Meeting Date: 22 October 2020

SYSTEM OPERATOR PERFORMANCE: 1 JULY 2019 – 30 JUNE 2020

SECURITY AND RELIABILITY COUNCIL

This paper provides the SRC with a copy of the system operator's annual self-review and gives an indication of the content of the Electricity Authority's corresponding review.

Note: This paper has been prepared for the purpose of the Security and Reliability Council. Content should not be interpreted as representing the views or policy of the Electricity Authority.

1 Background to annual reviews of the system operator's performance

1.1.1 The Security and Reliability Council's (SRC) functions under the Electricity Industry Act 2010 include providing advice to the Electricity Authority (Authority) on:

a) the performance of the electricity system and the system operator

b) reliability of supply issues.

1.1.2 The SRC was given a specific mandate for system operator performance because of the information asymmetry that arises between the Authority and the system operator. As a group with industry and consumer representation, the SRC can bring perspectives to the system operator's performance otherwise unavailable to the Authority.

1.1.3 The Electricity Industry Participation Code 2010 (Code) requires the Authority to review the system operator's performance each year. In doing so, it must take account of a self-review that the system operator must perform each year under the Code.[1]

1.1.4 The system operator has completed its self-review of its performance for the 2019-20 financial year, and the Authority is currently drafting its corresponding review (collectively, the reviews).

1.1.5 The purpose of this paper is to enable the SRC to formulate advice to the Authority about the system operator's performance in the 2019/20 year. To inform that advice, this paper has a copy of the system operator's annual self-review (attached as Appendix A) and gives an indication of the preliminary content of the Authority's corresponding review (included in Appendix B).

2 The reviews are structured around four key aspects of the system operator's service delivery

2.1.1 The system operator's self-review is structured around four sections based on areas that the system operator considers are key aspects of its service delivery. These four areas are:

a) delivering secure power system operation

b) enabling a more efficient market

c) improving the system operator's service

d) learning from others.

3 Previous SRC advice

3.1.1 When the SRC considered last year's reviews the SRC advised that:

a) "the system operator's performance for 2018/19 was good as was the quality of its report, especially the trend toward more scenario testing", and

[1] Clause 7.11 of the Code specifies the requirements of both the system operator and the Authority in reviewing the system operator's performance.

b) "the SRC encourages the system operator to provide performance trends in its reporting and demonstrate watchfulness of proper separation of Transpower's system operator and grid owner roles."

3.1.2 As a result of the SRC's advice, the Authority included a recommendation to include performance trends in the system operator's self-review. The system operator has adapted its 2019/20 self-review accordingly.

4 SRC feedback is valuable

4.1.1 The Authority appreciates feedback from SRC members on any aspects of system operator performance that they may wish to comment on, even if it is not included in either the reviews. The SRC's advice to the Authority on this matter is valuable, as evidenced by SRC advice over the years typically being adopted as recommendations into the Authority's annual reviews.

4.1.2 An indication of the preliminary content of the Authority's review is included in Appendix B. It provides a useful indication of the initial assessment of the system operator's performance and what recommendations the Authority is considering making to the system operator as opportunities for improvement.

This is a first draft and is subject to extensive amendment as it goes through the Authority's internal review process, including incorporating feedback from the system operator and the SRC.

4.2 Questions for the SRC to consider

4.2.1 The SRC may wish to consider the following questions.

Q1 What aspects, if any, does the SRC wish to highlight of the system operator's performance as strengths or having markedly improved?

Q2 What concerns, if any, does the SRC have about the performance of the system operator?

Q3 What aspects, if any, of the system operator's functions would the SRC like the system operator to give greater weight to in its dealings with stakeholders?

Q4 What further information, if any, does the SRC wish to have provided to it by the secretariat?

Q5 What advice, if any, does the SRC wish to provide to the Authority?

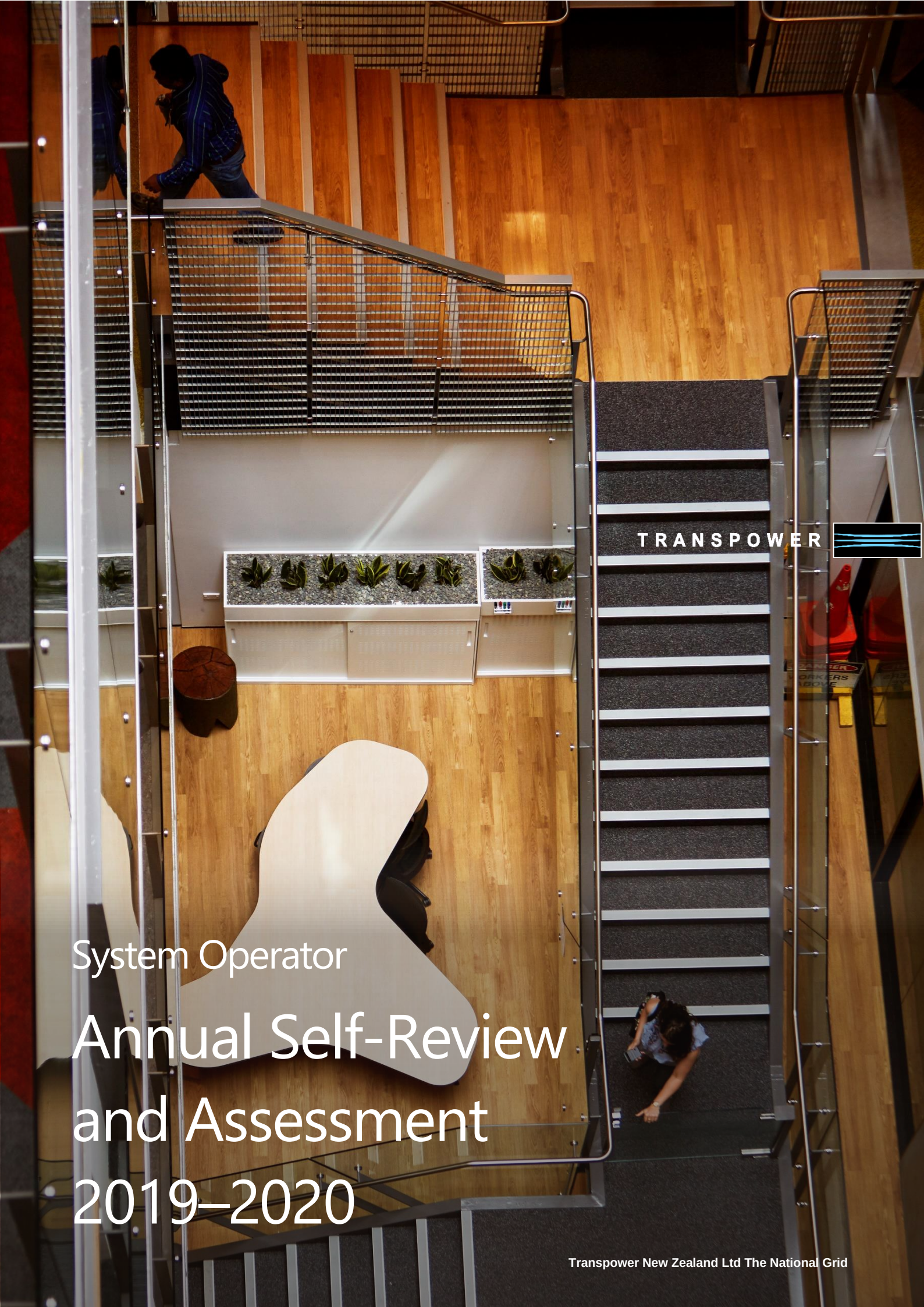
5 Attachments

5.1.1 The following items are included as attachments to this paper:

a) System operator annual self-review and assessment: 1 July 2019 – 30 June 2020 (Appendix A)

b) Indication of preliminary content of Authority's annual review of system operator performance, for the period 1 July 2019 – 30 June 2020 (Appendix B).

Appendix A System operator annual self-review and assessment: 1 July 2019 – 30 June 2020



System Operator

Annual Self-Review and Assessment 2019–2020

Transpower New Zealand Ltd The National Grid

Contents

Foreword

In taking over the reins from my predecessor John Clarke, I am proud that as system operator we've built a legacy of solid performance while seeking opportunities to improve and evolve our service.

This review highlights some of the key achievements and elements of our performance over the last year – from successfully managing the power system through a set of major asset outages in early 2020, to completing the design phase of the Real Time Pricing project. Our review also shows we were well placed to respond to the challenges of COVID-19 –maintaining supply and keeping our control room operators safe while the remainder of our people worked from home and seamlessly continued to deliver our service.

This coming year, our strategic focus will be on preparing ourselves for a time of unprecedented change for system operations – looking at what changes we need to make now to our services and systems so they are able to manage the challenges of changing supply sources and demand in the future. I am excited by the opportunities this presents for industry and for us as system operator.

Dr Stephen Jay
GM OPERATIONS

Key deliverables – *at a glance*

Transpower is central to the New Zealand electricity industry and connecting New Zealanders to their power system through safe, smart solutions for today and tomorrow. In our role as system operator, our priority is to operate a competitive electricity market and deliver a secure power system.

Strategic Priorities

Play an active role in enabling New Zealand's energy future

In our role as system operator, we have a valuable role to play in enabling New Zealand's energy future – in particular, the future state decarbonisation of the economy. Alongside our contribution to *Whakamana i Te Mauri Hiko*, we have explored potential energy sector game changers including an investigation of **Distributed Energy Resources** and the role that can be played by **Battery Energy Storage Systems**.

The introduction of **Real Time Pricing** represents a significant step towards New Zealand's energy future. We have built a strong foundation to be able to progress this work and enable the capital build phase to begin in July 2020.

Accelerate organisational effectiveness

Our work on **Streaming Analytics** will deliver the first capital project in the **Situational Intelligence Programme** to support real time operations in the National Control Centre. This work will establish an on-premise solution to stream data from the Market System and SCADA to enable the business to build business rules and alerts as well as establish a useful data visualisation layer.

Sustain our social licence to operate

Strengthening our management of **Compliance** and **Impartiality** is fundamental to maintaining our social license to operate. We established the SO Compliance and Impartiality manager role; and continue to reinforce the importance of impartiality through a staff education programme, developing new business processes and the establishment of a portal for reporting incidents, and registering perceived potential issues.

Early action and preparedness safeguarded the country's electricity supply throughout the **COVID-19** crisis. Critical functions were protected while we continually adapted to conditions and maintained operations.

Delivery of strategy to ensure **Security of Supply** has included an updated annual assessment and forecasting and information policy, incorporating an energy wide view of fuel positions.

Evolve our services to meet customers needs

We have enhanced **Outage planning coordination** and communication by refreshing our planning processes. Developed through collaboration and consultation, this work has been commended by industry participants.

New **Dispatch Service Enhancements** were successfully commissioned into the market system this year and included additional, enhanced functionality. This project allows participants to receive dispatch instructions via ICCP or web-services and will enable a greater array of information to be sent with dispatch instructions.

Match our infrastructure to need over time

Harnessing technology to ensure our tools can adapt to change remains a priority. This year, to reduce complexity and cost for ongoing development and maintenance activities we have implemented a **Market System Simplification** project and changed the code for our Market System tool to a modern language code.

Part 1: Delivering a secure power system operation

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 power system for New Zealand.

