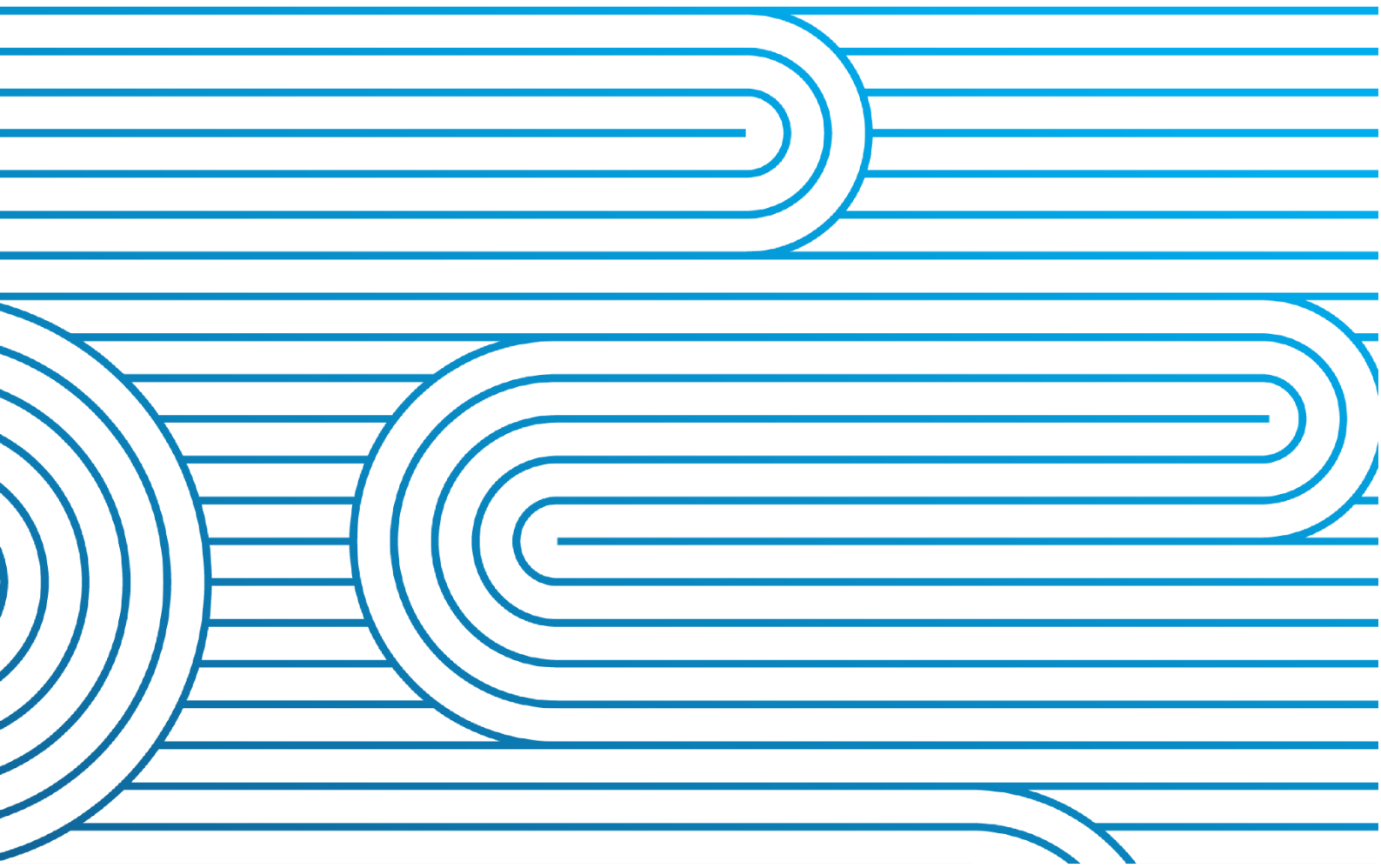


System Operator annual self-review and assessment

2021-2022

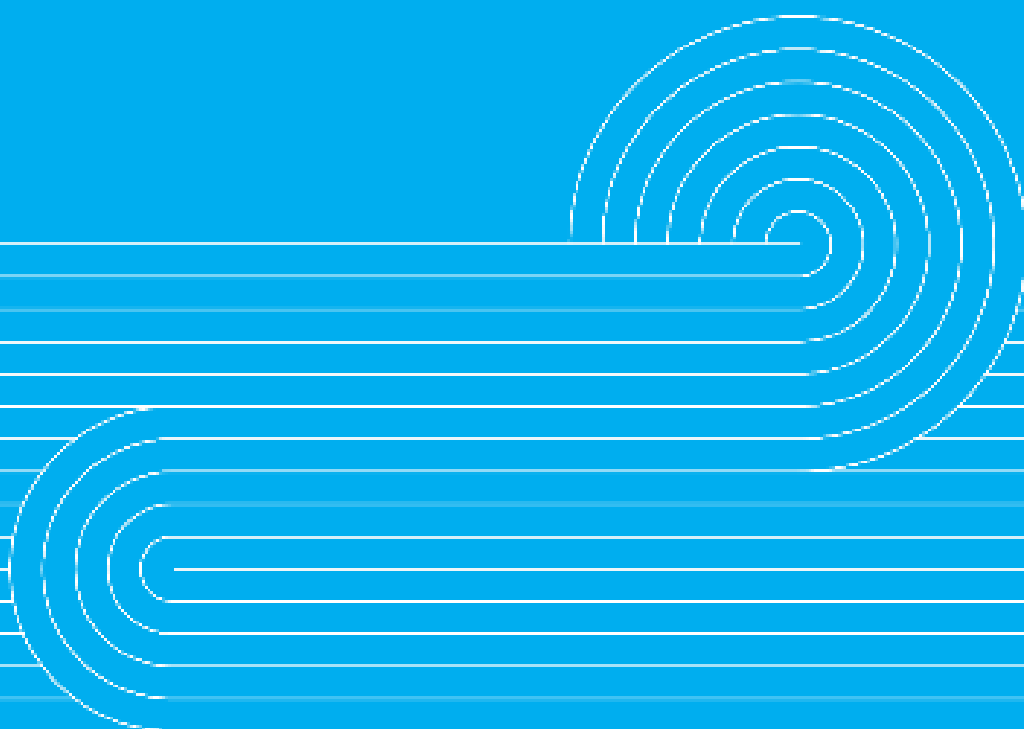
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1 About this document



1.1 Purpose

This is our self-review and performance assessment for the period 1 July 2021 – 30 June 2022, as required in the Electricity Industry Participation Code 2010 (Code)¹ and the System Operator Service Provider Agreement (SOSPA)².

