QUARTERLY SYSTEM OPERATOR AND SYSTEM PERFORMANCE REPORT

FOR THE ELECTRICITY AUTHORITY

Transpower New Zealand Limited

January to March 2021

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 Q3 2020/21 (January to March 2021), in accordance with clause 3.14 of the Electricity Industry Participation Code 2010 (the Code).

As this is the final self-review report of the quarter, additional information is included as per SOSPA clause 12.3. This includes performance against the performance metrics year to date, and actions taken in regard to the system operator business plan, statutory objective work plan, participant survey responses, and any remedial plan agreed under clause 14.1(i). A summary of technical advisory services for the quarter is also provided.

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

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Commentary

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

- System operator performance
- System performance.

Update (January to March 2021)

COVID-19 response

- We reactivated our Operational incident management team with additional protocols to protect our control room staff when Alert levels increased; it has since been stood down. We are working with the incident management team to review plans for changes in Alert levels, particularly for when we see short, sharp changes in Alert levels.

Real Time Pricing (RTP) and awareness preparations

- Real Time Pricing is progressing well and tracking to time and budget, with phase 1 on target for deployment in May.

Dispatch Service Enhancements (DSE)

- The Dispatch Service Enhancements project has transitioned all participants to the new dispatch platforms. The project has moved into the close-out phase.

Tiwai exit and Clutha Upper Waitaki Lines Project (CUWLP)

- We are assessing the impacts of Tiwai's exit on transient stability and management of a bi-pole tripping. Initial results indicate there could be operational limits to manage under certain generation and loading scenarios in Southland. We are currently working to quantify the likelihood of these scenarios occurring before communicating with industry. Reporting is expected before July 2021.

Security of Supply

- Hydro storage has continued to decline in both the North and South Islands due to the extended run of low inflows. Continued pressure on gas availability and low wind generation have also contributed to us getting very close to the 1% risk curve in April. Despite this, our risk status remains 'Normal', as we expect (based on our current hydro storage projections and assumptions of fuel availability in an emergency) that we will not reach the emergency curve this winter.
- To ensure we are well-prepared, should the situation unexpectedly deteriorate, we have set up an internal incident management team to manage the potential dry year event. This includes increased reporting and stakeholder communications, and early preparations for an Official Conservation Campaign.
- These actions will continue until the risk of crossing the 1% risk curves has sufficiently dropped. As at 15 April, the hydro storage position is 155 GWh above the 1% risk curve (equivalent to roughly 1.5 days of New Zealand daily demand).

Code and SOSPA deliverables

- We delivered our proposals as part of year's Statutory Objective Work Plan (SOWP) this quarter.

- We are progressing the third and fourth of our five SOSPA business assurance audits relating to Regional Contingency Planning and Event Management.
- The SOSPA software audits for the Scheduling, Pricing and Dispatch tool (SPD) and the Reserves Management Tool (RMT) began in January and completed in early April.

System operator self-breaches

- We incorrectly modelled Ngawha B as a secondary AC CE risk. This resulted in an over-procurement of North Island reserves worth an aggregate of $93,250 over the 70 trading periods. This market impact of this breach exceeds the threshold of $40k set in the performance metrics and counts against the target agreed with the Electricity Authority.

Outages

- On 28 January, the grid owner published the 2021/22 draft Annual Outage Plan. The system operator subsequently completed its review of the draft plan and recommended some changes. We contributed to the annual Outage Planning Forum on 24 March, joining grid owner representatives to provide information on our assessment processes, our recent outage disclosure advice, and the review of our Outage Planning Policy.

Generator commissioning - Waipipi

- All turbines have now been commissioned and our focus is moving to assessing final Code compliance and validation of asset models against test results.

Simulation exercise for loss of supply scenario

- On 24 February, we held a simulation exercise for the scenario of a parallel black start and restoration of the North Island core grid. Our system operator and grid control operational teams were joined by representatives from Mercury, Genesis Energy, Contact Energy, Powerco and WEL Networks.

Recent initiatives

2030 Code and market evolution sprint

- We ran a sprint to consider what the market may look like in 2030 and what the system operator needs to do to be ready. The outcome of the sprint will help clarify our thinking and enable discussions with industry.

Business Improvement - Modelling working group established

- We continue to implement a program of modelling improvement initiatives via our modelling working group. These initiatives were largely surfaced through an end-to-end review of the modelling process completed in 2020 and includes the process to make the required changes to the market model.

Current investigations

Fault ride through performance of assets

- We are investigating the fault ride through performance of assets after an event; this has been prompted by the circumstances on 20 January when several windfarms output dropped following an AC fault at Bunnythorpe.

System operator performance

1 Customers and other relationships

Security of Supply Stakeholder Engagement

Our communications and interactions with stakeholders are continuing to increase as the current dry year situation evolves. In February we met with staff and management from MBIE and the Authority to brief them on the roles and responsibilities of the parties in a developing security of supply event. We also met with Gas Industry Company and Concept Consulting, who took us through a study they have completed (at the Minister's request) on short term gas supply and demand. Their analysis and assumptions were largely consistent with our own.

We are now holding either weekly and/or fortnightly meetings and briefings with Authority and MBIE, as well as monthly webinars for industry, in addition to our various ad-hoc interactions. The Department of Prime Minister and Cabinet also requested a briefing to help them better understand our operational analysis and reporting, which we provided in mid-April. From Monday 12 April we began daily reporting to the industry.

Wholesale Market Information Disclosure Stakeholder Briefing

We presented new Outage Disclosure guidance at the Electricity Authority Wholesale Market Information Disclosure Stakeholder Briefing in February and have now published the guidance. We have had useful discussions with a number of customers since publishing the advice around publication of their outages.

Commissioning, testing and assurance – Meridian and Mercury

We visited Meridian's Christchurch engineering staff in January to introduce recent changes in roles and responsibilities within the SO Power Systems Group regarding commissioning, testing and assurance. We also socialised potential changes and improvements to the operational test plan process, which were met with support.

We had a similar catch-up session with Mercury along with discussions around their Turitea windfarm development.

Extended reserves project - Winstone Pulp International

We worked with the Electricity Authority to provide an update to this customer on the extended reserves project, particularly clarifying what automatic under-frequency load shedding (AUFLS) requirements are in force at present.

GM Stakeholder Meetings

Dr Jay has met with a variety of stakeholders this month to talk about emerging new tech and connection of generation, as well as ensuring the industry is kept abreast of the potential dry year situation. Stakeholders have included Methanex, the Gas Industry Company, Connex, Mercury and Genesis.

APEx - Association of Power Exchanges

Dr Jay attended an APEx board meeting, as well as a webinar on the topic of market changes to enable storage in February, which featured an international panel. The group is arranging a webinar later this year which will discuss the American weather-related blackouts in early 2021.

2 Risk & Assurance

COVID-19 response

We continue to remain vigilant regarding COVID-19. The additional control room desks set up last year remain available if we need to instigate our COVID-19 shift protocols.

In January, with the announcement of the community cases in Northland and Auckland we reminded our Senior Leadership Team of when we would reactivate our incident management team and where to find all the latest supporting colleterial.

In February. due to the increase in Alert levels within the Auckland region and the remainder of New Zealand, our Operational incident management team (IMT) was reactivated with the additional protocols required to protect our control room staff. When Alert levels were decreased, we stood down our IMT and additional protocols. We are working with the IMT to review plans for changes in Alert levels, particularly for when we see short, sharp changes in Alert levels.

Business process audits

This quarter, the next two SOSPA business assurance audits relating to Regional Contingency Planning and Event Management were planned, auditors engaged and are nearing completion. We are currently reviewing them and anticipate having draft reports next month.

Software audits

Planning for the SOSPA software audits for the Scheduling, Pricing and Dispatch tool (SPD) and the Reserves Management Tool (RMT) began in January and the audits were completed in early April.

Simulation exercise for loss of supply scenario

On 24 March, we ran a joint black start simulation exercise that included both system operator and grid operational teams and representatives from Mercury, Genesis Energy, Contact Energy, Powerco and WEL Networks.

The scenario was a parallel black start and restoration of the North Island core grid. A parallel black start is where we divide our operational team into two, one team carries out a black start from Maraetai and heads north to Huntly and Auckland while the second team black starts Tokaanu and heads south to the Taranaki and Wellington. Our objective was to share and test our contingency planning with key industry participants. The exercise provided an opportunity to trial a proposed back up communication process using text over satellite. This showed good potential and findings will be shared with industry.

Feedback from the event was positive with participants wanting to see more of this type of collaborative training in the future. We gained some valuable insights from our external participants regarding their assets and internal processes which we will incorporate into our contingency plans. The exercise identified some specific challenges with restoration to Hawkes Bay and we are commencing a series of workshops to review this part of our contingency planning.

3 Compliance

January

We self-reported one system operator breach in January (previously reported in the October to December 2020 Quarterly report).