1.1 Responding to COVID-19

From February 2020, Transpower, in both its role as system operator and as grid owner, began actively preparing for the risk of a potential COVID-19 outbreak. From the beginning, we took a prudent and cautious approach based on Ministry of Health guidelines and Transpower's pandemic plan. This included requiring self-isolation following travel to certain countries and limiting domestic and international travel.

As system operator, we instigated a separate incident management response to the overall Transpower response in mid-March. We took a number of steps to protect the control rooms and people with specialist skills. This included limiting access to the control rooms and in some cases adjacent areas such as kitchens and bathrooms. The Government-directed lockdown was a key control in the process as requirements for self-isolation reduced the immediate need for further measures in control rooms.

Control room operators adapted well to the COVID-19 protocols which were developed in line with our pandemic plan. Alongside hygiene measures, pandemic planning included introducing two additional control rooms in the control centres, perspex screens, social distancing markers, team shift bubbles and remote working. These measures ensured safe and continued operations without reducing the level of service.

Throughout the lockdown, our IST systems allowed the rest of our people to successfully carry out their functions remotely so that COVID-19 had minimal impact on our ability to perform our role as system operator.

As a result of the level 4 nationwide lockdown, the power system experienced a reduction in commercial and industrial loads which we needed to manage. This included:

- Adjusting the load forecasting tool to adapt to the changes in demand profile.

- Monitoring the changes in natural gas demand and associated gas prices to manage concerns of upstream impacts on thermal generation if gas fields had to be closed to balance supply.
- Re-evaluating our approach to outage co-ordination and assessment to address changes in system conditions, variations to planned outages, and an increase in short-term changes to outage plans.
- Undertaking studies to understand the impact that the reduction in demand would have on system voltages overnight. This analysis provided critical assurance that the power system would remain manageable and allowed for mitigation measures to be developed.
- Actively managing voltage through the low loads.
- Identifying the possibility that Automatic Under-Frequency Load Shedding (AUFLS) may not have responded as expected due to the changing demand profile. To mitigate this, we requested participants inform us of any concerns they had regarding the ability to meet their obligations.
- Updating the Reserve Management Tool (RMT) to modify the value used to represent load exempt from providing AUFLS. We continued to monitor and adjust this value in RMT as industry load came back on after lockdown. As a result of making this change less reserve was required to cover high HVDC northwards transfer.

To enable assessment and discussion of potential security of supply risks arising from the lockdown, we chaired a weekly working group which included representatives from the Gas Industry Company, First Gas, the Authority, and the Ministry of Business, Innovation and Employment. In addition to this, from early March, weekly updates were provided to the Authority, along with a daily update to the National Emergency Management Centre.

A dedicated Transpower COVID-19 webpage with links to relevant system operator information was also implemented to ensure industry could be kept informed. The webpage complemented existing channels such as Customer Advice Notices (CANs) which were used to provide information on a range of issues including load forecasting, voltage management, outage co-ordination and assessment, and AUFLS requirements.

To help inform our own response and the plans of other international system operators, we engaged with international counterparts to share experiences. These included:

- video conference discussions with Eirgrid and National Grid UK
- informal discussions with the Australian Energy Market Operator (AEMO)
- participating in Edison Electricity Institute webinar on preparations in North America and Europe
- contributing to an Institute of Electrical and Electronics Engineers (IEEE) Power Engineering Society white paper.

We also used our lessons from the lockdown to develop protocols for moving between alert levels, which meant we were able to act immediately when alert levels changed on 11 August 2020.

1.2 Security of Supply

Changes in fuel supply and impacts on generation

Hydro

While the 2019/20 review period started with below average hydrology, the security of supply risk remained low due to reduced demand and the fact that the Electricity Risk Curves (ERCs) decline during this period until summer.

As anticipated, there were seasonal high inflows in the South Island in October and November. A further large inflow event at the start of December pushed many of the lakes above their operating ranges, resulting in spilling.

North Island inflows from January through to the end of April were the lowest since 2003. However, the successful completion of major infrastructure outages, combined with reduced demand due to COVID-19, positioned the market well to enable conservation of North Island hydro storage until inflows began to rise towards winter.

Although storage reached the 10th percentile of historical levels in June 2020, the risk to security of supply remained low as by June each year the risk has peaked.

Thermal

A closer working relationship with the gas industry ensured the system operator was informed of outages to gas supply this year and could proactively plan accordingly.

We sought, analysed and shared our assessment of the risks to thermal fuel supply during the HVDC 2020 outages, in particular the effects of the outage of the Ahuroa gas storage facility in February, and Pohokura's large planned maintenance outage from 11 to 24 March 2020.

The Pohokura shutdown was expected to constrict the gas market and was modelled in the ERCs, but due to the high national hydrology at the time presented no risk to security of supply.

The outages placed reliance on North Island generators to meet North Island demand at a time when North Island inflows are typically low. Genesis initially ran two Rankine units and unit 5 at Huntly, and when the output from the Rankine units reduced due to Waikato river heating (common for the time of year), Contact's combined cycle generator at Stratford came online to cover Genesis' reduced output.

Security of Supply strategic work programme

Our security of supply strategy is a key enabler of proactive and early signalling of security supply risks. The work programme this year included:

- modelling and the publication of North Island Simulated Storage Trajectories (SSTs) to show the impact of the HVDC outage on North Island hydro storage and under a gas-constrained scenario.
- inclusion of a forward-looking section in the weekly security of supply reports to highlight upcoming major infrastructure outages identified as potentially having a large impact on electricity generation.
- an update to the Security of Supply Forecasting and Information Policy (SoSFIP) to include contingent storage for risk analysis.
- modelling how changes in the SoSFIP and Lake Pukaki contingent storage could impact the ERCs and SSTs depending on the solutions adopted.
- revising the thermal fuel de-rating in the ERCs in the months leading up to the Pohokura outage.
- regularly publishing quarterly ERC scenarios related to potential thermal fuel supplies disruptions.
- using the software package Matlab to conduct the analysis for the SoSAA. This enables seamless consideration of a wide range of sensitivities and demand forecasts, including a sensitivity looking at what would happen if demand growth was flat for the next 18 months and then returned to pre-COVID-19 levels over the following six months.
- holding a workshop in July 2020 for industry participants to share insights on security of supply issues; notably regarding gas supply considerations.

Announcement of the Tiwai smelter closure

The July 2020 announcement regarding the closure of the Tiwai Point aluminium smelter will have potentially significant implications for security of supply and our analysis will be updated accordingly. While current risk curves do not currently factor in the closure, the SoSAA looks at a 10-year horizon and does contain a scenario for this outcome. We will be building on this scenario and adapting it to take into consideration a range of sensitivities posed by this change.

1.3 Operational performance

Responding to operational events

The flooding of the Rangitata river in December represented the largest weather-related impact this year. The flood led to extensive damage to nine transmission towers on the Islington-Livingstone section of the line which supplies the upper South Island. A temporary line was erected as an interim solution and was later modified to increase the operational capacity.

To keep industry informed, the system operator and grid owner held joint industry teleconferences to discuss load management with relevant parties, providing advice and recommendations on planned outages which may impact system security.

Despite challenges associated with planning and sourcing materials during the COVID-19 restrictions, good progress was made, with full co-operation from all parties.

Several fires created power system impacts this year.

A large fire on Flagstaff hill near the Halfway Bush and Three Mile Hill substations included a recall of a planned outage of the South Dunedin–Three Mile Hill circuit.

A scrub fire reported under the Clyde-Cromwell-Twizel circuits resulted in an assessment to classify these circuits as a single risk, which would have required Manapouri to be dispatched down by 345 MW; however, risk to the lines was assessed as insufficient to take this step.

Other events during the high fire risk season included an auto reclose of Fernhill-Redclyffe circuit 2 due to a hedge fire on 30 January, the removal from service of Oamaru-Blackpoint-Waitaki circuit 1 on 31 January, a fire near the Islington–Tekapo B circuit on 31 January, and close monitoring to ensure the safety of both the Islington-Kikiwa 220 kV circuits and Southbrook-Waipara 66 kV circuits on 3 February.

Loss of supply events

On 27 November 2019, there was an approximate 180 MW loss of supply to the Northland region. Our control room operators instigated a limited restoration of Northland via the 110 kV circuits, while additional analysis was undertaken of protection information relating to the tripping. A risk assessment undertaken by the Coordinated Incident Management System (CIMS) group determined that manual restoration of the tripped circuit was appropriate, and the restoration switched to the 220 kV circuits.

On 12 March 2020, during the switching sequence to enable maintenance on part of the Haywards 110 kV bus, the bus tripped causing a loss of supply to 157 MW of load in the Wellington region. A subsequent investigation recommended four actions to improve the restoration process, and three further considerations were proposed to the grid owner.

On 8 June 2020, towards the end of the morning peak, there was a loss of supply event affecting the Far North, due to a tripping of the Kaikohe-Maungatapere circuit 1, while circuit 2 was out of service for a protection upgrade. A voltage excursion notice was issued. The tripping resulted in a 61 MW loss of supply to Kaikohe, plus a loss of 25 MW of Ngawha generation. The real time operations team worked closely with Top Energy and re-energised the tripped circuit after 44 minutes, and the Kaikohe bus shortly after. A full line patrol was completed following restoration, with no fault found. It is suspected that bird streaming was the cause of this event.

On 8 June, a tripping of transformer at Henderson during the evening peak, coincided with planned outages of Ōtāhuhu-Mt Roskill circuits 1 & 2 and Albany-Wairau Road circuit 4. This resulted in approximately 40 MW of load having to be shed at Mt Roskill under a Grid Emergency. The transformer was returned to service 1 hour 41 minutes later, at which point the remaining non-controllable load was restored. Controllable load continued to be restored as system conditions allowed, with all load fully restored and the Grid Emergency ended at 20:47 the same day.

SCADA availability

SCADA availability was maintained at 99.98% for the period. However, on 31 October two SCADA system failures occurred, one of which resulted in a complete loss of service for 45 minutes. This was the first "Moderate" incident identified under the new significant incident reporting process[3]. The final report delivered to the Authority in early February 2020 identified two breaches of the Code by the system operator.

1.4 Informing our stakeholders

This year we continued to improve the information we publish to assist participants with their planning and decision-making. We have also committed to sharing our lessons learned from major events.

Low residual situations

As a result of lessons learned from our experiences during the November 2018 HVDC outages, and to improve forward-looking market information, we began sending out CANs in response to low residual situations. Two CANs were issued in August, both as a result of Monday morning peaks. We closely monitored actual loads and intermittent generation (particularly wind). While prices were high (around $650/MWh at peak for the first instance), in real-time normal reserve requirements were able to be met, due in part to participant response to the CAN.

System Security Forecast (SSF) minor update

Our six-monthly review of the System Security Forecast (SSF) was completed in December 2019, with revised documents published on our website. The revisions in this minor update include the impact of new committed projects including:

- Ngawha geothermal expansion
- New Plymouth substation exit
- Junction Road generator
- Ohinewai capacitors
- Turitea wind farm
- Te Awamutu capacitors
- Ōtāhuhu T4 replacement
- Ōtāhuhu T2 decommissioning
- Penrose T10 decommissioning
- Kikiwa reactor.

Reporting on significant incidents

Following an external consultancy review of our event management processes, new processes for reporting major power system events have been implemented.

As part of this significant incident reporting process, reports are classified as Major and Moderate. This year, reports have been written for the following incidents:

- Northland loss of supply on 27 November; identified as a Moderate incident under the new significant incident reporting process. Our report was delivered to the Authority in March 2020.
- Wellington region loss of supply on 12 March; identified as a Moderate incident. The final report was delivered to the Authority in June 2020.
- Tripping of a transformer at Henderson on 8 June; identified as a Moderate incident. A final report will be delivered to the Authority in September 2020.

