QUARTERLY SYSTEM OPERATOR AND SYSTEM PERFORMANCE REPORT

FOR THE ELECTRICITY AUTHORITY

Transpower New Zealand Limited
April to June 2020

Keeping the energy flowing




TRANSPOWER

Transpower New Zealand Limited The National Grid

Report Purpose

This report is Transpower's review of its performance as system operator for Q4 2019/20 (April to June 2020), 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 (April to June 2020)

COVID-19 response

- We worked with stakeholders, including the Authority, to manage our COVID-19 response. We kept the industry informed throughout via our dedicated webpage.
- We engaged with other international system operators to help inform our own response and the plans of other operators.
- We ran power system studies to give us assurance that the power system would remain manageable based on what we were expecting to occur and confirmed the mitigation measures available to us.
- We investigated how AUFLS may respond with the demand profile changing and how the reserve management tool (RMT) modelled AUFLS considering the large industrial loads not operating.
- We continued to adapt the load forecast to match the changes in demand profile during lockdown levels 3 and 2.

SOSPA 2 reset

- We have been preparing for the review and reset of our agreement with the Electricity Authority for the delivery of the system operator service (SOSPA); negotiations commence next quarter.

HVDC 2020 outages

- We initiated a lessons-learned exercise in May which provided us with strongly positive feedback both internally and from our external stakeholders for our approach and detail of our communications, planning, collaboration and governance arrangements.
- We received a supportive report from the Electricity Authority's independent reviewer on the risk assessment and communication in the planning and implementation of the HVDC outages by both grid owner and system operator.

Security of Supply

- The risk to security of supply remains low due to the time of year. Our risk has peaked and is now in decline until summer. There are no scenarios in our hydro storage forecasts that lead to us crossing any of the electricity risk curves this winter.
- During the quarter, national hydro storage levels declined quite quickly after a dry sequence starting around mid-May and an extended run of below average inflows. While this put upward pressure on prices, it is underpinned by thermal fuel availability and the re-entry of Contact's Stratford combined cycle plant into the

market. In addition, Genesis released information saying that it was making a third Rankine unit available to the market that could run concurrently with units 5 and 6.

- We published our Annual Security of Supply Annual Assessment on 30 April. This year's assessment concluded that generation would need to be built in the next half of this decade and that there is a sufficiently large pipeline of consented projects ready to go to meet this need.
- The announcement on 9 July of the closure of the Tiwai Point aluminium smelter will have significant implications on medium term security of supply; we will be updating our analysis accordingly. While current Electricity Risk Curves do not currently factor in this closure, our annual security of supply assessment which looks at a 10-year horizon does contain a scenario for this outcome.

Real Time Pricing (RTP)

- Work on the detailed planning for the build and implementation phase is well underway. The detailed bottom-up baseline effort and duration planning for the capital delivery phase of the project resulted in a delivery cost higher than the previously stated upper end cost. It also identified the need for a small increase in project duration. The delivery business case was presented to the Authority on 10 July.
- Preparations for business change planning and industry engagement are progressing well.

Extended reserves

- We completed the Extended Reserves technical advisory service report in April.
- The Authority has confirmed that next phase of this work will be funded from 1 July when the system operator will carry out a formal procurement process to select a vendor who will deliver a data portal to collect the 2-block AUFLS data from North Island providers.

Situational Intelligence

- Following the first three sprints of this Agile project, we are forecasting to deliver the first increment (the dashboard is populated with market system and SCADA live data) in October 2020.

Dispatch Service Enhancements (DSE)

- Trustpower, Genesis and Mercury have transitioned to the new DSE platforms this quarter. We are working with other participants to transition them before the end of the calendar year.

Sensitivity schedules

- The project is on track for the upper and lower sensitivities to the load forecast to be available on our website in July/August.

Changes in Transpower's Operations division

- From 16 May 2020, the reporting line of the Real Time System Group moved from Grid Delivery to Operations.
- Effective 1 June 2020, Dr Stephen Jay became Transpower's General Manager Operations, swapping roles with John Clarke who moves to the role of General Manager Grid Development.

- Richard Renouf joined the Operations division on 15 June as SO Compliance and Impartiality Manager. This is a new senior leadership role tasked with further strengthening our management of compliance and impartiality.

New initiatives

Whakamana i Te Mauri Hiko – Empowering our Energy Future

- On 2 April, Transpower released a report on the opportunity to decarbonise our economy, including changes required to interface DER platforms with the system operator.
- Post-COVID, engagement has ramped up with the industry discussing how accelerated electrification stands to provide a stronger, more reliable system with much lower reliance on fossil fuel imports at the same time as cutting average household energy costs.

Current investigations

Moderate incident: Wellington region loss of supply 12 March 2020

- Our final report on the investigation into the 12 March 2020 Wellington region loss of supply was delivered to the Electricity Authority in June 2020.

Moderate incident: Auckland load shedding 8 June 2020

- We have started an investigation into the 8 June 2020 Auckland load shedding event. Our final report is due to be delivered to the Electricity Authority in September 2020.

System operator performance

1 Customers and other relationships

COVID-19 response

For the first two months of this quarter, our most significant customer engagement was discussions in relation to managing the COVID-19 situation, including with the Authority.

To help inform our own response and the plans of other operators, our international engagements have included:

- video conference discussions with Eirgrid and National Grid UK
- informal discussions with staff level contacts at AEMO
- participating in an Edison Electricity Institute Webinar on preparations in North America and Europe
- contributing to an IEEE Power Engineering Society white paper developed from surveys of operators around the globe.

SOSPA 2 reset

During the next quarter (July to September 2020), we will commence the review and reset of our agreement with the Electricity Authority for the delivery of the system operator service (SOSPA). There are strict parameters around timing and the elements that can be negotiated (i.e. commercial funding details and any other aspects of the contract agreed by both parties prior to the review period). Any agreed changes will take effect on 1 July 2021, for the next funding period.

In July, we provided the Authority with details and supporting information of both our performance in the existing SOSPA term (SOSPA 1) and our planned capex and opex expenditure for the new SOSPA term (SOSPA 2) as part of the negotiations for the reset.

GM Introductions

Dr Jay met with General Managers from the Authority, Meridian and Genesis to introduce himself and provide continuity of the relationship with Mr Clarke. Further meetings with stakeholders are planned.

2 Risk & Assurance

COVID-19 response

We continued to update the industry via our dedicated COVID-19 webpage with links to relevant system operator information. As the level 4 restrictions progressed, we communicated with customers via this webpage and through customer advice notices on a number of issues: load forecasting, voltage management, outage coordination and assessment, and AUFLS requirements.

To ensure the ongoing ability for us to provide our control room services and protect our people, we introduced two additional control rooms in the control centres, perspex screens and social distancing markers as well as a range of hygiene measures. This enabled us to continue operations without any reduction in service.

All staff returned to working from office premises on 15 June, after successfully working from home. Standby arrangements including spare control desks have been stood down but remain in place in case of a return of COVID-19 risks.

Business process audits
The final three business process audits under our annual SOSPA audit plan (Medium–term load forecast, Conflict of interest and Outage Planning Policy) have been completed this quarter.

We have agreed to carry out an additional business audit, outside of our original audit plan, National Coordination Centre (NCC) Procedural Comms. This addition audit is the result of an Enterprise audit for an HVDC setting error recommending that we complete an NCC procedural audit. This audit is scheduled for completion next quarter.

Annual SOSPA audit plan
The 2020/21 annual SOSPA audit plan has been shared with the Authority. Audits planned for 2020/21 include: Managing insufficient generation offers and reserve deficits; Security of supply; Managing and assessing grid owner offers; Event reporting & investigation; and Contingency plan principles and procedures.

Software audits
In April, the software audits of the Reserve Management Tool (RMT) and Scheduling Pricing and Dispatch (SPD) software were completed as required under the Code, with no defects raised. A general comment was made by the auditor that solve times for SPD are starting to approach the agreed limit. We will continue to monitor solve times to identify if this becomes an issue.

Lifting risk management
A challenge session was held with the Operations senior leadership team (SLT) to review a proposed approach to lift risk management within the division. This approach will deliver a refreshed risk bowtie and documentation to be used for the next Control Self-Assessment in October.

Transpower System Operator Committee
A paper was prepared and presented to the Transpower System Operator Committee (TP SOC) outlining risk and assurance management for the systems operator, along with an overview of conflict of interest management. The paper was well received, and the TP SOC have requested future papers outlining strategic risks, and more detail on how we are managing specific operational threats.

3 Compliance

April

We did not report any system operator breaches to the Authority in April.

During the month, we continued to have discussions with the Authority concerning some participant behaviour as they were not offering the correct ramp rates which created infeasibilities that impacted the production of final price schedules. This was subsequently reported to the Authority as a breach in June.

May

We did not report any system operator breaches to the Authority in May.

The Authority compliance committee met during May and closed three breaches for the system operator. A warning letter was sent to the Compliance Manager for the event when a network model error incorrectly modelled Haywards 11 kV and 33 kV market nodes and was used in real-time. The other items were closed with no further action by the Authority.

