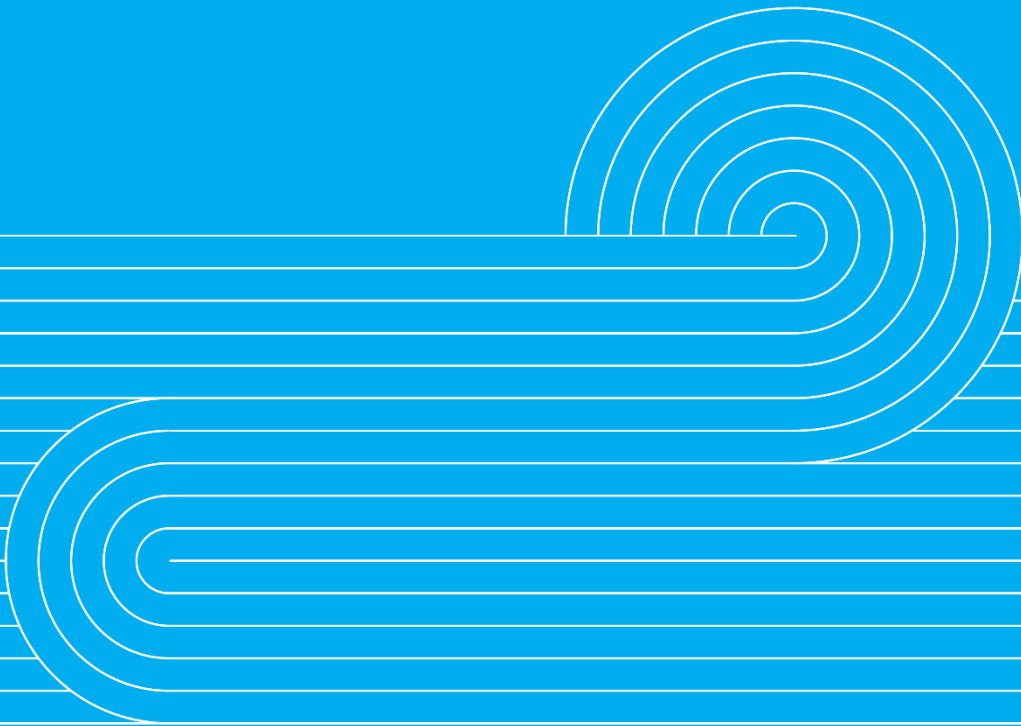
A detailed system performance report (Code obligated) is provided for the information of the Electricity Authority (Authority).