[3] Other events identified and reported on under this process are noted in section 1.4.

1.5 Impartiality

To demonstrate our continued commitment to carrying out our system operator role impartially, we implemented the following:

- We established a new senior leadership role of SO Compliance and Impartiality Manager who reports directly to the General Manager Operations and is tasked with further strengthening management of compliance and impartiality.
- We established a sub-committee of the Transpower Board with a focus on the role of the system operator. This committee has the responsibility for providing strategic direction, approving risk management policies, and assessing the performance of the system operator. The meetings are held quarterly, with the first meeting in 2020.
- We maintain a register to record instances where there may be a perception that our impartiality as system operator could be contested. A number of the identified situations involved requests for data by a participant which requires the permission from a third-party data owner. Processes have been established to ensure correct data sharing protocols are followed. Other issues involve conflicts of interest, specifically related to system operator employees with non-work relationships with personnel from other industry participant organisations. In these cases, where possible, we will avoid putting these individuals in situations where a conflict of interest could be challenging to manage. Conflict of interest items are reported to the Authority in our monthly reports.

1.6 Compliance, Risk & Assurance

Code compliance

We did not breach any of our principal performance obligations in the 2019/20 year, but self-reported 14 breaches of the Code; none of which had a noticeable market impact. The number of breaches continues our downward trend in breaches and is below the average since 2013/14, of 18.

Risk

Our risk management framework was updated to incorporate the results from our control self-assessment process and includes a refreshed risk bowtie. The control self-assessment process demonstrated growth in our risk maturity, with control accountability and improvement activities better reflecting risk preparedness.

Business Assurance Audits

Our five business process audits in the 2019/20 annual SOSPA audit plan year covered how the system operator:

- processes test plans on behalf of asset owners
- manages a system event including a grid emergency
- monitors and adjusts the medium-term load forecast
- manages conflict of interest
- meets the obligations in the outage planning policy.

Each of the five business process audits confirmed our capability in the selected processes, while identifying areas where we can improve.

One of the key areas for improvement related to subjectivity of the audited processes. The auditor recommended that matrices and measures should be created to avoid subjectivity. We have responded to this recommendation and updated procedure documents to reflect the knowledge of peers.

We also agreed to carry out an additional business audit, outside of our original audit plan which assessed the National Coordination Centre (NCC) procedural communications. This additional audit was a recommendation of a wider Transpower audit which examined an HVDC setting error.

The 2020/21 annual SOSPA audit plan includes:

- Managing insufficient generation offers and reserve deficits
- Review of actions and suggested improvements from the 2017/18 security of supply audit
- Managing and assessing grid owner offers
- Event reporting and investigation
- Contingency plan principles and procedures.

Software Audits

Software audits of the Reserve Management Tool (RMT) and Scheduling Pricing and Dispatch (SPD) software were completed as required under the Code, with no defects raised. A general comment was made by the auditor that solve times for SPD are starting to approach the agreed limit. These will continue to be monitored.

In addition, an audit of the RMT change processes was completed. This action was identified following a breach in January 2019 when reserves from a generator were not recognised as procured during scheduling, so additional reserves were purchased. All recommendations from this audit have been completed and there is now a fully operational change process in place for any changes made to RMT.

Incident Management and Business Continuity Planning

We carried out a business continuity exercise for team managers in November 2019. The exercise simulated an earthquake in Wellington and involved a CIMS structure to be established in Hamilton. This provided a valuable opportunity to apply CIMS training and share experiences of previous real-life events/exercises within the group. In addition, this year, four members of the Operations senior leadership team completed a two-day training session on CIMS level 4.

In December 2019, system operator staff took part in a two-day GridX[4] simulation of a sustained cyber and physical attack to the New Zealand power system. This presented a further opportunity to apply our CIMS training to a major event and grow capability in this area. Our teams performed very well and were able to successfully navigate the situation.

In September, work commenced with First Gas on business continuity planning to ensure that we are aware of the interactions and impacts for each organisation during a major event.

In December 2019, a regional industry restoration workshop was hosted at the Omaka training centre for the upper South Island. This involved Buller Electricity, Marlborough Lines, Nelson Electricity, Network Tasman, Trustpower and Westpower. It was the latest in a series of workshops to discuss restoration of the respective island core grid and regional restoration following a blackout.

A May workshop was planned for the lower South Island as a combined industry CIMS exercise involving lower South Island generators, distributors and New Zealand Aluminium Smelters (NZAS) to practice working through contingency plans across multiple CIMS teams. This was postponed due to COVID-19.

We also worked with generators to conduct two successful black start tests this year:

[4] GridX: a leading provider of big data, cloud-based Business Operation Support System to utilities and retail energy suppliers.

- Aviemore on 17 August 2019 - this included a successful demonstration of the remote synchronisation functionality.
- Clyde on 2 November 2019 - recommendations have been made to streamline future testing or use of black start at Clyde.

Credible Event Review

Last year we developed a methodology which uses a framework to identify potential credible events and consider the probability of the event, the cost of not mitigating the risk (including loss of supply), and the costs of mitigating the risk. This methodology is used to classify each credible event as either a contingent event (CE), an extended contingent event (ECE) or 'Other'[5]. This year, the methodology was applied to the classification of busbar frequency risk. The only amendment proposed was that Manapouri will now be treated as an 'Other' event during bus outages, where previously this had been treated as ECE. The new policy took effect on 13 January 2020.

Actions from the 2017 South Island AUFLS event

All remedial actions arising from this event were closed this year. These included:

- Creating a change lead role to provide oversight and ensure the effective delivery of operational change arising from any project across Transpower.
- Delivering against the actions identified in an external risk and assurance review. The review was positive, and commended improvements over the last 24 months. Recommendations from the review are being monitored for Transpower's Board Risk committee.
- Publishing the procedure for the reporting of major incidents and near misses.
- Developing a procedure for system operator significant incident reporting, which has been used to investigate a number of moderate events this year.
- Working to improve the risk management framework by documenting a process for capturing/maintaining risks, consequences and associated controls.
- Completing both basic and lead investigator Incident Cause Analysis Method (ICAM) training for relevant people.
- Updating the system operator compliance policy and associated event reporting and investigation procedure to strengthen requirements for the timely reporting of breaches.
- Preparing for a follow-up audit of use of command language in the control rooms.

In June, a final decision was reached by the Rulings Panel in relation to the AUFLS event, penalising Transpower in both its roles as grid owner and system operator for its part in the event. The findings and decision of the Rulings Panel have been accepted and several operational changes and process improvements for both the system operator and grid owner have been implemented as a result.

1.7 Enabling new generation

We completed commissioning activities to enable a variety of new generation on the power system. In February, Todd Generation Taranaki Limited commissioned their new Junction Road (2 x 52 MW gas turbine) generating station, located close to New Plymouth. Other commissioning work for 2020 has been delayed due to work stopping during the COVID-19 lockdown. However, the following three projects are well underway:

- Ngawha (30 MW geothermal into Kaikohe 110 kV)
- Turitea North (118 MW wind into Linton 220 kV)
- Waipipi (130 MW wind into Waverly 110 kV).

[5] For an event classified as 'Other', the policy is not to constrain loads to pre-contingently manage the event.

With similar commissioning dates being targeted by customers, we will need to manage their expectations should clashes occur for access to the grid for testing.

Enquiries for smaller generation, such as potential solar farm connections in Northland have also been received. At least one of these connections may also include a battery. Heightened interest in smaller distribution connected generation has resulted in approaches for commissioning support, some at short notice with commissioning only months away. This involves working with the asset owner to obtain asset information and determine any obligations they might have.

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

Part 2: Enabling a more efficient market

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

2.1 HVDC 2020 planned outages

Transpower, as grid owner, had major outages of the HVDC poles from January to March 2020. As well as the annual maintenance and inspection of the HVDC equipment, the outage period was required to reconductor the Churton Park section of the HVDC Benmore-Haywards circuits 1 & 2 and replace Pole 2 control system equipment at the Haywards and Benmore converter stations. This required the industry to work in a coordinated way, and as system operator we were keen to learn from the lessons identified from the 2018/19 HVDC outages to improve communication with industry.

Communications

Joint industry briefings (with the grid owner) began in July 2019 with a follow-up meeting in October. System operator representatives provided advice on generation margins and treatment of frequency keeping during outages. In addition, we provided the system operator review of the testing plan, reminders of the changes to the New Zealand Generation Balance (NZGB) and industry notifications for low residual situations. The November NZGB report was published early in order to present the analysis at the October briefing. This included a detailed analysis for a number of scenarios, including reduced thermal generation due to the Ahuroa and Pohokura outages, and the potential for unplanned outages during the scheduled Pohokura pipeline inspections. The briefings were attended by traders, generators, retailers, large industrial users, the Authority and OMV.

We set up a webpage on the system operator section of the Transpower website to share information, which continued to be updated throughout the outage period. Extensive industry engagement and increased collaboration with customers and the gas industry was undertaken throughout the period of the outages.

HVDC expert engagement

TransGrid Solutions (TGS), an independent consultancy from Canada, was engaged to review testing requirements and reinforce impartiality. TGS has experience with New Zealand's HVDC, and has also been involved with other HVDC projects around the world. The TGS report concluded that the proposed work would not impact the dynamic performance of the HVDC link. TGS also recommended two further tests which were formally conveyed to the grid owner with a request to update their proposed testing accordingly. The grid owner subsequently modified proposed testing to take the TGS recommendations into account.

Outage scheduling

As a result of industry co-operation:

- Transpower's grid owner rescheduled the HVDC 2020 bipole outages during the January–April period to weekend dates. Analysis confirmed a lower risk of generation shortfalls, compared to the original weekday dates.
- Assumptions were tested with generators and the gas industry for the Pohokura gas outage scheduled for 11-24 March 2020 to coincide with the HVDC outages.
- Genesis rescheduled a Huntly 1 outage.
- Initial analysis based on the available outage information and reduced gas, low wind scenarios showed that N-1-G shortfalls[6] may be possible during the Ahuroa outage, 8-23 February. These shortfalls reduced significantly when some customers rescheduled outages outside this period.

In advance of the HVDC outages, options were discussed with the Authority to ensure participants updated offers in the week-ahead schedules, as this can have implications for the accuracy of security assessments. The Authority Chief Executive issued a letter to the chief executives of relevant market participants which helped to support successful outcomes.

Lessons learned

The outages completed on Saturday 28 March with the successful return of Pole 3 to service – almost two weeks ahead of plan. These 13-week outages were the most significant outages since Pole 3 commissioning in 2013.

We conducted a review of lessons learned through the planning and implementation phases. There was positive feedback from external stakeholders on the overall approach and detail of communications, planning, collaboration and governance arrangements. Suggestions for improvements were also captured, including earlier development and recognition of scenarios, tailored HVDC refresher training for real-time teams, and encouraging stakeholders to raise concerns early. Further feedback was received in a draft report from the Authority's independent reviewer. Their review focused on the risk assessment and communication in the planning and implementation of the HVDC outages by both grid owner and system operator. The report was supportive of system operator planning and approaches.

