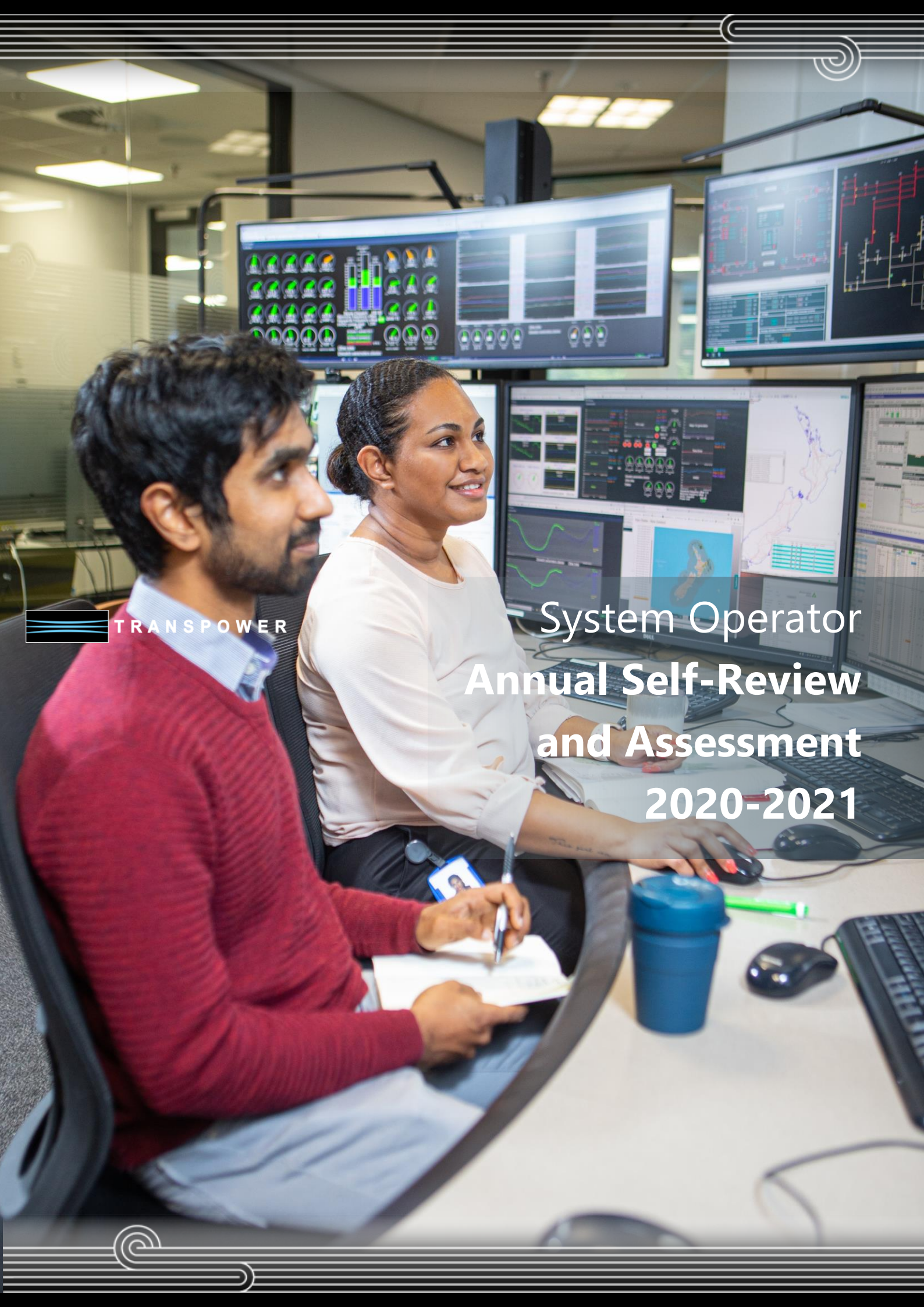


TRANSPOWER

System Operator
Annual Self-Review and Assessment 2020-2021

Contents

Foreword

Our critical role in operating a secure power system and electricity market for New Zealand means expectations for our day-to-day performance are high. Our current performance metrics show it has been a strong year of performance across the board, in a year where we have dealt with the complexities of a potential 'dry year' over a period with low gas output.

Whilst I am proud of our performance, there are two areas where we have sharpened our attention during this year, which I would like to highlight.

The first is in working on areas where we can see opportunities to learn and improve. Guided by feedback last year from the Electricity Authority, and participants in our annual survey, we have worked hard on these through the year and we have highlighted them in this review.

The second reflects our responsibility to prepare ourselves and enable others to manage the challenges of unprecedented change in the energy industry. We have improved our long-term strategic planning and I look forward to delivering on these plans and supporting change in the industry.

At the time of writing, investigations are underway into the Grid Emergency of 9 August 2021. While the event falls outside the reporting period for this review, it was a significant event which we consider should be acknowledged. Reports about our own and other investigations will published as soon as possible.

Dr Stephen Jay
GM OPERATIONS

2020/21 Key deliverables – at a glance

Meeting our strategic priorities

Play an active role in enabling New Zealand's energy future market	• Proactively updating our preparation for a potential 'dry winter'. Meeting our milestones for this area, and building improvements into our processes and communications. • Maintaining regular contact with international equivalents, via Association of Power Exchanges (APEx), CIGRE, and the Electricity Engineers Association (EEA). • Providing technical advisory support to the Authority to aid their response to the "G2" recommendation in the Electricity Pricing Review. • Conducting a pilot of Reactive Technologies service that monitors system inertia.
Sustain our social licence to operate	• Strengthening our impartiality and completing all the recommendations from the Deloitte review by February 2021. • Undertaking a preliminary assessment of the impacts of Tiwai exit and developing a task list to assess and plan for the implications. • Lifting our preparedness by carrying out the industry black start simulation and our cyber-attack exercises which provided lessons for our incident management and business continuity plans. • Investigating potential Code changes to better incorporate inverter connected resources. • Starting the review of the Procurement Plan to ensure it considers new generating technologies (consultation will be in early in 2021/22).
Match our infrastructure to need over time	• Implementing some innovative approaches to work: building and testing prototypes (sensitivity schedules), running a market development sprint. • Commissioning changes into the market system which upgrade software code to a modern language to reduce complexity and cost for ongoing development and maintenance activities. • Undertaking a high-level forecast of potential peak capacity issues for Hawkes Bay. • Publishing our guideline on system studies for asset owners, as part of our work to enable generation connections.
Evolve our services to meet our customers' needs	• Successfully deploying phase 1 of the Real Time Pricing project which enables to examine new system functionality. • Completing the dispatch service enhancements project and transitioning all participants to the new platform by the end of February 2021. • Conducting a discovery sprint in March 2021, as part of our future thinking work, to ensure we are prepared for the changes we expect to see by 2030.
Accelerate our organisational effectiveness	• Running a joint black start simulation exercise that included operational teams from the System Operator, Grid Owner, Mercury, Genesis Energy, Contact Energy, Powerco and WEL Networks. • Launching the final release of the streaming analytics project to enable future development of the Situational Intelligence solution and establish real-time feeds from critical systems. • Establishing a data lake, partially commissioned in June 2021, to enable deeper analysis of real time data streams within the control room and across planning time horizons.

Figure 1

Introduction and overview

This is our self-review and assessment for 2020-2021[1]. It covers our performance and responds to the requirements identified in the Electricity Industry Participation Code 2010 (Code) and the System Operator Service Provider Agreement (SOSPA). Although, by its nature our review is retrospective, the work for this last year sets the groundwork for how we will go forward, both in terms of how we can learn, improve and develop to face the changing electricity future.

SOSPA reset variation

This year was the final year of our five-year funding period. The SOSPA is our agreement with the Electricity Authority (Authority) for delivery of the System Operator service. The current funding period completed on 30 June 2021. We undertook a review and negotiation process with the Authority which finalised when the Authority Board approved the agreement reset in December 2020 with changes taking effect on 1 July 2021.

Our performance metrics

Our performance metrics (in Appendix 1) show how we've done this year, which has been a strong year of performance across the board while dealing with the complexities of a potential 'dry year' over a period with low gas output.

Change is the new normal, from 2022/23 we want to evolve the performance metrics to ensure they represent how well we are positioning ourselves for the inevitable and exciting changes ahead as we move to a greater percentage of renewable and distributed generation. This will form part of our work with the Authority during 2021/22.

Review of the year

We came into the 2020/21 year on the back of the upheaval of New Zealand's COVID-19 lockdown, with an eye on the La Niña year and uncertainties in gas supply. As well as these immediate concerns we also were focussed on the huge change looming from increased reliance on decarbonised electricity, increased distributed energy resources, and uncertainties around the future of major electricity users, in particular the aluminium smelter at Tiwai Point.

We have completed the year with some significant deliverables behind us, which we describe in this report and have highlighted in the one-page summary in Figure 1.

Communication continues to be an area where we are committed to making improvements. Sharing our knowledge and stakeholder engagement is important, allowing us and our customers to make better decisions. We have identified throughout this report where our communication has been tailored to improve our performance. We have also provided an overview of our progress in communications, education and engagement in section 2.5. Details of our plan for 2021/22 and beyond are in our Education and Engagement Plan 2021/22.

[1] This review covers the period 1 July 2020 to 30 June 2021. The events of August 2021 were subsequent to the review period and as such are not covered by this report.

We've taken the opportunity this year to learn and strengthen our processes and tools – this has been a focus in response to feedback from the Authority and our customers. At the end of this review we have included a one-page summary (Figure 3) where we have identified those areas, and where we have made progress against previous feedback. We have also highlighted areas where participants have noted in our survey that there are opportunities to respond and improve.

Preparing for the future change

We've been working closely with our customers and value these interactions. Developing our relationships with stakeholders and international peers help us learn and respond, as well as influence and lead in our role as System Operator in this changing environment. We have sharpened our attention on our strategic planning. Key to this work this year were the following workstreams:

- Conducting a discovery sprint to understand what evolution the market and Code might need to deliver the electrified future described in our Whakamana i te Mauri Hiko report.
- Working with the Authority following their request for technical advisory support to aid their response to the "G2" recommendation in the Electricity Pricing Review which focusses on future security and resilience.
- Technical reports on expected changes
- Keeping open dialogue with stakeholders and overseas experts and equivalents

Based on our strategic planning for the future, we understand there are risks of forecasting with more certainty in some areas than others and that we need to evolve our services. We have laid the foundations this year in several ways. In particular, our SO Service Strategy describes what we believe success would look like.

Strengthening our impartiality

We are committed to carrying out our System Operator role impartially to Transpower's role as the Grid Owner. This includes maintaining effective policies and procedures to ensure the functions remain separate and any conflicts of interest are actively monitored and managed.

In recent years, we have taken actions to strengthen our three lines of defence risk and assurance model, as advocated by the Deloitte report commissioned in 2019.

A table of Deloitte recommendations and actions was a standing agenda item at the Authority's System Operator Committee meetings from 2019 until February 2021, when the final actions were completed. All the organisational and policy changes have been undertaken in collaboration with the Authority. We continue to regularly engage with the Authority at both a management and Board level on System Operator independence and steps and actions the System Operator takes to maintain role separation.

Responding to the Authority's 2019/20 recommendations

Following our 2019/20 self-review, the Authority made the following recommendations.

Recommendation 1: *The System Operator reviews its approach to monitoring the accuracy and compliance of third-party information and advises the Authority of the findings of the review and any potential improvements to the relevant regulatory*

We provided two papers on third party information to the Electricity Authority System Operations Committee this year. In February 2021, we acknowledged the importance of participant data and the types of static and dynamic data we rely on for system security and efficient market outcomes. We followed this up in May 2021 with a paper specifically looking at asset outage information.

Details of these papers are included in section 1.4 of this report.