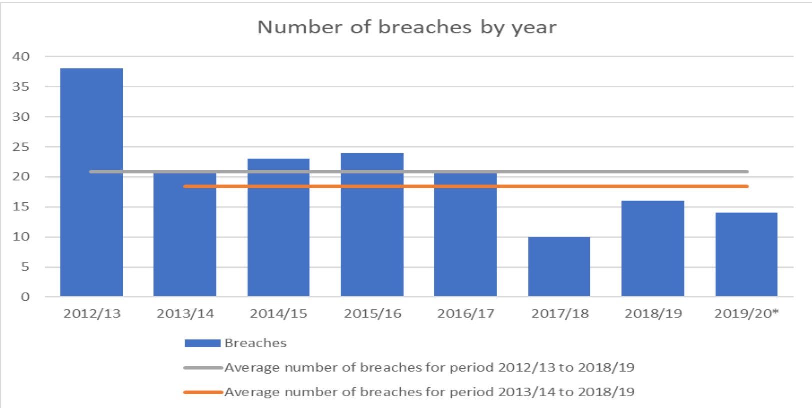
June

We reported two breaches of the Code in June.

One related to a constraint created during planning time to run scenarios for upcoming real-time, that was mistakenly left in place. The constraint was found and removed after it appeared in the forward-looking schedules. There was no market impact from this breach.

The second breach related to incorrect modelling of a circuit used to manage very high voltages during lockdown at the same time as the daylight savings switchover. Alarms to alert the security coordinator were missed during a daylight saving switch over in the market system which did not go as planned. The error did reach real-time, but resulted in a market impact of $0.07 due to the very low loads of lockdown.

We have five outstanding breaches with the Authority compliance team.



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

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

In June, a final decision was reached by the Rulings Panel in relation to the AUFLS event, penalising Transpower in both its roles as grid owner and system operator for our part in the event. We have accepted the findings and decision of the Rulings Panel and welcome these formal proceedings being concluded. Like all events this has presented an opportunity for us to learn and continue to improve our service. We've investigated and implemented a number of operational changes and process improvements for both the system operator and grid owner over the last few years as a result of this event.

4 Separation of Transpower roles

The entries in the table below are the open issues in the conflict of interest (COI) register. These issues are being handled in accordance with our policy for managing conflicts of interest.

The dates below refer to the calendar months and not the dates of the Monthly reports which cover 10 business days of the following calendar month.

April

No items were reported or closed in the register during April.

May

Four items were reported in the register during May.

- 35 – Annual security of supply assessment – RCPD sensitivity inputs

  We identified a potential perception of conflict of interest during the development of our Annual security of supply assessment regarding the inputs for the RCPD sensitivity. As part of managing the risk, our assessment used publicly available information (from Concept Consulting), rather than information from the grid owner.

  Note: this item although opened in April was not reported until May.

- 36 – Grid request for information

  Transpower, as grid owner, requested confidential third-party commercial information from the system operator which was denied. The third-party participant must provide the authority for supply of information.

- 37 – Participant request for information

  A participant requested a feed of information that is confidential and restricted. This information was not provided, and we are ensuring the process set up to access only the information appropriate to each customer is applied correctly.

- 38 – Information provided without using the correct process

  Third party information was provided to the system operator by the grid owner without using the correct process. The error in the process has been notified and the information is being held in confidence until proper process is followed.

Three entries were closed.

- 9 – HVDC Outages 2019/20
- 28 – Investigation into loss of SCADA 31 Oct 2019
- 36 – Grid request for information

June

One item was reported in the register during June.

- 39 – SO Compliance and Impartiality Manager role

This relates to the potential perception that could be created with the person filling this role also working for Transpower's legal team on a part time basis.

Two entries were closed.

- 35 – Annual security of supply assessment – RCPD sensitivity inputs
- 38 – Information provided without using the correct process

We have 12 open items in the register.

System Operator Open Conflict of Interest Issues		
ID	Title	Managed by
18	**Recommendations from the Advisian conflict of interest review**: Ensure that the recommendations are fully implemented across the whole of Transpower to strengthen our conflict of interest management around the dual roles.	Compliance and Risk Manager
21	**Staff interest in generator commissioning**: Manage the personal conflict of a staff member who has a family relationship with the project lead for a generation commissioning project.	GM Operations
22	**Security classifications for PI Vision database access**: Seek assurance that Transpower's information security policies have been adhered to and applied for the implementation of PI vision.	SO Power Systems Group Manager
26	**Response to 14 December UFE recommendation**: Ensure the system operator maintains role separation with regard to determining the causer of the event – including with the provision of information and carrying out the process	SO Power Systems Group Manager
27	**SO employee partner to work for GO:** Partner of a System operator employee hired by the grid owner.	SO Power Systems Group Manager
29	**Preparing the Net Benefit test – SO involvement:** System operator reviewing how it can provide information for use by the grid owner undertaking a Net Benefit Test	Operations Planning Manager
31	**Discussions concerning Demand Response:** System operator ensure options and involvement does not favour one demand response option over another.	SO Market and Business Manager
32	**Use of the same legal advisor:** Electricity Authority raised potential for a breach of the Policy Statement due to the use of the same legal advisor as the grid owner.	SO Power Systems Group Manager
33	**Sharing working space during lockdown:** Staff member sharing work-space with wife who works for another industry participant.	Grid and Systems Operations Manager
34	**Impartial response to COVID-19 pandemic:** System operator instigated separate BCP response to ensure impartial response and monitoring of participant behaviour during the pandemic.	General Manager Operations
37	**Participant request for system operator information via the wrong process:** We are ensuring the process set up to access only the information appropriate to each customer is applied correctly	SO Power Systems Group Manager
39	**New SO Compliance & Impartiality Manager:** Relates to the potential perception; the person filling this role also working for Transpower's legal team on a part-time basis	GM Operations

5 HVDC 2020 outages

With the HVDC 2020 outages completed in late March, we initiated a lessons-learned exercise which we completed in May. This exercise included canvassing ideas and feedback from a subset of stakeholders. We provided a lessons-learned document to the Authority's Market Monitoring team.

We had strongly positive feedback both internally and from our external stakeholders for approach and detail of our communications, planning, collaboration and governance arrangements. We also captured some suggestions for improvements: earlier development and recognition of scenarios, tailored HVDC refresher training for real-time teams, and encouraging stakeholders to raise concerns earlier.

Additionally, we received a draft report from the Electricity Authority's independent reviewer on the risk assessment and communication in the planning and implementation of the HVDC outages by both grid owner and system operator. This report is supportive of system operator planning and approaches.

6 Project updates

6.1 Market design and service enhancement project updates

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

Real Time Pricing (RTP)
This project has been in the initiation phase this quarter, preparing the delivery business case to be provided to the Authority in early July. At the same time preparations are being made for business change planning and industry engagement.

During this quarter, the impacts of the COVID-19 level 4 and level 3 lockdown on progress over March, April and into May were clarified. The current phase of the project requires high levels of effective collaboration as we work to complete the solution requirement and design workshops. As a consequence, lockdown has resulted in small delays to both the solution requirements and high level design streams of work. Both of these pieces of work are now in the final review and approval cycles.

Also during this quarter, two change requests were approved:

- CR002 – Pre-funding build phase through to end August 2020.
- CR003 - TAS087: Improve dispatchable demand under RTP.

Work on the detailed planning for the build and implementation phase is well underway. The detailed bottom-up baseline effort and duration planning for the capital delivery phase of the project resulted in a delivery cost higher than the previously stated upper end cost. It also identified the need for a small increase in project duration. We are currently carrying out a detailed validation exercise, however it is expected the business case cost will be higher than the previous forecast.

All of these changes impacted the delivery business case, but we were able to meet the 10 July delivery date to the Authority.

We recruited a change manager into the project team to assist with the planning and execution of the business change required over the next two years. The scale and timing of the training, process change, and internal and external communications needs have been identified

We are working with the Authority on the industry engagement model to prepare market participants and wider industry for the change. The approach is being adjusted to accommodate expected ongoing reduced travel and lower appetite for industry gatherings by planning a move to an on-line delivery model. A schedule of topics to engage on is currently being finalised.

Dispatch Service Enhancements (DSE)

During this quarter we had conversations with participants about the impacts of the COVID-19 lockdown on their transition plans; no major impacts were identified.

Trustpower and Genesis completed cut overs to the new DSE platform (ICCP solutions) in April and May. Mercury transitioned to the new DSE platform in June, being the first customer to leverage the new web services platform to receive dispatch instructions. Work continues to prepare for next transitions, Meridian and Vector. Participants are required to transition to the new system by the end of December 2020.

In parallel, the HVDC Genco replacement was successfully commissioned in June.

Situational Intelligence

During April, the project team completed training in the Agile project management methodology. This was in preparation for sprint zero (planning and organisation stage) in early May. The first development sprint was completed in May, delivering real time dispatch generation data from SCADA and the market system into the Situational Intelligence application. Sprints 2 and 3 were completed in June.

We are preparing a business case adjustment to recalibrate the project milestones and delivery dates following detailed planning in sprint zero. The project is forecasting to deliver the first increment (dashboard populated with market system and SCADA live data) in October 2020.

Extended Reserves (AUFLS)

We completed the Extended Reserves TAS report in April and submitted it to the Authority for review. The report outlined what data would need to be gathered for the existing 2-block and future 4-block scheme to enable a transition and provide ongoing assurance of AUFLS performance. Since early May, we have been working with the Authority to develop the TAS statement of work for the next phase of the project.

The new TAS will commission the system operator to deliver a data portal to collect the 2-block AUFLS data from North Island providers.

The Authority has confirmed that Extended Reserves will be funded from 1 July.