For the period 27 November 2020 to 15 December 2020, the system operator did not include Glenbrook power station's instantaneous MW injection values in the real time pricing (RTP) schedule. This resulted in Glenbrook's generation output being set to zero in the RTP schedules. The RTP schedule sends a 5-minute price signal to the market via WITS, but is not used to dispatch, generate forecast schedules, or calculate final pricing. The error was caused by incomplete process documentation, which has now been updated.

February

We self-reported one system operator breach in February.

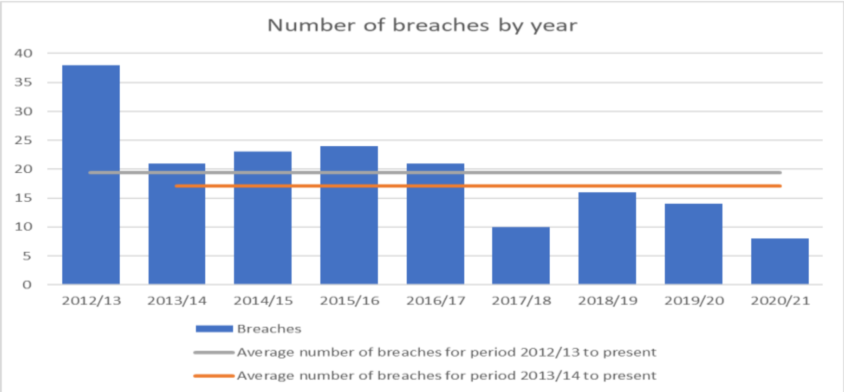
This breach related to a reverse-flow constraint on 14 December. An automatically created system constraint had been generated to manage potential offload violations on the Studholme_Timaru circuit. However, due to pre- and post-contingent flows being in different directions, the constraint did not bind. With no constraint binding, the market did not see appropriate signals in the forward schedules. Although a real time solution was prepared, it was ultimately not required.

March

We self-reported one system operator breach in March. The market impact of this breach exceeds the threshold of $40k set in the performance metrics[1] and counts against the target agreed with the Electricity Authority.

We incorrectly modelled Ngawha B as a secondary AC CE risk. This resulted in an over-procurement of North Island reserves worth an aggregate of $93,250 over the 70 trading periods. This occurred because manual overrides in the market system expired before the end of the Ngawha B commissioning period.

We have eight outstanding breaches with the Authority compliance team including one alleged breach by the Authority in September, six of these were in 2020/21.



Appendix A shows instances where the system operator has applied discretion under 13.70 of the Code.

[1] The performance metric is: Three or less market breaches ≥ $40k

4 Impartiality of Transpower roles

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

January

No items were opened in the Register during January.

February

No items were opened in the Register during February.

March

We have included a new general item in the Register that will remain permanently open to cover potential conflicts arising under a relationship situation (e.g. husbands/wives/partners/spouses/relations working for other participants, including the grid owner). The inclusion of this new item means that we have closed a specific relationship item in the Register, as it will now be managed as part of this general item (the same mitigation measures and monitoring will continue to apply). We have also closed another specific relationship item in the Register, as the affected person is no longer employed at Transpower.

There are 5 open items in the Register that are being actively managed.

System Operator Open Conflict of Interest Issues		
ID	Title	Managed by
29	**Preparing the Net Benefit test – system operator involvement:** The system operator is reviewing how it can provide information for use by the grid owner undertaking a Net Benefit Test.	Operations Planning Manager
31	**Discussions concerning Demand Response:** A system operator employee is part of a Transpower working group investigating the possible future use of the Transpower demand response platform. The system operator role is to provide the system operator perspective on any demand response proposals. Impartiality mitigations have been implemented to ensure the grid owner is not treated more favourably than any other participant with respect to demand response.	SO Market and Business Manager
39	**New SO Compliance & Impartiality Manager:** This relates to potential perception; the person filling this role also works for Transpower's legal team on a part-time basis. Workstreams will be allocated accordingly.	GM Operations
40	**General system operator/grid owner dual roles:** This is a general item that will remain permanently open to cover all employees with a dual system operator/grid owner role. The item documents the actions necessary to ensure impartiality in these circumstances; these items will be monitored to ensure their continue effectiveness.	SO Compliance & Impartiality Manager
41	**General relationship situation:** This is a general item that will remain permanently open to cover all potential conflicts of interest arising under a relationship situation. This item documents the actions necessary to prevent an actual conflict arising and will be monitored by the SO Compliance & Impartiality Manager to ensure their continued effectiveness.	SO Compliance & Impartiality Manager

4.1 Independence recommendations update

In terms of item 4A in the Deloitte Recommendations Table, Transpower's Risk & Assurance has engaged Deloitte to conduct an audit of the breach process managed by the system operator to ensure impartiality in the end-to-end breach process (grid owner vs other participants). An audit of the breach process covers the system operator inherent independence threat around monitoring the grid owner's compliance with the Code. The audit is scheduled for Q4 and is currently being scoped by Deloitte. It forms part of the Transpower annual assurance programme.

5 Project updates

5.1 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)

Overall, the project is progressing well and tracking to time and budget, there are currently no high or severe risks under management.

Phase 1 deployment is now scheduled for 13 May, one week later than previously reported resulting from a slight delay caused by the Oracle upgrade project. This revised deployment is still over three weeks ahead of the baseline milestone date agreed with the Authority. Phase 1 testing is on target to complete in early May. Business preparation for phase 1 deployment is on schedule with training in progress for affected staff and operational procedure updates in final review and approval to be ready to be published on deployment.

The phase 2 work is now ramping up with design nearing completion in all areas and development under way in the first two workstreams. The phase 2 forecast deployment date is 28 March and will have more of an operational change impact than phase 1. The full project is being delivered in four phases to be completed in April 2023.

The third industry engagement session took place on 25 March. It focussed on how the power system effects price and how price creation relates to the real world; this is one of a planned series of nine industry sessions in this phase of engagement. The next session is planned for late April and will be led by the Authority who will be covering the policy and intent behind the new energy and reserve scarcity market model.

Dispatch Service Enhancements (DSE)

In January, the two remaining customers still to transfer from the existing dispatch platform, GENCO, worked with Transpower to plan their final transitions following delays. Both participants submitted self-breaches to the Authority.

One party requested additional regression testing, which took place in early February. The other participant who had already transitioned one site, performed regression testing of their site transitioning to Web Services sites in mid-February and transitioned these sites into production later that month. Additionally, their sites transitioning to ICCP did so in early February.

All transitions to the new platform were successfully completed by the end of February 2021. The project has moved into the close out phase.

Situational Intelligence

A Test Exit Report for Release 3 of the streaming analytics was approved in December and the final release for the project was deployed on 26 January. This part of the project is now closed. Work has started on the data lake which is forecast to commission in mid-June. In parallel with this work we are preparing a roadmap for future work; the roadmap is forecast to be delivered at the end of May.

Extended Reserves (AUFLS) Portal, and Customer Portal–Asset Capability Statement (ACS)

In January, the system operator held a formal project kick-off with all project team members and the high-level design for the AUFLS portal was finalised with endorsement from the Community of Practise (COP).

Detailed planning confirmed that the build of the AUFLS data portal will take 10 sprints and be commissioned by mid-June 2021. As at the end of March, the data portal was in the process of completing sprint 5 and tracking well to plan.

As well as the data portal development, the project activity also includes supporting the Authority through the Code amendment consultation by providing input into the AUFLS Technical Requirements (ATR) document, and planning for deployment of the data portal to Distributors (including communications and training) which will commence in July 21 once the Code change is confirmed by the Authority.

5.2 Other projects and initiatives

2030 Code and market evolution sprint

As part of our future thinking work to ensure we are prepared for the changes we expect to see by 2030, we conducted a discovery sprint with Creative HQ in the week of 1-5 March. The main objective of this sprint was to discern what evolution the market and Code might need to deliver the electrified future described in our Whakamana i te Mauri Hiko report.

As part of the sprint we interviewed 25 diverse stakeholders across the industry, analysed both work already undertaken in New Zealand and internationally, and tested our conclusions against a panel of industry stakeholders, including from the Authority.

We will share findings with the Authority in due course.

Business Improvement - Modelling working group established

We established a modelling working group last year to implement a program of modelling improvement initiatives. These initiatives were largely surfaced through an end-to-end review of the modelling process completed in 2020 and includes the process to make the required changes to the market model.

This working group has created a collaborative forum that:

- has representation from end-to-end modelling groups within Transpower, including the system operator function
- discusses common issues and makes action plans to address them
- evaluates and prioritises resolving issues in a consistent and structured way

- can engage with projects on modelling related queries and implications.

The group is now meeting fortnightly and actively working through implementing improvements. Recent successes include:

- Improved Excel templates for outage blocks which has resulted in improved usability and ensures all key information is being correctly transferred between the different parties.
- Establishment and ongoing improvements to a model issue tracker providing a consolidated view of modelling errors. This aids visibility and collaboration on fixes and remediation activities across the modelling groups.
- Increased collaboration and improvement to market model documentation resulting in error reduction when new generators are introduced into the market system.