Recommendation 2: *The System Operator improve its financial forecasting of projects.*

In 2020/21, we passed both financial metrics for Service Maintenance, and Market Design & Service Enhancement projects, which had previously been identified as an area for improvement. We agreed with the Electricity Authority this year to re-baseline projects where the scope has been changed for a valid and improved project outcome. This will mean the forecast is based on like-for-like delivery of project scope and we should see further improvements in 2021/22.

The project metrics are included in Appendix 1.

Recommendation 3: *The System Operator 's annual self-review should better reflect on areas of poor performance during the period and what the System Operator has learned from those experiences.*

The System Operator's self-review is an opportunity for us to reflect on all the achievements in the year. Our performance against the metrics reflects this. However, we recognise that there are always areas we can improve on.

We have highlighted areas where we have identified opportunities to learn and improve throughout this review.

In this review, we have included comments from our customers, both positive and areas for improvement. As noted earlier, we have also produced a summary of lessons learned at the end of this review.

PART 1: Maintain a secure and reliable power system

Ensuring a secure power system is a critical aspect of the System Operator 's role. This section sets out the actions we undertook throughout the review period to deliver a secure and reliable power system for New Zealand.

Who we want to be, how we need to operate.

- We are continually looking forward and addressing emerging security and reliability risks.
- Our ability to model and predict the complex behaviour of the power system supports real time operations.
- We are well-prepared to integrate and connect new energy sources.

1.1 Comments from our customers

Positive reinforcement

Very satisfied with the service we receive from the system operator.

Dealing with tricky situations of late, I have always had good engagement with the system operator team. Recent example is the webinar briefings - doing an awesome job.

Good flexibility where testing of assets gets delayed by plant issues.

Outage planning managers are highly engaged and have a great understanding of the system and generation requirements.

SO remains solid. Have experts that understand the key issues.

The SSF is a very helpful document and we would welcome an offer for more feedback , ie open it up to industry participants for feedback.

Dispatch instruction queries are well managed and real time testing is good.

Emails or telephone calls are responded to promptly and outcomes provided.

Energy and Security desk team are professional and always helpful.

Areas for improvement

Test Plan approval process lacks tracing ability, and template is clunky and hard to use.

The only slight niggle would be the length of time I've had to wait for some information. I understand how busy things are though and I've done the same to others.

1.2 Security of Supply

This year presented some challenges. We saw a 20% national reduction in gas supply, and a La Niña event leading to prolonged low inflows. These two events contributed to declining storage through Autumn, high prices, and heightened concern from stakeholders. This combination tested the security of supply framework, preparedness, and modelling inputs and assumptions.

System Operator preparedness

While we learned lessons from the event, we were well-prepared and met our milestones. We had an Official Conservation Campaign developed, funding approved, modelled the thermal constraints and gathered and received advice from stakeholders. In these particular circumstances, we needed to make some deviations from the process, following consideration.

Being well prepared was largely down to our work earlier in the year.

- We outsourced the production of the Electricity Risk Curves to an external provider who we have worked closely with over many years (Energylink). This allowed us to focus our attention on looking ahead, identifying risks and improving preparedness.
- We worked with the MetService to develop a hydro inflows forecast to better understand when we might cross the risk curves (this is in line with the Security of Supply Forecasting and Information Policy.)
- We audited our internal processes and ran a desktop dry-year exercise. This led to us changing our event management plan and processes to follow a Coordinated Incident Management System (CIMS) structure.
- We completed the early stages of work to develop the rolling outage processes and committed to a rolling outage exercise with a small number of distributors.
- In late 2020, we presented to industry and stakeholders two market insights outlining the impacts on security of supply of reduced gas supply for Autumn 2021.
- We proactively engaged all key stakeholders to validate our modelling of thermal fuel constraints was accurate, refined our modelling and engaged an external consultant to review the resulting modelling.

During this potential dry winter event we improved our information provision. We now actively push information to our subscribers and have improved our weekly security of supply reporting. The reporting now includes a full market commentary, as well as smaller focused insights. During the declining storage situation, we ran fortnightly webinars to keep industry informed. We also provided daily reporting and have retained this capability if this is needed in the future. Alongside this, we have simplified the security of supply homepage with quick links to key information. Our information provision has received positive feedback from the industry, including from Major Electricity Users' Group (MEUG), the Ministry of Business, Innovation and Employment (MBIE), the Electricity Authority and Meridian.

Working with the Authority

We received positive feedback from the System Operations Committee on our communications during the potential security of supply situation.

While we continue to make improvements, there are areas we need to work on. These include working with the Authority to develop greater understanding and confidence in our

information and analysis, such as the forecasting and reporting aspects during a potential security of supply situation.

Following the tight energy situation through winter 2021 we have identified some additional improvement opportunities and will work with the Authority to develop a prioritised work programme to implement further changes.

Security of Supply Annual Assessment

Owing to increased workloads from the low hydrology situation this year, the Authority approved delaying the production of the Security of Supply Annual Assessment until October 2021.

1.3 Responding to COVID-19

During most of 2020/21, New Zealand has been operating at a reduced COVID-19 alert level. However, with the emergence of new strains and the remaining risks, our System Operator Incident Management Team (IMT) continues to meet as required. The team has been in action in response to elevated alert levels in Auckland and Wellington. During those periods, we implemented our COVID-19 protocols in which all control rooms respond to the highest level in the country. These protocols include restricted entry to the control rooms and surrounding areas. Our IMT also prepared plans for changes in alert levels, particularly for when we see short, sharp changes in the alert levels.

In July 2020, we held a workshop with the Operations COVID-19 IMT to capture lessons. These will help improve our business continuity planning preparedness and coordination between Enterprise and divisional responses.

We continue to follow national and international developments to ensure we protect our core services.

1.4 Compliance, Risk & Assurance

Code compliance

We did not breach our Principal Performance Objectives (PPOs), but self-reported 11 breaches of the Code. The Authority raised two further breaches. Of the 13 breaches, three reached the threshold for a material market impact. Overall, the number of breaches continue a downward trend and is below the average of 17 over the previous six years.

The breaches with a material market impact[2] were:

- In March 2021, we incorrectly modelled Ngawha B as a secondary AC contingent event risk. This resulted in over-procurement of North Island reserves over 70 trading periods. This occurred because manual overrides in the market system expired before the end of the Ngawha B commissioning period.

[2] Greater than the threshold of $40,000 set as part of the Performance Metrics and Incentives Agreement.

- In April 2021, as part of the Mangahao 33kV substation outage, we incorrectly modelled part of the bus that was disconnected as still in the market model. Because of this, the market solver set the price to $0 and discarded the metered load from its calculations.
- In April 2021, we detected an issue dating back to February 2021, when the Grid Owner advised a change in the PAK_WKM2.2 static limits and impedances. This triggered the System Operator's standard model change process. However, two values in the model change process were incorrectly transposed and incorrect PAK_WKM2.2 data was modelled in SCADA and the market system from 17 March 2021 to 30 April 2021. This resulted in around 1.1 MW of generation per trading period being short-procured for the affected six week period. The error was detected and corrected on 30 April 2021.

Following a modelling error, our model change process document was reviewed and updated in May 2021 to include a new step to improve the manual process. This new step allows us to use an automated script to check data.

Modelling process improvements to mitigate errors

Modelling is a critical function which enables us to match our IT system and tool behaviour to the characteristics of the New Zealand power system and electricity market. Last year we carried out 60 model changes, comprising between 20 to 50 projects, each of these potentially containing hundreds of individual changes.

A number of the breaches this year related to modelling processes. As a result, we established a Modelling working group to review our end-to-end process and implement an improvement programme.

This working group has created a collaborative forum that:

- has representation from end-to-end modelling groups within Transpower
- discusses common issues and makes action plans to address them
- evaluates and prioritises issues in a consistent and structured way
- can engage with projects on modelling related queries and implications.

We have already made significant improvement and have an ongoing focus through our modelling working group. The group is actively working through the remaining improvements.

Risk

We completed a self-assessment of our critical risk controls, and reviewed our risk bowtie. The new bowtie includes risks associated with tools, facilities or people and has fewer critical controls, reduced from 25 to 10, to provide a clearer picture of how we manage risk. These critical controls cover:

- 24-hour real-time operations
- Incident preparedness and response
- Support & delivery of critical tools & systems
- Business support functions
- Power system planning, modelling & coordination
- Change management
- Connected asset and system monitoring
- Monitor and evaluate potential operating environment
- People management
- Stakeholder management.

Credible event review

In January 2021, we reviewed the classifications of several interconnecting transformers including new transformers at Stratford and Ōtāhuhu and the classification of the existing Kikiwa and Stoke transformers now that the Kikiwa reactor has been commissioned. We communicated the review to industry via a brief update, but it has not resulted in substantial changes to classifications.

Business assurance audits

This year we carried out five business assurance audits, namely:

- Managing insufficient generation offers and reserve deficits
- Markets Security of Supply (follow-up review)
- Managing grid offers
- Event reporting and investigation
- Regional contingency planning

The audits of our processes for managing insufficient generation offers and reserve deficits and the follow up Markets Security of Supply review were assessed as effective with only minor findings.

The managing grid offers audit identified three low risk findings relating to the System Operator gatekeeper function communicating requirements to the Grid Owner.

The event reporting and investigation audit identified two medium risk findings and one low risk finding relating to prioritising events, improving staff awareness and timely closure of events.

The regional contingency planning audit was deemed effective with three low risk findings identified for management to consider.

All agreed actions are tracked in our corrective actions register.

Software audits

The Reserve Management Tool (RMT) audit and Scheduling Pricing & Dispatch (SPD) audit were completed in April 2021 and sent to the Electricity Authority. The auditors highlighted nothing of concern.

Incident management and business continuity planning

Simulation exercise for loss of supply scenario: In March 2021, we ran a joint black start simulation exercise that included operational teams from both the System Operator and Grid Owner and 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. One team carried out a black start from Maraetai and headed north to Huntly and Auckland while the second team carried out a black start from Tokaanu and headed to the Taranaki and south to Wellington.

Feedback from the event was positive with participants wanting to see more of this type of collaborative training in the future. We gained valuable insights from our external participants about 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 reviewing this part of our contingency planning.

The exercise also 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.

Business continuity planning: During May 2021, we undertook a business continuity exercise. This provided an opportunity for us to check our plans and continue to train our people. The exercise took place in a workshop environment and simulated a cyber-attack impacting key systems, including the loss of the Wholesale Information and Trading System (WITS), Supervisory Control and Data Acquisition (SCADA) and Inter-Control Centre Communications Protocol (ICCP).

The industry black start simulation and our cyber-attack exercises provided lessons for our incident management and business continuity plans as part of lifting our preparedness.

Third party information

This was one of the recommendations from the Authority last year.

We provided two papers to the Electricity Authority System Operations Committee this year on the reliance on third party information. In February 2021, we acknowledged the importance of participant data and the types of static and dynamic data we rely on for system security and efficient market outcomes. We followed this up in May 2021, with more material specifically looking at asset outage information.

We believe the System Operator should be able to rely on participant data because:

- the System Operator can only act on the information it is provided (i.e. we don't know what we don't know). Participants are the only ones who can keep us informed of changes to their assets or grid/network configurations
- participants must ensure they are meeting their Code obligations, which includes providing accurate data to the System Operator

- the current regulatory framework penalises asset owners if they fail to meet their Asset Owner Performance Obligations, which gives them incentive to ensure their asset data is of suitable quality.

Regardless, we will continue to have checks and balances in place to help assure data quality:

- by reviewing information provided to us and clarifying with asset owners where we see anomalies
- by monitoring asset performance as part of dispatch and investigating where we identify issues or non-compliances.

In relation to outages, there have been no undisclosed outages to date that mean the System Operator has been unable to plan to comply, or comply with, its Principal Performance Objectives (PPOs). However, in a small number of circumstances, planning and assessing outages has taken longer due to late, or a lack of, information. These outages have tended to involve smaller generators, and the System Operator has reminded them individually of their obligations. We have also assisted participants in how to use the Planned Outage Coordination Process (POCP) and have communicated guidance on outage disclosure (see section 1.7.) As more generators seek to connect to either the grid or the distributor networks there is increased reliance on distributed energy resources. As such, failure to disclose outages may become more of an issue.