Sensitivity Schedules
We have been developing a proof of concept (POC) investigating the sensitivity of prices and carbon emissions to changes in demand, specifically the impact of +/- load variations. This work is nearing completion.

We briefed the Authority senior leadership team about the project and have been working with the Authority on a communications plan for making the POC to visible to the industry. The project is on track for the upper and lower sensitivities to the load forecast to be available on our website in July/August.

Market System (MS) Simplification
Due to COVID-19 constraints, the MS Simplification commissioning date was pushed back to July. We are monitoring any further delays to this project and impacts to portfolio dependencies.

Customer Portal – SO Modelling Database
The first phase of the Customer Portal project, delivering a like-for-like replacement of the system operator modelling database, went live in March. The data has been migrated to new platform and planning is underway for the second phase of project – which will re-platform the system operator Asset Capability Statement (ACS) register to the same platform.

SCADA programme
The new SCADA environments to support the delivery of the SCADA programme were delivered in January. Parallel work in the SCADA programme involves us upgrading the SCADA front end, Habitat and desktop; and working on ICCP, file transfer, and the energy management platform.

6.2 Other projects

Whakamana i Te Mauri Hiko – Empowering our Energy Future
As we emerge out of the COVID-19 lockdown, we can now have meaningful conversations with the industry about our Whakamana i Te Mauri Hiko report (initially released on 2 April) which discusses how accelerated electrification stands to provide a stronger, more reliable system with much lower reliance on fossil fuel imports at the same time as cutting average household energy costs. One such forum was the webinar on 30 June, hosted by Infrastructure New Zealand, to discuss how we can integrate the zero-carbon future we mapped out with the post-COVID recovery.

Energy Futures: New Generating Technology for Ancillary Services (TAS89)
This TAS looks at how inverter connected energy resources such as batteries could provide ancillary services. A final version of the TAS report was delivered to the Authority in May which recommended changes required to Parts 8 and 13 of the Code for reserve types, and the removal of technical performance requirements out of the Code and into the ancillary service procurement plan. The solution the team recommends is pragmatic and would not involve a large timely and expensive market system change.

Energy Futures: Requirements for inverter connected resources (TAS91)

The Authority has deprioritised their work on changes to Parts 8 and 13 of the Code to adapt to the expected change in power system security resulting from an uptake of inverter-based generating technologies. The team completed the deliverables under the TAS, which was closed out in June.

Inertia monitoring project

Our New Zealand inertia monitoring pilot project is underway. The project aims to evaluate the performance of this monitoring technology against the system operators existing inertia modelling techniques. The COVID-19 level 4 lock-down initially delayed the installation of monitoring devices, however all devices have now been installed. The trial is scheduled to be completed during September 2020.

Operations “Big 4” – Lift, Deliver, Refresh, Future

Lift	Deliver	Refresh	Future
• Lift our capability through addressing recommendations from recent events and reviews	• Deliver Real Time Pricing - will change focus of energy dispatch, to be delivered by 2023	• Refresh with industry our external reports and engagement processes	• Future - implement new systems to achieve the real time operating vision

During this quarter:

- We prepared the terms of reference for undertaking a follow-up audit of our use of command language in the control rooms.
- We looked at how we could continue to engage with industry to undertake restoration exercises while remote working.
- Advanced RiskView training was cancelled due to lockdown and has been rescheduled for late-July.
- We are targeting October 2020 for the updated risk bow tie as part of the risk management framework review.
- We made changes to Planned Outage Coordination Process (POCP) website to enable Transpower tentative outages to be visible in June. This will provide industry with further visibility of Transpower’s outage plans, and the effects of these tentative outages on generation balance will also be seen in NZGB.
- The final report for the POCP review was published on our website in March. The system operator response to the POCP review has been completed and will be published in early July. Recommendations include making POCP (or an alternative platform) mandatory to ensure quality outage information for the system operator to make assessments; for the system operator to provide industry with information on which type of outages materially impact system security; and to progress the first set of suggested enhancements to the tool. We are also developing additional training and information materials for users to assist with using the web-based tool.

- A proof of concept to validate a lean solution for future phases of the Customer Portal is approved and underway to inform next steps for the Customer Portal programme.
- The detail for the RTP project is included in section 7.1.

Continuous business improvement initiatives

End to end modelling review: A review of the Operations end-to-end modelling processes is now complete. A working group has been created to classify and prioritise the review recommendations and to create a work programme for the next 12-24 months, including quick wins and longer-term initiatives.

Assurance review: Interviews with several external parties has been completed to obtain input on use of assurance. All input has now been collected and a recommendation report has been delivered.

7 Technical advisory hours and services

The following table provides the technical advisory hours for Q4 and a summary of technical advisory services to which those hours related (SOSPA 12.3 (d) refers).

TAS Statement of Work (SOW)	Status	Hours worked during Q3
TAS SOW 87 - Options for improving the operation of DD under RTP	Complete	9.00
TAS SOW 88 - Extended Reserve: project reset scoping	Complete	28.50
TAS SOW 89 - New generating technology in the wholesale market	Complete	148.00
TAS SOW 90 - Simultaneous Feasibility Testing (SFT) SFT Studies for UTS Claim	Complete	0.00
TAS SOW 91 - New generating technology in the wholesale market Performance requirements for inverter connected resources	Complete	237.00
TAS SOW 92 - Modifying vSPD for RTP stakeholder engagement work	In progress	12.00
Total hours		**434.50**

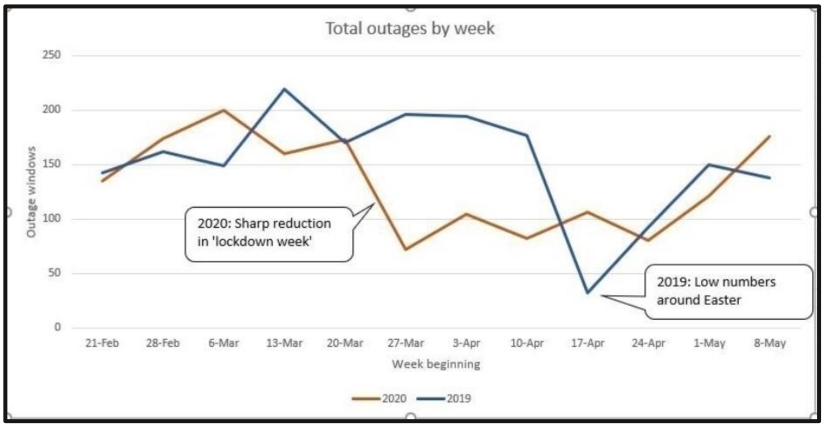
8 Outage planning and coordination

COVID-19 response

As a result of the COVID-19 response we saw changes in system conditions, variations to planned outages, and an increase in short-term changes to outage plans. We considered our approach to outage coordination and assessment in this environment and published an outline of our approach on our COVID-19 webpage.

Near real time

In the COVID-19 environment, we experienced low demand and high volumes of outage changes as shown in the chart below.



The chart compares grid owner outage numbers with last year. Outage numbers started to climb from the end of April, with some high volumes for May. There was also a large number of short notice requests within the 3-week lead time (85 in April, 46 in May and 53 in June – some of these requests cover multiple outages).

Our operations planning team who assess the operational impacts on the system was busy managing the outage churn assessments and rework and handled a high number of complex issues.

New Zealand Generation Balance

The NZGB June report forecasted no N-1 or N-1-G shortfalls for the next six months under normal conditions. Tight generation margins due to Wairakei Ring work in late October/early November, have allayed since the May report. This demonstrates that generators are responding to NZGB analyses and scheduling work appropriately. The outcome of this strongly reduces the likelihood of operational impacts in real-time.

9 Power systems investigations and reporting

Moderate incident: Wellington region loss of supply 12 March 2020

Our final report on the investigation into the 12 March 2020 Wellington region loss of supply was delivered to the Electricity Authority in June 2020. This was in accordance with our new significant incident reporting process.

Moderate incident: Auckland load shedding 8 June 2020

We started an investigation into the 8 June 2020 Auckland load shedding event. Our final report is due to be delivered to the Electricity Authority in September 2020.

10 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.

		Annual Target	Actual	Weighting
Annual participant survey result		81%	92%	5
Annual participant survey result response rate - First tier stakeholders		80%	80%	
On-time special event preliminary reports		90% ≤ 10 business days	No projects	5
Future thinking and insights	Future thinking report	≥ 1	0	5
	Publicly available market insights	≥ 8	50	5
Quality of written reports		100% of standard	100%	
Market breaches remain below threshold		≤ 3 @ ≥ $40k	0	10
Breaches creating a security risk - below threshold/within acceptable range		≤3	0	10
On-time SOSPA deliverables		100% (54 *)	100%	10

We deliver projects successfully

Improved project delivery	Service Maintenance projects	≥ 60% on time	50%	
		≥ 60% on budget	50%	
	Market Design and Service Enhancement projects	≥ 60% on time	0%	
		≥ 60% on budget	50%	
Accurate capital planning		≥ 50%	25%	10

We are committed to optimal real time operation

Sustained infeasibility resolution	80% ≤ 10am or equiv	87%	5
High spring washer resolution	80% ≤ 10am or equiv	100%	

Our tools are fit for purpose

Capability functional fit assessment score	75.00%	67.61%	
Technical quality assessment score	65.00%	65.60%	
Sustained SCADA availability	99.90%	99.98%	10
Maintained timeliness of schedule publication	99.00%	99.99%	10

* No Market Design investigation proposals were agreed or developed this year (by agreement with the Authority)

As part of the Strategic Objective Work Plan for 2019/20, we developed a Dispatch Accuracy dashboard for energy dispatch. This is a means of monitoring overall industry performance and is contained in Appendix B.