6 Technical advisory hours and services

The following table provides the technical advisory hours for Q3 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 95 – Battery Energy Storage Systems Offering Reserve	In progress	393.00
TAS SOW 96 – Reliability standards for inverters	In progress	157.00
TAS SOW 97 – RTP engagement session support	In progress	77.00
Total hours		**627.00**

7 Outage planning and coordination

Outage Planning – near real time

Although outage numbers reduced slightly in January as a result of the holiday break, for the rest of the quarter outage numbers continued to remain high and there are some busy outage weeks planned over the coming months. These large weeks put pressure particularly on our system security engineers who work close to real time.

Assessment of Annual Outage Plan and Forum

The System Operator assessment of the grid owner's proposed outage plan is complete and we made recommendations for some changes which the grid owner is working through ahead of publishing the final plan by 19 May. We joined the grid owner on 24 March in presenting to customers on outage-related matters including the System Security Forecast, our assessment approaches, our outage disclosure guidance and the Outage Planning Policy. We also covered key outages like the HVDC outages for the next three years and the Clutha and Upper Waitaki Lines Project Outages.

HVDC outages

The annual HVDC outage ran successfully from Thursday 18 February to the following Tuesday (six days, with a full bipole outage over the weekend). We had provided customers with an overview of the outage at a briefing in December at which they raised no concerns. With a backdrop of high prices, prices during the HVDC outages were only slightly increased on recent prices.

New Zealand Generation Balance reporting

We published our February and March NZGB reports, which include forecasts through the winter period to September. Under our base scenarios, we are seeing no shortages, but once we overlay low-gas and no-wind scenarios we see some shortages. The availability of Genesis' third Rankine at Huntly should reduce these.

Outage Planning events or items of note

We had a two-day planned outage of Huntly_Te Kowhai_1 in January. It is a difficult outage due to high voltages overnight at Te Kowhai, especially in a low load period. The outage went ahead and was well coordinated between Transpower, Te Rapa Cogen, WEL Networks and several other stakeholders.

During a Kikiwa bus outage in February, a contingency caused unwanted violations. This was largely due to a concurrent outage but also due to unusual conditions on the day. Approval was gained to put Kikiwa T1 into service. This is now an option offered to the system operator, which provides more options for outages in the area.

We published two outage assessments to South Island 220 KV circuits during March in accordance with the outage planning policy. Both circuits feed Zone 3 (South Island north of Waitaki Valley) and "at worst-case loads" cause the Zone 3 voltage stability limit to exceed 97.5%, hence the publication of an assessment and options to mitigate.

8 Power systems investigations and reporting

Operational impact of Tiwai exit

Following Rio Tinto's announcement in January of its plan to delay the closure of Tiwai until 2024, the Operations Tiwai exit working group reviewed its work programme to decide what activities to pause and which to continue. Our engineering studies will continue, and include:

- South Island transient (rotor angle) stability analysis, including challenges managing a bi-pole tripping
- South Island Over-Frequency performance analysis
- Small signal stability analysis across the North and South Islands.

We plan to publish our findings before the end of July 2021.

There is a page on the Transpower website to keep industry informed of the findings from our operational studies into the impact of Tiwai's exit on our ability to operate the power system.

Credible Event Review

In January, we reviewed the classifications of several interconnecting transformers including new transformers at Stratford and Otahuhu and the classification of the existing Kikiwa and Stoke transformers considering the commissioning of the Kikiwa reactor. The review has not resulted in substantial changes to classifications and will be communicated to industry with a brief update to our existing reports in due course.

Huntly Unit 5 testing

On 3 March, Genesis successfully completed an under-frequency performance test on Huntly unit 5. The test involved tripping Huntly unit 4 at 180 MW to see how unit 5 would behave given control system changes introduced after previous under performance was identified. As unit 5 was the risk setter at the time generating around 369 MW, an additional level of planning and simulations were required right up to the time of testing to ensure the system would survive if unit 5 did not perform as expected. This testing required a high level of collaboration between the system operator and Genesis Energy to complete.

Hawkes Bay regional capacity issues

We have undertaken a high-level forecast of potential peak capacity issues for Hawkes Bay. This indicates we may see peak shortages in several periods in April, May and June as peak demands increase, if we do not see increased inflows to Waikaremoana. We have existing real time processes to mitigate security concerns. We shared our analysis and communicated our processes with regional stakeholders at an online briefing on Wednesday 7 April.

9 Performance metrics and monitoring

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

Only those metrics with a weighting are used in the calculation of the system operator score and incentive payment.

Smart about money

Metric		Annual Target	Actual to date	Points
Perception of added value by participants		80%	N/A	

Customers are informed and satisfied

Metric		Annual Target	Actual to date	Points
Annual participant survey result		82%	N/A	5
Annual participant survey result response rate - First tier stakeholders		80%	N/A	
On-time special event preliminary reports		90% ≤ 10 business days	0 to date	5
Future thinking and insights	Future thinking report	≥ 1	0 to date	5
	Longer Market Insight reports	≥ 4	2	5
	Bite-sized Market Insights	≥ 45	36	
Quality of written reports		100% of standard	100%	
Role impartiality		80%	N/A	5

Code compliance maintained and SOSPA obligations met

Metric		Annual Target	Actual to date	Points
Market breaches remain below threshold		≤ 3 @ ≥ $40k	1	10
Breaches creating a security risk - below threshold/within acceptable range		≤2	0	10
On-time SOSPA deliverables		100% (54)	100%	10

Successful project delivery

Metric		Annual Target	Actual to date	Points
Improved project delivery	Service Maintenance projects	≥ 60% on time	0%	
		≥ 60% on budget	100%	
	Market Design and Service Enhancement projects	≥ 60% on time	0 to date	
		≥ 60% on budget	0%	
Accurate capital planning		≥ 50%	N/A	10

Commitment to optimal real time operation

Metric		Annual Target	Actual to date	Points
Sustained infeasibility resolution		80% ≤ 10am or equiv	94%	5
High spring washer resolution		80% ≤ 10am or equiv	100%	
Dispatch Accuracy	Energy (Optimal dispatch)	Baseline set during 2020/21		
	Reserve Management Objective	Baseline set during 2020/21		

Fit-for-purpose tools

Metric		Annual Target	Actual to date	Points
Capability functional fit assessment score		75.00%	N/A	
Technical quality assessment score		65.00%	N/A	
Sustained SCADA availability		99.90%	99.99%	10
Maintained timeliness of schedule publication		99.00%	100%	10

9.1 Dispatch accuracy dashboard

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, along with an explanation of the methodology we used to create the dashboard.

The purpose of this year is to evaluate how well each of these measures illustrate industry dispatch performance. We have used this year as an opportunity to evolve the dashboard measures, the standards and metric calculation so that it provides the greatest insight. This evaluation has been performed in consultation with the Electricity Authority.

Since the last quarterly report in December, we have not made any further changes to the dashboard. However, we have proposed to continue including the dashboard in the Quarterly report as it is proving a useful way to identify changes in energy dispatch performance in the different months.

January to March 2021

- *Frequency excursions (January)*

  There were five occurrences during the month

  - Two of these were when a Tiwai line tripped
  - Two relate to generation trippings – one of Kawarau geothermal generation and one of Nga Awa Purua generation
  - One relates to a line tripping – Bunnythorpe_Linton_Wilton 1.

- *Time error - SI (February)*
  - The slight increase in both North and South Islands occurred during the HVDC bipole outage (18-23 Feb).

- *FK outside of band limit (February)*
  - This also relates to the HVDC bipole outage (18-23 Feb).

Optimal dispatch

During our March 2021 update we noticed an inconsistency in the treatment of wind generation in the “Wind offer accuracy (%)” metric used in the dashboard.

Some non-wind generators that are classified as Type B co-generators were being modelled as wind generation in the calculation. This included the Type B co-generation at Glenbrook, Whararoa and Kinleith. This issue has now been corrected and has resulted in a slight reduction in the wind offer accuracy (%). The reduction in the “Wind offer accuracy (%)” metric with the removal of these Type B co-generators is due to these co-generators having less uncertainty in their output over the five-minute dispatch horizon compared to wind generators.

10 Cost-of-services reporting

We provided the Authority with a final report on the cost-of-services for financial year 4 (2019/20) on 22 December 2020.

11 Actions taken

The following table contains a full list of actions taken during Q3 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**:	• Completed a system restoration exercise simulation in March and one internal dry year exercise (in addition to a number of other preparedness activities to provide assurance to industry). • Continued to work through our planned activities which strive for operational excellence in our control room practices; managing events to minimise impact. • Incorporated our stakeholders' feedback assessing how we deliver value through innovation, communication and responsiveness as part of the performance metrics. • Used the agile delivery method and practices as part of the market evolution sprint to help us prepare to respond to the fast pace of technology change.
(ii) To comply with the **statutory objective work plan**:	Delivered proposals as part of SOWP 2020/21 to: • incorporate feedback on innovation, communication and responsiveness • evaluate the dispatch accuracy metrics for energy and reserves
(iii) In response to participant responses to any **participant survey**:	**Feedback from the 2019-20 survey** • *"Keep up/increase the communication/information-sharing"*. Customer relationships have been a focus for us this year. For this quarter the notable work has been that our communications and interactions with stakeholders have increased as we prepare for a potential current dry year situation.
(iv) To comply with any **remedial plan** agreed by the parties under SOSPA 14.1	N/A – No remedial plan in place.