2.2 Planned Outage Coordination Process (POCP) review

This year we reviewed the POCP process and held a series of meetings with representatives from a cross-section of organisations involved in the energy industry to form a Technical Advisory Group. As part of the meetings, we provided an overview of the tool functionality issues and covered a wide range of topics. Engagement with POCP has increased over the years, and there are now 1,500 logins to POCP a month compared to 118 in 2013; this review was used to highlight the range of different requirements from the process.

[6] The difference between the available generation capacity and the capacity required to securely supply demand after the occurrence of the worst-case contingent event (i.e. reserves need to be restocked to cover the next worst case contingent event).

The final report for the POCP review was published on our website in March and the system operator response followed in July 2020. Recommendations included making POCP (or an alternative platform) mandatory to ensure quality outage information for the system operator to make assessments; for the system operator to provide industry with information on which type of outages materially impact system security; and to progress the first set of suggested enhancements to the tool. We are also developing additional training and information materials for users to assist with using the web-based tool.

In addition, in June we made changes to POCP to enable Transpower tentative outages to be visible. This has provided industry with further visibility of Transpower's outage plans, and the effects of these tentative outages on generation balance will also be seen in NZGB.

2.3 Innovation

Real Time Pricing (RTP)

The RTP project will deliver accurate and reliable spot prices immediately after the finish of each trading period.

Our focus this year has been on preparing detailed solution requirements and high-level design for the technical solution, refining the operational impacts of moving to real-time pricing in the control room, considering the business impacts to the system operator market support functions, and completing the detailed planning for the build and implementation phase.

The detailed bottom-up baseline effort and duration planning for the capital delivery phase of the project resulted in a delivery cost higher than the previously stated upper end cost. It also identified the need for a small increase in project duration. The delivery business case was approved by the Authority Board on 6 August 2020.

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

IQANZ have provided an independent quality health check of the project. The report was positive, concluding that the likelihood of the project meeting its objectives is "likely" given the strong foundations in place. The recommendations in the report are designed to strengthen existing practices which will support the project as it moves into its delivery stage.

Dispatch Service Enhancements (DSE)

DSE allows participants to receive dispatch instructions via ICCP or web-services. It also enables the legacy GENCO system to be decommissioned and a greater array of information to be sent with dispatch instructions.

The new dispatch interfaces were successfully commissioned into the market system on 8 August 2019 with deployment of additional functionality (ICCP block 5) on 24 October. As of August 2020, three participants had transitioned over to the new DSE platform. Participants must be transitioned by the end of December 2020.

The DSE project is the first Service Enhancement project delivered by Transpower under SOSPA. Post the initial deployment, we commissioned an IQANZ review to provide an independent assessment of the project's investigation and delivery phases. The report highlighted that the final DSE product is fit-for-purpose. It also documented key lessons from the project and recommendations for future Service Enhancement projects which we have shared with the Authority.

Wind Offer Arrangements

The new Wind Offer Arrangements went live on 19 September 2019, enabling wind generation to be offered in the same way as other generation is offered into the market (through multiple tranches and unrestricted offer prices).

We were also able to fast-track our part of an Authority initiative to remove the payment of constrained-on to generation when it was down-ramp rate constrained, by including the market system changes required for that proposal the wind offer arrangements project.

Situational Intelligence

Streaming analytics is the first part of the Situational Intelligence programme. It will provide a foundation for future development of the Situational Intelligence solution as well as establish real-time feeds from critical systems (SCADA and the market system). Situational Intelligence will enable the business to visualise data, create business rules and alerts, and establish business processes to support real-time decision making.

As part of this project, training was completed in Agile project management methodology - this is the first project in which we have used this methodology. This collaborative style of working was able to continue during the COVID-19 lockdown. During this period both the planning and organisation stage (sprint zero) and the first development sprint were completed, delivering real-time dispatch generation data from SCADA and the market system into the Situational Intelligence application.

The project is forecast to deliver the first increment (a dashboard populated with market system and SCADA live data) in October 2020.

Extended Reserves

The Extended Reserves project was reactivated by the Authority with a refined focus on achieving a secure transition to a 4-block Automatic Under Frequency Load Shedding (AUFLS[7]) scheme in the North Island.

Prior to the reset of the Extended Reserve project, system security for identified extended contingent event (ECE) risks with the existing 2-block AUFLS scheme had been confirmed. However, we also saw benefit to New Zealand in moving to a simple 4-block AUFLS scheme, as less load may be shed responding to an ECE or 'Other' event.

A reset of the project was approved by the Authority Board in October 2019. The project will be delivered incrementally, starting with an investigation outlining what data would need to be gathered for the existing 2-block and future 4-block scheme to enable a transition and provide ongoing assurance of AUFLS performance.

The second phase of the work will commission the system operator to deliver a data portal to collect the 2-block AUFLS data from North Island providers.

2.4 Planning for the future

Distributed Energy Resources (DER)

In Whakamana i Te Mauri Hiko, Transpower examined the potential future scenarios that may impact New Zealand's energy future and what can help enable the decarbonisation of New Zealand's economy.

Internationally, Distributed Energy Resources (DER) has been highlighted as a potential enabler of decarbonisation. As system operator, we commissioned external consultants to investigate the potential value of DER in a New Zealand context. By commissioning and publishing this report (expected late August), we seek to advance a discussion on how the electricity industry and market may need to evolve with increased penetration of DER.

The report broadly considers the following:

- The value of DER to the New Zealand power system

[7] 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.

- The use of DER that could be encouraged with the right pricing
- The impact of barriers to deployment and transaction cost.

New Generating Technology for Ancillary Services

On behalf of the Authority, we undertook an investigation to verify whether Battery Energy Storage Systems (BESS) and other inverter-controlled devices could offer into the market as instantaneous reserves (IR) using the existing IR offer types in the Code. Following a literature review of how other markets have enabled this, we conducted an assessment of the applicability in New Zealand. We also held industry workshops to understand impacts on the Code, market, and power system overall. Our final report outlined the regulatory and IST system changes required to facilitate the efficient operation of storage technology in the wholesale market and enable batteries to contribute to reserve response. Our report presented to the Authority recommended changes to the Code, and that technical performance requirements be moved into the ancillary service procurement plan.

Inertia monitoring

Reactive Technologies offer a global service to monitor system inertia. To understand how this may be of value in a New Zealand context, we started an inertia monitoring pilot project. The aim is to evaluate the performance of this monitoring technology against our existing inertia modelling techniques and determine if, and when, New Zealand would want to invest in a system of this nature. The COVID-19 level 4 lockdown initially delayed the installation of monitoring devices; however, all devices have now been installed. The trial is scheduled to be completed during September 2020.

Reserve Management Tool (RMT)

RMT calculates the amount of instantaneous reserve to be procured for each trading period. This is a key component in managing risk and is an important component in determining the secure scheduling of generation. As the power system continues to evolve, we need to consider how these changes will affect the quantity of reserves procured. A project to define enhancements to RMT began in February to make sure the on-going functionality of the tool remains fit-for-purpose. The delivery business case for this project is scheduled for completion in August 2020.

Load forecast sensitivity schedules

As price forecasts can be very sensitive to changes in load, we have developed a proof of concept to investigate the sensitivity of prices and carbon emissions to changes in demand, specifically the impact of +/- load variations. The proof of concept went live on our website in August and will run for 3 months. Our analysis of the outputs, as well as industry feedback, will inform future work in this area.

Customer Portal – SO modelling database

Over the next 2-3 years, we plan to update the means by which customers can interact with our various databases. The first phase of the Customer Portal project, delivering a like-for-like replacement of the system operator modelling database, went live in March. The data has been migrated to new platform and planning is underway for the second phase of project – which will re-platform the system operator Asset Capability Statement (ACS) register to the same platform.

SCADA programme

SCADA operational data provides us with the key information to optimally and securely run the power system. It is therefore vital this software, which monitors and controls processes and devices, is kept current by rolling out continuous improvements. New SCADA environments to support the delivery of the SCADA programme were

delivered in January. Parallel work in the SCADA programme involves upgrading the SCADA front end, habitat and desktop; and working on ICCP, file transfer, and the energy management platform.

Market System (MS) Simplification

The MS Simplification project re-platforms the market system. The first phase is to move from an out-dated software code to a modern language to reduce complexity and cost for ongoing development and maintenance activities. The project successfully commissioned this non-functional change in July. The deployment was a major undertaking for both IST and our co-ordination centres and required running of parallel operations prior to final deployment and go live.

2.5 Outage Planning and co-ordination

All proposed outages on the system by generators, direct connects and transmission owners require assessment for system security. Part of this assessment highlights when coincident outages require parties to evaluate and possibly reschedule their plans. Providing information from the planning stage through to real-time is critical to enabling effective decision making for market participants.

We successfully dealt with a high number of outage changes this year, particularly in the spring maintenance season while managing the outage churn assessments and rework as part of the COVID-19 response. A significant proportion of outage changes were Short Notice Outage Requests (where requests are less than 12 weeks out) which adds an extra degree of complexity to the process. Other complex issues we managed this year included:

- Two significant but successful Manapouri bus outages
- Kawerau outages - we published a CAN to inform participants
- Kupe gas outage - we published an outage assessment for the period of 13-15 November when there was a tight generation period during the Kupe gas outage (30 October–27 November). This tight situation was due to generator outages of Huntly unit 5 and the Taranaki combined cycle plant concurrent with the transmission asset outage of Te Mihi–Whakamaru 1
- Marsden T6 and STC maintenance
- Bream Bay- Huapai outage.

Advice was also provided on the potential rescheduling of outages following the loss of the Islington-Livingston circuit.

Transpower published its 2020/21 draft annual outage plan on 29 January. We provided feedback on the plan, in our role as system operator, identifying potential security issues or concurrencies with other asset owner outages that may cause security concerns.

Transpower held its annual outage planning forum on 16 March. This is jointly hosted by teams from the grid owner and the system operator functions. The grid owner shared the year-ahead outage plan with stakeholders, and outage planning issues were discussed from both a grid owner and system operator perspective. This opportunity was used to inform a range of related stakeholder initiatives, and smaller, focussed training sessions were held to understand how customers use tools provided by the system operator.

Part 3: Continuous Improvement

We are committed to improving the service we offer to the industry and responding to feedback we receive.

3.1 Addressing Authority recommendations

Recommendation 1: Ensure that future self-reviews include trends that demonstrate performance over time and discussion of any adverse trends (including trends from the results of the customer satisfaction survey).

In response to this recommendation, we have included a number of trends as Appendix 2. This information highlights our own performance, as well as the external factors influencing our performance.

Recommendation 2: Review the effectiveness of security of supply practices.

A key focus of our security of supply work this year has been the move to use of analytic tools such as Matlab to enable us to more easily consider and produce scenarios in response to changing conditions. We believe our practices are effective but will undertake an audit this year to confirm whether there are other areas that could be improved.

3.2 All Ideas Matter (AIM)

To capture and leverage staff ideas, we developed an internal portal called "All Ideas Matter" (AIM) where ideas can be registered and tracked. It has been well supported with over 19 suggested changes already implemented, including process improvements, cultural changes, tool enhancements and areas for targeted training. Each idea is categorised by urgency and identifies expected benefits. We have recently re-platformed this portal to enable better tracking of the existing suggestions and improve our reporting.

3.3 Communications and engagement

This year we refreshed both the look and substance of some of our industry communications with a focus on making them more customer-centric. This included:

- Updating our operational notifications (customer advice notices, warnings and grid emergency notices) to enable participants to more easily recognise and respond to different notices.
- Updating wind forecasting trial graphs in the WITS (Wholesale information and trading system) data to improve our industry reports and interfaces. These are available on Transpower's website.
- Co-ordinating an industry review of POCP.
- Improving our market insights including simplifying the market summary and the addition of a Q&A section on the Transpower website.