1.2 Structure of the report

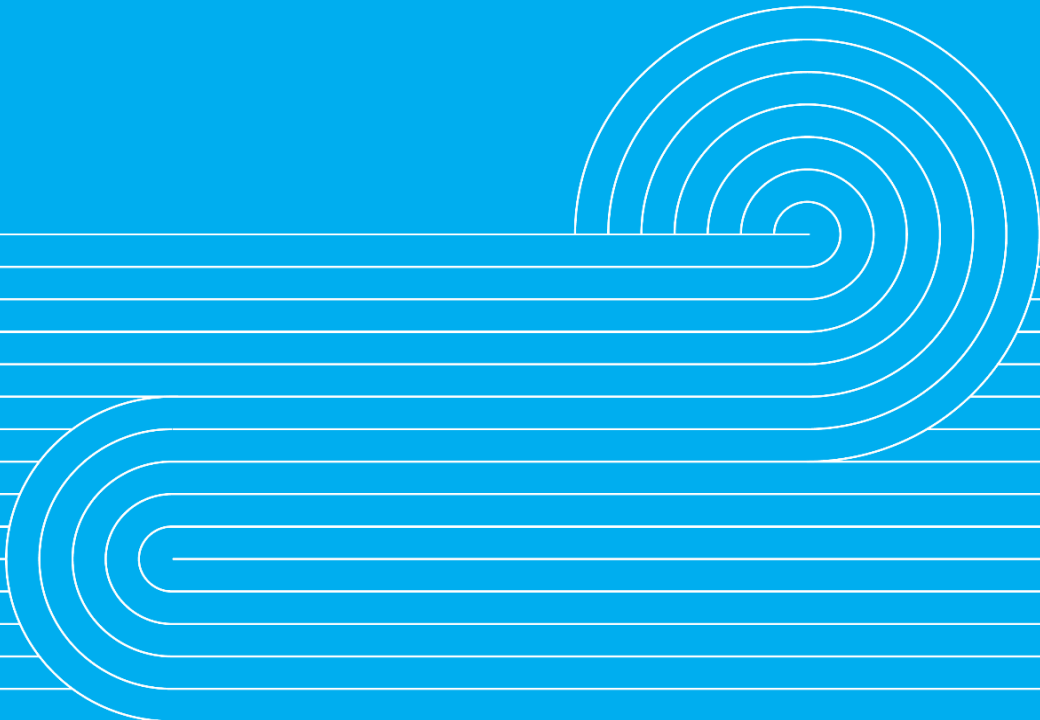
The role of the System Operator is a complex one, sitting at the centre of real time power system and market operations. Our role is broad and involves strategic planning far ahead of the day-to-day activities. This report covers deliverables under two different timeframes:

- long-term planning
- short to medium-term activities, and
- other, non time-defined deliverables are in a separate section.

¹ Electricity Industry Participation Code 2010, section 7, clause 7.11

² SOSPA, clause 12.4

2 Overview



2.1 Overview of the year

Our critical role in operating a secure power system and electricity market for New Zealand means expectations for our daily performance are high. We take heart that 95% of respondents in our annual survey (taken in April) of market participants agreed or strongly agreed we perform well in providing the system operator service, particularly in a year of increasingly tight supply margins, the generation shortage event of 9th August 2021, and the multi-faceted impacts of and responses to the COVID-19 pandemic.

The generation shortage system event on 9th August which resulted in consumers losing supply of electricity is something we are not proud of, but is something from which we, and the industry, have learnt. These hard-earned learnings have been reflected in significantly better outcomes from the generation shortage events which have been a notable feature of the recent winter period, especially as demonstrated on 23rd June 2022.

We have actioned nearly all the recommendations made by four independent reviewers of the 9th August event and expect to conclude the remainder by 30th September this year. We have received positive feedback from industry regarding the operational and communications changes we have made so far.

The challenges of operating a rapidly evolving power system will continue to grow over the coming years³ and it is crucial that, working with the industry and regulators, we actively look to address these. The year's La Niña weather pattern reminded us of the risks sustained dry periods pose to generation availability. We also saw continued tightening of, and uncertainty in, generation capacity margins driven by increases in variable generation⁴, ageing thermal plant and increasingly high demand peaks (six of the 10 highest demand peaks occurred in the last year).

While responding to power system events is always a priority, preparation for doing so is what enables us (and the industry) to ensure we can maintain a secure and reliable supply of electricity for consumers. We place great importance on collaboration with industry as we prepare for future system challenges, and this has been reflected in new fortnightly industry forums, leading a much more extensive industry-wide event simulation exercise than we have previously held, and consulting upon security of supply policy changes following the 2021 dry year review.

We have progressed two big, future-oriented projects, in concert with the Authority, each of which is an ambitious change programme and, we think, signs of more to come. First, we completed phase two of the Real Time Pricing project, an important step towards unlocking greater demand-side market participation and integrating greater levels of renewable generation. Secondly, delivery of the ten-year roadmap for the Authority's Future Security and Resilience (FSR) programme was a highlight; this roadmap in turn led to a step-change in our own business planning and emerging thinking about how the system operator service will deliver consumers the power system of the future and is reflected in our SO Service Strategic Plan.

We have achieved a score of 94% in the system operator performance metrics agreed with the Authority. These metrics drive performance across the breadth of our role, but we acknowledge they need review as our sector and role evolves and we are working with the Authority to reset these.

³ See [Security of Supply Assessment 2022](#) published 30 June 2022

⁴ The 118MW Turitea North wind farm connected to the grid in July 2021 with additional wind and solar generation expected to come online in the next 2 years the largest of which are the Turitea South wind farm (103MW) and Harapaki wind farm (176MW).

It is exciting to work at the centre of such a nationally critical and rapidly evolving sector. This report gives further detail of our performance including successes, challenges, and opportunities to add further value as we continue to work for the benefit of consumers.

Dr Stephen Jay
GM Operations



2.2 Response to the Authority's 2020/21 recommendations

In its review of the system operator performance for FY21, the Authority made two recommendations which we have acted upon:



Recommendation 1:

The System Operator should report on the progress of the Modelling Working Group in its quarterly and annual performance reports and consider the merits of additional resourcing for the Group.



The modelling working group is an initiative referred to in section 5.4 of this report as one of several Continuous Business Improvement Initiative.

The modelling working group's sessions, governance group updates, ideation workshops and ongoing collaboration with projects have been reported regularly, as recommended. The group has made particular progress with dispatch modelling updates (to reduce opportunities for error), improving the customer name change notification process (to ensure all modelling parties are aware of the changes and avoid data and tooling errors for misalignment) and improvements to the automation of gatekeeper changes (reducing opportunities for error through manual data entry).



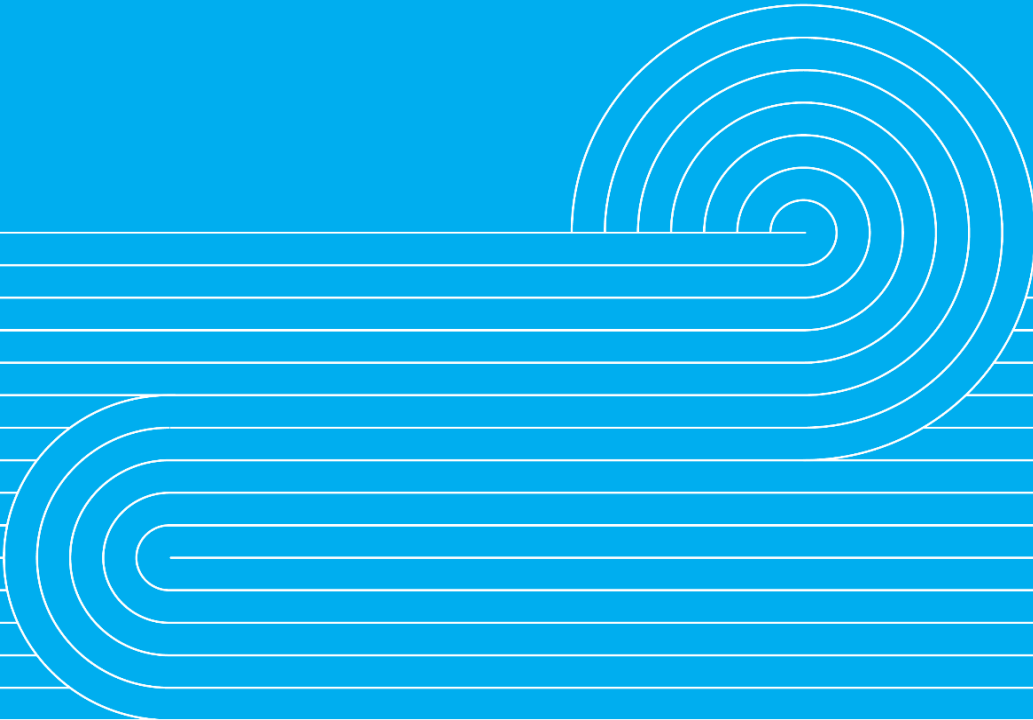
Recommendation 2:

The System Operator should, once the lessons from 2021 are known, revise the work programme of its security of supply function and report on progress in its quarterly performance reports.



We consulted on changes to the Security of Supply Forecasting and Information Policy (SOSFIP) and Emergency Management Policy (EMP) in March and made recommendations to the Authority taking account of feedback received. The recommended changes will enhance transparency and reduce the subjectivity of the analysis used to calculate the risk curves.

3 Delivery: strategic and long-term activity



3.1 Statutory objective workplan

The statutory objective work plan is outlined in the SOSPA and supports the system operator to provide its service in a manner which assists the Authority to give effect to its statutory objectives.

Our 2021/22 strategic objective workplan contained only one objective – to evaluate and revise performance metrics, targets, and the incentive payment calculation, recognising the need to review the current performance metrics.

3.1.1 Our performance

- We engaged a market-leading expert on performance measurement and adapted their methodology to meet the needs of the system operator as a complex regulated organisation.
- In addition to developing the framework for metrics to be reported to the Authority at a governance level, we developed an internal metrics framework to drive performance in the metrics for the Authority at a management level.
- We ran two pilots to experiment with the application of best-practice performance metric methodology to our organisation. Beyond informing the resource and time required for the full metric rollout, these pilots explored how to adapt a generic performance measurement methodology to the organisational and regulatory complexity inherent in the system operator role.
- We accelerated delivery of the pilot for system events in response to the Authority's request for new metrics to go live in the 2022-23 SO Metrics and Performance Agreement – 12 months ahead of the planned full refresh of the agreement.
- We utilised multi-disciplinary teams to consider the end-to-end processes and activities which deliver the outcomes being measured.
- We worked collaboratively with Authority staff throughout the process, to ensure alignment between the metric methodology being developed and the incentive payment which the metrics inform.

3.1.2 Further opportunity

The full refresh of SO metrics and incentives will be completed in 2022-23. There is an opportunity to work closely with Authority staff to further adapt good practice methodology to the regulatory and organisational complexities of the system operator in the New Zealand context.

3.2 Strategic and business planning

Long term strategic planning must be both nimble and considered. We have been preparing for the future system operator services and this year worked closely with the Authority and industry on the FSR programme which contributes to all three arms of the Authority's statutory objective.

3.2.1 Our performance

- Developed the Phase 1 FSR report identifying ten significant opportunities or challenges for power system security and resilience

- Delivered three industry FSR workshops to discuss the draft Phase 1 report; these received positive feedback.
- Delivered the Phase 2 FSR roadmap in mid-March 2022; this outlines how the Phase 1 opportunities and challenges will be met, and delivered information sessions on the roadmap.
- Developed a long-term plan (our 2030 Ambitions) for the Operations division (which includes the people who deliver and support delivery of the system operator service) to identify how we will prepare for the developing new energy landscape.
- Incorporated knowledge gained from our FSR and Ambitions work into the SO Service Strategic Plan, SO ICT Strategic Roadmap and Capex Plan and Roadmap.
- Launched our Operational Excellence programme with support from external consultants in May. This has assessed the current state of our real time operations, determined our desired future state, and proposed a high-level roadmap to address gaps between the two and prepare us for an increasingly complex future. The work noted that the system operator is well placed to manage our current operational responsibilities and commented on the robustness of procedures and commitment/talent across the control room teams. A more detailed implementation roadmap is being developed to ensure that we are prepared for the future state of increased complexity, intermittent and distributed technology.

3.2.2 Further opportunity

- While the Authority provided feedback on how our SO Service Strategic Plan and associated documents could be enhanced, much of which has been implemented, there remains opportunity to further improve the plan's strategic context and to better align the plan with the Authority's statutory objective.
- Some stakeholders provided feedback that the FSR outcomes were too system operator-centric. While this reflected the original programme scope set by the Authority (which focussed on the operation of the transmission system), we agree that there is opportunity to integrate the original scope with interdependent issues across industry, and value in communicating these issues with stronger links to how they impact consumer benefit.
- Opportunities to improve our ability to manage system events will be progressed through our Operational Excellence roadmap as part of our system operator workplan. These steps are expected to be detailed planning and delivery of six key workstreams: governance, assurance, process, resourcing, training, and capability, and change capability.

3.3 Security of supply – long-term

We reviewed and updated the annual Security of Supply Assessment (SOSA) which assesses the power system's ability to meet prudent winter energy and peak requirements over the next ten years. This assessment is key to ensuring a reliable supply for consumers.

3.3.1 Our performance

- In February we sought industry comment on a new approach to the analysis and proposed moving from scenarios to using a reference case and sensitivities. Industry was supportive and we incorporated this feedback into a consultation paper.
- We consulted with industry in May, updated our proposal reflecting feedback and published the final document in June.
- Participant feedback was especially positive regarding the value of having a range of sensitivities (regarded as useful for understanding the growing number of future uncertainties).
- While we were unable to include a separate NZ battery assessment sensitivity (due to insufficient available information), we considered NZ battery as part of our 100% renewable energy case study.

3.3.2 Further opportunity

It is still not possible for us to include a greater demand response sensitivity to explore the impact of increased uptake in demand response in both the North and South Islands. We sought additional information from electricity distribution businesses (EDBs) and industrial users on their expectations of demand response but received too few responses to be able to generate a sensitivity. We expect to continue to work with EDBs and industrial users to develop a demand response sensitivity for future analysis.

3.4 System security forecast

The System Security Forecast (SSF) is a forecast of the system operator's ability to meet the Principal Performance Obligations over the next three years. The System Security Forecast (SSF) is produced every two years and revised every six months if required.