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Commentary



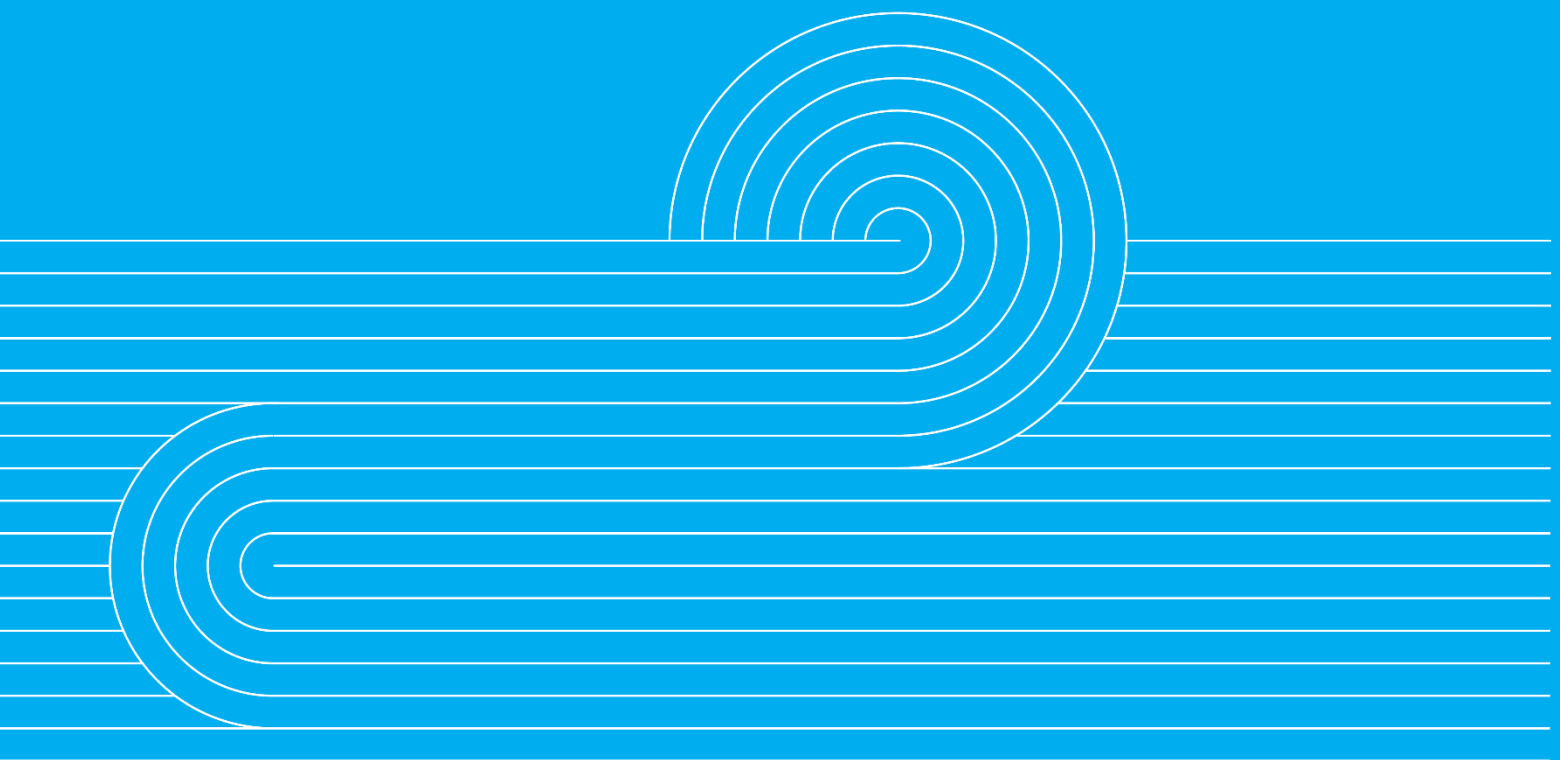
This section provides a high-level update for this quarter. The remainder of the report provides supporting detail on system operator performance.

Update (July to September 2023)

- John Clarke is now acting as GM Operations until a permanent appointment is made following Steve Jay's move to a new role outside Transpower on 24 August.
- We have coordinated operation of the power system over the winter period, which included the second highest ever amount of demand on record in New Zealand on 2 August. Due to where the generation that supplied the load was provided, this was highest ever amount of injected generation in New Zealand.
- We completed and submitted our annual self-review to the Authority covering the period 1 July 2022 – 30 June 2023.
- We agreed a refresh of the Joint Development Programme with the Authority, which provides a view of shared change programmes from 2023-28.
- We engaged with local industry and international peers as part of our commitment to keeping abreast of the evolving industry needs and informing others of work we have been carrying out. The engagement included CIGRE, IEE, EirGrid, Vietnam Electricity, AEMO, APEX, and forums of the ENA, Energy Traders and Taranaki Energy.
- We published a thought leadership publication on the enduring suitability of the New Zealand security of supply frameworks which invited stakeholder feedback.
- We continue to work with the Authority on the FSR programme, working on studies for the Common Quality Technical Group and tabling changes we would like to implement in Part 8.
- We shared our draft Winter 2023 review paper with the Authority to ensure alignment prior to publishing.
- We met with the Authority to provide our suggested enhancements for the winter initiatives implemented earlier this year (residuals, sensitivities, wind forecast and discretionary demand).
- A Low Residual Situation CAN was issued for the morning peak of 11 August. An industry conference was held. Lower than expected demand and higher actual wind generation resulted in no actions being taken on the day.
- We published a NZGB Customer Advice Notice inform the industry of the potential shortfall November. The main risk we are looking for is a sudden cold spell that can increase loads and any further generation or transmission outages that will worsen the shortfall.
- We formally closed the RTP project which has successfully transitioned to a BAU activity.
- SolarZero went live, this quarter, as the first participant in the Dispatch Notification service, implemented through the Real Time Pricing project.
- We shared the consolidated transition plan for AUFLS with the North Island connected asset owners in July. We are working with the Authority on the transition process under TAS 107.