11 Cost-of-services reporting

We provided the Authority with a final report on the cost-of-services for financial year 3 (2018/19) in February. This incorporated feedback from the Authority to the report sent out in January.

12 Actions taken

The following table contains a full list of actions taken during Q4 regarding the system operator business plan, statutory objective work plan, participant survey responses and any remedial plan, as required by SOSPA 12.3 (b).

Item of interest	Actions taken
(i) To give effect to the **system operator business plan**:	• In response to the POCP review, our recommendations include making POCP (or an alternative platform) mandatory to ensure quality outage information for the system operator to make assessments; for the system operator to provide industry with information on which outages materially impact system security; and to progress the first set of suggested enhancements to the tool. We are also developing additional training materials for users to assist with using the web-based tool. • Our Market System Simplification project is on track for completion in July • We completed the System Operational Modelling Database phase of the Customer Portal project. • The proof of concept for Sensitivity Schedules project is on track for the upper and lower sensitivities to the load forecast to be available on our website in July/August • We adopted agile project delivery, example of which are the three sprints already undertaken in the Situational Intelligence project.
(ii) To comply with the **statutory objective work plan**:	The proposed metrics for: • Role impartiality • Perception of Added Value • Project delivery performance • Dispatch accuracy - energy • Dispatch accuracy - reserves were incorporated into the Performance metrics and incentives agreement for 2020/21.
(iii) In response to participant responses to any **participant survey**:	**Area of growth identified in the June 2019 survey** • *Improve engagement*: This year we have been focussing on customer engagement and have refreshed our Stakeholder Education and Engagement Plan for 2020/21 to expand on the current work and use of communication channels.
(iv) To comply with any **remedial plan** agreed by the parties under SOSPA 14.1	N/A – No remedial plan in place.

System performance

13 Security of supply

The COVID-19 level 4 lockdown resulted in electricity demand reducing by 15-20 per cent. Five per cent of this reduction was from major users with the remainder from residential, commercial, and medium-sized industrial users. This drop in demand improved margins and did not cause any security of supply issues.

The drop in demand from major users lead to a reduction of around 150 MW in reserves, as much of the interruptible load is provided by large industrial users. This increased the cost of HVDC transfer for a single pole tripping. These reserve requirements were offset somewhat by our reassessment of North Island AUFLS requirements for a full HVDC bi-pole tripping, with the shutdown of major industrials (who are also exempt from providing AUFLS).

As we moved through COVID-19 levels 3 and 2 to level 1, demand has largely returned to pre-COVID levels:

- large industrials that we can monitor are now at around 96 per cent of their pre-COVID levels. Tiwai's Potline 4 and Marsden Point are still yet to return which combined make up approximately 1 per cent of national demand. Uncertainty remains around these two loads as both are yet to conclude reviews of their operations, including if their business in New Zealand remains viable in their pre-COVID forms

- residential and commercial load, somewhat counter-intuitively, showed early signs of an increase. The first full week in level 2 saw a 1 per cent rise in demand compared to the same time last year when adjusted for weather. Our assumption was that this increase has been driven by additional residential heating with people working from home while commercial businesses are now also open and heating their space at the same time.

During level 4, there was a significant drop in natural gas demand and associated gas prices and concerns of upstream impacts if fields had to be shut to balance supplies. Those with access to gas storage took advantage of the low prices. The Ahuroa gas storage facility appeared to be filling at injection rates close to its daily maximum. The Pohokura outage and inspections were successfully completed in April. This signalled the end of the run of major infrastructure outages in Q1 2020 (HVDC, Pohokura, Ahuroa).

North Island inflows for the year to end April were the lowest since 2003. However, with South Island storage close to average for the time of year, low North Island storage did not present a security of supply issue. By the end of May, national hydro storage levels were hovering just below average for the time of year and continued to sharply decline during June, at the same time as demand is rising to its typical winter peak. Storage is now at the 10th percentile of historical levels.

However, the risk to security of supply remains low due to the time of year. Our risk has peaked and is now in decline until summer. There are no scenarios in our hydro storage forecasts that lead to us crossing any of the electricity risk curves this winter.

The market is well placed to enable conservation of North Island storage for the following reasons:

- North Island inflows typically start to rise at this time of year, as evident with recent rain
- the HVDC is back from outage allowing greater transfer of South Island energy
- once we reached COVID-19 level 3, greater levels of interruptible load returned to the system supporting greater levels of HVDC transfer
- Contact Energy's Stratford combined cycle plant has entered the market. We expect the thermal station to run through the winter months
- Genesis Energy released information detailing that it was making a third Rankine unit available to the market that could run concurrently with units 5 and 6.

This assessment is further supported by a loosening gas market underpinned by:

- a 10 – 20 per cent reduction in Methanex gas consumption as global methanol demand and prices drop in a post-COVID world
- a robust thermal fuel supply chain with the successful completion of Pohokura pipeline inspections, and no major infrastructure outages planned in the short term. Although OMV have flagged that deliverability is declining faster than expected, in next quarter they will install an additional compressor which should help mitigate the decline.
- growing storage levels of both gas and coal as electricity generators capitalise on low gas prices. During levels 3 and 2, storage in Ahuroa increased by 1,800 TJ, and the Huntly Rankine units are running on low priced gas, conserving and building their coal stockpile.

While security of supply is comfortable as the risk has peaked, market prices are up. This primarily driven by low hydro storage, and with all thermal generators generating, we expect prices to remain elevated until a material inflow event lifts hydro storage levels.

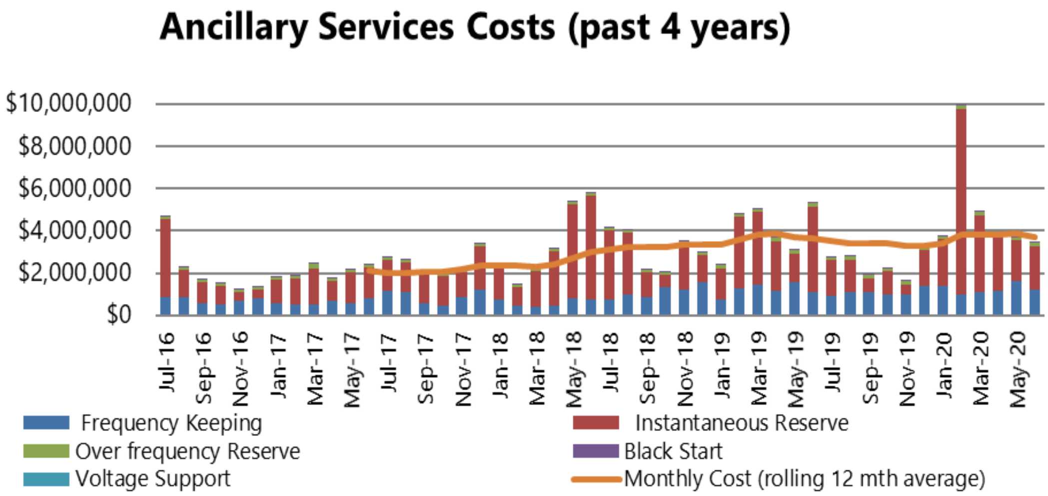
Security of Supply Annual Assessment

We published our Annual Security of Supply Annual Assessment on 30 April. This year's assessment concluded that generation would need to be built in the next half of this decade and that there is a sufficiently large pipeline of consented projects ready to go to meet this need. This year we used the software package Matlab, instead of MS Excel, for the analysis. Matlab enabled us to more easily consider a wide range of sensitivities and demand forecasts, including a sensitivity looking at what would happen if demand growth was flat for the next 18 months and then returned to pre-COVID-19 levels over the next six months. We are planning to do more work on potential COVID-19 impacts later in the year.

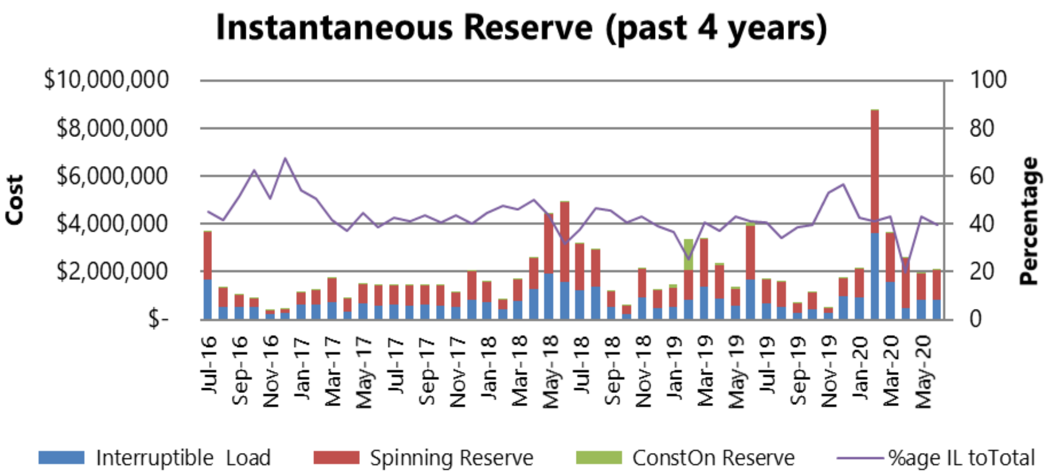
Tiwai exit

The announcement on 9 July of the closure of the Tiwai Point aluminium smelter will have significant implications to security of supply; we will be updating our analysis accordingly. While current Electricity Risk Curves do not currently factor in this closure, our annual security of supply assessment which looks at a 10-year horizon does contain a scenario for this outcome.