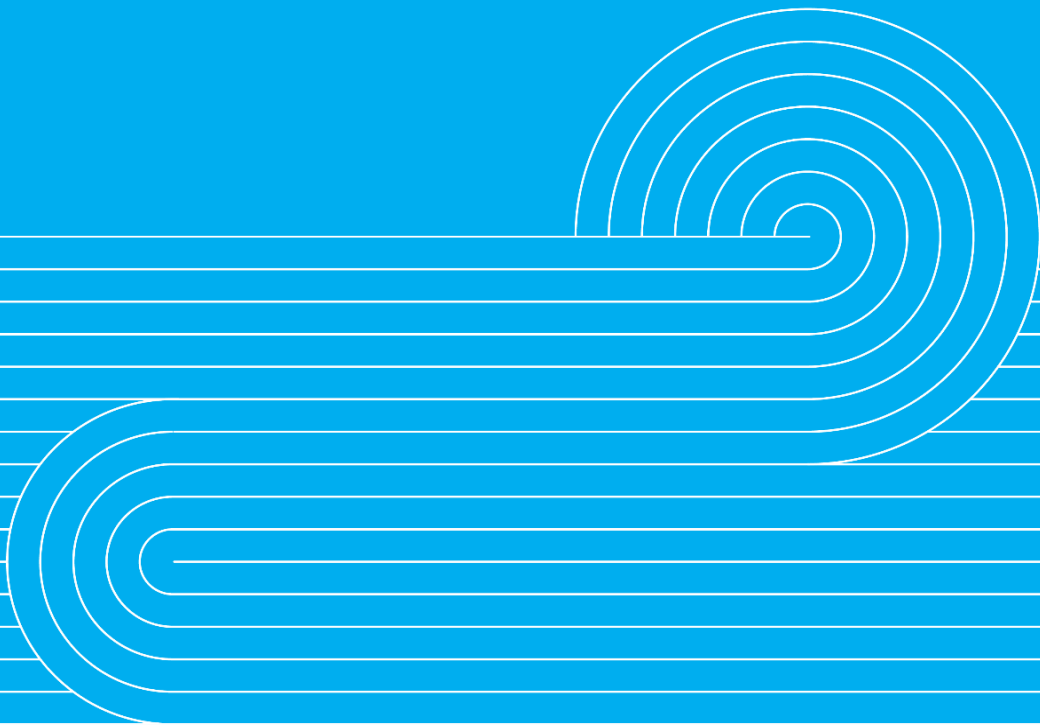
3.4.1 Our performance

- We published two updates – in December and June – which included analysis of the security constraints in the Lower South Island region to account for the recently completed Clutha Upper Waitaki Lines Project.
- In June we started a project to complete this full 2022 SSF update. This update will include new wind projects at Turitea, solar projects at Kaitaia and Rangataiki, geothermal at Tauhara, grid upgrades to install reactive equipment at Islington and Hamilton, and a new GXP at Norward (near Christchurch).

3.4.2 Further opportunity

We are considering how to evolve the SSF to consider future operational challenges, such as transient rotor angular stability, which may become operationally important as the proportion of inverter-based resources increases on the system.

4 Delivery: short to medium-term activities



4.1 Security of supply - medium to short-term

2021/22 has been another year where security of supply of energy has been at the forefront of industry concerns. New Zealand hydro storage fell from 136% of average at the end of September 2021 to 82% of average by April, accompanied by forecasts of a dry summer and a strong La Niña pattern by NIWA.

Generation capacity has also been a focal point, with the 9th August generation shortfall event being followed by a series of tight margin events in winter 2021, and 6 of the 10 highest demand peaks on record being seen in winter 2022. The root cause of the 9th August 2021 event – a shortage of offered generation – has been repeated several times in the current winter, notably on 23 June where a demand response was requested.

4.1.1 Our performance

- In response to recommendations from the MartinJenkins review of the 2021 dry year event, industry feedback, and our own engagement and education plan, we significantly improved our communications with industry regarding security of supply. New channels, such as our fortnightly industry forum, and government and regulatory stakeholder email updates, allow us to better inform stakeholders of risks as they emerge and develop, in a way that is relevant and helpful to them.
- We communicated early, clearly, and comprehensively to all levels of stakeholders across the market and government around the significant risks through the year, including, monthly briefings to MBIE, EA, GIC, and First Gas.
- We published a 2022 security of supply outlook of risks, including highlighting the two largest risks (excluding infrastructure failure) over the summer period (these were the restriction of personnel to operate the thermal fleet at full capacity due to COVID-19, and market shortages of thermal fuel supply in an emergency).
- We recalculated and published the electricity risk curves for major impacts including Contact Energy advising the Taranaki Combined Cycle (TCC) will operate with a 2,000-hour limitation and a significant Maui gas field outage.
- We communicated with and coordinated market participants in response to many forecast generation shortfalls during winter 2022, using multiple channels, including our industry forum, operational notices, NZGB, emails, letters, and bilateral meetings.
- The System Operator Rolling Outage Plan (SOROP) was assessed by running a rolling outage exercise on 24 February.
- We procured and implemented a new load forecasting-as-a-service solution. The service was launched into the control room on the 24 February 2022 and is now the primary forecast used in real-time delivering a 30% to 50% improvement in forecast accuracy across all forecast horizons.

"Recent briefings have been very effective in keeping EDBs in the loop and assist in us preparing for possible or expected events"

Electricity Distribution Business

- We engaged MetService to provide daily consulting on temperature and wind uncertainty to inform briefings to market participants and improve our operational decision making.

4.1.2 Further opportunity

- There would be value in increased clarity in roles and responsibilities with the Authority regarding changes to Security of Supply policy and procedure. On an ongoing basis, the Authority is accountable for these policies, while the System Operator delivers the activity outlined by the policies, however the roles and responsibilities are less clear when it comes to changing policies. While the SOSFIP and EMP consultations achieved a good outcome for consumers, clearer roles and responsibilities would improve the efficiency of the process.
- There is scope to further improve the load forecast by focussing on the accuracy of the inputs to the model:
 - working with MetService to understand a more granular level of uncertainty in the forecast temperature
 - explore whether a blended weather forecast can reduce the risk of outlier errors in the temperature forecast (which is in turn an input to the load forecast).
- Engaging a premium wind forecast provider to deliver half hourly wind generation forecasts would assist in benchmarking uncertainty in wind offers from generators.
- Work with the Authority to improve the quality of wind generation offers.
- Work with the Authority to improve the quality of offers in the Weekly Dispatch Schedule (WDS) as slow start, less reliable thermal units are increasingly being used to firm intermittent generation.
- Work to support the integration of an increasingly diverse generation mix. This could involve collaboration with industry on providing timelier, or better quality market information, or with industry and the Authority on the potential for changes to market settings to mitigate the growing generation capacity risk.

4.2 System events

- The system operator manages the electricity system to meet the Principal Performance Obligations. We record and review system events and report to the Authority on any moderate or major events using a definition agreed with the Authority.
- As outlined elsewhere in the report, our operating environment is becoming increasingly challenging due to tightening capacity margins, increasing quantities of variable generation and less flexibility available. Managing (often potential) system events is part of our core role and events are logged and reviewed on a daily basis. This section shares detail on a handful of the more significant events through the 2021-22 year.

4.2.1 Our performance

- On 9 August 2021 we managed a generation shortage event which ultimately resulted in consumer disconnections, some of which were caused by our actions. The root causes of the event and the actions we took to manage the power system are well explained in a

report by PBA Consulting (an independent engineering consultancy) which has been widely published and is available on our website. Four other reviews were carried out focussing on different aspects of the event – two by the Authority, one by MBIE (authored by the Hon Pete Hodgson) and one by Thompson Lewis. All are publicly available.