Commissioning workload continues to be high with two current commissioning activities – one wind and one solar - and four pre-commissioning activities underway, including a proposed battery currently planned for Autumn 2024

System Operator performance



1 Commitment to the evolving industry needs

We took part in, and presented at, a number of New Zealand and international events this quarter:

- CIGRE (International Council on Large Electric Systems):
 - We helped to organise the New Zealand market development and regulation event at Victoria university and presented on “Move to RTP and updating distribution network setting”.
 - We attended the Cairns conference which shared knowledge on technologies, systems and markets, and changes in IT systems.
- Institute of Electrical and Electronics Engineers (IEEE):
 - We presented a paper on "Analysis of wind and solar resource correlation and its impact on real-time balancing in NZ" at the power engineering society annual general meeting in Florida, USA.
 - We hosted an event at which Dr. Lin (Powertech Labs Inc., Canada) covered current practice, challenges, and trends for dynamic security assessments of power systems.
- Energy Traders conference: In conjunction with the Authority, we presented on recent changes and the upcoming work programme.
- EirGrid: We met with Eirgrid, owner and operator of the Irish electricity grid, to discuss optimal grid ratings and operational limits.
- EVN (Vietnam Electricity): We hosted EVN, the largest power company in Vietnam, and as part sharing our experiences, presented on distributed energy resources aggregation.
- Australian Energy Market Operator (AEMO): In preparation for the Authority’s consultation on wind forecasting, we met with AEMO to discuss their experience of wind and solar forecasting.
- Taranaki Energy Forum: We presented on the challenges of security of supply, and talked through changes to reporting, monitoring and management of security of supply.
- Electricity Networks Aotearoa (ENA) Future Networks Forum: We led workshops on SO/EDB interfaces and hot water cylinder load control.
- Association of Power Exchanges (APEX): We presented a session on price formation.

We published our [Evolving Security of Supply Assessment in New Zealand](#) consultation paper in July 2023 to highlight opportunities to enhance and evolve how security of supply is considered. The thought leadership publication considers the enduring suitability of the New Zealand security of supply frameworks and invited stakeholder feedback.

We continue to provide early visibility of low residual situations to enable industry to react where possible. We issued a Low Residual Situation CAN on 10 August for the morning peak of 11 August, after increasing the load forecast based on expected lower temperatures across the country. An industry conference was held on the afternoon of 10 August, drawing attention to the CAN, outlining the drivers for issuing the CAN, and reminding industry of the process that would be followed should a shortfall eventuate. A further Low Residual Notice was issued on the 10 October for the morning peak on the 11 October. Demand was above

average, but not high for the time of year, the cause of the low residual was low wind generation, units on outage, and low unit commitment. The time period of low residual was 7.30am to 9.30am. An industry conference was held on the afternoon of the 10 September. Additional generation, deferring some outages to start after 9am, reduced the size and length of the low residual. In both instance residual remained above 200MW over the peak.

Winter Review

We shared our draft Winter 2023 review paper with the Authority to ensure alignment prior to publishing. We expect the Authority's comments by 13 October and we will determine the most appropriate time for publishing given the election.

We recently met with the Authority to provide our suggested enhancements for the winter initiatives implemented earlier this year (residuals, sensitivities, wind forecast and discretionary demand). The Authority is due to publish a consultation paper as part of its winter review, which will inform its decisions around which existing initiatives to continue and any new ones to progress.

2 Risk & Assurance

Risk Management

We are developing a risk register to provide visibility and assurance of system operator risks with the industry (including the Authority); these risks are subject to be reviewed/challenged by the industry. This register fulfils one of the KPI requirements for this year and also serves as an input to our internal risk bowtie and will help identify threats/risk controls which have not yet been captured.

We have started our six-monthly control self-assessment review, covering five critical controls in the areas: 24-hour real-time operations, business support, incident preparedness and response, power systems planning and support, and delivery of critical tools.

Business assurance audits

The 2023/2024 Audit Plan is ahead of schedule. The first audit regarding our system operator gatekeeper process is complete, with two priority 3 findings only. This will be provided to the Electricity Authority in October. Our auditor is undertaking field work for the second audit on use of discretion within the demand/generation shortfall process. We have agreed the scope for a third audit, Management of Inputs to RMT.