1.5 Outage planning and co-ordination

Clutha Upper Waitaki Lines Project (CUWLP) outages and operational impacts: Shortly following the Grid Owner's decision to accelerate its CUWLP project, we hosted an online industry conference in September 2020 to discuss the project and set out any operational impacts. We also set up a new webpage to provide up-to-date information on the outages. Over 40 generators, retailers, traders, distribution companies and Authority representatives joined the briefing. Questions focussed on contingency planning, the impacts the work will have on transfer limits out of Southland and how rarer risks such as double circuit contingencies and frequency risks would be managed.

During the outages there have been increased constraints on the lines out of Southland. To reduce this impact, we consulted with industry and in November 2020 we set out conditions where we would use a 10-minute offload time (previously 15 minutes) on lines out of Southland to support the CUWLP work. This allows approximately 20 MW of extra flow out of the region during the Clyde-Cromwell-Twizel outages and 50 MW during Naseby-Roxburgh and Livingstone-Naseby outages.

The System Operator published a new frequency management constraint to industry. This constraint will only be used when there is a risk of separating the Southland area from the main grid in the event of a fault.

Annual outage planning forum: We joined the Grid Owner in the annual outage planning forum to provide an overview of the outage assessment process, and provide updates on our work programme.

1.6 Operational performance

Identifying issues

Hawkes Bay regional capacity: We undertook a high-level forecast of potential peak capacity issues for Hawkes Bay. This indicated we may have seen peak shortages in several periods in the June 2021 quarter as peak demands increase and if inflows to Waikaremoana did not increase (we do have existing real time processes to mitigate security concerns.)

We shared our analysis and communicated our processes to handle security concerns with Hawkes Bay stakeholders at an online briefing in April 2021.

We also reassessed generation outages, distribution load shifting and transmission outages in the area and provided options and advice to assist asset owners to secure their outages.

Water levels rose in May 2021 to levels that alleviated the risk of peak capacity issues in the region.

South Island power system oscillations: We detected oscillations between Manapouri and Clyde of 1.7 Hz in early May 2021. While these did not cause concern, we asked Meridian and Contact to provide information of any plant changes, but neither identified any changes. Subsequently we have correlated the oscillations with the operations of Manapouri unit 1. Meridian replaced a Power System Stabiliser control card on the generating unit which resolved the issue.

Responding to operational events

Fibre optic communications cables: Severe flooding on 31 May 2021 damaged one of the two fibre optic communications cables south of Christchurch. To understand the impact, should the second cable be compromised, we undertook studies to understand the potential risks. We worked closely with the IST Incident Management Team to identify and share critical risks.

Loss of supply events

Huntly unit 4: On 30 October 2020, Genesis Energy's Huntly unit 4 tripped, removing 144.4 MW of injection into the power system resulting in an under-frequency event. Instantaneous reserve providers responded, returning the frequency to the normal band within 17 seconds. Genesis Energy believes the tripping of Huntly unit 4 was the cause of the under-frequency event and the System Operator's investigation supports this position. Accordingly, the System Operator submitted a causer recommendation report to the Authority on 23 December 2020. This recommendation was agreed in July 2021 and the event closed.

Commissioning assets: Several generation assets that are undergoing or have recently completed commissioning have been observed tripping. We will continue to monitor, however these trips appear unrelated to other events on the system and are therefore covered under our existing contingent event management processes for generators.

Dispatch accuracy dashboards

As part of the Strategic Objective Work Plan for 2019/20, we developed dispatch accuracy dashboards for energy dispatch and reserves management. The energy dashboard is a means

of monitoring overall industry performance which includes capturing elements of System Operator response. During the 2020/21 year and in consultation with the Authority, we evaluated and developed the measures, the standards and metric calculation so that they provided a greater insight.

The reserves dashboard enables us to see how the amount of reserves varies compared to the risk and more generally we have confirmed the Reserves Management Tool (RMT) is performing as anticipated.

Via the dashboards, we have collected a snapshot of performance since January 2019 which provides valuable trend data and a mechanism to see how changes to the power system, such as the introduction of more wind generation and RMT enhancements affect performance.

1.7 Keeping our stakeholders informed

Asset testing procedure update

We published an update to the procedure PR-EA-010 Planned asset testing while connected to the power system and presented changes at the Asset Owner forum. Asset owners need to be familiar with this procedure to ensure the success, and avoid delays to, any planned commissioning or testing. Guidelines on testing and modelling requirements can also be found under the Asset Testing section of the Transpower website.

Planned Outage Coordination Process (POCP)

The System Operator response to the POCP review was published in July 2020, along with additional user information for POCP users. This is available on our website. We are progressing the suggested tool enhancements and have discussed our recommendations with the Authority.

With the support of the Electricity Authority, we have been encouraging large users to use the tool to enable them to get early warnings of major outages, and to help them meet their own compliance obligations. Our Operations Planning group provided training to MEUG members on the use of POCP and we will continue to work with them to assist them in using the tool.

Outage disclosure guidance

We published new outage disclosure guidance to help asset owners understand when their outages need to be communicated to us as System Operator. We have had useful discussions with several customers since around publication of their outages.

System Security Forecast (SSF) major update

We published the 2020 SSF in early December 2020. This confirms we are confident that we will be able to meet the Principal Performance Obligations over the next three years and continue to maintain the secure, reliable power system our customers and New Zealand's electricity consumers expect. Key findings include:

- The announced Tiwai Exit will tighten existing transmission constraints as a result of high generation export out of the Southland region. (Note that the SSF update was completed based on an August 2021 Tiwai exit.)

- The potential displacement of thermal generation in the upper North Island would increase reliance on other North Island generation and HVDC transfer to meet demand.
- An increase of approximately 350 MW generation from new wind farms being commissioned in the Taranaki and Bunnythorpe regions stands to tighten some existing constraints in the central and lower North Island.

We are reviewing how we produce the System Security Forecast and seeking ways to improve the forecast and help meet its purpose. Options analysis and solution enhancements will begin in August 2021 with a report on recommended improvements targeted for October 2021.

Reporting on significant incidents

We reported two moderate incidents in 2020/21.

- At 19:50 on 8 August 2020, the market system stopped operating. Operators switched to stand alone dispatch (SAD) at 19:59 and sent a customer advice notice (CAN) to the industry. The market system remained on SAD for over one hour, which operated as required.

  We sent our investigation report to the Authority by 8 November 2020 as required. Subsequent to the investigation the root cause has been confirmed and controls implemented to prevent a reoccurrence.

- At 09:24 on 15 May 2021, we issued a CAN notifying participants that we had switched to SAD due to issues with the market dispatch system. This issue lasted 2 hours 47 mins, during which SAD operated as required until we could switch back to the market system and process bids and offers as normal.

  We sent our investigation report to the Authority by 13 July 2021. We identified the root cause to be an Oracle software issue. Mitigation has been put in place to reduce the risk of the outage recurring; the recommended fix is to update the Oracle kernel driver.

1.8 Enabling new generation

During 2020/21 we completed commissioning activities on the following new generation.

- Ngawha (Top Energy, 32 MW geothermal), in Northland connected to the power system in December 2020 and was fully commissioned by 27 January 2021.

  In mid-May 2021, a team from our Hamilton control centre visited Top Energy at Ngawha Geothermal to build relationships and share information related to the System Operator requirements and operational processes. For both Top Energy and the System Operator this was valuable and helped the connecting party understand expectations.

As part of the connecting new parties process we are including a session on System Operator requirements and operational processes.

- Waipipi (Tilt, 133 MW windfarm), in South Taranaki started injecting into the power system in November 2020; all turbines were commissioned by 11 March 2021.

In addition, Todd Corporation has commissioned the country's largest grid-connected solar farm (2.1 MW) in Kapuni, South Taranaki.

We are continuing with the following commissioning.

- Turitea North (Mercury, 117 MW windfarm), in Manawatu, started commissioning in July 2021.

We have also attended kick-off meetings for the commissioning of the following new generating stations.

- Tauhara B (Contact Energy, 180 MW geothermal.)
- Harapaki (Meridian Energy, 176 MW wind farm) new generating stations.

Given the deferral of Tiwai's potential exit, we have been approached in our role as System Operator regarding several grid connected generation projects. We are also seeing 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.

Support for new connections

As part of our ongoing work to enable generation connections in New Zealand, we published our guideline outlining requirements for system studies that asset owners will need to complete. These studies will enable asset owners to satisfy us that their new asset is able to meet relevant Code performance obligations. This will help to ensure timely commissioning and successful integration and operation of new assets into the New Zealand power system.

PART 2: Operate a competitive and transparent electricity market

As System Operator, we must prepare for the future, anticipating how we need to evolve our service in response to a changing system. In this role, we can assist the market to work efficiently by publishing non-confidential data and information that enable participants to make well-informed decisions.

Who we want to be, how we need to operate.

- We empower our regulators in support of acceleration of electrification.
- Our tools enable dynamic and flexible response to change.
- We achieve broad and tailored market engagement.

2.1 Comments from our customers

Positive reinforcement

Good communication:

- *Direct interactions with staff either through real time operations or general staff is always very good*
- *CAN notices, real time updates from Operations Managers during events, very helpful*
- *Market Insights, Security of Supply*
- *Notifications of SO forums and workshops, outage notifications*
- *Switching actions, and assurances*
- *Emails are clear and concise. Phone comms great*
- *Industry briefings are very valuable*
- *Participant survey is a good opportunity to provide feedback*
- *Webinars on issues such as the constraints into Hawkes Bay, CUWLP, etc.*

Areas for improvement

More communication on:

- *Lessons learned on projects, near misses. engagement with industry.*
- *Planning 10, 20, 30 years.*

2.2 Looking to the future

Long-term planning

New Zealand's energy system will be very different in the future. There will be higher electricity demand in a decarbonised economy, more distributed generation and resources, and more renewables. This will result in a less predictable, more variable and dynamic electricity system. To achieve this outcome, the market and regulatory settings will need to change. However, the expectations on us as System Operator will remain: the need to maintain a secure and reliable power system and operate a competitive and transparent electricity market system.

As System Operator we have progressed several individual pieces of future-thinking work, but we have also sharpened our attention on our strategic planning. This has given us a clearer picture of our strategic ambitions as New Zealand's System Operator out to 2030, and enabled us to lay out a 10 year-plan to support these. This plan brings together work we had already started into workstreams which will help us to meet expectations through our people, process and technology.

2030 Code and market evolution sprint

As part of our future thinking work to ensure we are prepared for the changes, we conducted a discovery sprint in March. As input for this, we interviewed industry stakeholders. 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. We also considered, if these issues are well-know, and we want to move fast, then what is slowing down the change?

Future Security and Resilience (FSR) work with the Authority

We are working with the Authority following their request for technical advisory support to aid their response to the "G2" recommendation in the Electricity Pricing Review. This includes understanding the future challenges and opportunities in relation to the long-term security and resilience of New Zealand's power system. This year, we agreed a statement of work which includes an indication of urgency to resolve. We will continue to work on this in the next financial year.

2.3 Planning for change

Tiwai exit

Following the announcement by NZAS of their plan not to renew the supply contract with Meridian and to exit Tiwai, we set up a working group to undertake a preliminary assessment of the potential impacts on the power system and market and developed a task list to assess and plan for the implications. This includes the impact of the deferral of Tiwai exit to 31 December 2024.

Our engineering studies covered transient stability analysis, over-frequency performance analysis and small signal stability analysis across the North and South Islands. In June 2021, we published a report, "Managing an HVDC bipole tripping". We found that under extreme South Island light load conditions without Tiwai demand, north HVDC transfer needs to be

limited to maintain security. However, as load increases so does our ability to manage larger HVDC bi-pole trippings, due to more generation being online. Looking at historic 2018 HVDC transfer and South Island load data, the need to constrain the HVDC would be minimal. Overall, we are confident that using our existing operational measures we can continue to manage frequency and voltage within limits. However, there are opportunities to improve management for over-frequency events and tools support lifting HVDC north transfer limits during periods of extreme light load in the South Island.