In addition to the shortage of generation offered on the day, other issues including some poor communications by the system operator with a variety of stakeholders, inadequate operational notices and industry knowledge of how to respond to them, and a deficient operational tool used by the system operator, all contributed to outcomes on the day which we acknowledge were inadequate.

The reviews recommended a wide variety of actions for the system operator to take by itself or in conjunction with industry. The majority of those have been taken up and are complete (the outstanding recommendations will be complete in September). Two matters are of particular note:

- The use of controllable load to assist in managing a generation shortage event has now been embedded in our operational procedures and has gained industry support (and has been used successfully in a recent generation shortage event).
- A large-scale industry exercise was held in May during which, under our leadership, a generation shortage event was simulated to see how well operational changes introduced after the 9th of August worked and were understood by industry and what additional changes might be needed. The exercise – Exercise Shortfall – was valuable and well received by industry. We gained confidence that the recent operational and communications changes (including the use of controllable load) are effective, reasonably well understood by industry and that better operational outcomes can be expected in the future – as in fact was demonstrated on 23rd June 2022 and on several subsequent days when generation shortages arose.
- During late summer and into autumn, we experienced extreme operating conditions in the Southland region. Lake Manapouri and Lake Te Anau levels dropped and, by early April, fell below their low operating ranges – determined by their resource consents. This led to unusually low generation from Manapouri; we saw output drop to 0 MW at times in early April.

The resulting voltage and thermal security issues required careful management by the coordination centre, forward assessments by planning teams and coordination with the grid owner and participants. The security issues required a request for an urgent grid reconfiguration, development of constraints, advice and coordination of outages, and communication with participants and stakeholders. Conditions improved by late April following increased inflows, enabling us to advise the grid owner the grid reconfiguration was no longer required and which wound back our assessment workloads.

- On 23 June the power system experienced a generation shortfall for the morning peak. We declared a grid emergency (GEN) and followed our updated procedures, which we had recently practiced with industry participants during Exercise Shortfall. Several factors contributed to the event: the failure of peaking plant at start-up, a cold snap that saw demand rise higher than forecast and lower than forecast wind generation. Immediately after the GEN was declared, a large thermal unit reduced output. The grid emergency was resolved without disconnection of customers and a return to a secure grid within one and a half hours of the GEN being declared. We followed our procedures to instruct distributors to shed controllable load and for generators to increase generation (including distributed generation).

We commissioned PBA Consulting and Thompson Lewis to undertake independent reviews of the 23rd June event; each review found, in general, the event was managed well by the system operator and reflected the improvements carried out since 9th August 2021.

- To maintain our capability to manage system events throughout the COVID-19 pandemic we initiated an Incident Management Team between August and May with regular reporting to the Authority. This coordinated a range of measures to protect our people, particularly our coordination centre staff. Measures included restricted access to office space, work from home for staff without a critical need for office access, shift team 'bubbles', and enhanced testing and response processes. We worked with market participants to share good practices and to understand any increase in risk to the electricity system because of COVID-19 impacts on their organisations.

4.2.2 Further opportunity

- Exercise Shortfall identified further opportunities to improve processes and communication both internally and across industry during system events. These opportunities are being progressed through appropriate channels such as Operational Excellence.
- Further industry exercises and event reviews, such as a review of winter 2022, continue to be valuable sources of lessons and opportunities to improve.

4.3 Programme delivery

We delivered the investigation and capital expenditure change projects outlined in our Joint Development Plan and capital work programme, each of which is agreed with the Authority.

4.3.1 Our performance

- We successfully delivered six Technical Advisory Services projects within approved budget for the Authority. Five of these were delivered on time, with one project requiring time extensions in response to delivery challenges experienced by third party project partners.
- We delivered more than 85% of commissioned Service Maintenance projects on or under budget, While one project was delivered 20% over budget, the portfolio of projects was 10% below budget.
- We improved our delivery process and governance:
- We implemented a Concept Stage Framework to develop the goals, problems, and opportunities of potential project more fully before launching investigations.
- We established a funding substitution process for SOSPA portfolio projects.
- We established a good working relationship with the Authority's incoming Joint Work Plan Team members and have collectively reviewed and updated the Risk and Dependency Registers for this group.

- We provided training for market participants for our projects, including the RTP project, and the migrations of applications⁵ to the customer portal. These sessions were well-attended and we received good feedback.
- Resourcing projects (both planned and unplanned) while suffering COVID-19 and skilled-labour shortages proved challenging and impacted timely delivery and cost of some projects.

4.3.2 Further opportunity

- Opportunities to improve our Capital Planning process have been identified to increase assurance of scope and cost estimation.
- The Service Delivery Framework (used to facilitate the delivery of projects) can continue to be shaped to fit our specific business needs. There is opportunity for a more nuanced project governance model across delivery teams to support more accurate planning, resource allocation, and delivery.

4.4 Performance metrics

The system operator performance metrics agreed with the Authority determine the system operator incentive payment⁶.

4.4.1 Our performance

- We achieved a performance score of 94% for 2021/22 for the incentivised performance metrics agreed with the Authority, above the 80% cap which recognises excellent performance. Detail is provided below in Figure 1 : Performance metrics 2021/22.
- We worked constructively with the Authority to incorporate the Authority System Operator Committee's request to develop new metrics relating to system events for 2022/23.

4.4.2 Further opportunity

Future development of the metrics will be progressed as a requirement of the Statutory Objective Work Plan and covered separately in this report.

⁵ Applications migrated to the customer portal include Automated Under-Frequency Load Shedding (AUFLS), Asset capability Statement (ACS) and Planned Outage Coordination Process (POCP).

⁶ as set out in the System Operator Performance Metrics and Incentives Agreement

Performance metrics dashboard

	Annual Target	Actual	Pass/Not Achieved	Incentive payment weighting	
We are smart about money					
Perception of added value by participants	80%	73%	Not Achieved		
Our customers are informed and satisfied					
Annual participant survey result	83%	95%	Pass	5	
Annual participant survey result response rate	80%	80%	Pass		
On-time special event preliminary reports	90% ≤ 10 business days	None this year	N/A	5	
Reports	Future thinking report	≥ 1	1	Pass	5
	Longer Market Insight reports	≥ 4	3	Not Achieved	5
	Bite-sized Market Insights	≥ 45	49	Pass	
Quality of written reports	100% of agreed standard ¹	100%	Pass		
Role impartiality	80%	92%	Pass	5	
We maintain Code compliance and meet our SOSPA obligations					
Market impact of breaches remain below threshold	≤ 3 @ ≥ \$40k	1	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 ²	43%	Not Achieved	
		≥ 60% achieved for approved budget	79%	Pass	
	Market Design / Service Enhancement projects	≥ 60% achieved for approved time	0%	N/A	
		≥ 60% achieved for approved budget	0%	N/A	
Accurate capital planning	≥ 50%	50%	Pass	10	
We are committed to optimal real time operation					
Sustained infeasibility resolution	80% ≤ 10am business day 1 or as required ³	87%	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%	69%	Not Achieved		
Technical quality assessment score	65.00%	72%	Pass		
Sustained SCADA availability	99.90%	99.99%	Pass	10	
Maintained timeliness of schedule publication	99.00%	99.99%	Pass	10	

Total points = 90

Figure 1 : Performance metrics 2021

No. points allocated to metrics which reported this year = **85** (there were no special events in 2020/21)
 No. points allocated to metrics which passed = **80** (did not pass number of market insight reports)
 Level of performance = 80/85
 = **94%**

4.5 Business assurance audits and plans

Each year we agree with the Authority which Business Auditable Services (BAS) will be audited during the financial year.