3 Compliance

We did not report any system operator self-breaches in this quarter.

4 Impartiality of Transpower roles

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

During the transition period between Stephen Jay's departure as GM Operations (24 August) and the appointment of a new GM Operations, John Clarke is acting as GM Operations. To maintain System Operator impartiality, John has relinquished his role as GM Grid Development for the period that he is acting as GM Operations. Chantelle Bramley will

act as GM Grid Development during this period. We recorded this arrangement in the System Operator Conflict of Interest Register.

System Operator Open Conflict of Interest Issues		
ID	Title	Managed by
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

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)

The project was formally closed in July, following completion of lessons learned documentation and transition to BAU activities.

Future Security and Resilience (FSR) Programme

The second FSR Common Quality Technical Group (CQTG) meeting was held on 10 August 2023. At the meeting:

- a short list of prioritised options to address the seven issues highlighted in the Authority’s Future Security and Resilience paper “Review of common quality requirements in Part 8 of the Code issues”, was confirmed.
- several CQTG members agreed they will provide distribution network models to the system operator to enable us to conduct the system studies.
- the draft scope document was submitted to the CQTG sub-group for feedback; this will be submitted to the wider CQTG members for final agreement.

We have subsequently completed the study scopes for the six studies identified by the CQTG at the meeting which have been circulated to the members for comment. We have been working on the study cases and will get some results by the end of October.

We tabled the other changes we would like to implement in Part 8 with the Authority’s FSR team. We will continue to discuss these with the Authority.

Extended Reserves – AUFLS Project

AUFLS assessment report 2022: The draft 2022 compliance assessment is progressing well. The system security modelling is based on real-time cases and load data from AUFLS providers for 2022. We have received and are reviewing the updated data from Transpower

as Grid Owner covering some missing data relating to Tiwai's AUFLS requirements. The AUFLS 2022 compliance assessment report will be delivered to the Authority at the end November 2023.

AUFLS Transition: During the quarter, we completed security studies, based on the submitted North Island connected asset owners' individual transition plans. We assessed system security to ensure we can maintain our Principal Performance Objectives (PPOs) during the 18-month AUFLS transition period. We shared the consolidated transition plan with the North Island connected asset owners in July.

We have progressed with detailing the AUFLS transition process under the new Technical Advisory Services (TAS) contract - TAS 107- to enable the transition to run as effectively as possible. An initial risk assessment was completed to determine any contingency plans that need to be put in place. A joint Authority/System Operator risk assessment will take place in October. In addition, as System Operator we are conducting further work optimising the tools in preparation for the transition to start in January 2024.

5.2 Other projects and initiatives

Operational Excellence

Operational Excellence is programme of ongoing tasks to lift and improve our system operator control room capability. During this quarter, we have been embedding the updated procedure review process, a robust approach with a checklist including validation of inputs and tools and compliance with the Code as appropriate. It has been well received by the teams and provides a methodology that captures learnings identified in real time use, in training, or through event investigations.

A prototype tool for resource planning has been developed. This will be used for forward planning of resourcing requirements and timing of recruitment and training.

Other initiatives completed included an audit of the dispatch training simulator to identify important gaps that have emerged between the testing, training, and simulation environment (TTSE) and the real time production environment. As a result, a number of immediate issues are being worked through with further enhancements to be considered for ongoing prioritisation.

System Operator Service Provider Agreement (SOSPA) contract reset

We are developing a plan for the preparation and negotiation for the next SOSPA contract period. An initial estimate of the SOSPA3 financial envelope has been provided to the Authority to signal the impact on the future appropriations. Engagement with the Authority team is planned to commence in October.

6 Technical advisory hours and services

The following table provides the technical advisory hours for Q1 2023/24 and a summary of technical advisory services to which those hours related (SOSPA 12.3 (d) refers).