14 Ancillary services



This quarter's ancillary service costs were $11.1 million, which is a 41 per cent decrease compared to Q3's costs of 18.7 million. This is a reflection of the high costs of instantaneous reserve costs in February during the HVDC planned outages which were almost $9 million, not a reflection of the costs in Q4. This year's Q4 costs were on a par with Q4 last year, similarly the 2019/20 full year costs were on a par with 2018/19 full year costs.

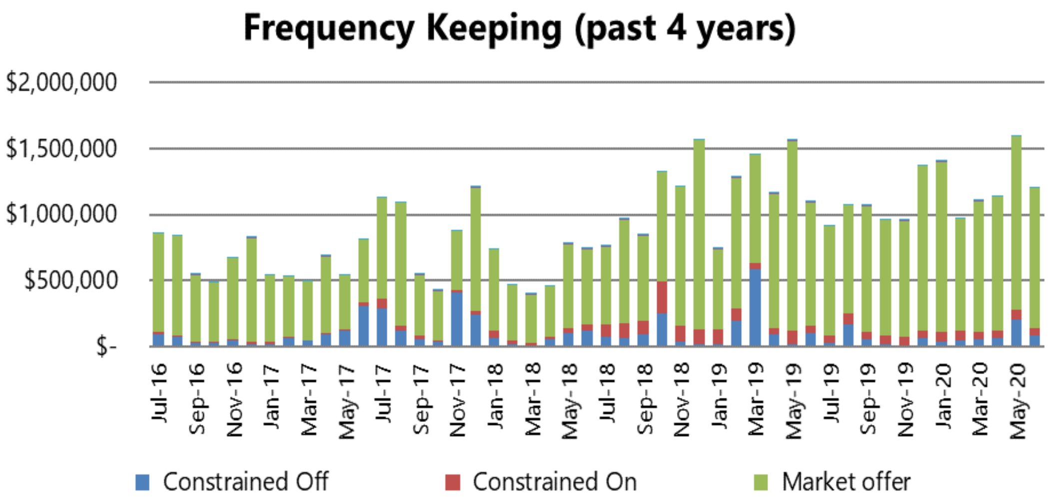


This quarter, the instantaneous reserve costs were $6.6 million, which is a decrease of 55 per cent from the previous quarter ($14.6 million) and the main driver for overall decreases in ancillary service costs this quarter. Interruptible load costs decreased by $4 million (65 per cent decrease), spinning reserves by $4 million (48 per cent decrease) and constrained on costs by $75k (66 per cent increase).

April's instantaneous reserve costs reduced from the previous month as a result of the HVDC outages finishing at the end of March. Reserve requirements and prices were greater during the HVDC outages as there was no self-cover for the loss of an HVDC pole and the capacity for sharing reserves across the HVDC was reduced. The cost reduction observed in April was mainly attributable to a reduction in Interruptible Load costs. A smaller quantity of Interruptible Load was available during COVID-19 level 4 lockdown restrictions, when most industrial load was required to shut down production.

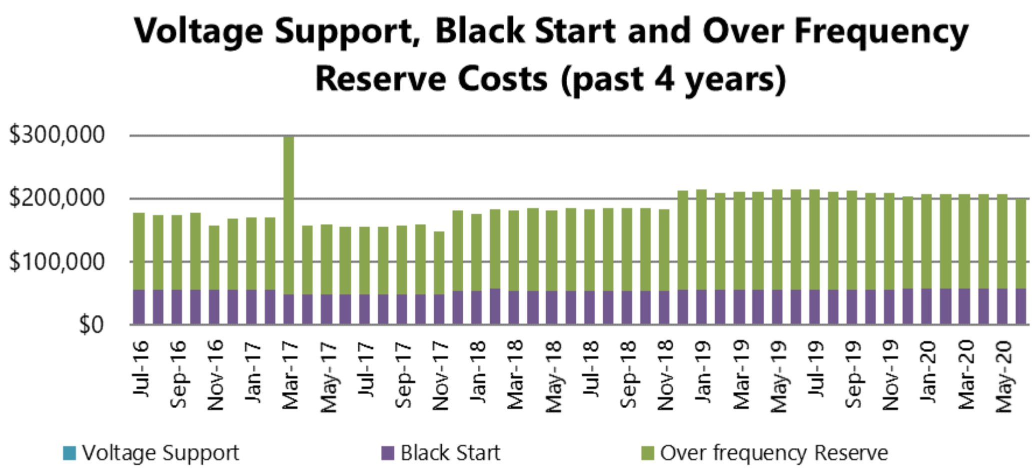
In May, the reduction in instantaneous reserve costs were a result of a large increase in the offered quantity of fast instantaneous reserve. Industrial load returned as COVID-19 restrictions were relaxed, increasing the availability of Interruptible Load.

In June, there was very little change in the interruptible load and spinning reserves costs from the previous month.



This quarter the frequency keeping costs were $4 million, a 13 per cent increase to the previous quarter's costs of $3.5 million.

The main reason for the difference were the costs in May when Genesis withdrew their Waikaremoana generation due to low lake levels. There was also an increase in constrained off costs in June when Contact's Stratford combined cycle plant re-entered the market.

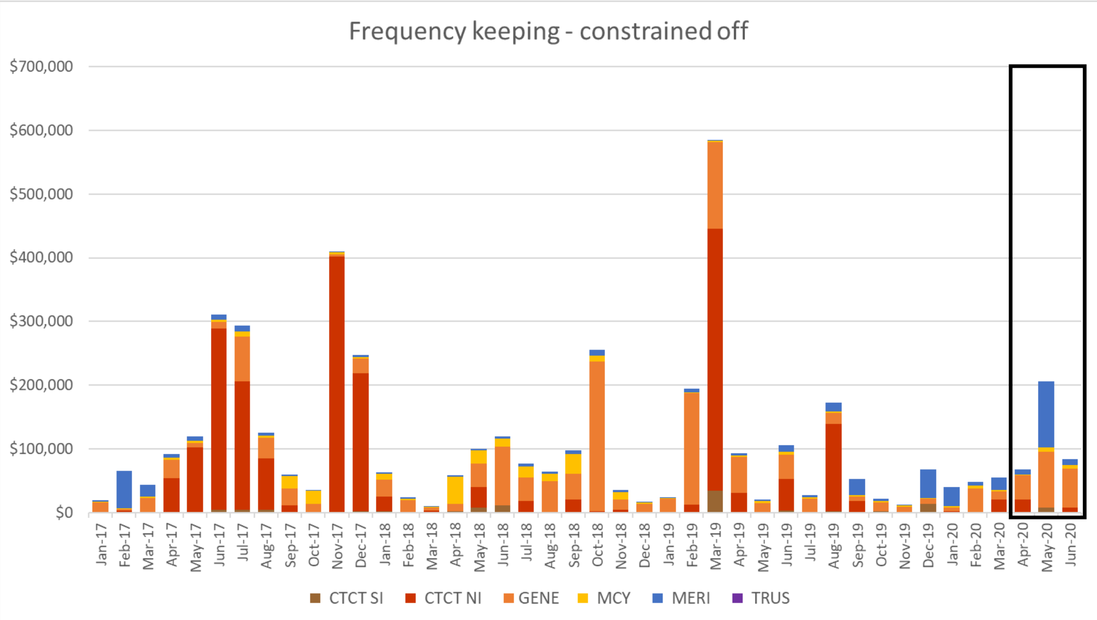


This quarter, April and May over frequency costs were both $148k, June was $6k lower due to one Manapouri unit being on outage. The black start costs were $58k for each of the three months. There are no voltage support costs as we do not currently procure this service.