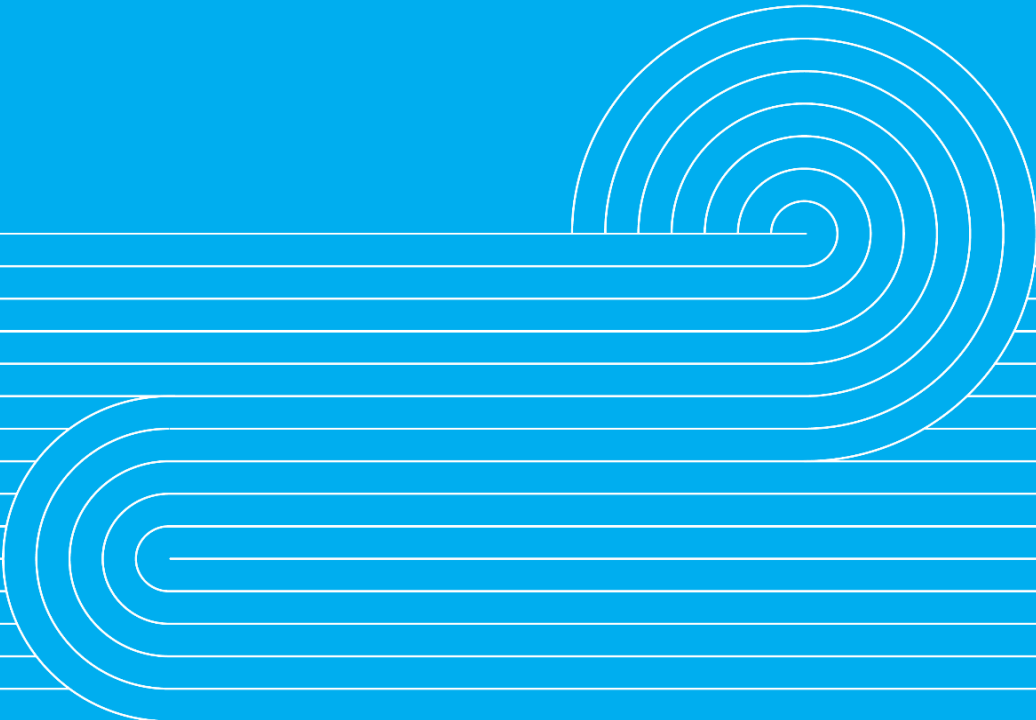
4.5.1 Our performance

- We successfully delivered our agreed audit requirements and agreed the FY21 BAS plan. The five audits focused on: outage block mapping, managing conditional offers, secondary risk management, managing how we make operational changes to the reserve management tool (RMT), and the process for determining under-frequency event causer recommendations.
- The five business audits for this year identified opportunities for improvement for which works are underway.
- We engaged auditors with extensive risk experience (including executive risk positions) to perform two audits.
- We agreed with the Authority a formalised approach to setting the annual audit plan, and to provide more frequent feedback on audit results.

4.5.2 Further opportunity

Progressing our programme of works to identify and address systemic audit issues.

5 Delivery: other activities



5.1 Business continuity testing

5.1.1 Our performance

We tested our business continuity through participation in the international 2021 GridEx simulation exercise⁷, which simulated a series of cyber and physical security attacks on the New Zealand power system. We worked through real-time response and recovery plans with two gentailers and one distributor and worked alongside representatives from the National Cyber Security Centre (NCSC), CERT-NZ, the Department of Prime Minister and Cabinet (DPMC), the New Zealand Police and Civil Defence Emergency Management (CDEM). Another gentailer and four distributors observed the exercise.

5.1.2 Further opportunity

There is opportunity to better align our coordinated incident management system (CIMS) roles to our internal roles and provide context to support our response. We included these learnings as part of Exercise Shortfall on 26 May when we ran an industry exercise designed to test improved procedures, tools, and communications put in place after the 9 August 2021 event last year, and plan to run a similar exercise annually in the future.

5.2 Industry engagement

We engage with industry on a regular basis, sharing our operational, engineering and planning knowledge and insights, and gathering advice and knowledge from our industry participants and colleagues.

5.2.1 Our performance

- 95% of respondents to our annual participant survey agreed or strongly agreed that, overall, Transpower performs well in providing the system operator service. The survey provides valuable feedback on our engagement with industry – a selection of verbatim quotes are included which provide flavour and context to the survey responses.
- Our stakeholder education and engagement plan set out the types of engagement that we plan to undertake each year. This year all aspects of this plan were completed (details in the appendix).



“Great to see the fortnightly ‘operations focused’ meetings. These will be useful, especially in building relationships across the country. Well done in standing these up”

Market Participant



⁷ Hosted every two years by NERC’s Electricity Information Sharing and Analysis Center (E-ISAC), GridEx gives E-ISAC member and partner organizations a forum to practice how they would respond to and recover from coordinated cyber and physical security threats and incidents. The 2021 exercise involved over 700 participants over two days.

- Our website provides a range of operational notices and reports, policies and other information that support our role. *Figure 2: Industry engagement - website activity* shows how the industry engages with these various forms of information.

- We developed online resources and educational tools for: Tiwai exit scenarios, CUWLP outages and operational impacts, carbon emissions information, and post-Regional Coincident Regional Peak Demand (RCPD) analysis which informed peak demand growth assumptions used in the New Zealand Generation Balance tool (NZGB).

"I trust the Transpower System Operator communications to keep me informed (so that I can intervene in our EDB's planning as necessary) and they provide valuable information"

Electricity Distribution Business

- We delivered project-specific communications: a series of Real Time Pricing awareness presentations, CUWLP and HVDC 2022 update, North Island shortfalls for June-August.
- We carried out several restoration exercises with industry and sought to improve industry preparedness: Taranaki regional contingency plan review (Jul), GridEx global system operator exercise (Nov), North Island industry restoration (Feb), Rolling outages exercise (Feb), Regional industry restoration exercise – Exercise Shortfall (May).
- We held a debrief with participants following the industry exercise in May designed to test improved procedures, tools, and communications. Industry regarded the exercise as highly successful and worthwhile. We received positive feedback from the Authority. The debrief identified further opportunities to improve processes which will be fed into our plans.
- We improved our processes around industry briefings for system risks and events. We responded to feedback on communicating the risks associated with notices and received thanks from participants for the industry briefings for issues including the HVDC Pole 2 failure in July, high winds, and lightning storms in the South Island early in September, the need to remove Pole 2 in November and regional voltage stability and thermal security issues in Southland in April.
- We established a project team to work collaboratively with a market participant in enabling a new business model of offering small scale solar and battery aggregation into the reserves market.

"While we have received GENs and CANs sometimes the risks associated with these notices are not clear and a 'cry wolf effect' eventuates"

Market Participant

5.2.2 Further opportunity

- As new technologies, business models, and participants enter the market there will be value in working collaboratively with these stakeholders to identify how our service and

the market more broadly may need to evolve to support them to engage on a level playing field.