Industry chief executives' feedback

The Authority engaged an external consultant to interview industry chief executives to seek feedback on the system operator role. This information was shared with us at an Authority System Operations Committee meeting. A key take-away from the discussion was that although we have put a lot of effort over the last 12-18 months to work with the wider industry - and shared our experiences with the Authority and the System Operations Committee - this has not necessarily been seen at industry chief executive level. Consequently, we are working to raise the profile of the work we have been doing at all industry levels.

Customer participation survey

Each year we survey stakeholders to gain feedback on the service we provide. Our overall customer satisfaction score increased from 85% last year to 92% this year. Feedback indicated that the area where respondents considered our performance had improved the most was focused on communications, assessment and planning of outages.

In response to earlier feedback from the Authority that the system operator improve meaningful participation in customer satisfaction surveys, we undertook the following changes this year:

- Increased the number of channels for distribution of the survey (email, industry forums, Transpower's customer newsletter, the Authority's Market Brief and Transpower's external website).
- Provided a point of contact for respondents should they need to clarify anything.
- Included an option for respondents to add further commentary and/or questions.

As a result, 29 responses were received this year – a 50% increase from the previous year's responses.

Asset Owner engineering forum

Our Asset Owner Engineering forum is an annual gathering of New Zealand's generation and distribution asset owners. It offers an opportunity for asset owners to interact with system operator staff as well as other asset owners and encourages collaboration at a technical level. The forum also provides an opportunity to discuss any challenges asset owners may have in meeting the required Asset Owner Performance Obligations (AOPOs). This year's forum focused on the successful commissioning of assets, with the aim of clarifying, informing and improving the commissioning process. The event was well attended and included representatives from generators, distribution companies and the Authority, as well as representatives from several academic institutions.

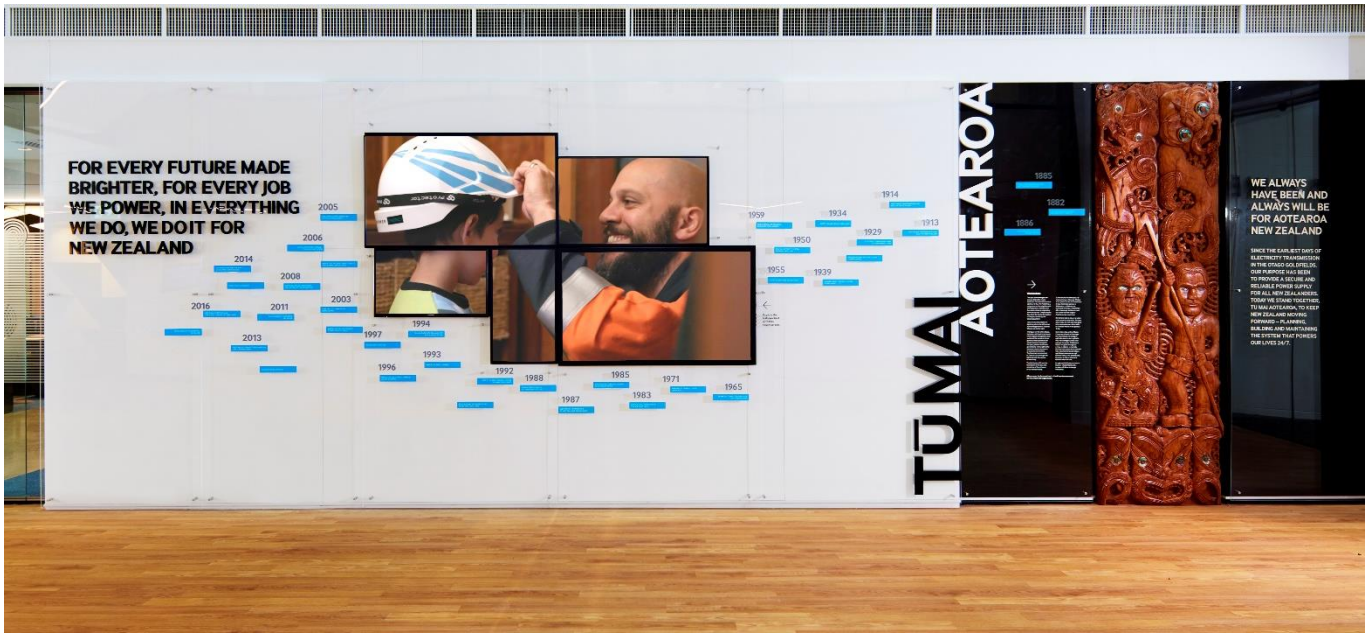
Reviews of international events

Despite the differences between the system operator functions across the world, the underlying commonality means we can benefit from each other's experience. Whenever there is a notable power system event in another jurisdiction, Transpower studies the event to see if there are any risks in the delivery of our current service and/or opportunities to improve our system operator service.

On 25 August 2018, there was a large power system event separating the Australian power system into three islanded systems with associated interruptions of electricity supply to customers. Transpower carried out a review to understand if New Zealand could benefit from implementing any of the eight recommendations made by the Australian Energy Market Operator (AEMO). Our review was published in October and identified three issues that may have implications for New Zealand – inverter standards, maintenance of special protection schemes and managing power system oscillations.

Another significant power system event we examined was the major loss of power on 9 August 2019 in the United Kingdom which impacted over 1 million customers. An overview report assessed if New Zealand could benefit from implementing any of the recommendations made by National Grid as the Electricity System Operator in its investigation. This report was published in March and identified three issues that may have implications for New Zealand – system resilience standards and embedded generation, critical infrastructure and communication.

We also closely followed the investigation and findings from the 16 June 2019 Argentina, Uruguay and Paraguay blackout with the aim of identifying lessons for New Zealand. System operator representatives joined a webinar hosted by the Electric Power Research Institute (EPRI) on what they had determined, discussing broader equipment and system failures leading to blackouts.



Appendix 1: Our Performance

A1.1 Progress against business plan

Our 2019/20 Business Plan identified 23 actions and initiatives, across our five strategic priorities. We completed (or made good progress against) 22 of these. Although we did not produce our planned future thinking report due to COVID-19 disruptions, we did contribute to the development of Transpower's Whakamana i Te Mauri Hiko - Empowering our Energy Future.

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 annually in late October as an addendum to the self-review and will show details about our financial performance as system operator.

A1.3 Performance metrics

A total of 20 performance metrics were agreed with the Authority to represent our overall performance for 2019/20, with weighting for the key metrics.

Based on this weighting, our overall score for 2019/20 was **81.25%**. This exceeds the target of 80% at which the full incentive payment is paid to the system operator.

Performance metrics dashboard

Customers are informed and satisfied

		Annual Target	Actual	Points	Target Met
Annual participant survey result		81%	92%	5	☑
Annual participant survey response rate for first tier stakeholders	Response rate from first tier stakeholders	80%	80%		☑
On-time special event preliminary reports		90% ≤ 10 business days	N/A	5	N/A[1]
Industry leadership and insights	Future thinking report	≥ 1	0	5	
	Publicly available market insights	≥ 8	50	5	☑
Quality of written reports		100% of agreed standard	100%		☑

Code compliance maintained SOSPA obligations met

	Annual Target	Actual	Points	Target Met
Market impact of breaches remain below threshold	≤ 3 @ ≥ $40k	0	10	☑
Breaches creating a security risk remain below threshold/within acceptable range	≤3	0	10	☑
On-time Code and SOSPA deliverables	100%	100%	10	☑

Successful project delivery

		Annual Target	Actual	Points	Target Met
Project delivery	Service Maintenance projects	≥ 60% on time	50%		
		≥ 60% on budget	50%		
	Market Design and Service Enhancement projects	≥ 60% on time	0%		
		≥ 60% on budget	50%		
Accurate capital planning		≥ 50%	25%	10	

Commitment to real-time operation

	Annual Target	Actual	Points	Target Met
Sustained infeasibility resolution	80% ≤ 1 business day	87%	5	☑
High spring washer resolution	80% ≤ 1 business day	100%		☑

Fit-for-purpose tools

	Annual Target	Actual	Points	Target Met
Capability functional fit assessment score	75%	67.61%		
Technical quality assessment score	65%	65.60%		☑
Sustained SCADA availability	99.90%	99.98%	10	☑
Maintained timeliness of schedule publication	99%	99.99%	10	☑
	Score = 65/80 = 81.25%		**Total points: 80[1]**	**Points where target met: 65**

[1] There were no special events in 2019/20; the points associated with this metric are disregarded for the purpose of calculating performance

Appendix 2: Trends

Trends are an important way of evaluating performance over time; they can be both incremental or a step-change resulting from one-off events or changes to processes or tools.

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 context in which we operate; this is affected by factors such as industry participant responses and actions, and weather impacts.

We have placed the trends included in this appendix into two categories:

- Our performance – which notes the trends in the functions of which we have direct control
- The external environment – to show 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.

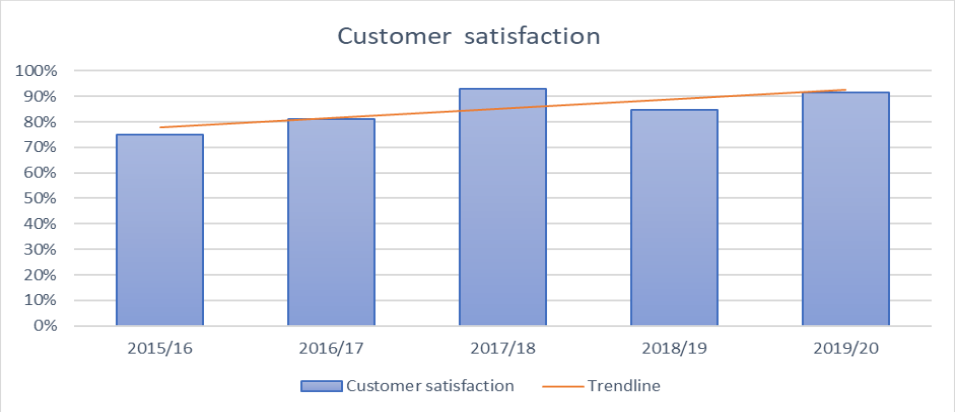
For each of these categories we have grouped the information under our critical success factors that form the framework to our performance metrics.