System performance

12 Security of supply

Hydro storage has continued to decline in both the North and South Islands this quarter due to the extended run of low inflows. At the end of March storage was 67% of average for this time of year (53% of full). By 15 April, storage had dropped slightly to 66% of average (51% of full) for this time of the year.

Continued pressure on gas availability and low wind generation have also contributed to us getting very close to the 1% risk curve in April. Despite this, our risk status remains 'Normal', as we expect (based on our current hydro storage projections and assumptions of fuel availability in an emergency) that we will not reach the emergency curve this winter.

Gas and hydro positions are combining to create market prices averaging around $200/MWh and climbing to $400/MWh during peaks or when wind is low; much higher than is usual at this time of the year. Future price estimates reflect expectations of a tight winter ahead with all-time highs on the horizon.

The market is responding in both the short and long term. In February, in response to current conditions, Genesis brought on a third Rankine at limited capacity. This unit, like the others, can run on coal. The coal stockpile is at its highest level for five years.

Long term, the market is responding to these price signals by building generation, particularly, to replace gas. A good example of this is Tauhara - which is expected to replace Taranaki Combined Cycle plant with geothermal in 2023.

In April, there are a number of thermal unit outages that are also affecting the overall generation position. Stratford's combined cycle plant (TCC) is on a short notice outage from 8 April and is expected to return 16 April; Stratford's peakers have taken up some of TCC's slack. With TCC (350 MW), Huntly unit 5 (385 MW) and one unit at Mckee (50 MW) out of action, there is approximately 780 MW of gas generation on outage. Mckee is due back 9 July and Huntly unit 5 is due back 26 April.

System operator preparedness

As part of our commitment to continuous improvement, this quarter we have undertaken a number of activities to inform our stakeholders and provide assurance of our preparedness for a dry year event:

- We analysed and reported on the effects of El Niño Southern Oscillation (ESNO) on New Zealand's hydrological inflows, of which La Niña is the cooling phase in the Pacific Ocean[2].
- We modelled and reported on reduced gas supplies and their effect on security of supply[3].
- We have increased the frequency of our conversations with relevant parties to check our assumptions, as well as with the Authority and MBIE to ensure our messaging to stakeholders is consistent.
- We held an industry briefing on 28 February to remind participants of roles and responsibilities for managing security of supply and our current risk assessment

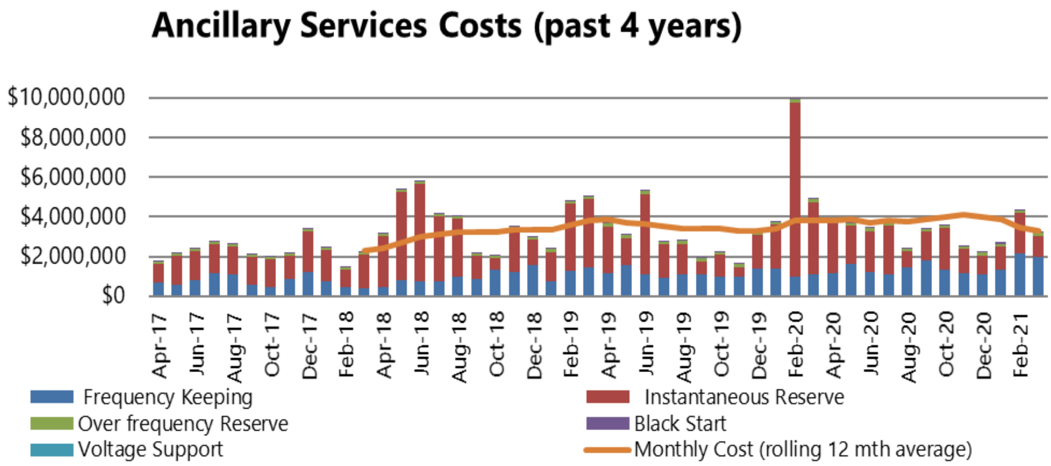
[2] https://www.transpower.co.nz/sites/default/files/bulk-upload/documents/La%20Nina%20%26%20El%20Nino.pdf

[3] https://www.transpower.co.nz/sites/default/files/bulk-upload/documents/Gas%20Outlook%20for%20Electricity%20Generation%20and%20Security%20of%20Supply%202021.pdf

and assumptions and are holding regular webinars upon release of our updated risk curves and SSTs (these will be two weekly while we are close to the 1% risk curve).

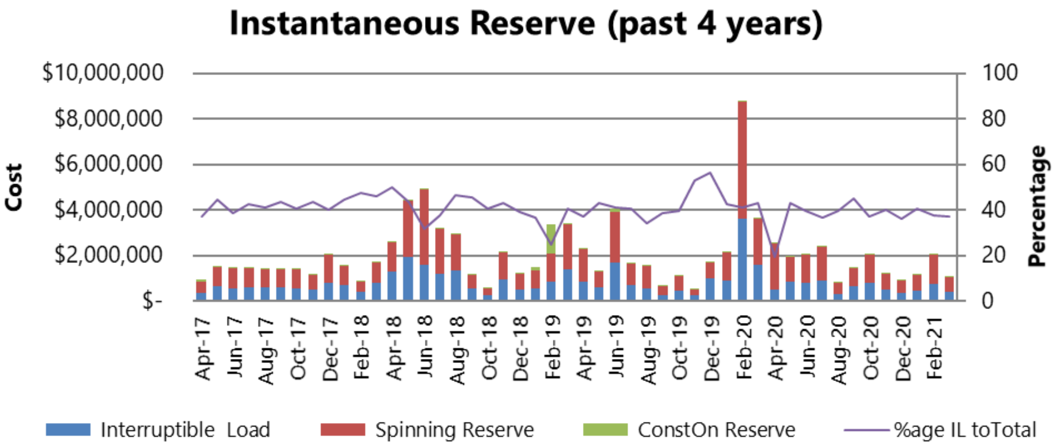
- We have set up an incident management team to start preparations for a dry year event. This involves increased reporting and stakeholder communications (including regular webinars[4] and daily reporting from Monday 12 April), and early preparations for an Official Conservation Campaign.
- These actions will continue until the risk of crossing the 1% Electricity Risk Curve (ERC) has sufficiently dropped. As at 15 April, the hydro storage position is 155 GWh above the 1% ERC (equivalent to roughly 1.5 days of NZ daily demand).

13 Ancillary services



This quarter's ancillary service costs were $10.4 million, which is a 22 per cent increase compared to Q2's costs of $8.5 million. The significant increase in ancillary services costs this quarter were primarily driven by the above average frequency keeping and instantaneous reserve costs in February as a result of the annual HVDC bipole outage. February has the highest ancillary services cost since March 2020, the previous annual HVDC bipole outage.

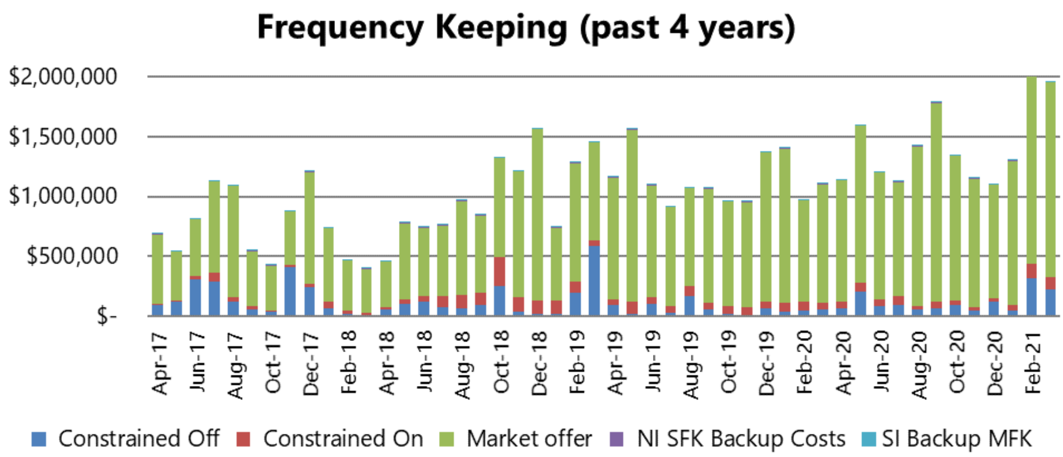
[4] https://www.transpower.co.nz/system-operator/stakeholder-interaction/industry-workshops



This quarter, the instantaneous reserve costs were $4.3 million, which was consistent with the previous quarter ($4.3 million). Interruptible load costs increased by $35k (2 per cent increase), spinning reserves increased by $79k (3 per cent increase) and constrained on costs decreased by $73k (72 per cent decrease).