TAS Statement of Work (SOW)	Status	Hours worked during Q1
TAS SOW 102 – Reviewing Part 8 of the Code – Common Quality	Completed	81.0
TAS SOW 103 - Extended Reserve Implementation FY22/23 - Planning for Transition	Completed	28.0
TAS SOW 106 – FSR Workstream – supersedes TAS 102	In progress	570.8
TAS SOW 107 – Extended Reserve Implementation	In progress	297.0
Total hours		976.8

7 Outage planning and coordination

Outage planning – near real time

Planned outages requested by the Grid Owner and other market participants are increasing as we come out of the winter period. For many weeks in the remainder of the year scheduled to have over 150 outages per week.

New Zealand Generation Balance (NZGB) analysis

During this quarter, the NZGB base N-1-G scenario highlighted potential shortfalls existed in September, October and one day in early November. The most significant outages during the quarter periods being the ongoing unplanned Huntly 5 outage, two Manapouri unit outages, an unplanned Stratford unit outage and the late September HVDC outage.

The November potential shortfall is due to the Huntly unit 5 outage, Huntly unit 2 outage, Taranaki Combined Cycle (TCC) outage, two Stratford Peaker outages, Maraetai unit outages and two Manapouri unit outages. In addition to the generation outages, there are also some transmission outages, including some outages that impact the maximum power transfer limit on the HVDC, as well as an outage that disconnects Junction Road generation; these also contribute to the potential shortfall in November. Low margins continue to persist around these periods.

A NZGB Customer Advice Notice was published to inform the industry of the potential shortfall November. The main risk we are looking for is a sudden cold spell that can increase loads and any further generation or transmission outages that will worsen the shortfall. We continue to bring awareness of this potential shortfall during our fortnightly System Operator Forums.

In contrast, from mid-November onwards the margins return to healthy levels as the loads decrease and as generation outages are completed.

8 Operating the power system

On 2 August we had the second highest peak demand on record in New Zealand. The peak was second only to the grid emergency of 9 August 2021 (by 7 MW), even though temperatures in the main centres were 1-2 degrees warmer than 9 August 2021. Meeting demand on 2 August required more generation than 9 August 2021. This was due to additional losses as more South Island generation was being transferred north over the HVDC. Unlike 9 August 2021 when a grid emergency was declared and load managed down, on 2 August 2023 demand was able to be supplied with 300 MW of residual capacity to spare, due to higher levels of thermal unit commitment and less outages.

9 Power systems investigations and reporting

Significant incident investigations

No new significant events were identified in this quarter.

Commissioning

Commissioning workload continues to be high with two current commissioning activities – one wind and one solar - and four pre-commissioning activities underway, including a proposed battery currently planned for Autumn 2024

SolarZero went live, this quarter, as the first participant in the Dispatch Notification service, implemented through the Real Time Pricing project. SolarZero began offering ~23MW of aggregated residential batteries, and this capacity will increase over time as part of an innovation pilot project in partnership with Ara Ake.

10 Performance metrics and monitoring

We have updated our performance metrics for the 2023-24 year to focus on desired outcomes as opposed to individual system operator tasks. This concentrates our focus on the big picture, a necessary requirement to support industry evolution as a whole.

Our performance against the objectives will be reviewed quarterly and annually. The quarterly review sessions are intended to provide an agreed interim / indicative score. This score will be for information purposes only and is intended to give us as system operator an indication of our performance. The annual review will be a joint determination of our performance, which is used to determine our performance incentive at the end of the financial year.

The first quarter review meeting is scheduled at the end of October, after this Quarterly Report is delivered to the Authority. We will be updating this section of the report to reflect the interim / indicative score agreed at that meeting.

The outcomes identify what Transpower needs to do to successfully perform the role of the system operator service provider. Although each outcome addresses a specific purpose required of the role, there is also a degree of interaction and inter-relationship between them.

We will report on the pieces of work completed that deliver to each of the outcomes and highlight the work planned for the remainder of the year. The degree to which the system operator is progressing against each outcome will be indicated on a scale of 1 (lowest) to 5 (highest), which refer to a set of agreed requirements with the Authority.