- We will continue the fortnightly industry forum initiated in March which improved transparency by increasing the amount and clarity of information available to market participants. It also highlighted some participants' discomfort that vertically integrated market participants engage with the system operator on operational security issues before their non-integrated competitors, highlighting the value of our communication with all market participants during the prelude to and during events; being early, often, and clear.

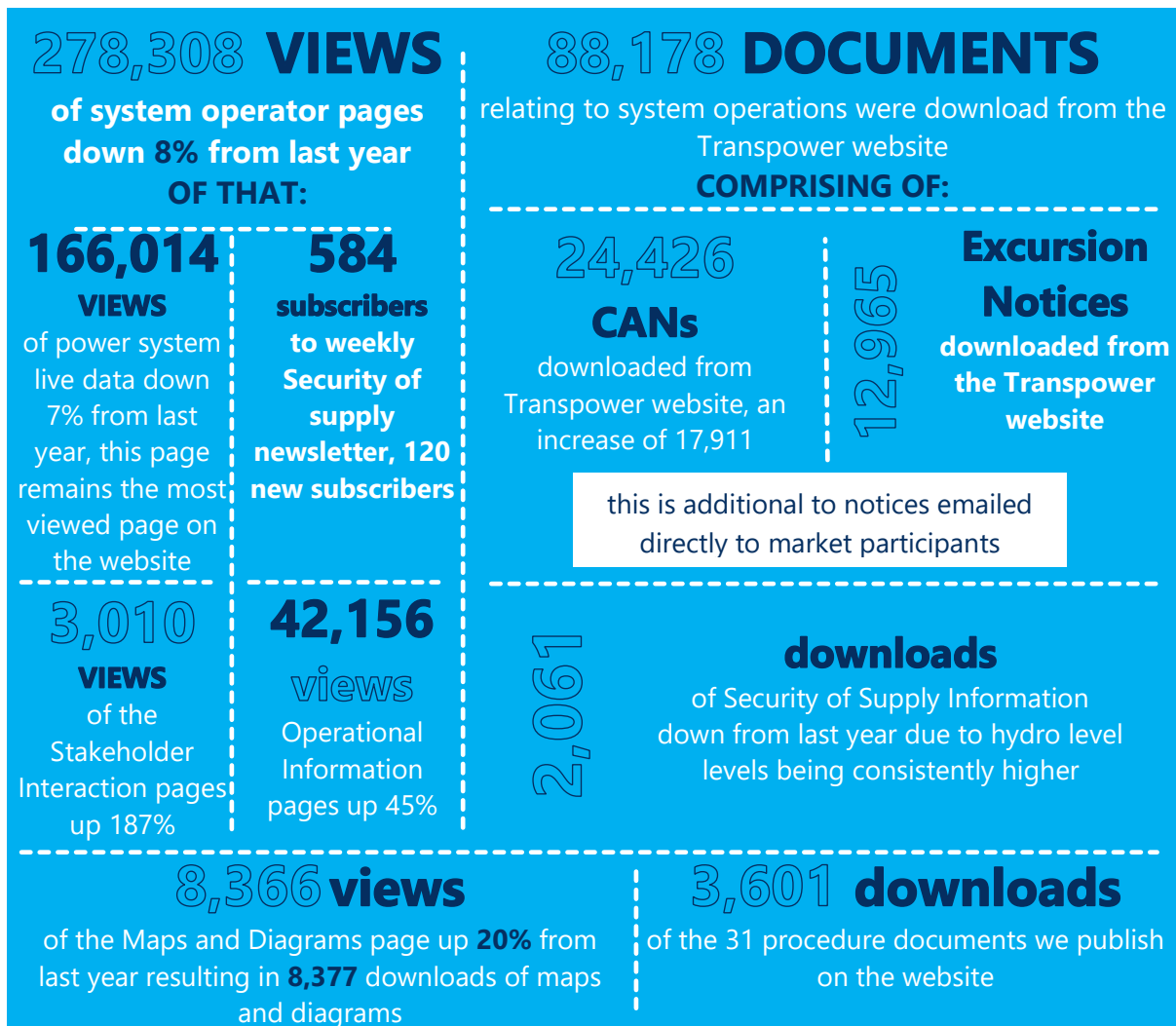


Figure 2: Industry engagement - website activity

5.3 International engagement

System operators around the world exist in regulatory and market arrangements unique to their respective jurisdictions. Each experiences change at different rates and may be more affected by some factors of that change than others. However, there are many similarities which make learning from our contemporaries important.

5.3.1 Our performance

- GM Operations is the current President of the Electricity Engineers' Association, and a Board member of both CIGRE Australia and the Association of Power Exchanges. He attended a variety of seminars, including global wholesale market design, energy future and strategy, emerging technologies, including the learnings from the Texas blackouts. He presented at several industry events.
- Our principal power systems engineers and principal market advisors are regular attendees of webinars presented by overseas energy professionals. Host organisers of these webinars include the Energy Systems Integration Group (ESIG), the Advanced Energy Economy (AEE), the Australian Energy Market Commission (AEMC), the Energy Users Association of Australia (EUAA), the Energy Security Board (ESB), and the Council on Large Electric Systems (CIGRE).
- We organised bilateral discussions with Australian Energy Market Operator (AEMO) on a variety of subjects, including forecasting and their experience of widespread distributed energy resources (DER).
- We facilitated a series of knowledge sharing sessions with counterparts in the UK (including National Grid Electricity System Operator, Scottish Power Transmission Electricity Networks, and the Energy Systems Catapult), focusing on system operation challenges and market design opportunities for operating a low carbon energy system.

5.3.2 Further opportunity

Electricity challenges and opportunities are unevenly distributed across the globe, which means we can learn from overseas peers in some areas (e.g. impacts of high levels of variable generation, operation of low-inertia systems) while those same peers can learn from our market and system (e.g. management of long term storage, system operation impacts of a nodal market). We see opportunity to increase knowledge sharing with overseas peers to deliver the benefits available from broader international experiences.

5.4 Continuous improvement activities

Throughout the period we continued to make improvements in our processes and assess work we do through a focus on continuous improvement. This section highlights priority activities through this review period.

5.4.1 Our performance

- We have established a modelling working group to regularly meet and focus on improvements to our modelling processes. Improvements implemented include:

- Automation of processes
- Changes for circuit ratings and transformer ratings provided by the Grid Owner to the System Operator
- Gatekeeper changes that reduce the opportunity for error through manually entering data
- Full automation of add/edit/delete of PI tags to reduce errors in PI
- Customer name-change notification process improvements to ensure that all modelling groups applied changes in a consistent and coordinated manner to avoid data and tooling errors
- Dispatch modelling improvement that streamlined the process for applying the models and reduced the opportunity for error
- Streamlined the VSTAT trouble shooting process which has reduced the errors with failovers.

The modelling working group continues to demonstrate its value in building a culture of collaboration and shared ownership across the modelling process.

- With the introduction of energy storage devices (such as batteries) to the system we identified a need to develop a process for modelling this equipment. We started by assessing the types of factors required to be modelled in systems for planning and real time operations. We now have clear direction regarding the type of modelling required in the current environment and we plan reviews to consider expansion over time as the volume of this equipment and the market evolves.
- Business Process Modelling capability has been developed over recent years. After review of needs, a tool has been selected and a business case underway to implement a solution to replace our current relatively manual processes and tooling. This tool will introduce benefits such as capturing our processes as data rather than static text/pictures, provide a more robust process architecture capability which can be easily created visually and maintained, and enable simulation of process effectiveness. Ultimately this will enable us to respond to changing needs more quickly and efficiently.