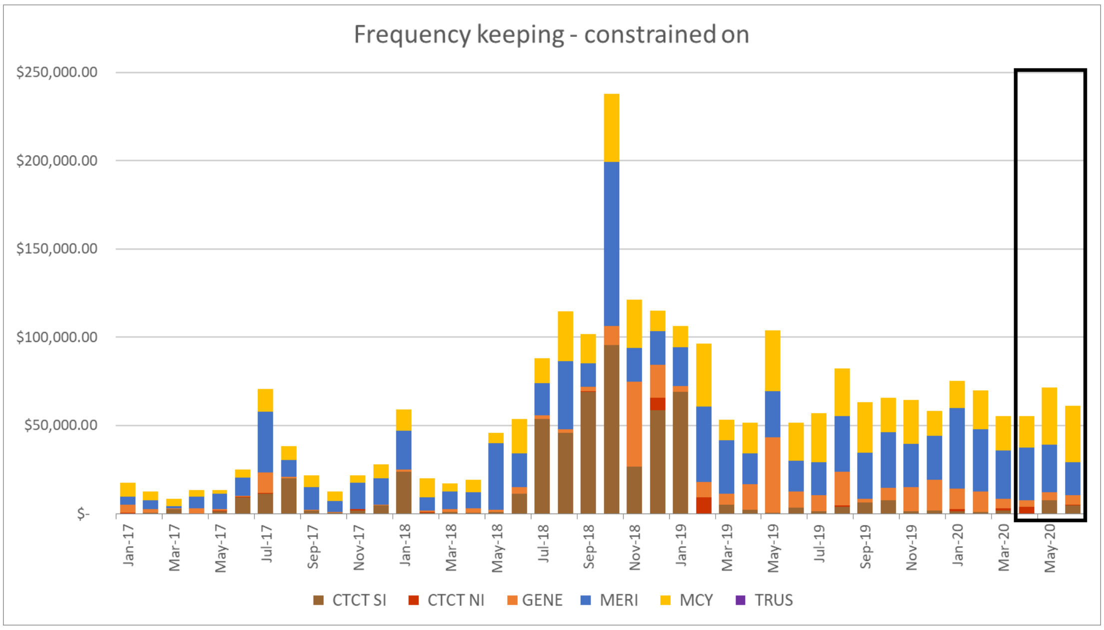
14.1 Constrained on/off costs

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

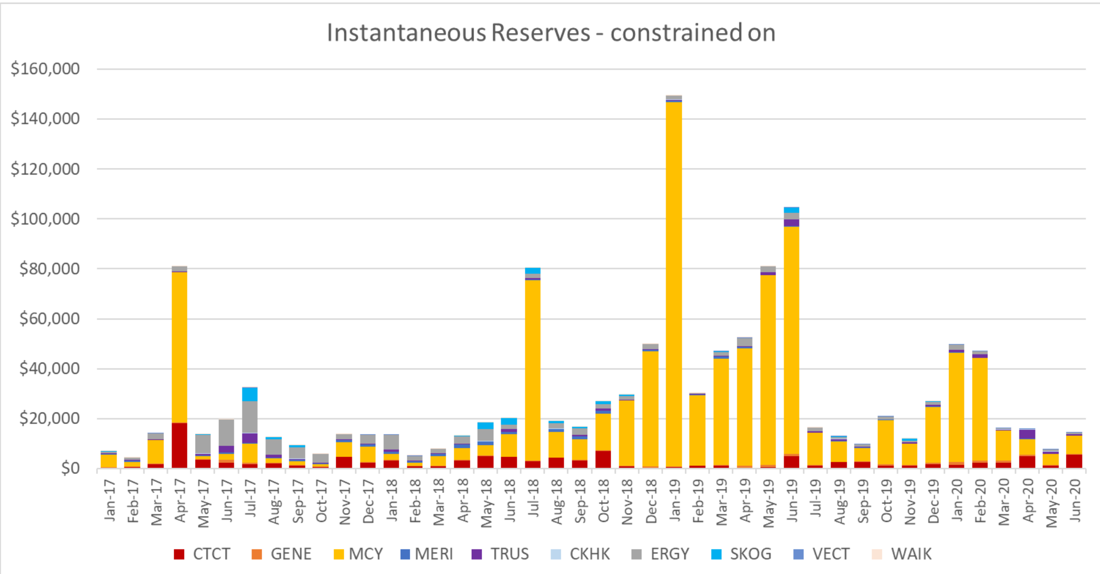


The constrained off costs for Frequency Keeping in May were three times higher than the costs in April. The May payments were mainly made to Genesis and Meridian, reflecting the higher price placed on water and that Genesis was offering more generation into the market.



Overall the frequency keeping constrained on costs for Q4 were roughly the same as those for Q3.

Instantaneous Reserves



The instantaneous reserves constrained on costs decreased this quarter (The variations in Q3 were mostly due to costs at Maraetai – to provide reserves during the HVDC outages).

15 Commissioning and Testing

Solar enquiry

We have received our third enquiry for a solar farm in the north of the North Island. At least one of these connections may also include a battery.

Wind generation

We are working with Mercury Energy to be able to model the proposed Turitea windfarm.

We are also developing the system operator's approach to managing multiple new wind generators commissioning at the same time, which will be the case over summer when there may be overlap at times.

Managing secondary risk during the commissioning of inverter connected generation

We have been working on agreeing and documenting approaches for managing secondary risk during the commissioning of inverter connected generation such as wind and solar. The intent is to ensure we are managing the risk to a suitable level without placing excessive additional reserve costs to New Zealand and provide certainty and consistency for generation developers.

Black start tests

Work is progressing to plan the next two black start tests: Tokaanu in October 2020 and Maraetai tentatively in May 2021.

16 Operational and system events

April

<u>High voltages</u>

With the nationwide COVID-19 level 4 lockdown, we were concerned that the anticipated reduction in commercial and industrial loads would result in high system voltages overnight. Leading into the lockdown we performed power system studies to anticipate the system state overnight accounting for possible scenarios such as Huntly unit 5 not generating. This analysis gave us assurance that the power system would remain manageable based on what we were expecting to occur and the mitigation measures available to us. We have been actively managing voltage through the low loads.

<u>Automatic under-frequency load shedding (AUFLS)</u>

Due to the changing demand profile we identified that AUFLS may not respond as we expect. As system operator, via a customer advise notice (CAN), we requested that participants inform us if they have concerns about being able to meet their obligations. One response was received from a South Island distributor and was assessed as having no impact.

<u>Exempt AUFLS load</u>

Most large industrial users in the North Island are exempt from providing AUFLS. We include these exemptions in our reserve management tool (RMT) to ensure we model the correct AUFLS response. With the reduction in industrial load during lockdown we modified the RMT value for exempt AUFLS load. This was communicated to industry via a CAN, and we will continue to monitor and adjust RMT as industry load come back on after lockdown. One benefit of the RMT change was less reserve required to cover high HVDC northwards transfer.

May

With the benign weather and reduced amount of work being undertaken, we had very few operational events of note.

COVID-19 protocols

Operators in the control rooms adapted well to the COVID-19 protocols which were in line with our pandemic plan; these included using separate desks, team shift bubbles and working remotely. Some of the innovations that were put in place will be continued as they encourage digital collaboration.

Incident response readiness

To ensure we maintain readiness with many of our incident response team members remote working, we worked with Transpower’s Grid Delivery division on an event simulation on Wednesday 15 May. The simulation involved injury to a member of the public, loss of supply, and was the first such event held using Microsoft Teams. The event was reviewed and we are pleased to confirm that our processes remained effective with some minor adaptions allowing for remote participation.

June

Following a very quiet period for unplanned events the control rooms handled two loss of service incidents on 8 June.

Far North Loss of Supply

Towards the end of the morning peak, there was a Loss of Supply event affecting the Far North, due to a tripping of the Kaikohe-Maungatapere circuit 1, while circuit 2 was out of service for a protection upgrade. A voltage excursion notice was sent out at 08:46. This resulted in a 61 MW Loss of Supply to Kaikohe, plus a loss of 25 MW Ngāwhā generation. The real time operations team worked closely with Top Energy and re-energised the tripped circuit after 44 minutes, and the Kaikohe bus shortly after this at 51 minutes. A full line patrol was completed following restoration, with no fault found. It is suspected that bird streaming was the cause of this event.

Tripping of transformer at Henderson

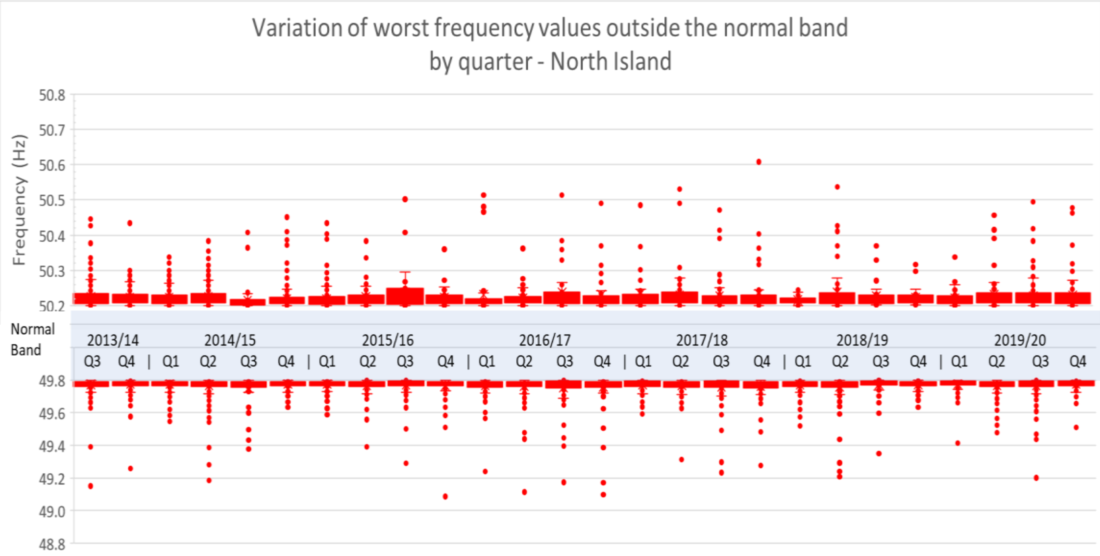
A tripping of transformer at Henderson (HEN T1) during the evening peak at 17:51, coincided with planned outages of Otahuhu-Mt Roskill circuits 1 and 2 and Albany-Wairau Road circuit 4. This resulted in approximately 40 MW of load having to be shed at Mt Roskill under a Grid Emergency (GEN). HEN T1 was returned to service 1 hour 41 minutes later at which point the remaining non-controllable load was restored. Controllable load continued to be restored as system conditions allowed with all load fully restored and the GEN ended at 20:47.