Outcome ref	External Outcomes	Purpose of outcome
O1	New security and reliability risks are identified and appropriately managed	To ensure that all security and reliability risks, including those for High Impact/Low Probability events, are identified and regularly reviewed by the system operator, with further review externally by stakeholders.
O2	Significant events are appropriately scoped, understood, prepared for and managed	A specific application of O1 with a more granular focus, to concentrate on assessing the preparation, management, and review of any significant events that occur in the year or adjacent years.
O3	The Authority is supported to evolve and develop the electricity market and power systems	To focus on the system operator's role in developing the electricity market and power systems by supporting the Authority in its work plan. ¹
O4	Relevant market information is made accessible to stakeholders	To make non-confidential market information available to stakeholders to enable all parties make better informed decisions. ²
O5	Stakeholders are effectively informed on and included in decisions where relevant	To ensure the viewpoints of all parties affected by a decision are taken into consideration as part of the process. ²
O6	Stakeholders are satisfied with our service	To understand if the system operator's view of good provision of the service meets the requirements of stakeholders.
O7	SOSPA delivery provides value	To evaluate if the system operator's provision of the service provides value for money to the Authority.

SOSPA and Code deliverables

- Joint Development Programme: In August, we agreed a refresh of the Joint Development Programme with the Authority, which provides a view of shared change programmes from 2023-28. The updated plan is available on our website.
- We completed and submitted our annual self-review to the Authority before the due date of 30 August. The self-review covered the period 1 July 2022 – 30 June 2023. Our performance score for this period, based on the previous set of agreed metrics, was 97%.

10.1 Optimal dispatch dashboard

The dashboard in Appendix B focuses on the results of the optimum dispatch tool, which compares what happened in real time to what would have happened if there had been perfect foresight of wind generation and load.

The optimal dispatch measure has increased this quarter. On average the real-time wind forecast accuracy has improved this quarter which helped improve the optimal dispatch metric.

¹ This is one of the three outcomes (O3, O4 and O5) which monitor good communication and collaboration across stakeholders in the industry.

During this quarter, the 2 August evening peak period had the largest impact on the optimal dispatch measure. During the evening peak the system reached its highest load this year with real-time spot prices reaching ~\$1,300/MWh at Benmore and ~\$1,800/MWh at Otahuhu. During these periods actual loads were lower than forecast, some of which may have been responding to the high real-time prices. Differences between forecast and actual conditions during high-priced periods have a greater assessed cost impact which impacts the optimal dispatch measure.

11 Cost of services reporting

The cost of services reporting for 2022/23 will be delivered to the Authority by the end of the financial year.