An increase in cost was seen in February. This is a result of an increase in the price of reserves procured over the course of the month; with a large spike in both the quantity and price of reserves procured during the HVDC bipole outage. Although the price of reserves procured over the whole of March decreased compared to February, there was a small price spike at the end of the month.

As the quarter progressed the amount of reserves procured in the North Island decreased while the amount of reserves procured in the South Island increased. Also notable is that reserve that was most heavily procured in January was North Island SIR which has a much lower price than the FIR prices in both islands.

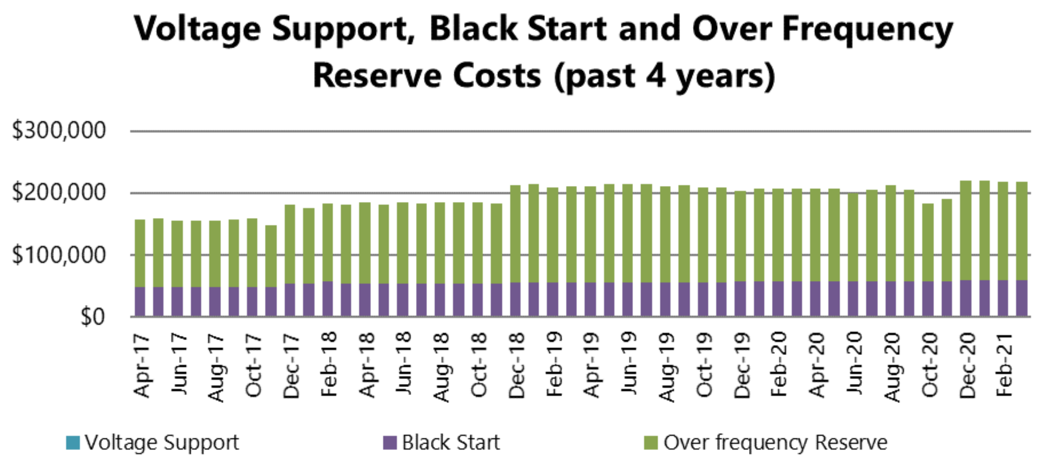


This quarter the frequency keeping costs were $5.4 million, which is a 50 per cent increase compared to Q2's costs of $3.6 million.

This significant increase in frequency keeping costs was driven by the HVDC bipole outage that occurred in February as well as significant periods of low hydrology in the

South Island market costs in March which saw a $97k increase in market costs on the previous month (11 per cent increase).

For all of this quarter, these higher costs have reflected a shift in the generation mix due to low hydrology, particularly in the South Island.

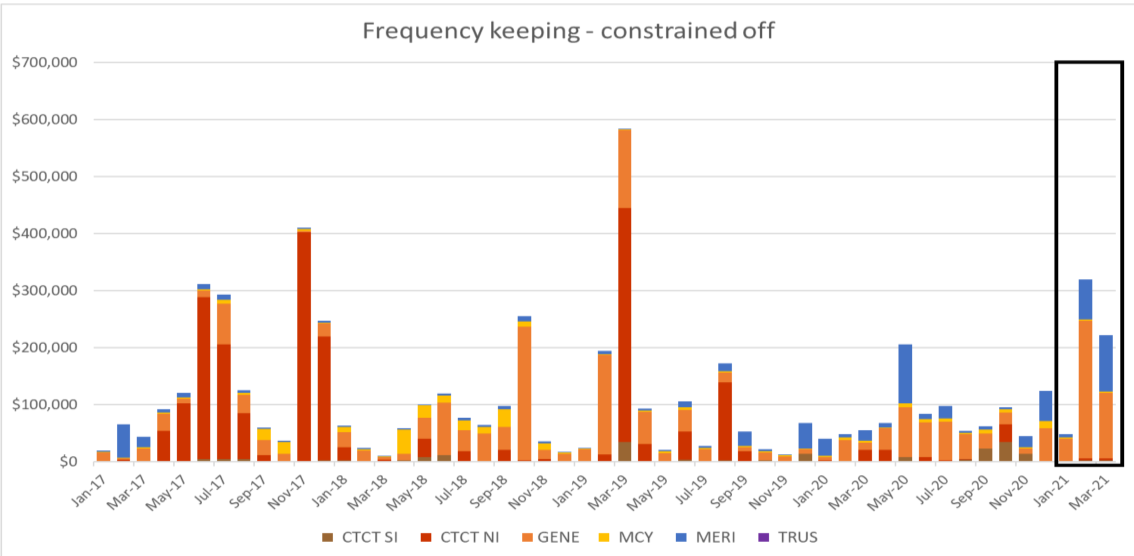


This quarter, there was very little variance to both the over frequency costs and the black start costs. There are no voltage support costs as we do not currently procure this service.

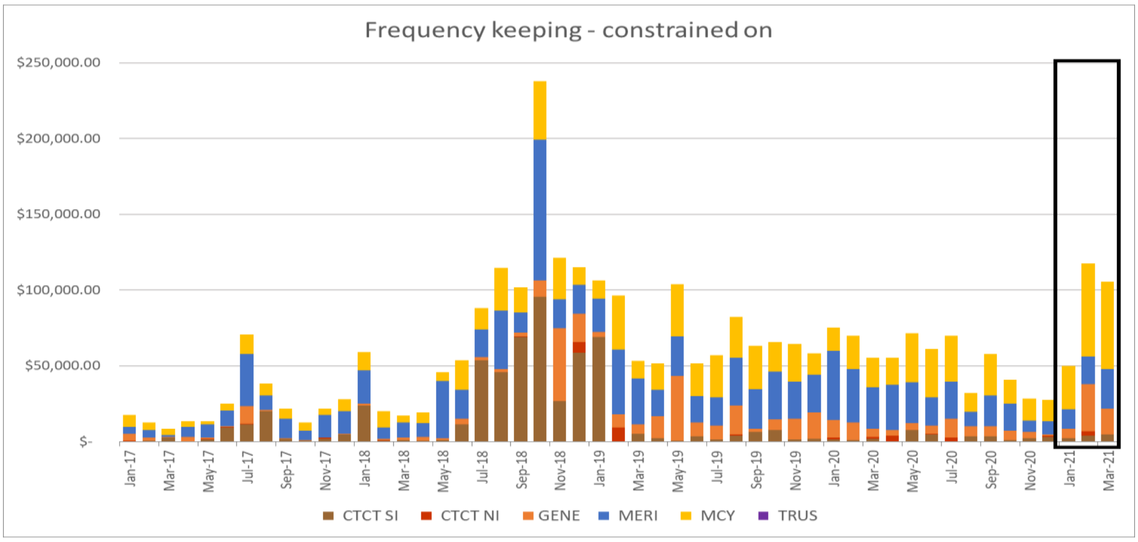
13.1 Constrained on/off costs

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

Frequency Keeping

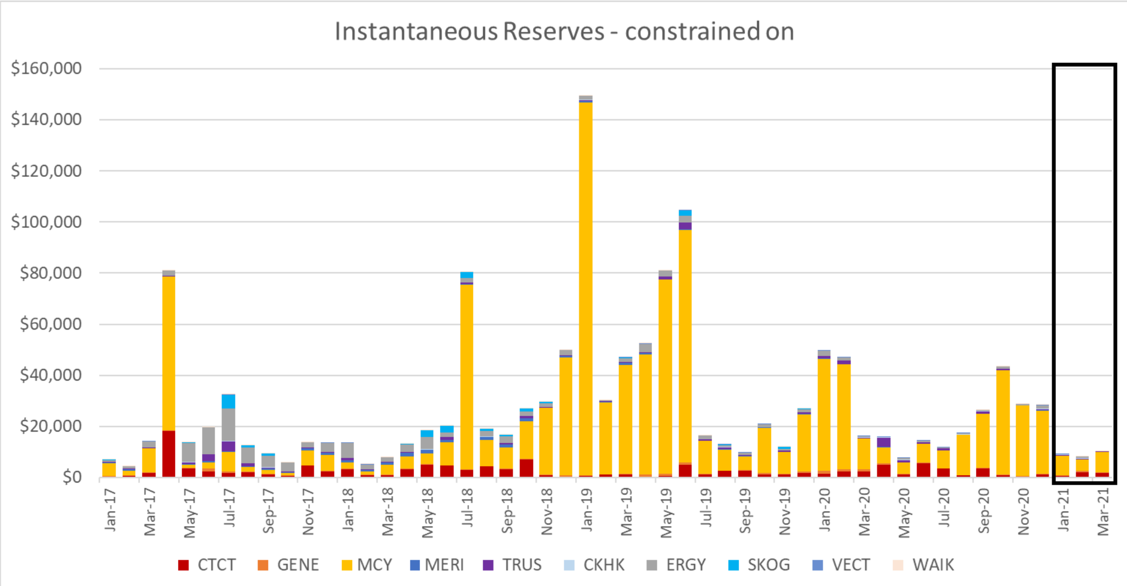


For 2020/21 Q3, the frequency keeping constrained off costs increased on the previous quarter. The costs were tracking down in January but subsequently the costs in February and March reached levels not seen since March 2019, the previous HVDC bipole outage. These higher costs have reflected a shift in the generation mix due to low hydrology, particularly in the South Island.