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

A2.1 Our performance

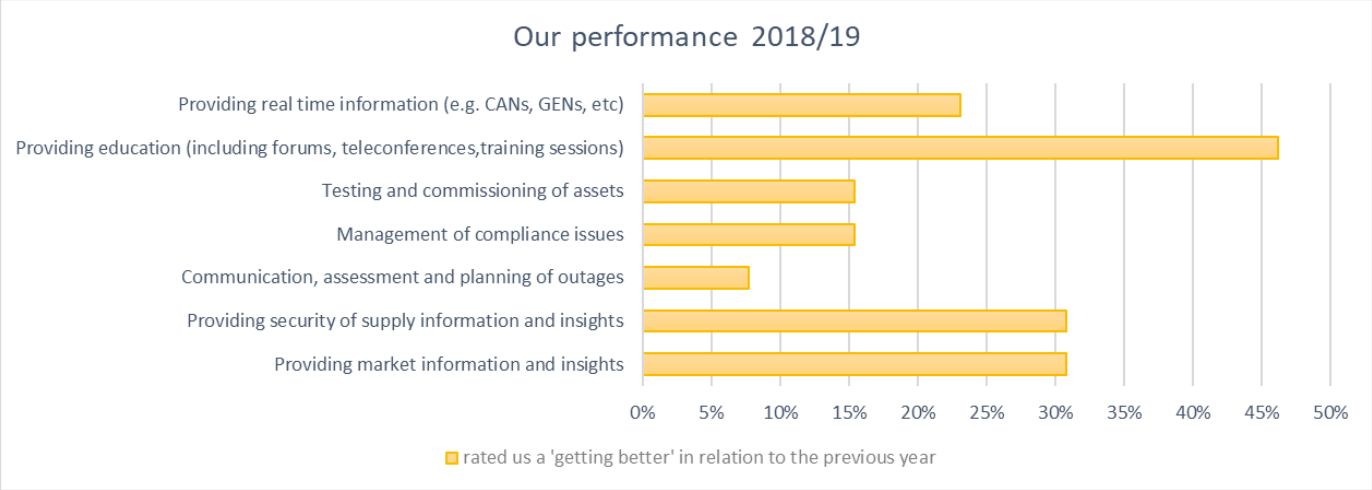
Our customers are informed and satisfied

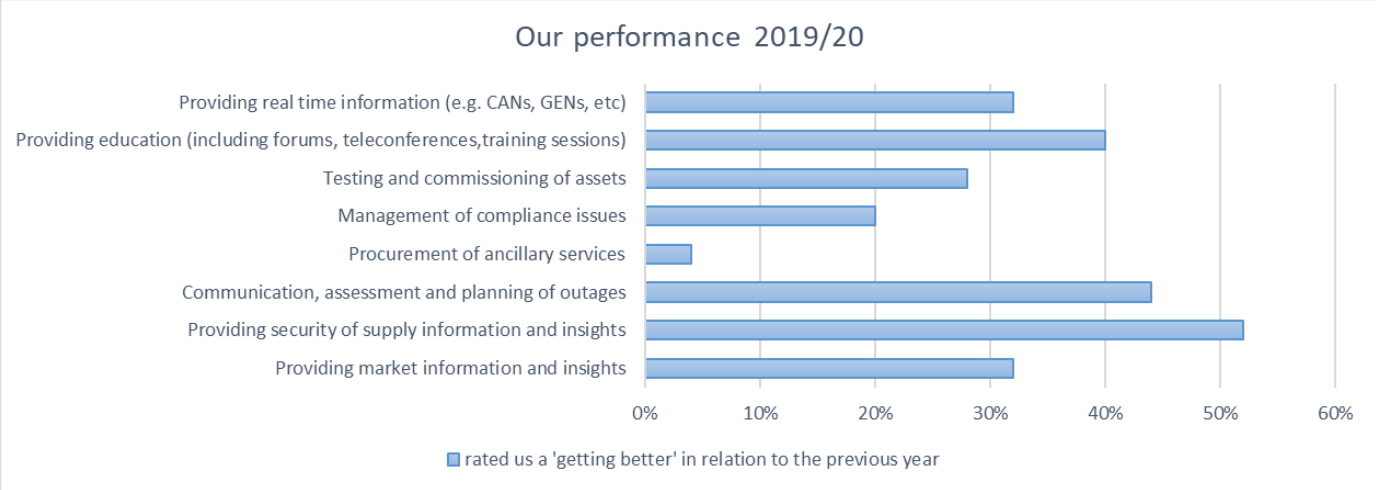
Overall customer satisfaction



Our overall customer satisfaction score increased from 85% last year to 92% this year. The score reflects responses that rate our service as 'Good' and 'Very good'.

Trends in specific performance areas

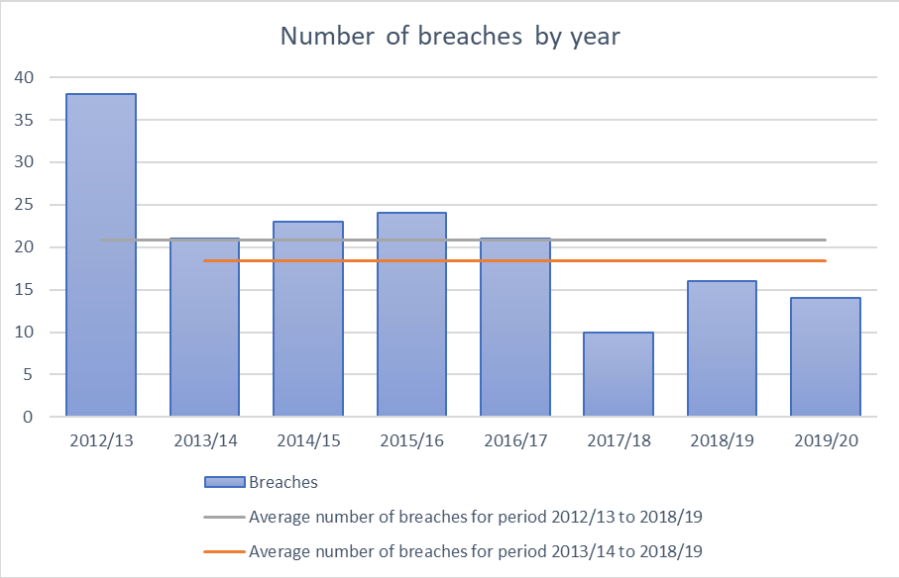




Both in 2018/19 and 2019/20, respondents have rated our performance in these surveyed areas as 'getting better'.
Note: We did not ask respondents about Procurement of ancillary services in 2018/19.

We maintain Code compliance

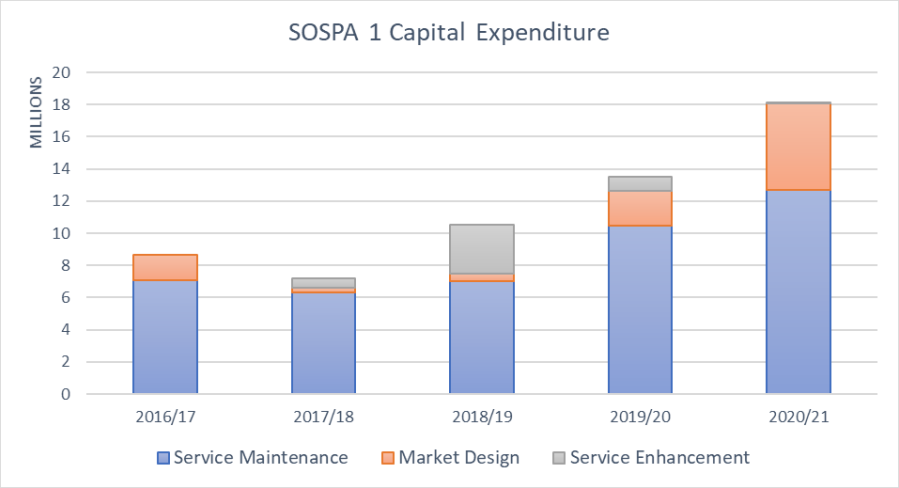
Breaches



The number of breaches each year continues to stay below the average since 2013/14. This year none of the 14 reported breaches had any noticeable market impart.

We deliver projects successfully

SOSPA 1 Capital Expenditure



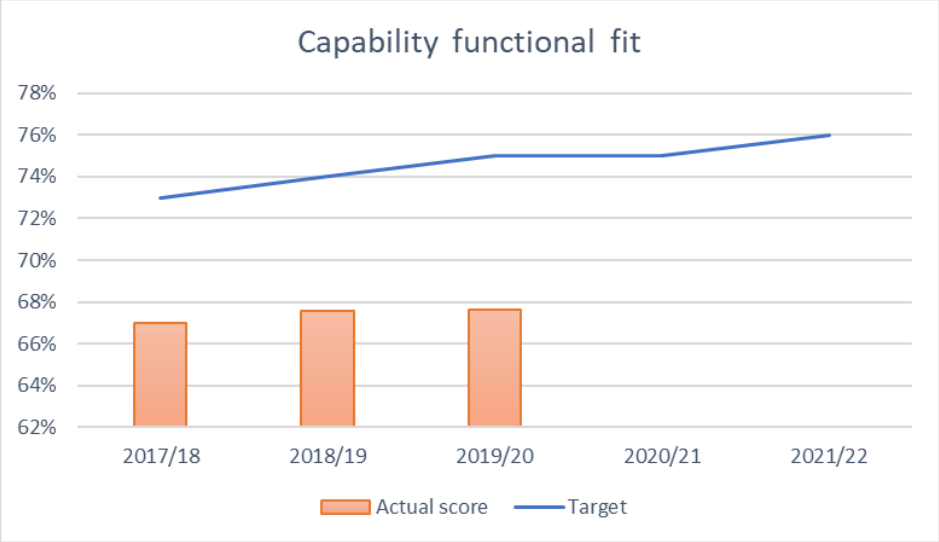
During the current period of SOSPA funding (SOSPA 1), our capital expenditure has trended upwards (2016/17 – 2019/20) and is projected to increase further in 2020/21 as we embark on the delivery stage of the RTP project whilst continuing to enhance both the technical quality and capability function fit of our tools.

Our tools are fit for purpose

Technical quality assessment score

We continue to improve the technical quality assessment score year-on-year, 65.6% this year compared to 63% last year. This reflects our commitment to improving the market system performance through initiatives such as Market System Simplification.

Capability functional fit assessment score

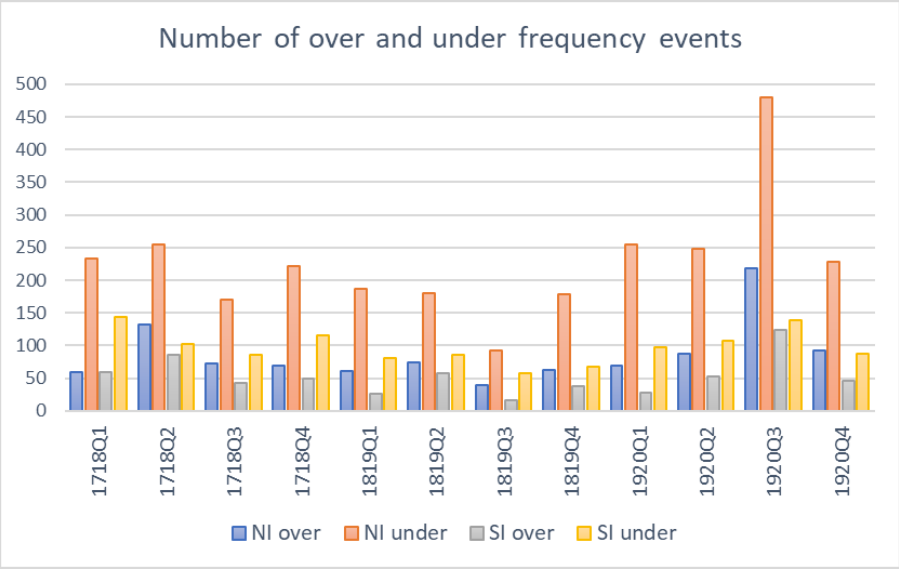


While the capability functional fit assessment score is still below the target, this reflects the priority to improve the technical quality and reduce complexity, which will then enable us to build on capability. We anticipate that we will begin to see larger changes in 2-3 years.