17 Frequency fluctuations

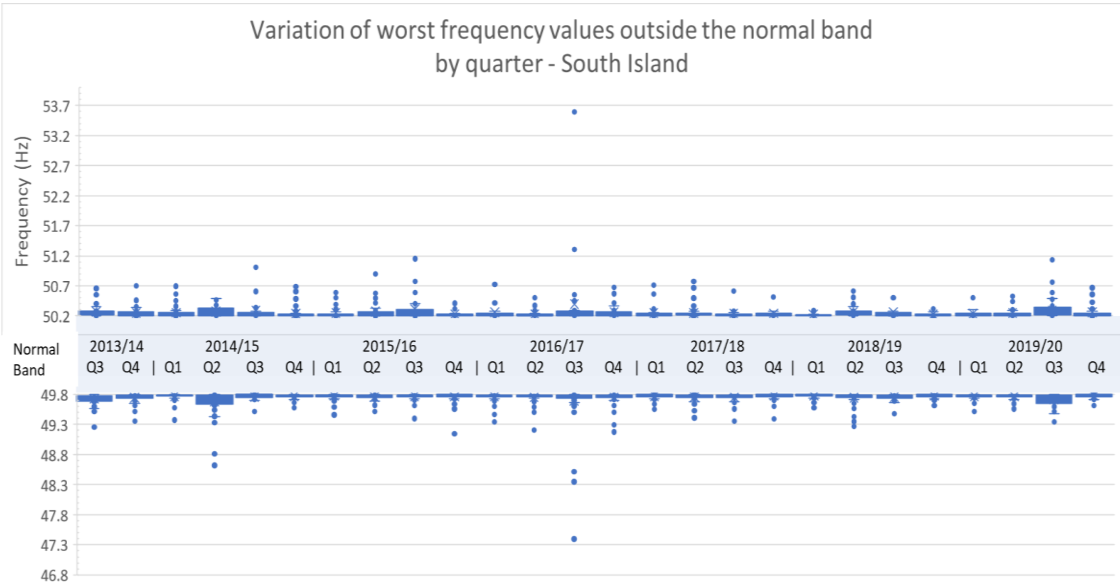
17.1 Maintain frequency in normal band (Frequency value)

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

North Island



South Island

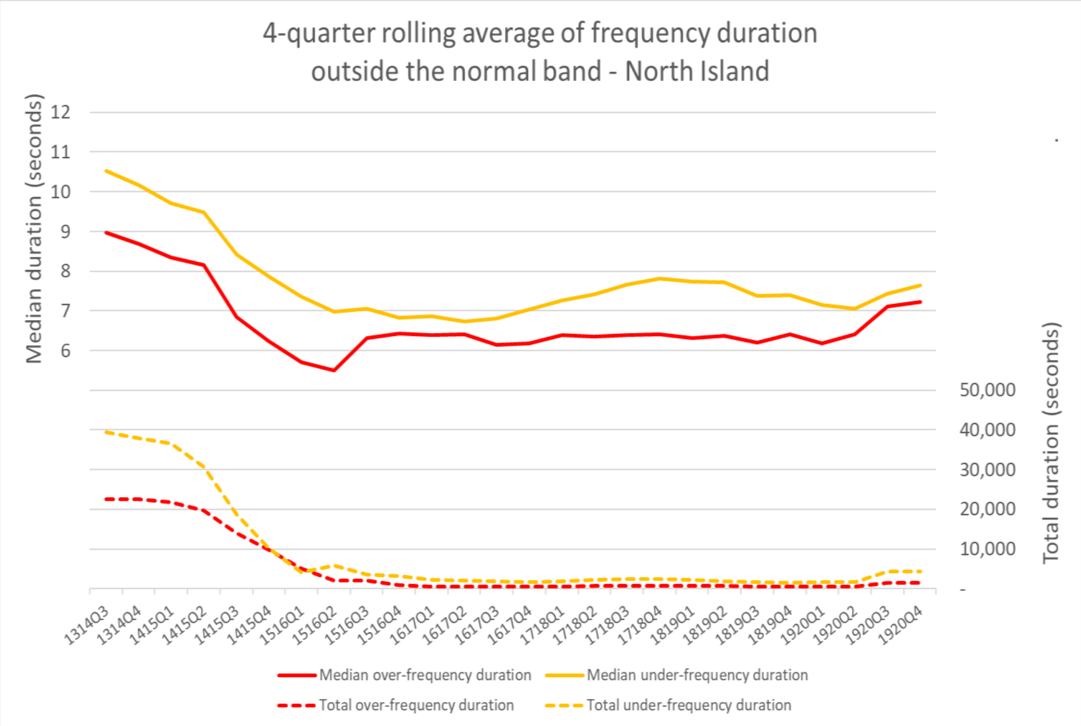


Note: These box and whisker charts show the distribution of data. The “box” represents the distribution of the middle 50% of the data, the “whiskers” indicate variability, and outliers are shown as single data points.

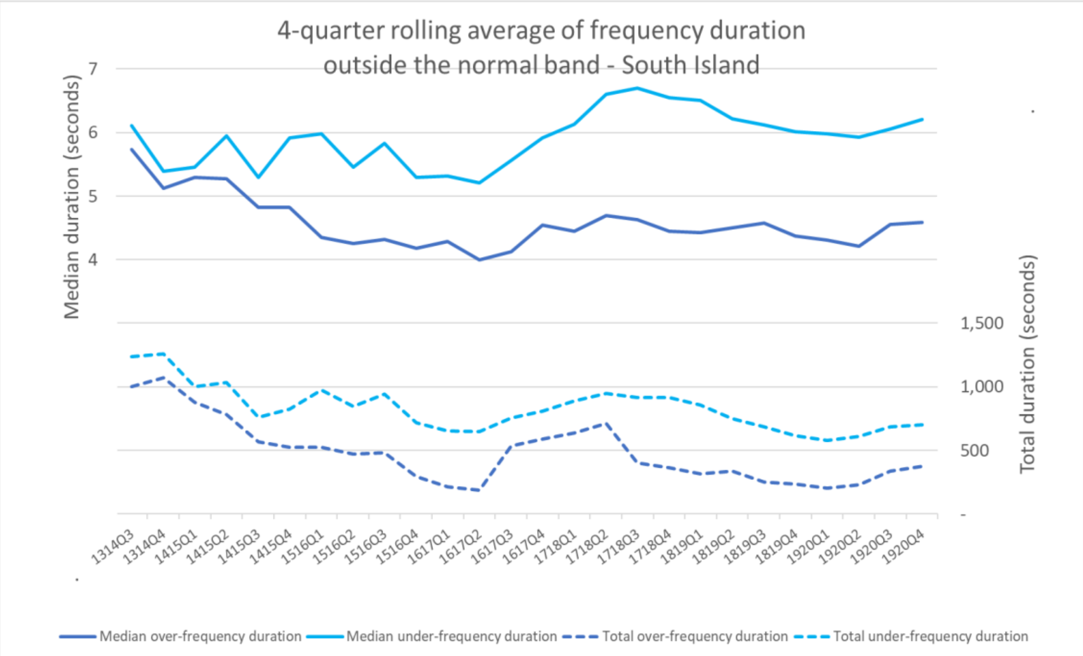
17.2 Recover quickly from a fluctuation (Time)