For 2020/21 Q3, the frequency keeping constrained on costs (like the frequency keeping constrained off costs) increased on the previous quarter. However, the costs were tracking up in January before the costs in February and March reached levels not seen since July 2018 – January 2019. These higher costs have reflected a shift in the generation mix due to low hydrology, particularly in the South Island.

Instantaneous Reserves



For 2020/21 Q3, the instantaneous reserves constrained on costs were significantly lower than the previous quarter. This was driven by low hydrology, as much of the idle hydro capacity found its way onto the reserves market.

14 Commissioning and Testing

Generation testing and commissioning and model changes

Mercury's Turitea phase 1 (North) windfarm is due to connect to Linton in May 2021. Progress has been made this quarter clarifying asset owner performance obligations with the windfarm project team after seeking guidance from the Electricity Authority.

All turbines have now been commissioned at Tilt's Waipipi windfarm and our focus is moving to assessing final Code compliance and validation of asset models against test results.

Given the deferral of Tiwai's potential exit, we have started to be approached in our role as system operator regarding several grid connected generation projects. We are also starting to see solar projects move past feasibility stage (both grid and distribution connected). This has highlighted the need to be clear when Transpower deals with customers whether we are doing so in our role as grid owner, system operator or both, especially when producing high level responses.

We have begun a review of distributors' published connection process information and how it links to Transpower. Our goal is to identify gaps and produce a useful reference guide to share with distributors to clarify required interactions with Transpower as either the grid owner or system operator.

15 Operational and system events

January

Effect of AC fault at Bunnythorpe on windfarm output

On 20 January, after an AC fault at Bunnythorpe, the output of several windfarms was identified as dropping. The most notable windfarm was West Wind which dropped approximately 100 MW of generation after the AC fault. The system operator has confirmed with the Asset Owner that West Wind has complied with the fault ride-through obligations in this instance, and will self-breach. Consideration is being given to the best way to manage this risk given the existing limitations of system operator tools.

Tripping of recently completed commissioning

Several generation assets that are undergoing or have recently completed commissioning have been observed tripping. We will continue to monitor the situation, however these trippings do not appear to be related to any other events on the system at the time and are therefore already covered under our existing contingent event management processes for generators.

February

No significant operational events to report.

March

No significant operational events to report.

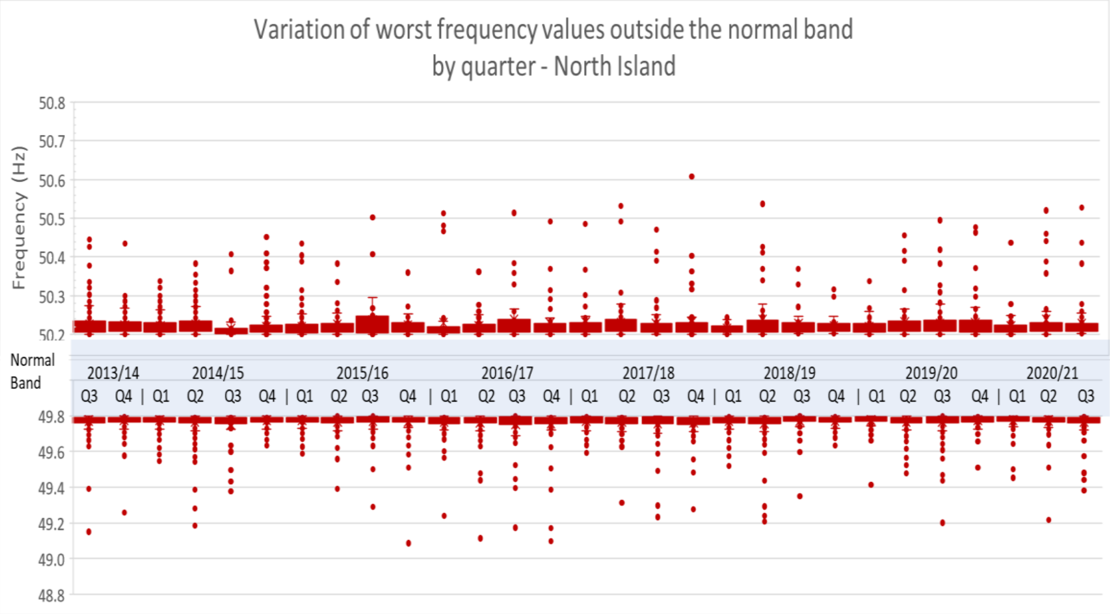
This concludes a very low incident quarter, which has resulted due to lots of proactive contingency planning.

16 Frequency fluctuations

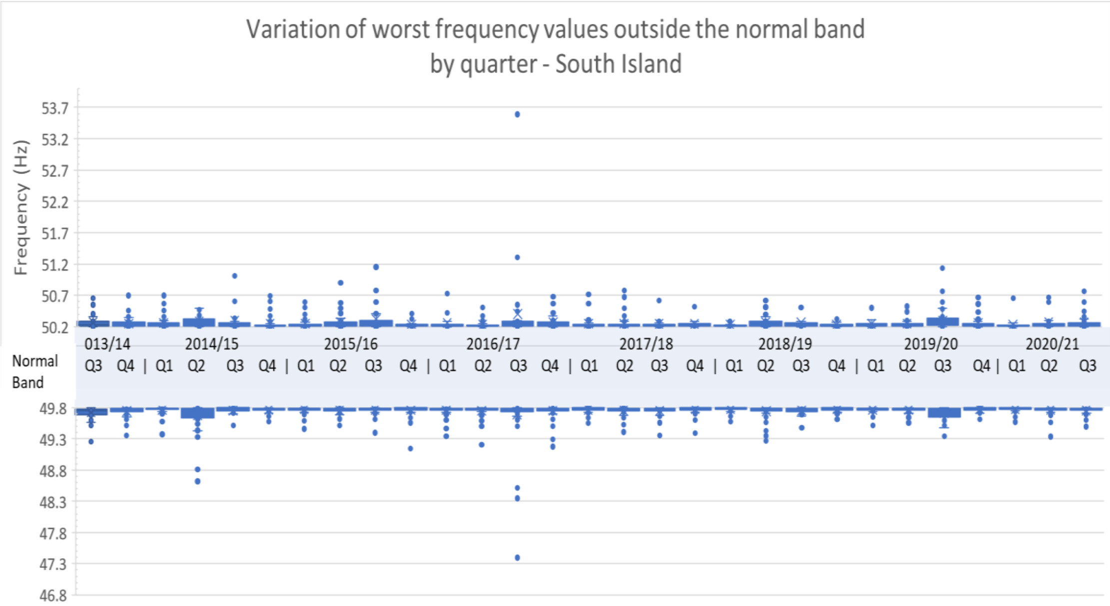
16.1 Maintain frequency in normal band (Frequency value)

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

North Island



South Island

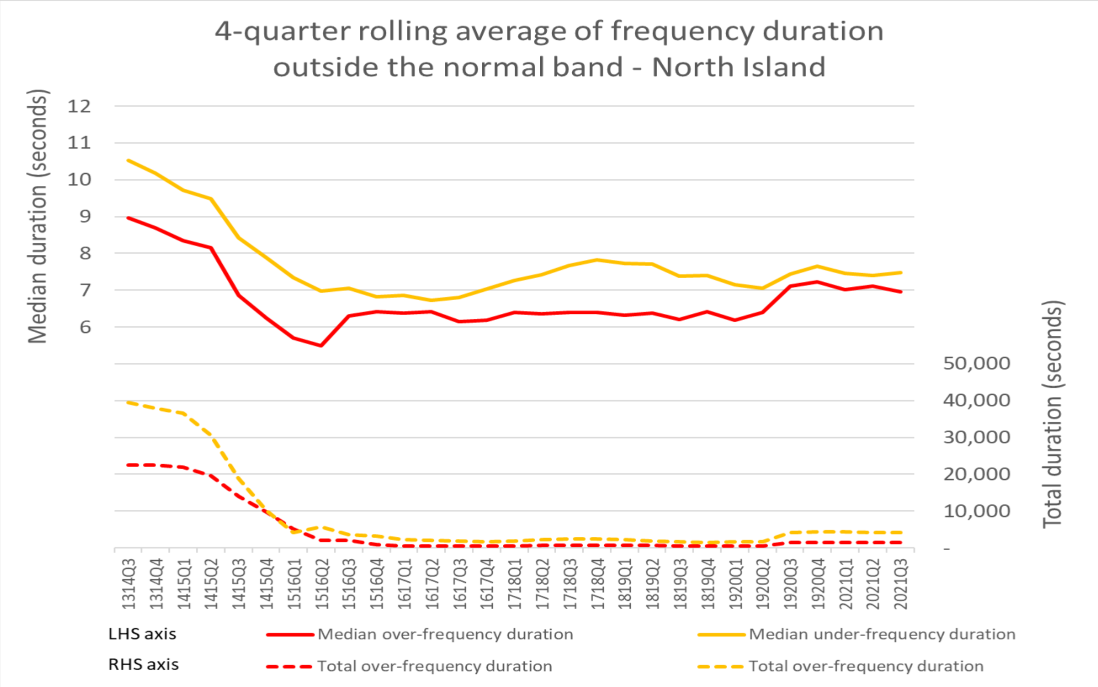


Note: These box and whisker charts show the distribution of data. The "box" represents the distribution of the middle 50% of the data, the "whiskers" indicate variability, and outliers are shown as single data points.