A2.2 The external environment

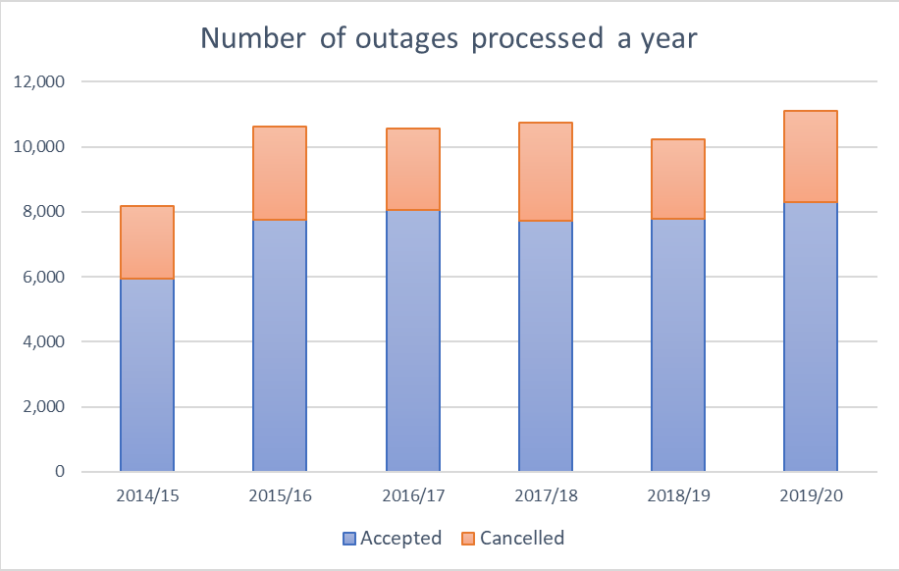
We are committed to optimal real time operation

Over and under frequency events



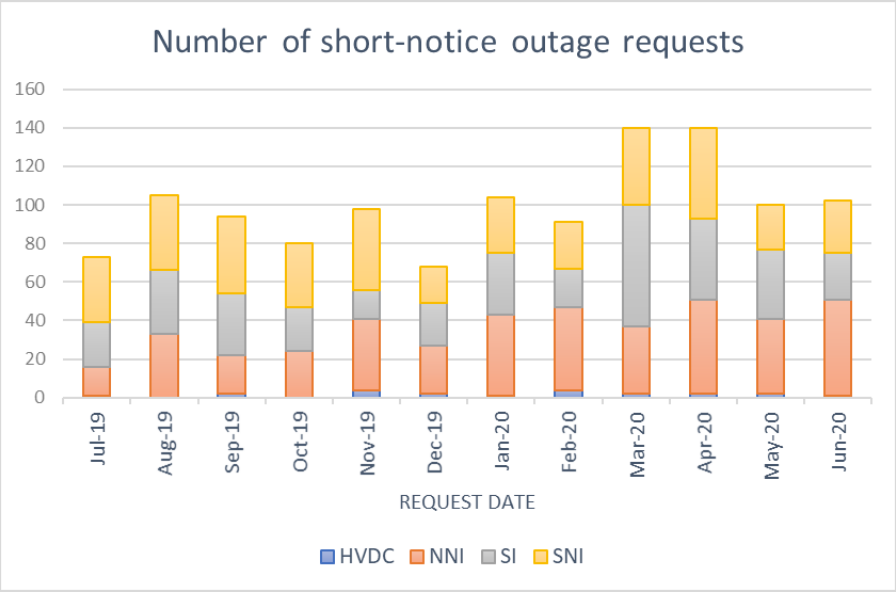
Quarter 3 of the 2019/20 financial year saw a rise in both the occurrence and durations of frequency excursions outside of the 49.8 –50.2 Hz deadband. The rise correlated strongly with the HVDC outages that lasted over the majority of the quarter. As these outages and the consequent reduction in HVDC modulation effectiveness explain the observed increase, this trend was not observed in the following quarter, quarter 4.

Outage numbers



This graph reflects the number of transmission outages processed by the system operator each year. Changes to POCP will enable us to report on generation outages in future years.

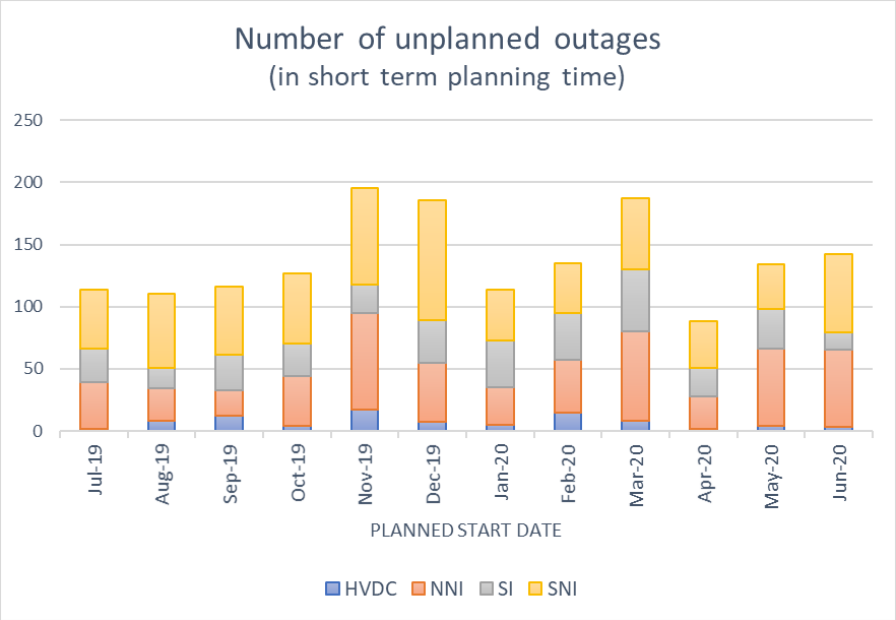
We continued the trend to process over 10,000 outages each financial year. This year the total number of outages processed increased by almost 10% to last year. There is a consistent proportion of outages cancelled each year, roughly 25%.



This graph reflects the number of transmission outages processed by the system operator this year.

It highlights that on average 100 outage requests are processed within 12 weeks of the work; noting that each request may cover more than one outage.

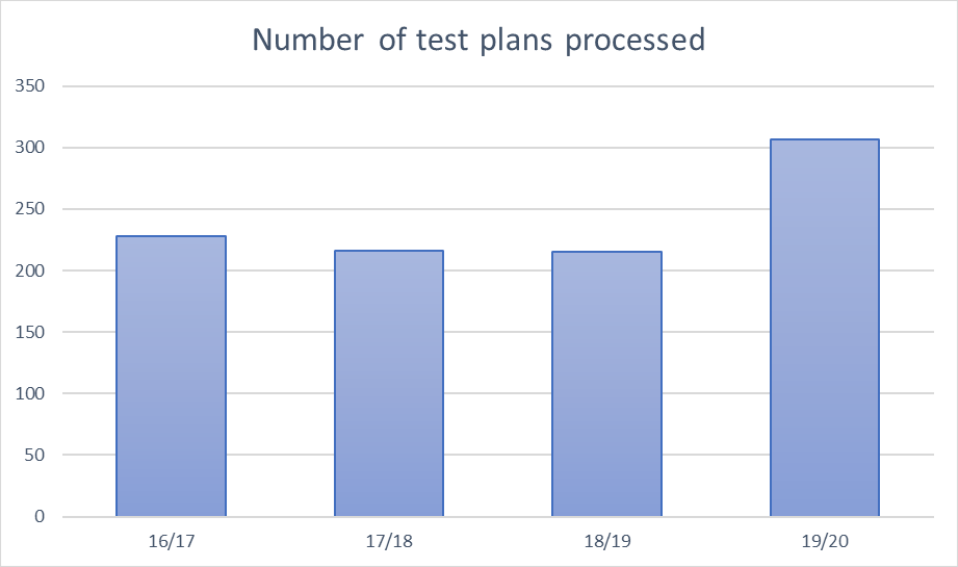
The increased numbers in March and April reflect the large amount of changes required as a result of the COVID-19 situation; an exceptionally busy period for our outage planners.



This graph reflects the number of transmission outages processed by the system operator this year.

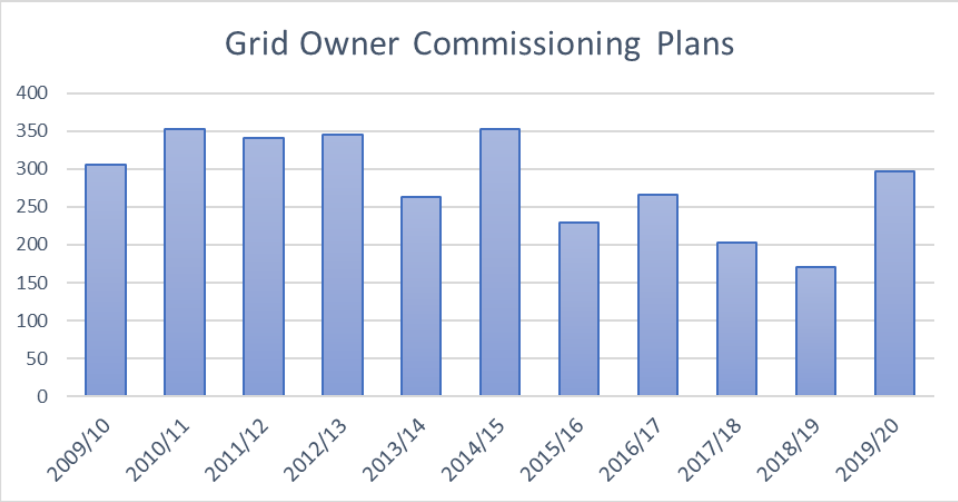
It shows the number of unplanned outages that are processed in real time. The increased workload in November and December reflects the seasonal pattern of higher workload due to weather conditions. The March data reflects the changes required at the beginning of the COVID-19 lockdown; similarly the smaller number of unplanned outages in April identify the period during the lockdown when there were no interruptions.

Test plans



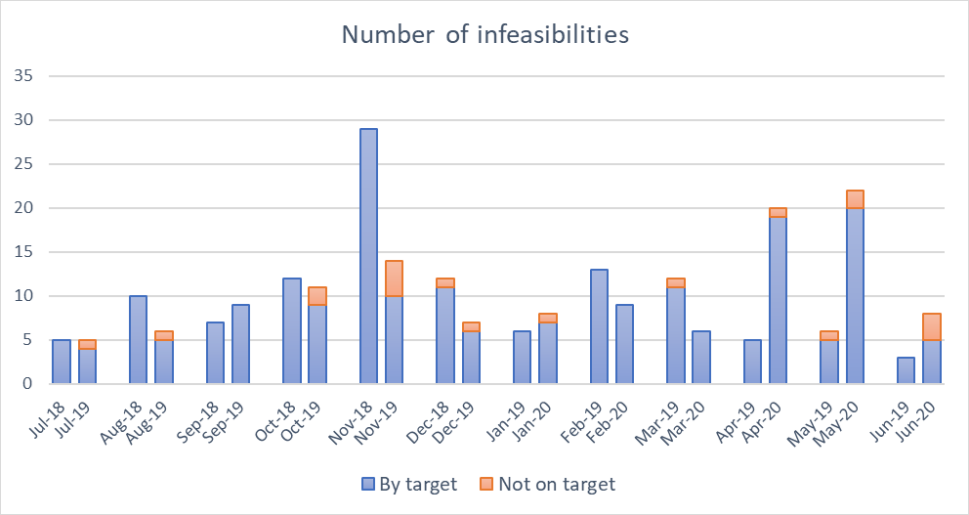
In the previous three years, the number of test plans processed by the system operator were in the range 200 to 225. In 2019/20, the number increased to 309. This 50% increase in activity can be attributed to a number of causes – test plans to ensure equipment is Code compliant, the stage in the regular testing cycle, generator commissioning and refurbishment work.