Distributed Energy Resources

Under a technical advisory service for the Authority, we investigated what potential Code changes are required to better incorporate inverter connected resources. Our investigation included a summary of the technical differences to be considered between synchronous and inverter generation, Code clauses to review in Part 8 and 13, and a two-plus year roadmap of further investigation required to support the review.

New generating technology for ancillary services

This year we have been reviewing the Procurement Plan to ensure it is future proofed considering new generating technologies. We will consult on the plan early in 2021/22.

Inertia monitoring

We conducted a pilot of Reactive Technologies global service that monitors system inertia. The trial period ended in July, after which we evaluated the final report from the vendor. We concluded that the technology is useful but still needs development to provide the required functions we require in the control room to manage system frequency should a low inertia future unfold. At this stage we are confident that we can manage system frequency with our existing tools. We will reconsider the technology again in the future should inertia levels fall.

Load forecast sensitivity schedules

Between August and October 2020, Transpower ran a proof of concept in the form of a low-cost prototype for publication of sensitivity schedule information, making this information available to industry participants, and testing its value.

A snapshot of the website information available is shown in Figure 2.

This proof of concept investigated the sensitivity of prices and carbon emissions to changes in demand, specifically the impact of +/- load variations. We sought feedback from industry to help inform decisions about the future design of a full sensitivity schedules solution.

Most of the feedback from the industry supported the initiative but at this stage we cannot justify increasing the priority for a full solution. We will revisit this decision in the future.

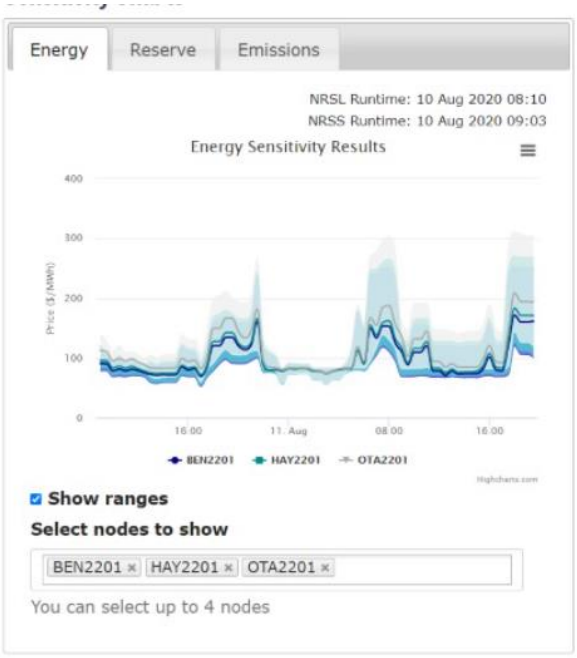


Figure 2

Battery Energy Storage System (BESS)

We continue to support industry participant enquiries regarding how BESS might be configured to enable instantaneous reserves in the future. This year we also implemented changed in our Reserve Management Tool (RMT) to enable BESS to provide reserves, and completed a report under a Technical Advisory Service (TAS) on how batteries can contribute to reserves.

Electricity Distribution Businesses (EDB) load control survey

The System Operator surveyed EDBs on their intentions around the use of controlled load (hot water and other ripple-controlled loads) if and when the Regional Coincident Peak Demand (RCPD) incentive was removed as part of the review of the Transmission Pricing Methodology. This was to determine if any changes in behaviour (for example ceasing load control activities once the incentive expired) may lead to increased peak loads and associated security issues.

We analysed this information to determine potential impacts and provided advice to the industry that we would alter our forecast assumptions including security of supply and New Zealand Generation Balance.

2.4 Development initiatives

Real Time Pricing (RTP)

The RTP project will deliver accurate and reliable spot prices immediately after the finish of each trading period. The project continues to track to schedule and budget, there are currently no high or severe risks under management. At the beginning of the year, we completed the capital investigation phase with the delivery business case submitted to the Authority in July 2020 as planned; this was approved by the Authority Board at their August 2010 meeting.

The forecast cost for the Real Time Pricing project increased from the initial business case. This included $1.8m for new scope items from the Authority and an additional $4m costs in the areas of project risk and contingency, business change management, data warehouse costs and additional roles to manage project complexity. These additions have in part been informed by lessons learned in recent high complexity development projects.

The full project is being delivered in four phases to be completed in April 2023.

Phase 1 was successfully deployed on 13 May 2021, three weeks ahead of schedule. This release has no direct market impact and introduces only minor changes to the System Operator function but is a significant preparatory milestone for the wider RTP project enabling us to examine some of the new functionality in our simulation environments.

The phase 2 forecast deployment date is 28 March 2022 and will have more of an operational change impact. Development for this phase continues to make good progress with initial functional testing, deployment planning and business procedure reviews all underway.

We supported the Authority with the RTP workshops this year. We presented material that outlined the obligations the System Operator operates under when clearing the wholesale electricity market, what needs to be considered when solving for generation dispatch, how this will change under RTP and how this flows on to real time price formation. We also presented on how the power system affects price.

As part communication and engagement plan, we modified a copy of vSPD[3] to reflect the changes to be implemented under the RTP project.

Dispatch Service Enhancements (DSE)

DSE allows participants to receive dispatch instructions via ICCP[4] or web-service and enables the legacy GENCO dispatch system to be decommissioned. This is important to enable future changes in the electricity market such as RTP. All transitions to the new platform were successfully completed by the end of February 2021.

It is the first service enhancement project delivered by Transpower under SOSPA provisions. Given its ground-breaking role, delivery was challenging, and we are proud of what we have achieved. The project faced some challenges, but we have responded to, and learned from, these. As a result of this we believe that we are well positioned to undertake similar projects in the future.

We commissioned an independent review of the Dispatch Service Enhancement project from Independent Quality Assurance New Zealand after completion of the delivery phase and provided the final report to the Authority in February 2020. We identified valuable lessons from the transition period that we can apply to other projects.

Lessons we have learned are to:

- identify early adopters to tease out any technical and/or procedural teething issues
- create an information pack explaining what participants are required to do to interface with Transpower
- continue working with an industry working group during a transition period to share any issues or updates to the technical design to enhance engagement further during a transition period
- provide clearer expectations around participant obligations under the Code if or when participants are unable to make these timeframes.

[3] vSPD (Vectorised Scheduling, Pricing and Dispatch) is the Electricity Authority's independently audited, mathematical replica of the Scheduling, Pricing and Dispatch (SPD) market-clearing engine used in the administration and operation of the New Zealand electricity market.

[4] ICCP (Inter-Control Centre Communication Protocol) is an industry standard which is used for data exchanges with customers

Extended reserves (AUFLS)

The Authority reactivated the Extended Reserves project with a refined focus on achieving a secure transition to a 4-block Automatic Under Frequency Load Shedding (AUFLS[5]) scheme in the North Island. We supported the Authority through the Code change consultation for AUFLS provision in the North Island and subsequently delivered the AUFLS data portal in June. This will enable the North Island AUFLS providers to confirm compliance with their obligations. In testing for completion, the team conducted external User Acceptance Testing with one distributor in early June 2021.

We have also worked alongside the Authority to assist large industrial users who no longer have an exemption for providing AUFLS.

In parallel, the System Operator has been working with the Authority confirming a TAS Statement of Work on the effort to roll out the data portal to North Island distributors and to conduct a Transpower industry consultation on the AUFLS Technical Requirements (ATR) document. This TAS was approved mid-June 2021.

2.5 Engagement, education and communications

Engagement, education and communications continue to be areas in which we are committed to making improvements. Sharing our knowledge and stakeholder engagement is important, allowing us and our customers to make better decisions. We have identified throughout this report where our communication has been tailored to improve our performance.

Our performance over the last year in this area, and our plans for the next are covered in our separate report to the Authority, the Education and Engagement Plan.

System Operator Education and Engagement Plan initiatives

Our initiatives this year were as follows.

- We continued to provide education and engagement for customer segments. One example is education focussed on large electricity users on the use of the Planned Outage Coordination Process.
- In our preparation for a potential security of supply dry year, we hosted monthly webinars to keep all interested parties informed. This is the first time we have used a digital channel for regular communication, and the start of our use of this media format.
- We started to use social channels (LinkedIn) to share stories and information to prompt peer-to-peer industry dialogue/discussion.
- We rolled out some "quick wins" to improve navigation and improve presentation on the System Operator section of the Transpower website. We have also archived some sections ahead of a planned upgrade of the Transpower website.
- We developed simple infographics depicting key elements of the System Operator's role and where we sit within the electricity system overall to help inform our connections with customers and stakeholders. These are included in Appendix 3: Infographics.

[5] AUFLS is the mechanism used to shed large blocks of load to prevent the electricity system collapsing if there is a rapid fall in system frequency.

Customer participation survey

We held our participant survey in April and May 2021. A selection of these comments are included at the start of parts 1, 2 and 3 of this review.

Overall, of the 53 responses, 84% rated our performance as 'Good' and 'Very good'. Although this is lower than the previous year's score of 92%, the number of people responding increased significantly and we are pleased with the breadth of comments on our service.

We also received feedback on role impartiality, with a score of 93%.

Our perception of added value was 79%. The work we have been doing around preparations for the future responds to several of the issues that were raised.

CUWLP engagement

The CUWLP conference was held in September 2021 and provided an opportunity for industry participants to hear about the project and the outages required. As system operator we discussed security assessments for the outages, focussing on the Clyde-Cromwell-Twizel outages.

We also presented alongside the Grid Owner at the Energy Trader Forum on 12 November 2021 and consulted with the industry on the introduction of a 10-minute offload time on lines out of Southland.

We provided information on the CUWLP outages, via a website

Asset Owner Engineering Forum

We hosted our annual Asset Owner Engineering Forum on 29 June 2021 which was attended by over 70 people. This included representatives from the Authority, generators, distributors, consultants, developers and universities. This year's theme was embracing new connections and we discussed improvement initiatives we have or are delivering to enable the participation of new technology. The forum offers the opportunity for the System Operator and asset owners to interact, encouraging collaboration at a technical level, and the chance to discuss any challenges in meeting the required Asset Owner Performance Obligations. Originally planned as a face-to-face forum, this was rearranged as a virtual forum due to Wellington being at COVID-19 Alert Level 2.

Outage Planning Forum

We jointly hosted an outage planning forum in March 2021, attended by over 40 external stakeholders. This provided us the opportunity to present and discuss the impact of key outages on the system and market, and developments in outage planning particularly. These included the new outage disclosure advice and the impacts of the CUWLP project.

North Island Electricity Distributor Forum

We attended the quarterly forum of the North Island distribution companies hosted by Counties Power. We used this forum to continue our education programme regarding System Operator processes.

GM Stakeholder Meetings

Operations General Manager, Dr Stephen Jay, met with General Managers from a wide variety of stakeholders to talk about subjects such as emerging new technologies and connection of generation, as well as ensuring the industry is kept abreast of the potential dry year situation.

In September, Dr Jay visited Huntly Power Station with members of the Authority and Commerce Commission leadership teams.

Industry body membership and overseas contacts

As New Zealand System Operator we recognise how important it is to keep abreast of development overseas. Several of our team members are in regular contact with international equivalents.

Dr Jay, represents Transpower on the following bodies:

- The Association of Power Exchanges (APEx), as a board member. During the year Dr Jay has attended Board meetings and a series of webinars. In February the topic was changes to enable storage, which featured an international panel. In May the topics discussed included lessons from the Texas weather related outages, and market development in Pakistan.
- CIGRE, as a board member.
- The Electricity Engineers' Association (EEA), as chair.

In addition to formal meetings, Dr Jay has corresponded with PJM (US), National Grid (UK), AEMO (Australia) and Mondo (Australia).