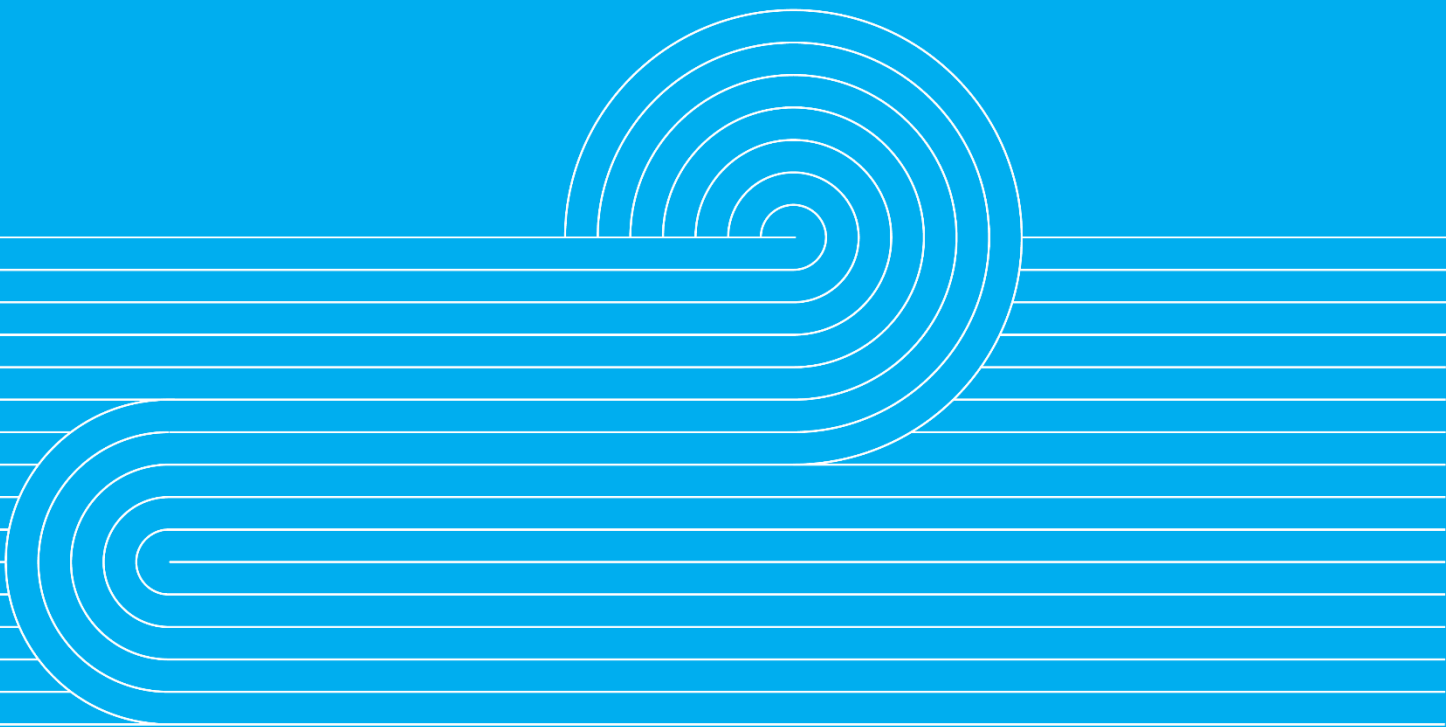
12 Actions taken

The following table contains a full list of actions taken during Q1 2023/24 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
<p>(i) To give effect to the system operator business plan:</p>	<ul style="list-style-type: none"> • Facilitate winter peak management <i>We provided early visibility of low residual situations to enable industry to react where possible. This involved issuing Low Residual Situation CANs and hosting industry conference to provide additional information and answer any questions.</i> • Support the Authority in developing the market <i>We played an active role in the second FSR Common Quality Technical Group (CQTG) meeting held on 10 August 2023, and have been working on six study cases identified at the meeting. We will get some results by the end of October.</i> <i>We also tabled other changes we would like to implement in Part 8 with the Authority's FSR team.</i> • Support stakeholders in the development of emerging technology and market evolution <i>We provided support to SolarZero who went live, this quarter, as the first participant in the Dispatch Notification service, implemented through the Real Time Pricing project.</i>
<p>(ii) To comply with the statutory objective work plan:</p>	<ul style="list-style-type: none"> • Identify the activities and themes we will use to support the SOSPA reset for 1 July 2025 <i>The SOSPA3 programme is working through the follow-up actions to the CE/GM meeting held with the Authority on 23 August and the project plan will be updated to reflect the approach agreed at the meeting. Governance meetings will be refreshed and scheduled from September, and an EA MOC update is planned for November</i>
<p>(iii) In response to participant responses to any participant survey:</p>	<p>Feedback from the 2022-23 survey</p> <ul style="list-style-type: none"> • Level of engagement between SO and the industry is very good. Keep it up folks <i>We have engaged with the industry at a variety of forums such as the Taranaki Energy Forum, ENA forum and the recent New Zealand-hosted meeting of CIGRE (details in section 1 of this</i>