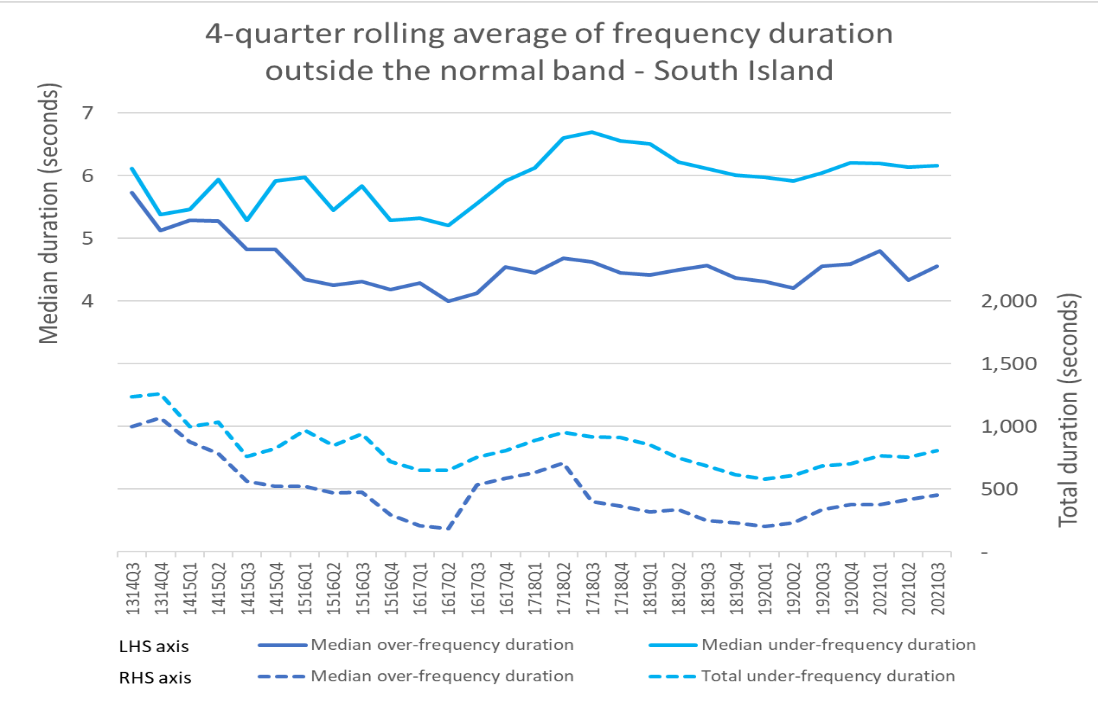
16.2 Recover quickly from a fluctuation (Time)

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

North Island



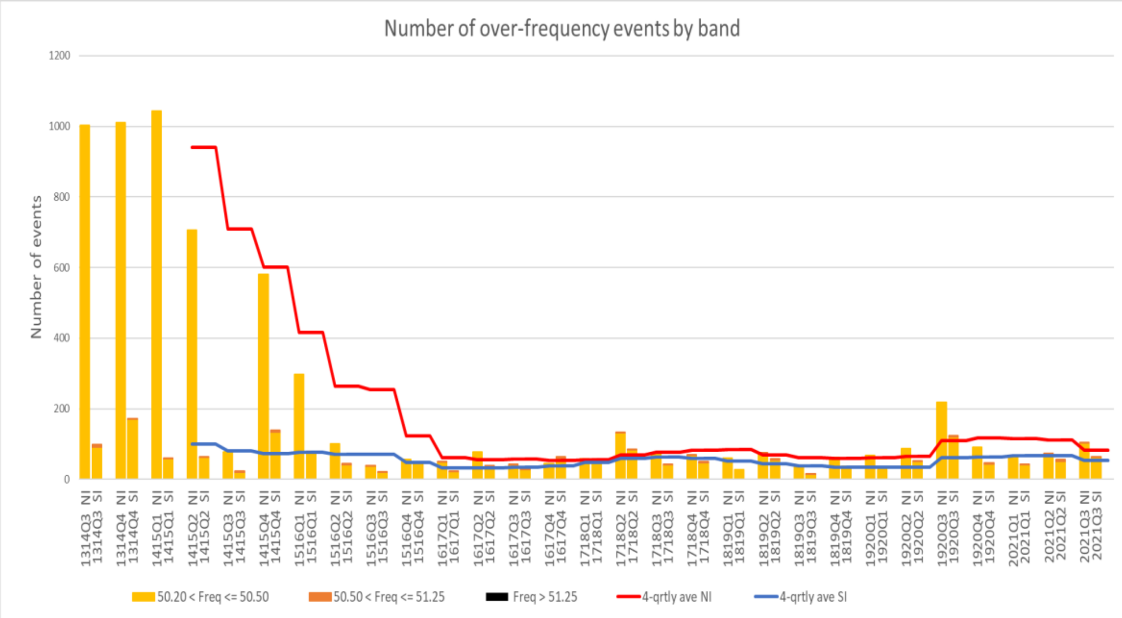
South Island



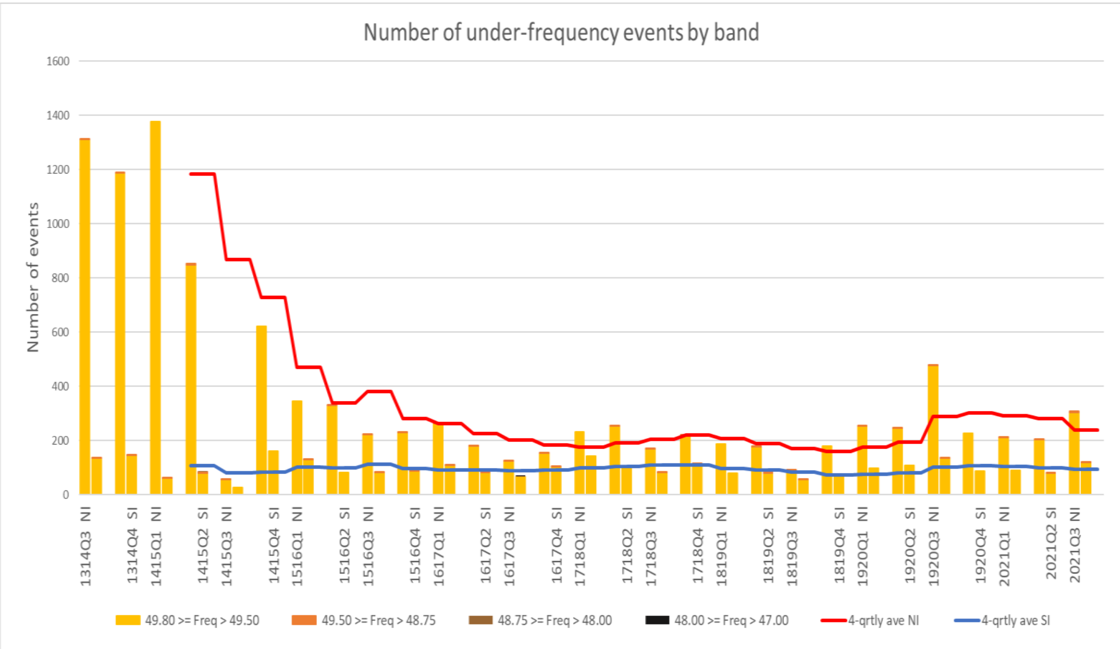
16.3 Manage frequency and limit rate of occurrences during momentary fluctuations (Number)

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

Over-frequency events



Under-frequency events



16.4 Manage time error and eliminate time error once per day

There were no time error violations in the reporting period.

17 Voltage management

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

18 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	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21
Demand Allocation Notice	-	-	-	-	-	-	-	-	-	-	-	-
Grid Emergency Notice	-	-	1	-	-	-	1	-	2	-	1	1
Warning Notice	-	-	-	-	-	-	-	-	-	-	1	-
Customer Advice Notice	13	10	13	11	15	9	6	12	10	8	4	4

19 Grid emergencies

The following table shows grid emergencies declared by Transpower as system operator from January to March 2021.