This year, the annual EEA conference was deferred until August 2021 due to Wellington entering COVID-19 Alert Level 2. Transpower had a range of presenters, covering topics including the New Zealand Generation Balance, system restoration, and future people requirements.

PART 3: Prepare our people, process and technology

We are committed to data integrity and operational excellence, while finding new ways of working and supporting our people to make the change.

Who we want to be, how we need to operate.

- Our workspaces, tools, and processes enable us to manage increased work volumes safely.
- We are acknowledged as industry leaders in data management and continuous improvement.
- We attract, support and develop our people to flex and adapt.
- We are an employer of choice.

3.1 Comments from our customers

Positive reinforcement

Transpower has certainly changed over the years, modifying technology, processes and equipment which I think has led to greater reliability and stability, has been quite interesting to have been part of and seen these changes.

As a part of the DSE project my team has worked with the SO team to verify Dispatch Instructions. They have always been supportive of and accommodating with the testing necessary for these changes.

All people I deal with respond in timely manner and have information I require.

Retain your engineering pragmatism.

Continue to be an impartial and balanced voice within the industry.

Keep up the good work.

Areas for improvement

Website navigation to active initiatives could be better.

Push the EA to re-write the code to be more technology neutral, e.g. from speed governor to active power control system and from exciter to reactive power control.

A more forward-looking approach would be helpful.

3.2 Cyber security

In an ever-changing cyber threat landscape, Transpower continues to develop and maintain our cybersecurity controls. We regularly review the controls to ensure we can respond to the events in the domestic and international environments.

Our programme includes the development and maintenance of security capabilities and systems along with influencing the security culture of Transpower and service providers through a security awareness programme.

To provide assurance that our control environment is fit-for-purpose and operating as effectively as designed, we undertake regular assurance activities. These activities, which include internal audits, management reviews, risk assessments and penetration testing, address the security of the organisation and include elements that directly relate to the Market Systems.

The current (and previous) reviews have confirmed that Transpower's cybersecurity related controls are fit-for-purpose and have also identified opportunities to improve. Improvements are tracked and reported through the Transpower Risk and Assurance function.

We present our annual system operator cyber-security assurance report to the Electricity Authority System Operations Committee in February each year.

3.3 Technology improvements and innovation

Situational Intelligence

Situational Intelligence will enable the business to visualise data, create business rules and alerts, and establish business processes to support real-time decision making.

The first part of the Situational Intelligence programme was deployed in January 2021. This involved the final release of the streaming analytics part of the project. It will provide a foundation for future development as well as establish real-time feeds from critical systems (SCADA and the market system) and has enabled alerts to be created based on combination of SCADA, market and lightning data.

During the year we established a data lake which was partially commissioned in June 2021. This will enable deeper analysis of these real time data streams within the control room and planning time horizons.

Customer Portal – SO modelling database

We are incrementally establishing an operations customer portal to provide a single point of interaction with our customers. We are migrating existing support tools to this new environment including Asset Capability Statement (ACS) which is currently under development, with Planned Outage Coordination Protocol (POCP) and New Zealand Generation Balance (NZGB) planned for next year. As noted in section 24 above, during the year we also implemented an AUFLS data portal on this platform.

Market System Simplification

The project successfully commissioned non-functional changes into the market system in late July 2020; upgrading software code to a modern language to reduce complexity and cost for ongoing development and maintenance activities.

The second phase of the project will continue with further changes to the market system code (re-factoring to further remove complexity and simplify based on the new language) to improve the design and structure while preserving its functionality. By undertaking this programme of work, we are preparing our core market system by removing complexity to enable functional changes to be made and modularising the system to support lower change impacts into the future.

3.4 People capability

Our people participate in Transpower people development initiatives, including a manager development framework, and Institute of Management NZ courses for both those new to management and experienced managers.. We have reviewed our performance and development template and our manager check-in template and hosted learning forums and learning syndicates to share ideas and experience.

We have continued to roll out command language and behavioural training in our control rooms. This has been well-received, with good feedback from the controllers. We can see improvements as a result.

When we have advertised for new positions, we have updated the position descriptions to make sure we target the skills we require for the future changes. This has included enhancing the strategic thinking element of certain roles.

In addition to skills-based capability, we have started to roll out a wellbeing framework to focus on the overall health of our people. This includes an updated section in everyone's performance and development plan. By understanding how our people like to work will help us and them to maximise their contribution to Transpower and have fulfilling roles.

Lessons learned

Opportunities to learn and improve

- Following the tight energy situation through winter 2021 we identified some improvement opportunities and will work with the Authority to develop a prioritised work programme to implement further changes.
- In July 2020, we held a workshop with the Operations COVID-19 IMT to capture lessons. These will help improve our business continuity planning preparedness and coordination between Enterprise and divisional responses.
- Following a modelling error, our model change process document was reviewed and updated in May 2021 to include a new step to improve the manual process. This new step allows us to use an automated script to check data.
- A number of the breaches this year related to modelling processes. As a result, we established a Modelling working group to review our end-to-end process and implement an improvement programme.
- The industry black start simulation and our cyber-attack exercises provided lessons for our incident management and business continuity plans as part of lifting our preparedness.
- We are reviewing how we produce the System Security Forecast and seeking ways to improve the forecast and help meet its purpose. Options analysis and solution enhancements will begin in August 2021 with a report on recommended improvements targeted for October 2021.
- As part of the connecting new parties process, we are including a session on System Operator requirements and operational processes.
- The forecast cost for the Real Time Pricing project increased from the initial business case. This included $1.8m for new scope items from the Authority and an additional $4m costs in the areas of project risk and contingency, business change management, data warehouse costs and additional roles to manage project complexity. These additions have in part been informed by lessons learned in recent high complexity development projects.
- We commissioned an independent review of the Dispatch Service Enhancement project from Independent Quality Assurance New Zealand after completion of the delivery phase and provided the final report to the Authority in February 2020. We identified valuable lessons from the transition period that we can apply to other projects.

Feedback from the participant survey

More face-to-face communication	• Come and talk to your customers. • Open up SSF to industry participants for feedback.
Provide training	• It would be good to bring back some of the regular SO Training sessions on topics like Reserves/RMT, SPD, HVDC and Transmission Constraints.
Increase context	More information on • Lessons learned on projects, near misses. engagement with industry. • Planning 10, 20, 30 year.
Improve information flow	• Website navigation to active initiatives could be better. • The only slight niggle would be the length of time I've had to wait for some information. I understand how busy things are though and I've done the same to others. • Test plan approval process template is clunky, hard to use.

Figure 3

APPENDICES

Appendix 1: Our Performance

A1.1 Progress against business plan

Our 2020/21 Business Plan identified 27 actions and initiatives, across our five strategic priorities. We completed or made good progress against 24 of these.

Due to increased workloads from the potential 'dry year' situation, the consultation of our review of the procurement plan and investigation into wind forecasting were deferred to 2021/22.

At this stage we have not progressed an operations trainee scheme. We do continue to offer placements to graduates in Transpower's graduate scheme. This allows younger members of the workforce to develop the skills required for many of the System Operator functions.

A1.2 Financial performance

As a regulated state-owned enterprise, Transpower is required to publicly disclose financial information under the Transpower Information Disclosure Determination [2014] NZCC 5. This is published in late October as an addendum to the self-review and will include financial System Operator performance.

A1.3 Performance metrics

A total of 23 performance metrics were agreed with the Authority to represent our overall performance for 2020/21. Of these, 13 contributed to the calculation that determines the incentive payment, although one of these – reports into special events – was not included as there were no special events in 2020/21. Based on the weighting applied to these metrics, our score for 2020/21 was 100%. This exceeds the target of 80% at which the full incentive payment is paid to the System Operator.

Of the remaining 10 metrics, we did not meet the target for four.

- The participants' perception of added value metric scored one percentage point lower than the target.
- Both the project delivery metrics that relate to delivering the projects by the time set in the original business case did not meet target. For 2021/22 we have agreed that business cases which alter the scope of the projects and the timing will have the benchmark against which the time of delivery is compared reset to accommodate the change.
- The capability functional fit assessment score did not meet its target. As explained earlier in the report, as we are making improvements to technical quality and reducing complexity, we are beginning to see a rise in the capability functional fit assessment score. Although this is still below the target, we anticipate that we will see further increases in subsequent years.

This year we passed both project delivery metrics that relate to delivering the projects under budget. This responds directly to the recommendation from the Authority System Operations Committee last year. We recognise that this is an area where continuous learning is required and will be focus for the comprehensive review of the performance metrics we will be undertaking with the Authority in 2021/22.

Performance metrics dashboard

		Annual Target	Actual	Pass/Not Achieved	Incentive payment weighting
We are smart about money					
Perception of added value by participants		80%	79%	Not Achieved	
Our customers are informed and satisfied					
Annual participant survey result		82%	84%	Pass	5
Annual participant survey result response rate - First tier stakeholders		80%	100%	Pass	
On-time special event preliminary reports [1]		90% ≤ 10 business days	None this year	N/A	5
Reports	Future thinking report	≥ 1	1	Pass	5
	Longer Market Insight reports	≥ 4	4	Pass	5
	Bite-sized Market Insights	≥ 45	48	Pass	
Quality of written reports		100% of agreed standard	100%	Pass	
Role impartiality		80%	93%	Pass	5
We maintain Code compliance and meet our SOSPA obligations					
Market impact of breaches remain below threshold		≤ 3 @ ≥ $40k	3	Pass	10
Breaches creating a security risk remain below threshold/within acceptable range		≤2	0	Pass	10
On-time SOSPA deliverables		100%	100%	Pass	10
We deliver projects successfully					
Project delivery	Service Maintenance projects	≥ 60% achieved for approved time	28%	Not Achieved	
		≥ 60% achieved for approved budget	79%	Pass	
	Market Design and Service Enhancement projects	≥ 60% achieved for approved time	0%	Not Achieved	
		≥ 60% achieved for approved budget	100%	Pass	
Accurate capital planning		≥ 50%	58%	Pass	10
We are committed to optimal real time operation					
Sustained infeasibility resolution		80% ≤ 10am business day 1 or as required	94%	Pass	5
High spring washer resolution		80% ≤ 10am business day 1 or as required	100%	Pass	
Our tools are fit for purpose					
Capability functional fit assessment score		75.00%	68.80%	Not Achieved	
Technical quality assessment score		65.00%	68.10%	Pass	
Sustained SCADA availability		99.90%	99.99%	Pass	10
Maintained timeliness of schedule publication		99.00%	99.99%	Pass	10
		Score = 85/85 = 100%	**Points where target met - 85**		**Total points: 85[1]**

[1] There were no special events in 20/21; points associated with this metric are disregarded when calculating performance

Figure 4

Appendix 2: TRENDS

The role of the System Operator is central to the delivery of an efficient power system, but it does not act in isolation. The work we do responds to the changing environment in which we operate; this is affected by factors such as industry participant responses and actions, and weather impacts.

The trends included in this appendix are in two categories:

- Our performance – trends in the functions for which we have direct control
- The external environment – trends which illustrate the context in which we work; including volume of activity.

We see benefit in highlighting both aspects together as they provide a rounded view of what is important in delivering the role of the System Operator.

To provide an internal as well as external focus, we have included employee engagement survey results and diversity statistics.

A2.1 OUR PERFORMANCE

A2.1.1 Our customers are informed and satisfied

Overall customer satisfaction

Figure 5

Our overall customer satisfaction score for 2020/21 was 84%, which is lower than last year but represents the views of twice as many participants who have provided valuable comments that we are analysing for areas to improve on. The score reflects responses that rate our service as 'Good' and 'Very good'.