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

North Island



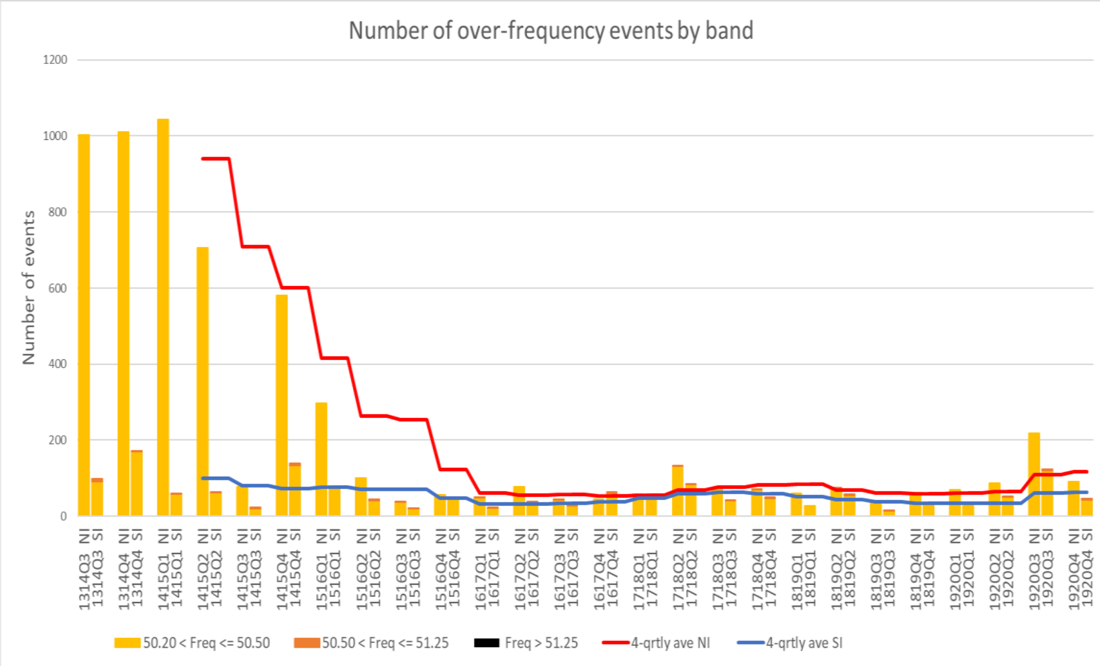
South Island



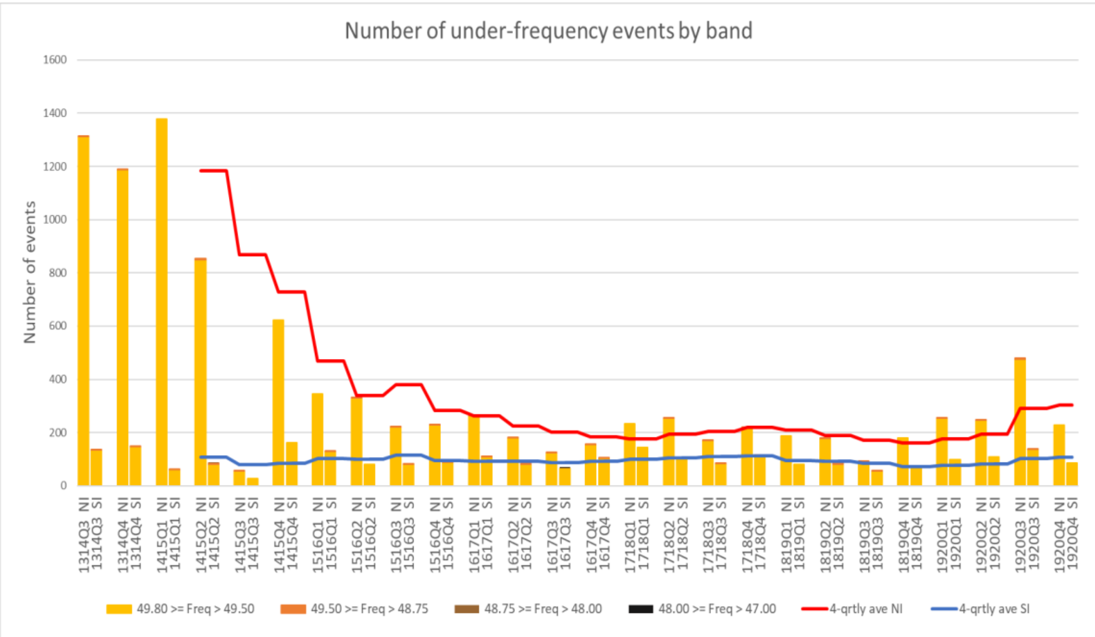
17.3 Manage frequency and limit rate of occurrences during momentary fluctuations (Number)

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

Over-frequency events



Under-frequency events



17.4 Manage time error and eliminate time error once per day

There were no time error violations in the reporting period.

18 Voltage management

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

19 Security notices

The following table shows the number of Warning Notices, Grid Emergency Notices and Customer Advice Notices issued over the last 12 months.

Notices issued	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
Demand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	-	1	-	1	3	-	-	-	1	-	-	1
Warning Notice	-	-	-	-	-	-	1	-	2	-	-	-
Customer Advice Notice	9	14	6	15	15	14	6	21	14	13	10	13

20 Grid emergencies

The following table shows grid emergencies declared by Transpower as system operator from April to June 2020.

Date	Time	Summary Details	Island
08-Jun-20	18:22	A grid emergency was declared to manage demand and reconfigure the grid in the north and west of Auckland. This was done to prevent overloads following the tripping of Henderson 220 / 110 kV interconnecting transformer T1.	N

Appendix A: Discretion

April

Event Date & Time	Event Description
	None

May

Event Date & Time	Event Description
05-May-2020 20:09	HLY2201 HLY4: HLY U4 tripped Last Dispatched MW: 110

June

Event Date & Time	Event Description
09-Jun-2020 05:41	WHI2201 WHI0: Discretion due to possible security issues and evening peak
25-Jun-2020 23:31	ARG1101 BRR0: BLN_KIK_1 Tripped discretion applied until modelled in market.
26-Jun-2020 04:25	ARG1101 BRR0: For the return of the BLN_KIK_1 circuit.

Appendix B: Dispatch Accuracy Dashboard

Dispatch Accuracy Dashboard

			March	April	May	June	July	August	September	October	November	December	2020 January	February	March	April	May	June
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	430	430	480	628	550	696	575	489	546	705	550	756	641	498	586	718
Frequency keeper (MW)	Average absolute deviation (MW) from frequency keeper dispatch point. A	NI	6.90	6.56	6.64	6.72	6.96	6.71	6.67	6.56	6.63	6.83	7.63	7.01	6.90	6.80	6.87	6.97
		SI	0.87	6.25	6.07	6.28	6.37	6.15	6.30	6.00	6.23	6.28	6.49	6.84	6.33	6.64	6.41	6.80
Time error (s)	Average absolute daily time error (s) indicates imbalance between generation and load, a reflection of imperfect dispatch	NI	0.1621	0.1921	0.2032	0.2431	0.1946	0.2021	0.1737	0.2198	0.2033	0.1996	0.2410	0.2340	0.2455	0.2843	0.2277	0.2768
		SI	0.1548	0.1741	0.2001	0.2123	0.1999	0.2161	0.1688	0.1989	0.2086	0.2137	0.1967	0.2309	0.2217	0.1923	0.2323	0.2845
FK within 5% of band limit	% of time frequency keepers spend near to or exceeding their regulation limits	NI	3.7%	3.1%	3.6%	3.9%	5.0%	4.2%	3.7%	3.5%	3.7%	4.0%	5.4%	5.0%	5.8%	3.5%	4.2%	5.1%
		SI	3.0%	4.7%	3.0%	3.7%	4.2%	3.5%	3.1%	4.0%	3.0%	3.3%	3.1%	3.9%	-	2.7%	3.5%	4.3%
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.		8.3%	10.1%	14.4%	14.8%	11.6%	13.6%	11.3%	10.8%	10.9%	10.5%	8.4%	12.8%	10.4%	6.9%	13.9%	9.6%
Constrained on energy- Total	Total Monthly Generation	MWh	3,469,377	3,398,188	3,658,987	3,786,198	3,921,132	4,003,430	3,656,770	3,621,216	3,418,901	3,475,825	3,501,768	3,329,074	3,407,184	2,931,637	3,629,018	3,710,599
	Total constrained on - All sources	MWh	24,238	23,687	29,352	29,941	36,182	34,394	36,974	25,683	29,286	31,997	23,641	28,565	24,912	32,088	26,537	24,247
		% of all generation	0.70%	0.70%	0.80%	0.79%	0.92%	0.86%	1.01%	0.71%	0.86%	0.92%	0.68%	0.86%	0.73%	1.09%	0.73%	0.65%
		$	603,987	357,336	466,469	1,015,133	1,227,521	1,173,614	930,592	534,069	609,542	517,746	365,863	468,969	304,255	303,542	491,296	427,272
Constrained on energy ($) - Frequency keeping	Total constrained on $ due to frequency keeping (within band is attributable to SO)	$	53,170	51,528	103,917	51,815	57,023	82,481	63,352	65,890	64,505	58,343	75,173	70,074	52,492	55,553	71,518	61,301
Optimal Dispatch (%)	Compares the average impact of a perfect foresight case against dispatch solutions. Indicates impact of wind offer, load forecast and PSD accuracy.	%	94.2%	93.6%	92.1%	93.0%	93.7%	93.1%	94.1%	91.6%	91.3%	88.3%	93.4%	90.7%	91.8%	87.2%	90.9%	92.8%
Load forecasting error (%)	Average absolute difference between forecast generation (load plus losses, including PSD) and actual generation relative to the average actual generation	%	99.62%	99.62%	99.56%	99.55%	99.61%	99.60%	99.62%	99.50%	99.48%	99.51%	99.62%	99.55%	99.57%	99.53%	99.53%	99.56%
Wind offer error (%)	Average absolute difference between persistence wind offer (based on 5mins prior) and the actual wind output relative to the average wind output	%	97.63%	97.31%	97.77%	97.15%	97.46%	97.55%	97.89%	97.71%	97.96%	97.71%	97.90%	97.80%	97.46%	97.79%	97.35%	97.80%
	Metric calculation rows	FK within 5%											2.0	2.0	1.0	5.0	3.0	1.0
		Constrained o											4.0	3.0	4.0	1.0	4.0	5.0
		Optimal Dispa											4.0	3.0	3.0	2.0	3.0	4.0
Dispatch accuracy %	Metric out of 5 (5 is best possible result)												3.3	2.7	2.7	2.7	3.3	3.3

Heat map

The dashboard uses a type of heat mapping which makes 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, through yellow and orange, to red. Each of the cells sits on a colour gradient within this scale. For the purposes of the dashboard this provides a way to identify patterns and trends.

NOTE: the scales used to calculate the metric are formulated separately (details on the performance metric can be found in the paper "Develop metric for efficient energy market operation: Dispatch Accuracy – energy")

NOTE 2: Summary data for "FK within 5% of band limit" is not shown for the South Island in March . The data collected for this month has missing values for a number of dates in the month which we are currently investigating.