Date	Time	Summary Details	Island
24/02/21	14:02	A grid emergency was declared to allow a grid reconfiguration to alleviate steady-state over-loading on 110 kV Fernhill-Redclyffe circuit 1 following the loss of generation at Tuai Power station. The parallel Fernhill-Redclyffe circuit 2 was out of service for planned work at the time.	N
05/03/21	10:19	A grid emergency was declared to allow the reconfiguration of the Northland 110 kV system following a tsunami warning. Had the tsunami eventuated there was potential to impact Transpower's network in the area.	N

Appendix A: Discretion

January

Event Date & Time	Event Description
	None

February

Event Date & Time	Event Description
20-Feb-2021 06:54:25	JRD1101 JRD0 Discretion Max : 0 CST_SFD_JRD_1 Auto Reclosed which tripped JRD G71 & 72 Last Dispatched MW: 33.33
12-Feb-2021 10:09:34	MAN2201 MAN0 Discretion Max : 390 TWI Line 2 extended offload Last Dispatched MW: 565
04-Feb-2021 11:16:58	SFD2201 SFD21 Discretion Max : 0 Contact claimed rule 13.82A. Not required for security Last Dispatched MW: 50

March

Event Date & Time	Event Description
03-Mar-2021 21:32:11	TUI1101 TUI0 Discretion Min : 11 RDF T4 loading/temperature issue. Last Dispatched MW: 7.54
03-Mar-2021 21:35:57	TUI1101 PRI0 Discretion Min : 8.5 RDF T4 loading/temperature issue. Last Dispatched MW: 5
30-Mar-2021 11:37:37	MAN2201 MAN0 Discretion Max : 320 To manage TWI Line 3 full restoration at 11:47. Last Dispatched MW: 500

Appendix B: Dispatch Accuracy Dashboard

Same quarter in 2019/20

This quarter 2020/21

			2020 January	February	March	April	May	June	July	August	September	October	November	December	2021 January	February	March
Operator discretion applied	Total number of instances (5-minute dispatches) where operator interventions depart from the dispatch schedule to ensure the dispatch objective is met.	100% binding	550	756	641	498	586	718	791	416	599	540	515	493	481	557	360
	Instances where the system operator has applied discretion under 13.70 of the Code to meet dispatch objective		2	4	4	-	1	3	3	-	4	10	3	-	-	3	3
Frequency keeper (MW)	Average absolute deviation (MW) from frequency keeper dispatch point. A movement of frequency keeping units away from their setpoint suggests greater variability in the system, but can also	NI	7.63	7.01	6.90	6.80	6.87	6.97	7.01	7.06	7.11	7.06	6.89	7.11	6.88	6.64	6.88
		SI	6.49	6.84	6.33	6.64	6.41	6.80	6.51	6.53	6.83	6.62	6.74	6.50	6.35	6.48	6.45
Time error (s)	Average absolute daily time error (s) indicates imbalance between generation and load, a reflection of imperfect dispatch	NI	0.2410	0.2340	0.2455	0.2843	0.2277	0.2768	0.2368	0.2018	0.2064	0.1815	0.2092	0.1777	0.1953	0.2447	0.2019
		SI	0.1967	0.2309	0.2217	0.1923	0.2323	0.2845	0.2507	0.1979	0.1973	0.1818	0.1947	0.1872	0.2266	0.2506	0.2051
Frequency excursions	Number of frequency excursions (>0.5Hz from 50Hz)		1	4	5	1	1	1	1	1	-	6	3	-	5	3	2
FK within 1% of band limit	% of time frequency keepers spend near to or exceeding their regulation limits indicates the need to redispatch.	NI	**3.7%**	2.9%	3.7%	1.8%	2.4%	3.2%	3.1%	3.7%	3.5%	2.8%	2.66%	2.87%	2.39%	2.88%	2.15%
		SI	**2.8%**	3.9%		2.7%	3.5%	4.3%	4.0%	4.6%	4.8%	3.9%	3.85%	4.16%	3.43%	3.78%	3.13%
FK outside of band limit	% of time frequency keepers spend outside their regulation limits	NI	**0.81%**	0.12%	0.54%	0.05%	0.00%	0.04%	0.11%	0.02%	0.02%	0.01%	0.00%	0.01%	0.01%	0.05%	0.02%
		SI	**0.03%**	0.01%		0.00%	0.00%	0.01%	0.00%	0.01%	0.00%	0.00%	0.01%	0.00%	0.00%	0.03%	0.00%
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.		**8.37%**	12.79%	10.37%	6.92%	13.90%	9.62%	14.65%	9.83%	9.72%	8.19%	8.50%	7.42%	9.00%	10.29%	11.97%
Constrained on energy- Total	Total Monthly Generation	MWh	3,501,768	3,329,074	3,407,184	2,931,637	3,629,018	3,710,599	4,006,808	3,861,813	3,671,507	3,642,908	3,396,766	3,429,779	3,349,472	3,155,453	3,338,962
	Total constrained on - All sources	MWh	**23,641**	28,565	24,912	32,088	26,519	24,247	23,649	26,426	24,579	24,672	23,347	18,499	24,386	13,538	10,561
		% of all generation	**0.68%**	0.86%	0.73%	1.09%	0.73%	0.65%	0.59%	0.68%	0.67%	0.68%	0.69%	0.54%	0.73%	0.43%	0.32%
		$	**365,863**	468,969	304,255	303,542	491,296	488,575	712,042	379,543	503,196	399,820	292,501	455,009	325,530	426,305	407,568
Constrained on energy ($) - Frequency keeping	Total constrained on $ due to frequency keeping (within band is attributable to SO)	$	**75,173**	70,074	52,492	55,553	71,518	61,301	69,715	31,973	57,712	40,822	28,503	27,411	49,807	43,198	35,972
Optimal Dispatch (%)	Compares the average impact of a perfect foresight case against dispatch solutions. Indicates impact of wind offer, load forecast and PSD accuracy.	%	**93.35%**	90.62%	91.74%	87.29%	90.77%	92.78%	93.19%	94.38%	94.34%	94.27%	94.0%	92.8%	93.3%	93.5%	93.4%
Dispatch load accuracy error (%)	Average absolute difference between forecast generation (load plus losses, including PSD) and actual generation relative to the average actual generation	%	**99.62%**	99.54%	99.57%	99.52%	99.52%	99.56%	99.59%	99.62%	99.62%	99.62%	99.6%	99.6%	99.6%	99.6%	99.6%
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	%	**97.62%**	97.66%	97.22%	97.65%	97.36%	97.81%	97.82%	97.42%	97.79%	97.74%	97.4%	97.5%	97.6%	97.3%	96.9%
	Metric calculation rows	FK outside band	1	3	1	3	3	3	3	3	3	3	3	3	3	3	3
		Constrained on	3	2	3	1	3	3	3	3	3	3	3	3	3	3	3
		Optimal Dispatch (%)	3	1	2	1	2	3	3	3	3	3	3	3	3	3	3
Dispatch accuracy %	**Metric out of 3 (3 is best possible result)**		2.3	2.0	2.0	1.7	2.7	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

Scale for measures: Variation of up to 0.25 std devs from standard ... up to 1 std dev from standard ... up to 2 std devs from standard ... over 2 std devs from standard

Scale for metric: 1 2 3

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

NOTE 2: Summary data for "FK outside of band limit" is not shown for the South Island in March 2020. The data collected for this month has missing values for a number of dates which meant the measure could not be calculated.

Understanding the dashboard

The purpose of this dashboard is to identify trends and outliers for measures that represent overall industry performance in energy dispatch. The system operator actions are only one of the influences in this performance. Three of the measures in which the system operator has some influence in the performance are converted into a metric. During 2020/21 we will monitor how well this metric represents performance, with the purpose of baselining a target and metric as part of the 2021/22 performance metrics.

Measures selected

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

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

Colour scale

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

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

Variation of up to 0.25 std devs from standard	... up to 1 std dev from standard	... up to 2 std devs from standard	... over 2 std devs from standard [5]

Metric

The measures that contribute towards the metric are:

- FK outside of band limit [6]
- Constrained on energy- Total
- Optimal Dispatch (%)

There are three stages to calculating the metric

1. **Determine a standard**
   This is based on what represents good performance
2. **Rate the comparison on a scale of 1 to 3**
   The monthly performance is compared to the standard against a predefined scale. There are two scales used in this calculation - FK outside of the band limit and Constrained on energy - Total; and Optimal Dispatch (%). These are shown in the tables below: [7]

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

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

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

Example:

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

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

[5] Since last quarterly report we have changed the way in which we measure variation, to make it in terms of standard deviations (instead of percentage variations) for both the conditional formula shading and the metric calculation
[6] Last quarterly report used the measure FK within 5% of band limit, we have updated this as variation outside of band limit was felt to be more meaningful
[7] The score was changed during the year from a five point (1-5) to a three point (1-3) scale.