Trends in specific performance areas

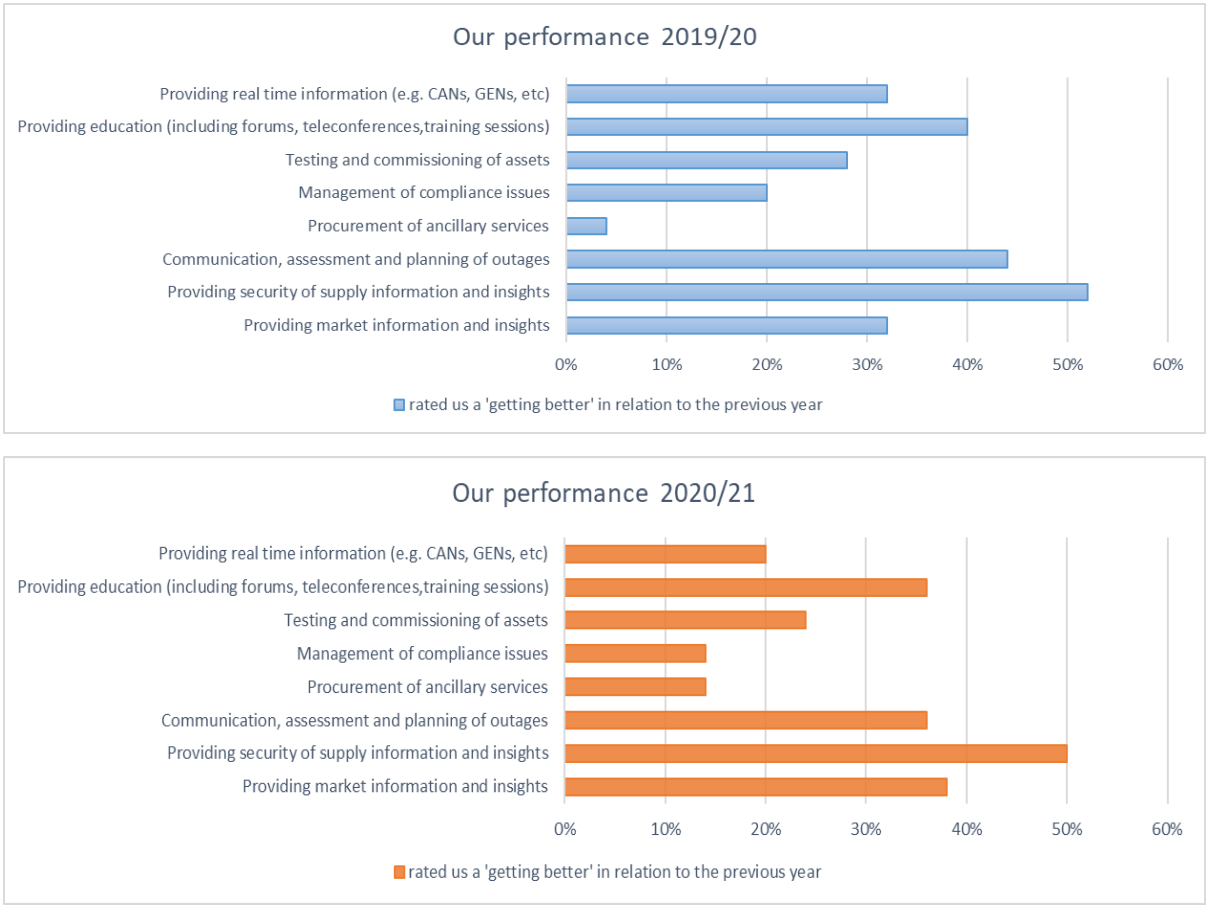


Figure 6

In 2020/21, we continued to see participants rating our services as getting better, notably in the area of information and insights in security of supply and market which likely reflects the increased communication during the potential 'dry year'.

A2.1.2 We maintain Code compliance

Breaches

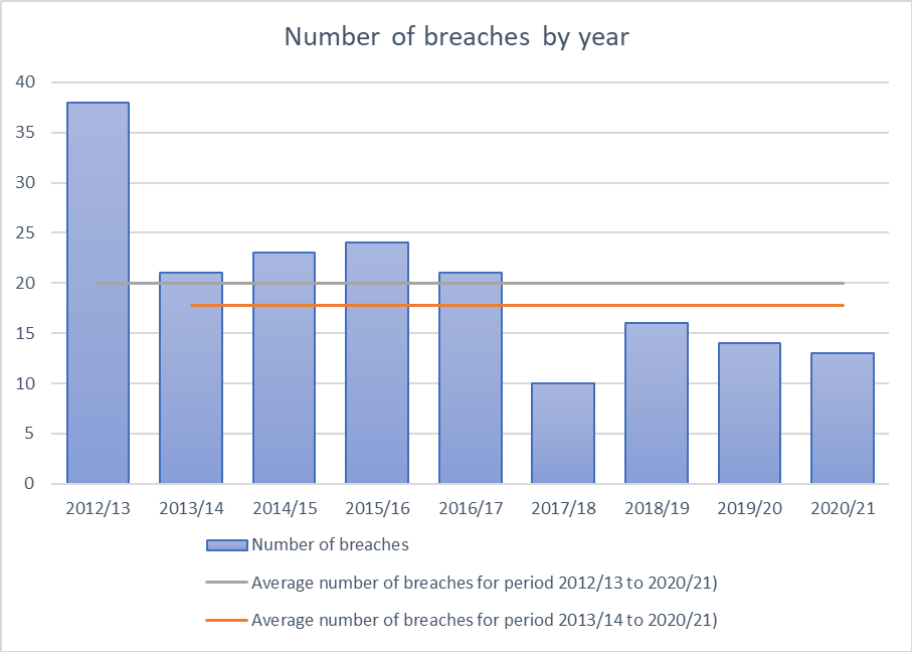


Figure 7

The number of breaches continues on a downward trend. Although the overall number reduced this year, three of the breaches had a market impact greater than the $40k threshold. We met our agreed performance metric target and are implementing lessons learned from these events. Of the 11 breaches reported by the System Operator, 8 of these had no or minimal market impact.

A2.1.3 We deliver projects successfully

SOSPA 1 Capital Expenditure

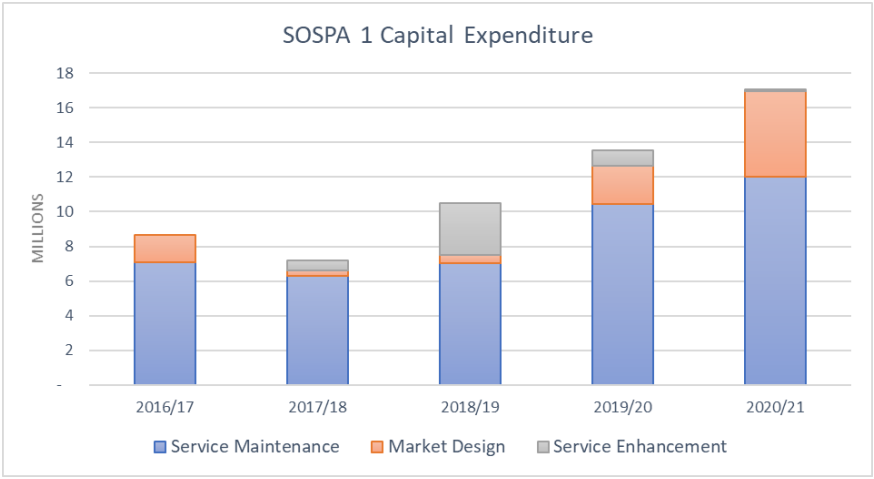


Figure 8

During the current period of SOSPA funding (SOSPA 1), our capital expenditure has trended upwards (2016/17 – 2020/21). This upward trend represents that we have embarked on the delivery stage of the Real Time Pricing project whilst continuing to enhance both the technical quality and capability function fit of our tools.

A2.1.4 Our tools are fit for purpose

Technical quality assessment score

Figure 9

This year's 3% rise to 68.8% reflects our commitment to improving the market system performance through initiatives such as Market System Simplification.

Capability functional fit assessment score

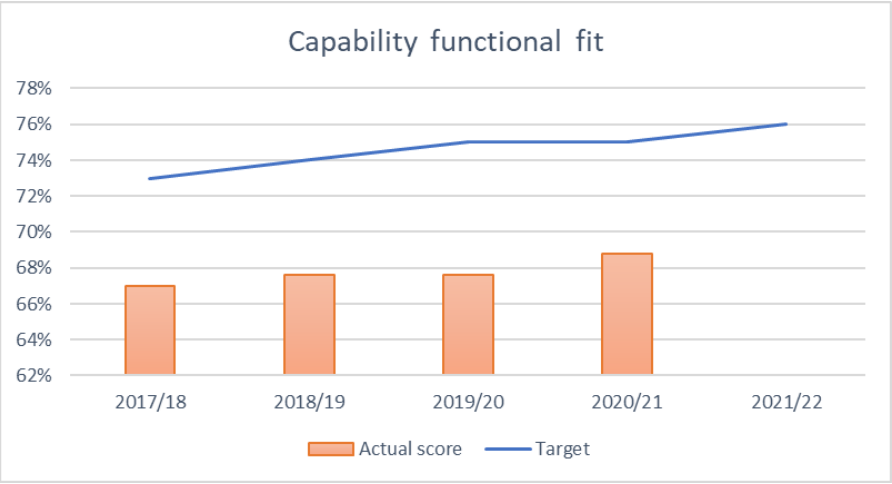


Figure 10

Now that we are making notable changes to technical quality and reducing complexity, we are beginning to see a rise in the capability functional fit assessment score. Although this remains below target, we expect further increases next year and beyond.

A2.2 THE EXTERNAL ENVIRONMENT

This section shows trends which illustrate the context in which we work. Although System Operator activity is not the driver of these situations, they have a bearing on where we spend our time and consequently affects the prioritisation of other work.

A2.2.1 We are committed to optimal real time operation

Over and under frequency momentary excursions outside the normal band

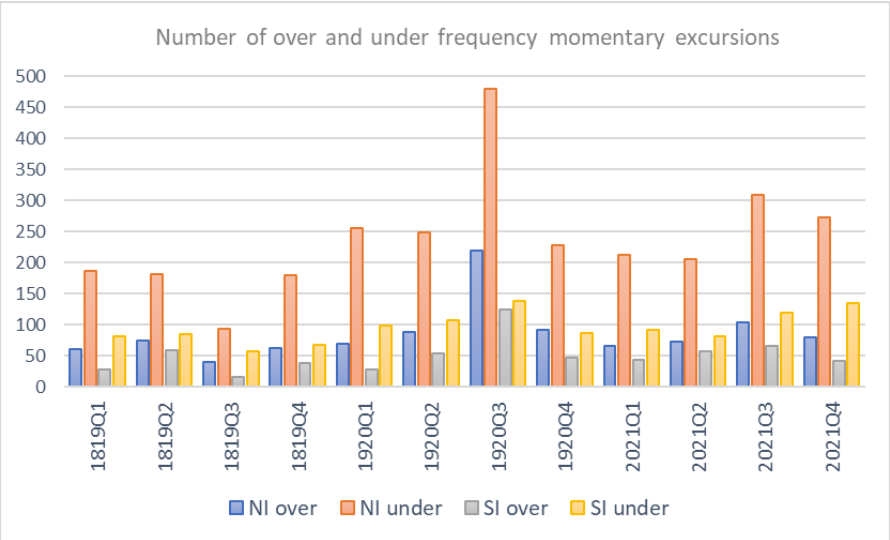


Figure 11

There were more North Island frequency excursions in the 49.8 – 49.5 band in Q3 and Q4 of 2020/21 than we would typically expect. This occurs due to imbalance in the system and it is a system operator principal performance obligation to restore frequency to the normal band as soon as reasonably practicable. A growth in number of excursions requires an increase in system operator workload in real time. Many factors affect these results which are a result of the generators and inherent inertia that is being supplied on the system at the time. In Q3 and Q4 we had less hydro generation on the system, and the results may be a reflection that hydro generation typically responds rapidly to frequency deviations. As the magnitude and duration of the excursions was comparable to previous years, we do not believe further investigation is warranted at this time. We will continue to monitor this trend.