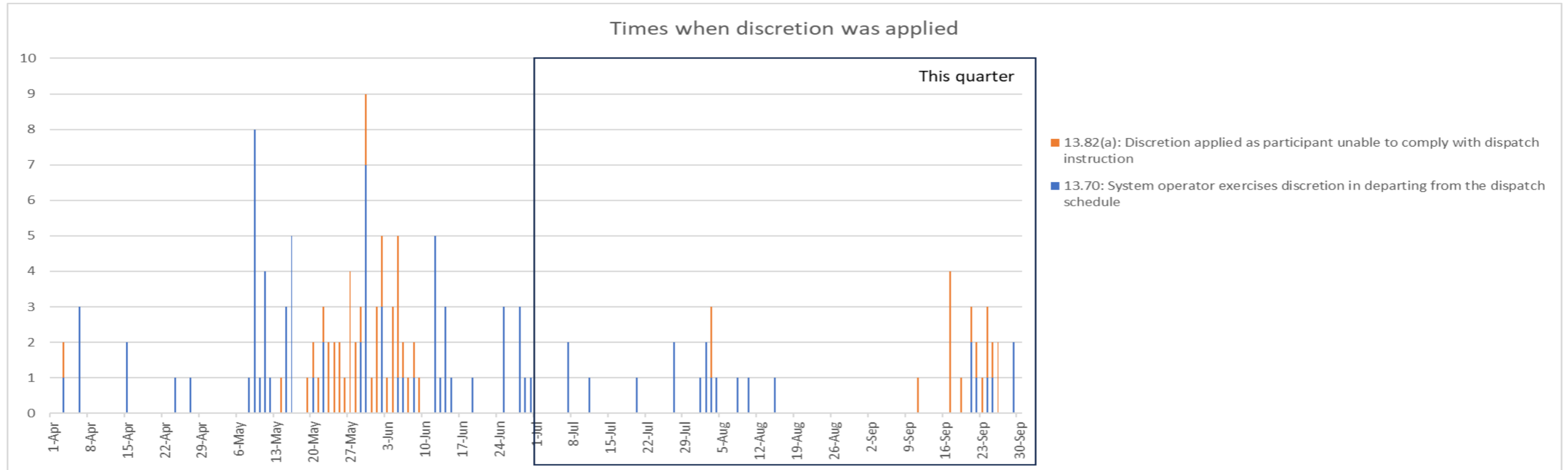
Item of interest	Actions taken
	<p><i>report). We have also published a paper to identify opportunities to enhance and evolve how security of supply is considered for the industry to consider.</i></p> <ul style="list-style-type: none"> • Transpower is too reactive and does not appear to have a clear view on intermittent renewables and how security of supply will be met in a low carbon economy. <p><i>This comment was made in the May survey. Since then, we have produced two papers that state our views. The first details work carried out to better understand the operation of different types of inverters and the second highlights opportunities we see to enhance and evolve our service in the security of supply space. Both papers can be found on our website.</i></p> <p><i>Preparing for an increase in inverter-based resources</i> (June 2023)</p> <p><i>Evolving security of supply assessment in New Zealand</i> (July 2023)</p>
(iv) To comply with any remedial plan agreed by the parties under SOSPA 14.1	N/A – No remedial plan in place.

Appendices



Appendix A: Discretion

The graph below shows all instances of discretion application with a summary beneath of some of the individual instances of application.



July – 6 instances

The number of discretions this month are fewer than in previous months due to the generation mix in the July. When there is low wind and hydro generation, as was the case in July, thermal generation is running more consistently and therefore the system operator is not required to discretion thermal generators onto their minimum safe running range prior to their generating.

August – 10 instances

2 Aug: SFD2201 SFD21 and WHI2201 WHI0 required for security due to low residual

3 Aug: WHI2201 WHI0 required for security due to low residual

4 Aug: SFD2201 SFD22 required for security due to low residual

1, 3, 8, 10, and 15 Aug: For extended potline reductions and restorations

September – 21 instances

The 14 instances of application of 13.82(a) were to dispatch NAP above its minimum running range so as to avoid a shutdown period, as NAP was required for voltage support

21 Sept: Work on WRK2202 CB

22 and 25 Sept: For extended potline reductions and restorations

29 Sept: Reduced DCN max in preparation for HVDC pole 2 outage

Appendix B: Optimal dispatch

The optimum dispatch tool compares what happened in real time to what would have happened if there had been perfect foresight of wind generation and load.

The main reasons for the variation this quarter are contained in section 10.1 of this report.

	2022						2023								
	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September
Optimal Dispatch (%) Compares the average impact of a perfect foresight case against dispatch solutions. Indicates impact of wind offer, load forecast and PSD accuracy. %	90.310%	92.020%	88.960%	91.590%	93.470%	80.920%	91.640%	90.130%	91.220%	89.680%	87.560%	88.870%	92.600%	94.440%	93.450%
Dispatch load accuracy error (%) Average absolute difference between forecast generation (load plus losses, including PSD) and actual generation relative to the average actual generation %	99.610%	99.620%	99.610%	99.610%	99.590%	99.600%	99.590%	99.600%	99.580%	99.580%	99.590%	99.590%	99.600%	99.590%	99.590%
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 %	97.510%	97.310%	97.090%	97.820%	97.500%	96.960%	97.360%	97.590%	97.320%	97.400%	96.860%	97.240%	97.860%	97.000%	97.820%