Commissioning activity



This year was the end of a Regulatory Control Period (RCP) which usually results in the system operator processing a higher than normal number of grid owner commissionings, similar to what can be seen in 2014/15. Although the usual pattern of the longer projects coming to fruition in the final year of an RCP period did occur, we were anticipating more activity prior to the COVID-19 lockdown period.

Infeasible solutions

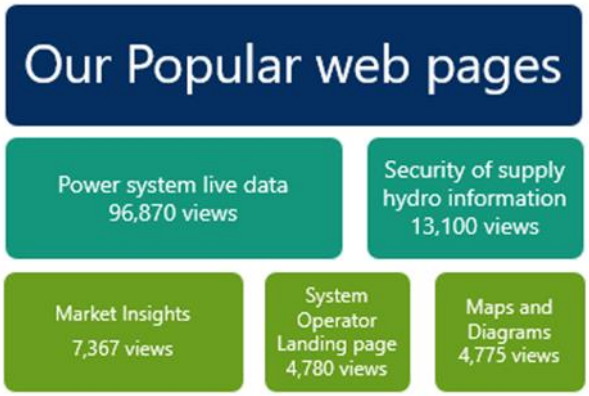


This graph compares the number of infeasibilities that occur on the first solve of final pricing by NZX. The Code requires the system operator to use reasonable endeavours to resolve the infeasibility in the timeframes prescribed in the Code. Resolution that is outside the target timeframe is a reflection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

In April and May this year we saw a large number of infeasibilities compared to the previous year, and to other months this year, this was a result of participant behaviour not offering the correct ramp rates.

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 the occurrence of infeasibilities.

A2.3 Website activity



Our website this year provided targeted information for industry for both the HVDC 2020 outages and during the COVID-19 situation. This led to increased traffic during these periods.

A2.4 Our people

Engagement

In 2019, we began using the Peakon framework for our people engagement surveys. During this time, the participation rate (a key indicator of engagement) has been high, varying between 89-92%. 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 0.6 above the global Energy and Utilities Benchmark (and in the top 25%).

Diversity

Age:

AGE GROUP	NUMBER
< 20 YEARS	1
20-29 YEARS	12
30-39 YEARS	33
40-49 YEARS	34
50-59 YEARS	48
60 YEARS +	4

Gender:

ROLE	F	M	TOTAL
NON PEOPLE MANAGER	25%	75%	110
PEOPLE MANAGER	19%	81%	16
SENIOR LEADER	50%	50%	6
GRAND TOTAL	**34**	**98**	**132**

In the 19/20 year, of the 16 people hired, 7 were female (44%)

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 2018/19, which show our team includes people in various different stages of their work careers and an even gender split in our senior leader roles.

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Appendix B Indicative content of Authority's annual review of system operator performance 2019-20

1. This review of the system operator's performance is for the period 1 July 2019 to 30 June 2020. The scope of the review includes the performance of the system operator under both the Code and the system operator service provider agreement (SOSPA).
2. The role of system operator is of critical national importance. Every minute of every day, the system operator needs to perform well for consumers to enjoy a secure power system at lowest cost. Excellent real-time operations is a composition of critical disciplines in its own right, but the real-time operators also need to be supported by well-planned system maintenance and development.

The system operator has continued to perform at a high level

3. Our review concludes that New Zealanders should feel assured that Transpower has performed its critically important role to a high standard in 2019-20 and embraces the need to continually improve.

System operator proactively managed COVID-19 disruptions

4. The latter half of financial year 2020 was significantly disrupted by COVID-19. The system operator's preparations in February and March were prudent and allowed it to operate core functions with minimal disruption during the level four nationwide lockdown. Importantly, critical control room operations were uninterrupted. There was some disruption and delay to the system operator's reporting and review functions, but we consider that this was a reasonable outcome from prioritising efforts during a difficult time.
5. During the nationwide lockdown levels 4 and 3, Transpower (including the system operator) produced weekly reports for stakeholders, including the Authority. These reports were of good quality, timely and of a consistent format.
6. Additionally, changes to the power system due to the COVID-19 lockdown required the system operator to undertake additional work to adjust many aspects of its forecasting and security of supply tools. In particular, demand profiles changed significantly due to temporary business closures and/or a shift to working-from-home for many New Zealanders. This had follow-on effects for management of automatic under-frequency load shedding (AUFLS), voltage and instantaneous reserves.

The system operator's planning for an HVDC outage was greatly improved

7. The system operator successfully planned and executed its functions in relation to the lengthy HVDC outage in early 2020. In particular, the system operator's engagement with stakeholders leading up to and during the event was exemplary. The system operator took on board concerns raised previously by the Authority and the SRC around gas availability in the planning phases and undertook additional modelling.
8. The overall performance was particularly noteworthy given that our 2018-19 performance review highlighted concerns around a similar HVDC outage in late 2018. Concerns were raised at the time about gas availability and the system operator set up a working group to improve future outage planning. This appears to have been a success.

9. The planning and communication of the HVDC outage was well supported by the system operator's security of supply function. The improvements to reporting seen in 2018-19 have been sustained and are now 'business-as-usual'.

The system operator's working relationship with the Authority continued to improve

10. The system operator's working relationship with the Authority has been pro-actively nurtured over time and is now a point of strength for both organisations. Many of our staff have worked with their system operator counterparts for several years and this has led to a trusted and efficient working relationship.
11. As should be expected in a healthy relationship, disagreements have occurred. From time to time, these disagreements have led to formal escalation. While ideally such escalation would not be necessary, this typically led to quick resolution of issues.
12. We consider there would be some benefit to reviewing the relationship charter between the parties (agreed in 2010) to refresh the charter. To that end, we will be initiating a review of the charter during the 2020-21 year.

Opportunities for improvement

13. While the system operator's overall performance has been good, there are some areas which could be improved or further developed.

The Real Time Pricing project progressed, but over time and budget

14. The Real Time Pricing (RTP) project is a significant initiative for the system operator spanning multiple review periods. The Authority was very pleased with the progress of the project during the 2018-19 review period. The system operator has continued to prepare for implementation of RTP and the Authority is generally pleased with its progress.
15. However, an increase in costs over budget and a failure to meet agreed timelines was disappointing. The Authority considers it should have been notified sooner of the request to increase budget and that the issue should have been resolved prior to formal escalation. The formal escalation process worked well.

The Extended Reserves project start was delayed

16. The Extended Reserves project was reactivated during the review period. The project involves some new staff at the system operator, which brings fresh perspective, but also requires new relationship building.
17. A change to Transpower-wide IT policy disrupted the originally planned approach for procuring software services for the project. This led to a period of robust discussion confirming the available budget and required timelines for implementation. Whilst this delayed the start of the work for 2020-21, we were jointly able to maintain the original project budget and timelines.
18. We realise that this policy change was not solely under the control of the system operator. However, there could have been better communication during the change process. This would have allowed the required discussion to start earlier, reducing the impact on the project start date.

Financial forecasting

19. The system operator spent 79% of its fixed fee capex budget over the four-year 2016-17 to 2019-20 period. Contributing factors to this result were cancellation and deferral of some

projects, reprioritisation of projects and some efficiency gains. The single biggest factor appears to have been an overly conservative forecast. As this was the first period in which the system operator operated under a fixed fee for capex, some conservatism is expected. We believe this variance will be significantly smaller in future years, as the system operator has shown us it more accurately understands its risks and has grounds for more confidence in its programme and project management.

20. While total capex was underspent in aggregate over four years, the RTP project experienced significant cost overruns during this review period. The Extended Reserves project experienced a period of cost uncertainty during the review period.

21. Overall, we consider that these factors suggest a tighter focus on financial forecasting of projects would be beneficial.

Breaches

22. The system operator self-reported 14 breaches of the Code during the review period. We identified one additional breach of the Code, which was later accepted by the system operator. This total of 15 breaches continues the downward trend of breaches in recent years and is below the seven-year average of 18.

23. None of the breaches identified had a significant market impact. The majority related to the forward price scheduling process.

Accuracy of third-party data

24. We have concerns about the accuracy of third-party data supplied to the system operator under the asset capability statement process. While the onus to supply accurate data correctly lies on asset owners, we recommend the system operator review its approach to see whether a more proactive approach may be warranted as a prudent system operator.

Incorporation of disruptive technologies

25. While the system operator failed to deliver its ‘future thinking’ report for the review period, we have generally been impressed with the system operator’s openness to adapt to commercial and technological trends that are disrupting the status quo. The system operator formally proposed amendments to its Ancillary Services Procurement Plan that make that plan more technology-neutral and publicly committed itself to further improvements. The system operator provided us valuable advice on opportunities to reduce or eliminate undue barriers to various distributed energy resources.

26. We look forward to working with the system operator on various initiatives to enable disruptive technologies, acknowledging this will be ongoing effort.

There is value in the system operator increasing its inhouse economic expertise

27. In previous review periods, we have had concerns with some aspects of the system operator’s analysis of economic impacts and made recommendations accordingly. We have no specific concerns this review period, though we remain of the view that economic considerations need to be embedded deeper into the system operator’s skillsets and planning and operational processes. We think the system operator’s continued development in economics expertise augments and complements its traditional strength in engineering and operational disciplines.

Performance against quantified targets

28. The system operator achieved an overall self-assessment score of 81.25% for key metrics in financial year 2020. The Authority agrees with this self-assessment. It exceeds the target of 80% at which the full incentive payment is paid to the system operator. One of the performance metrics was not applicable because the relevant circumstance did not arise during the financial year. [2]

Response to previous recommendations

29. The system operator addressed recommendations from the previous performance review:

- **Recommendation 1**: Ensure that future self-reviews include trends that demonstrate performance over time and discussion of any adverse trends (including trends from the results of the customer satisfaction survey).
    a. The Authority is pleased with the system operator's progress on this recommendation. The system operator's self-review includes an appendix outlining trends in data and this is thorough. The system operator highlighted the adverse trend of an increase in frequency excursions and offered the HVDC outage as an explanation for the observed outcomes. We look forward to more interpretation in future self-reviews, with a particular emphasis on any trends which materially affect security and reliability.
- **Recommendation 2**: Review effectiveness of security of supply practices.

30. This recommendation arose because some issues arose that highlighted incomplete or inaccurate security of supply modelling. The system operator's main stated improvement in this area was implementing the use of more tractable analytical tools. We support this development as it should assist the system operator with future modelling work, and eliminate some sources of inaccuracy.

31. The system operator has also committed to undertake an audit to look for more ways to improve this area. While we support this undertaking, we note that such an audit is the type of response that this recommendation envisaged. Accordingly, we hoped that more concrete progress could have already occurred for this recommendation.

We have made two recommendations for further improvement

32. We have made two recommendations to the system operator in this performance review. We recommend that the system operator:

- **Recommendation 1**: The system operator reviews its approach to accuracy and compliance of asset owner information to see whether a more proactive approach may be warranted as a prudent system operator.
- **Recommendation 2**: The system operator improve its financial forecasting of projects.

[2] One of the performance metrics was that 90 per cent of special event preliminary reports would be completed within 10 business days, but the system operator was not required to prepare any special event preliminary reports during the financial year.