Outage numbers

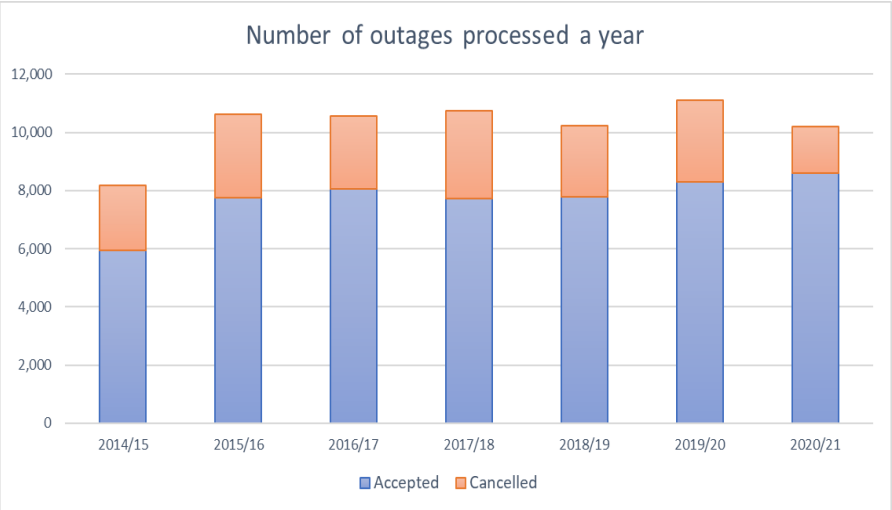


Figure 12

This graph reflects the number of Grid Owner's transmission outages processed by the System Operator each year.

We continued to process over 10,000 outages each financial year, with a slight increase in 2020/21 accepted outages (the blue bars). This can lead to very busy periods for our outage planners.

This year the percentage of cancelled outages has reduced from an average of 25% for the years up to 2019/20, to 16% in 2020/21. This may be attributed to some extent to the better planning and relationships we've been building with stakeholders.

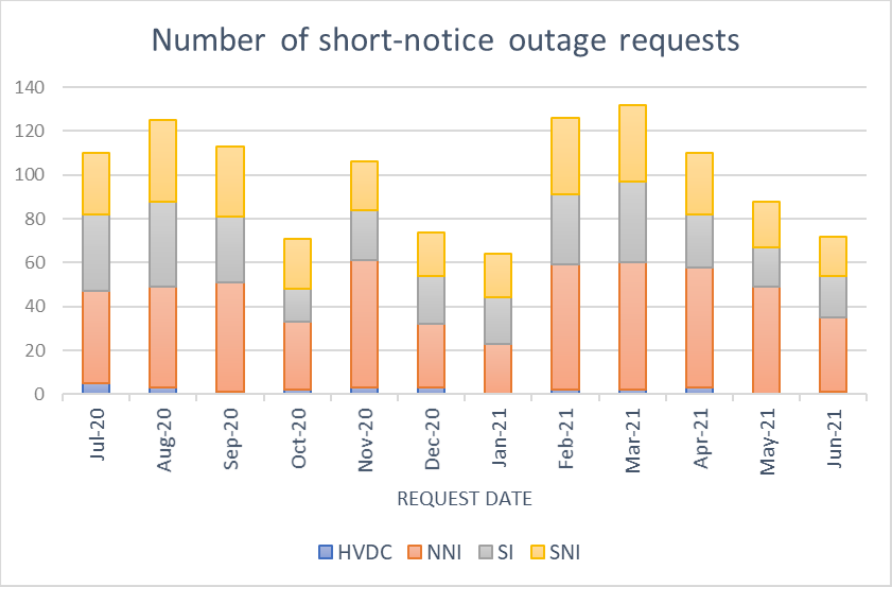


Figure 13

This graph reflects the number of short-notice transmission outages, largely as a result of issues on the Grid, which were processed by the System Operator in the year.

For the second year in a row, each month there were on average 100 outage requests processed within 12 weeks of the work; noting that each request may cover more than one outage. We are working with the Grid Owner on reducing this number.

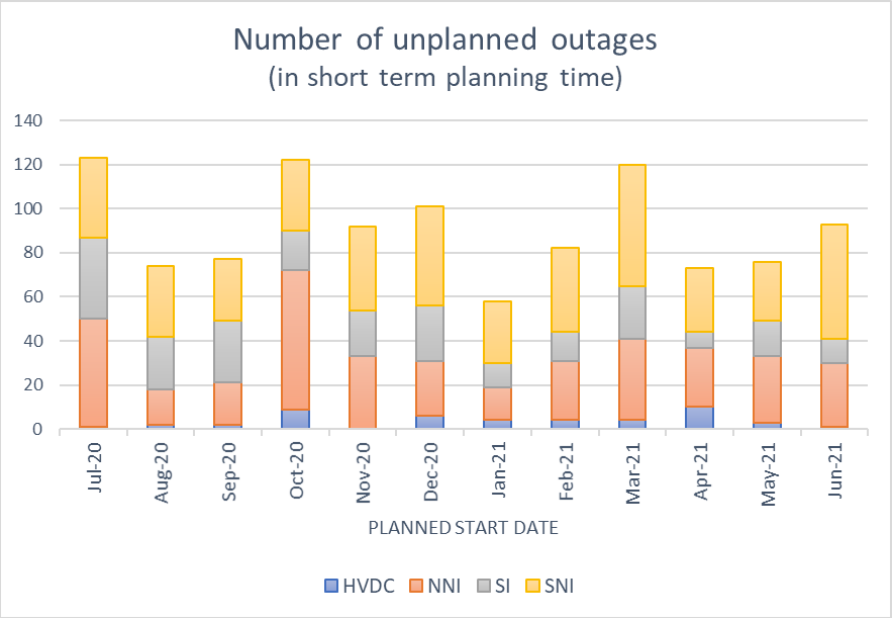


Figure 14

This graph reflects the number of unplanned transmission outages processed by the System Operator coordination centre during the year. It shows the number of unplanned outages that are processed in real time as a result of issues such as faults/trips, connected party requests, and GXP ties.

Test plans

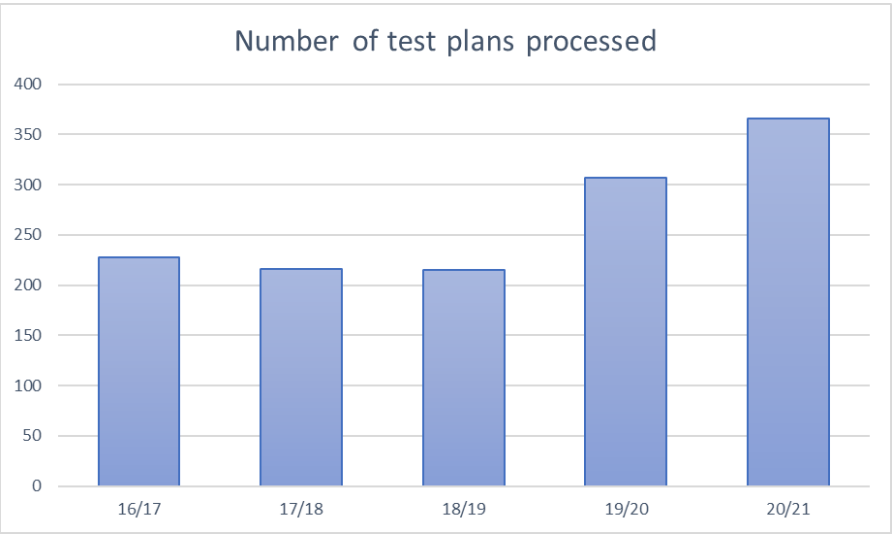


Figure 15

We continued to see an upwards trend in the number of test plans processed by the System Operator. This can be attributed to several factors:

- Delays for resources and workforce from previous years due to COVID-19
- A continued high volume of commissioning
- A considerable amount of rework as many plans were resubmitted for updates.

Transmission Commissioning activity

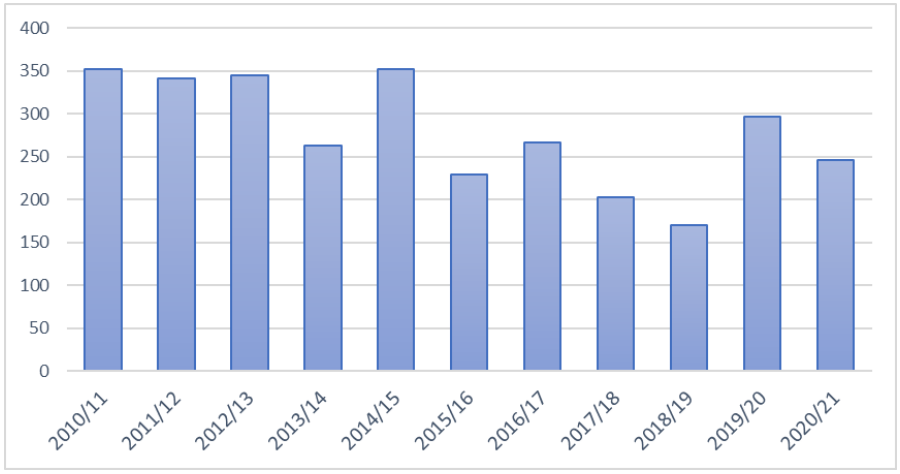


Figure 16

This year there was less transmission commissioning activity compared to last year as a result of Transpower delivering on its regulatory expenditure commitments. For the next few years, we anticipate the numbers will be around 250 commissionings a year as there is no major build happening; work will be mostly augmentation.

Details on the two completed generation commissionings where we were involved in, and the Todd solar generation commission, are included in the main body of this report.

Infeasible solutions

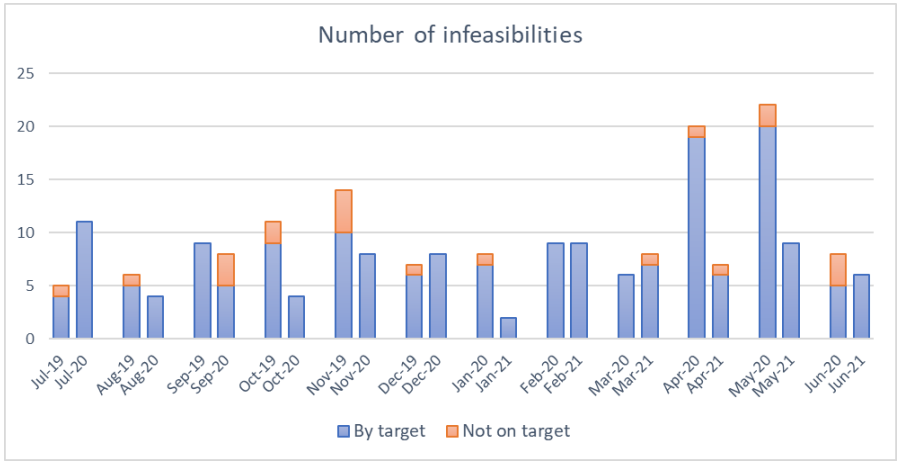


Figure 17

This year there were fewer infeasibilities, most noticeably in April and May (last year we saw infeasibilities as a result of participants offering incorrect ramp rates). Most infeasibilities were required when outage times required changing when lines returned to service during the trading period.

This graph compares the number of infeasibilities that occur on the first solve of final pricing by NZX. The Code requires the System Operator to use reasonable endeavours to resolve the infeasibility in the timeframes prescribed in the Code. Resolution that is outside the target timeframe reflects the complexity required to solve the infeasibility.

Note: The introduction of Real Time Pricing (RTP) will deliver accurate and reliable spot prices to be published during or immediately after the finish of each trading period; removing infeasibilities.

A2.3 WEBSITE ACTIVITY

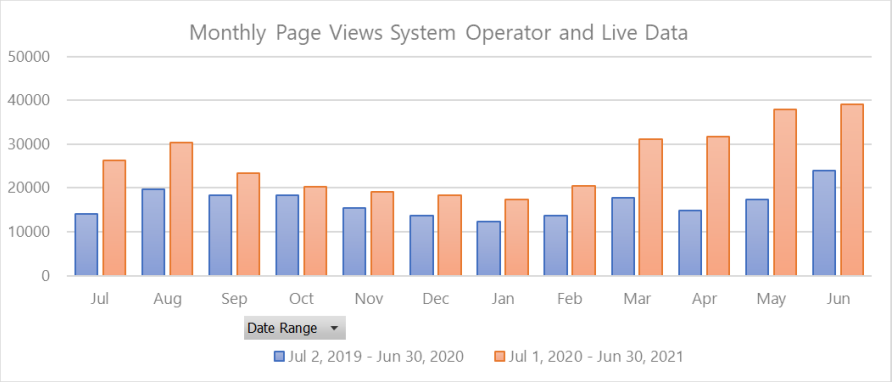


Figure 18

Over the last 12-month period our website continued to be a key vehicle providing information to our stakeholders. The number of monthly page views every month exceeded the previous year's views. There is a sharp increase in page views during the potential dry-year issue over the March to June period.

The following graphic shows the type of information our stakeholders have been consuming from the Transpower website during the last review period.

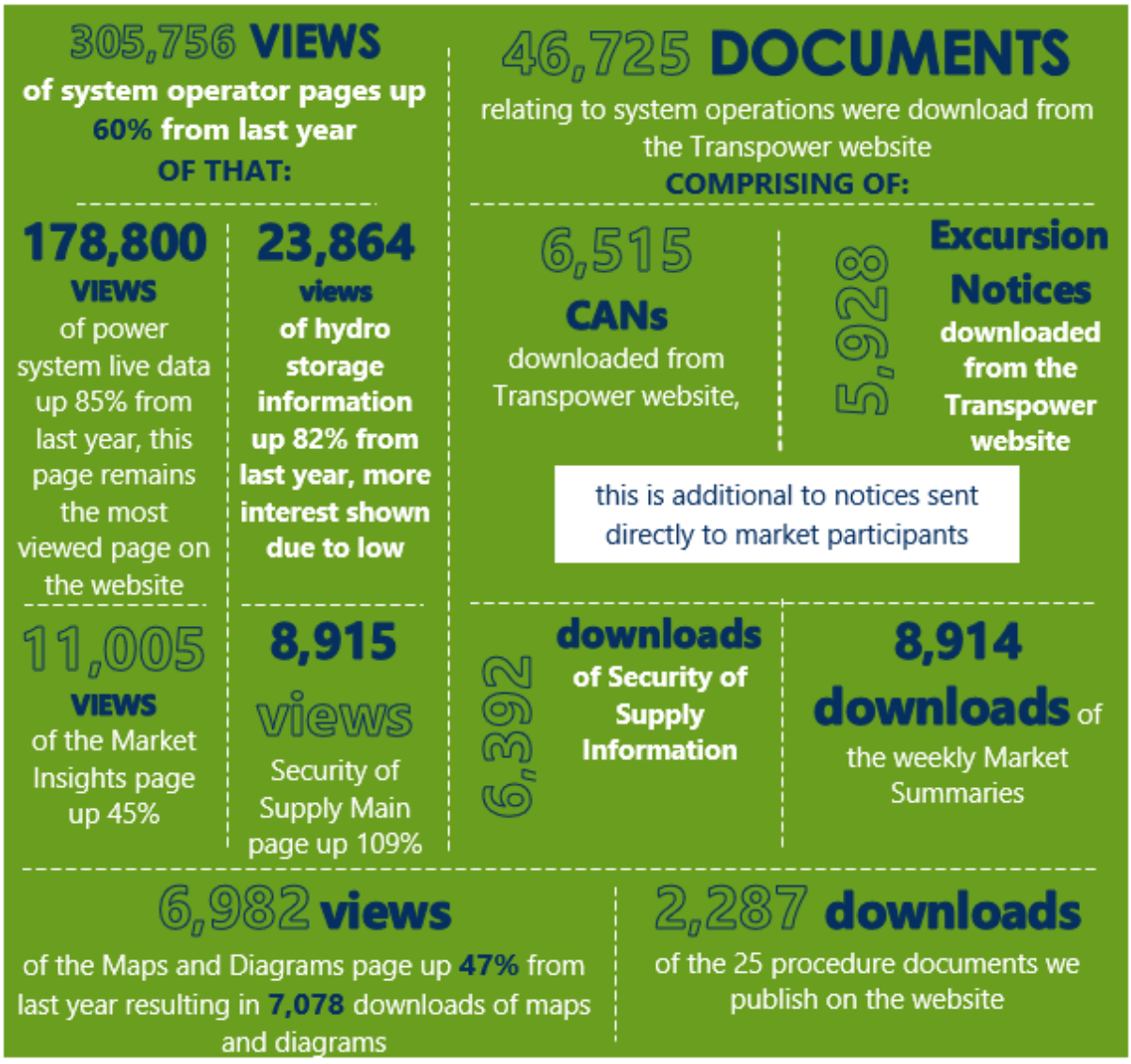


Figure 19

A2.4 OUR PEOPLE

A2.4.1 Engagement

We use the Peakon framework for our people engagement surveys. This year our participation rate (a key indicator of engagement) has been high for each of the four periods in which we sampled data, varying between 77% and 93%.

Our engagement is categorised by the individual Transpower divisions – the System Operator function forms part of the Operations division. The latest engagement score for the Operations division is 7.7 which is at the global Energy and Utilities Benchmark (and just 0.3 below the top 25%). This global benchmark has lifted steadily over the past 12 months due to the global impact of COVID-19; Peakon saw a similar climb during the Global Financial Crisis.

A2.4.2 Diversity

Table 1

Age:

AGE GROUP	NUMBER
20-29 YEARS	13
30-39 YEARS	21
40-49 YEARS	27
50-59 YEARS	37
60 YEARS +	5

Gender:

ROLE	F	M	TOTAL
NON-PEOPLE MANAGER	29%	71%	85
PEOPLE MANAGER	8%	92%	12
SENIOR LEADER	50%	50%	6
GRAND TOTAL	**34**	**98**	**103**

In the 20/21 year, of the 11 people hired, 4 were female (36%)

At Transpower, we are focusing on creating and maintaining a positive work environment where all our people feel included, welcome and valued. These statistics refer to those people carrying out the System Operator function in 2020/21, which show our team includes people in different stages of their work careers and an even gender split in our senior leader roles.

In addition to these permanent staff we have employed, 16 contractors contribute to the System Operator function. Of these 50% were female.

The number of vacancies during the year was between 2 and 6 per month; which rose to 13 in July 2021 (the start of the next review period) reflecting the current market trend.

Appendix 3: INFOGRAPHICS

As part of our education and engagement programme, we have developed new infographics depicting elements of the System Operator 's role and where we sit within the electricity system overall.

Figure 20

Where we fit in

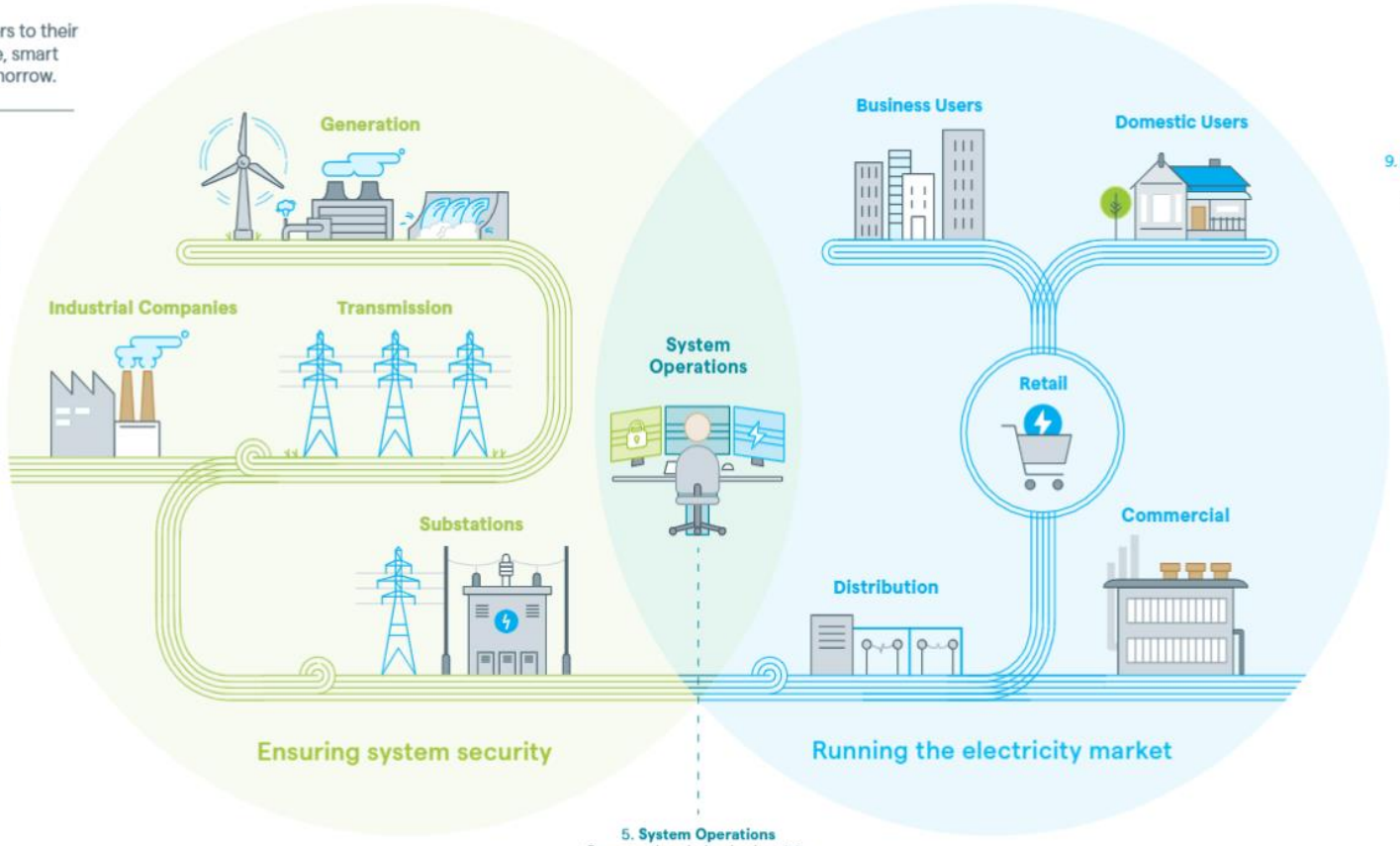
We connect New Zealanders to their power system through safe, smart solutions for today and tomorrow.

1. Generation
Generation companies generate power from wind, thermal, hydro and geothermal. They sell the power they generate on the electricity market. Emerging distributed generation includes electric vehicles, batteries and solar photovoltaic.

2. Transmission
Transpower transports high voltage electricity from where it is generated to distribution companies and some large directly connected customers.

3. Industrial Companies
A few major industrial companies receive their power directly from Transpower.

4. Substations
Substations reduce the voltage at the point where electricity is delivered to distribution companies – our customers.



5. System Operations
Operates the wholesale electricity market and manages system security.

9. Domestic and Business Users
Domestic and business users receive their electricity directly from retail companies, which deliver power to homes, businesses and commercial operations using distribution companies' lines.

8. Retail
Retailers buy power on the electricity market, package it together with other costs of delivering power (transmission and distribution), and on-sell it to customers.

7. Commercial
Some commercial customers that consume large quantities of energy purchase power directly from the wholesale electricity market.

6. Distribution
The lower voltage electricity is transported by distribution companies to homes and businesses throughout New Zealand.

Figure 21

TRANSPOWER