5.4.2 Further opportunity

- Modelling is increasingly complex as the capacity of the grid is extended with systems and tools rather than building new assets, placing increased importance on the skills, competency, tools and capacity required to support effective modelling activities to be carried out. Continued focus on modelling improvements and good practice is required to ensure errors in modelling are minimised.
- We have a continuous improvement Kanban board to collect, prioritise and track initiatives. Through the next period we will continue to progress implementation of priority opportunities.

5.5 Cost of services reporting

We delivered the required cost of services reporting for 2020/21 to the Authority in December 2021.

5.6 Compliance

This section covers compliance with both the Code and Policy Statement.

5.6.1 Our performance

We self-reported the same number of breaches (11) in this reporting period as in 2020/21.

Of these breaches, seven involved grid modelling errors. Historically, modelling the grid has been the system operator's primary risk exposure (e.g. we self-reported 14 modelling breaches in 2014/15 and 12 in 2016/17). In the last few years, we have implemented system enhancements to maximise grid capacity and efficiency, resulting in a significant increase in modelling complexity. For example, some circuits are now modelled with 12 separate ratings, where previously modelled with only two. Despite the significant increase in modelling complexity, we are experiencing fewer modelling errors, and none of the errors in this reporting period had the same root cause.

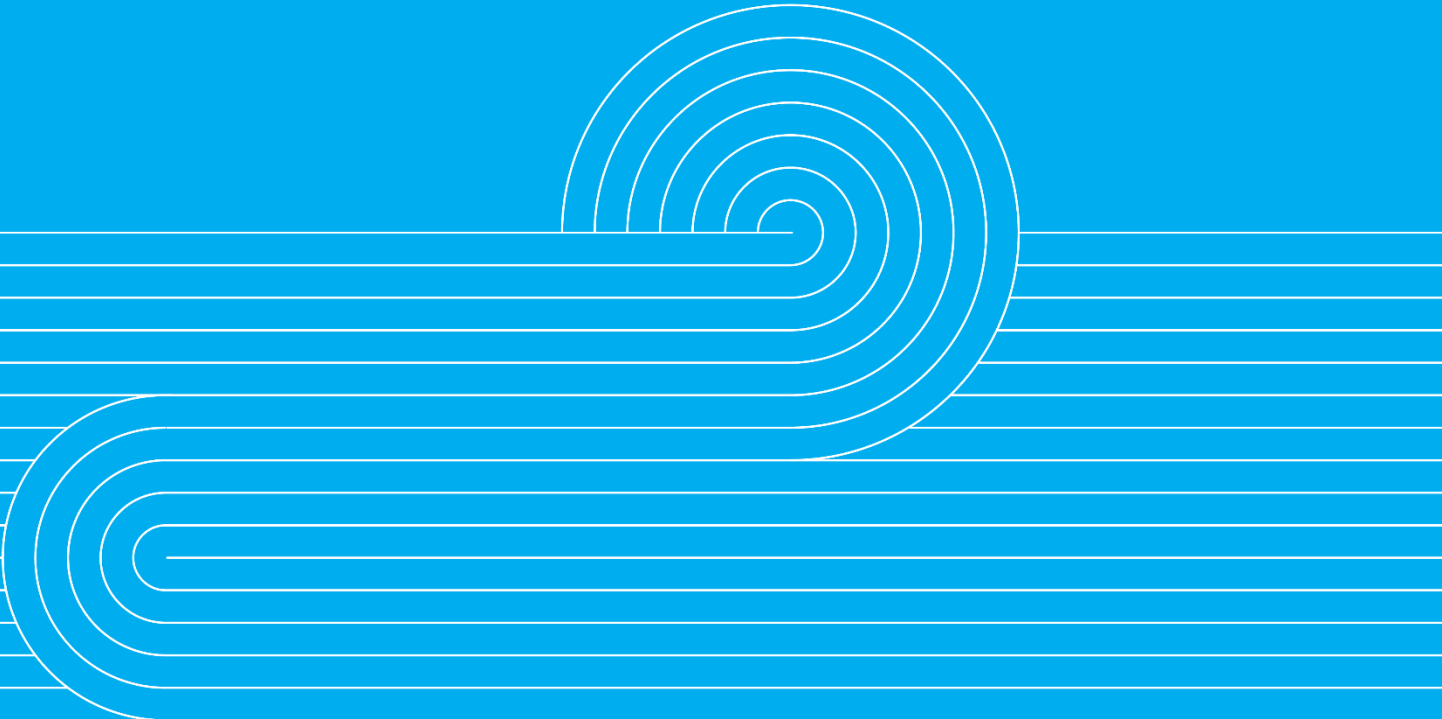
Details of breaches:

- The system operator self-reported breaches of the Code and/or Policy Statement in respect of 15 events during this reporting period (2021/22 FY). This consisted of 11 events in the reporting period, and four events which occurred in the prior reporting period.
- The four breaches relating to events in the previous reporting period (2020/21 FY) were not reported until this reporting period as investigations into the circumstances continued between FYs.
- 1 breach (Event 4200 – 9th August) had a market impact above the \$40k threshold. This event has been referred to the Rulings Panel for determination.

5.6.2 Further opportunity

We believe there is an opportunity for the Authority to re-iterate to the industry its expectations around self-reporting and alleging breaches (e.g. should reporting be limited to breaches that impact common quality and security). We would be happy to work with the Authority to clarify its expectations.

6 Appendix



Our delivery against the Education and Engagement Plan for 2021-22 is summarised in the table below

Forums/workshops	
<i>To present on several areas of system operator work that will affect and/or are of interest to the industry. Areas of work will vary depending on what is topical at the time.</i>	
2 forums to focus on system operations (one in each half of year)	
1 st half	<ul style="list-style-type: none"> Restoration on HVDC Pole outage (Weka Pass) (Aug) Distribution networks workshop (Oct) Security of Supply Annual Assessment workshop (Oct) FSR Phase 1 opportunity and challenges workshops (Nov/Dec)
2 nd half	<ul style="list-style-type: none"> North Island industry restoration exercise (Feb) Rolling outages exercise (Feb) Outage Planning forum (Mar) SO Industry Forum (Mar onwards) FSR Phase 2 Roadmap workshops (Apr) Asset Owner Technical forum (Jun)
Relationship management - General industry participants	
<i>To address specific issues with affected industry participants. Meetings will be attended by relevant system operator employees, based on the issues being discussed.</i>	
6 meetings (one in each quarter of the year, plus two additional meetings)	
1 st quarter	<ul style="list-style-type: none"> NINO distributors' meeting (Jul) and Q3 (Feb)
2 nd quarter	<ul style="list-style-type: none"> Pakuranga-Whakamaru Cable voltage stability options (Oct) CUWLP and HVDC 2022 update (Nov)
3 rd quarter	<ul style="list-style-type: none"> NINO distributors' meeting (Feb) NZAS/MEL combined asset meeting (Feb) HVDC outage extension (Feb) Managing regional voltage stability and thermal security issues in Southland (Mar)
4 th quarter	<ul style="list-style-type: none"> Regular updates on Maui gas platform outage (May/Jun) Regular updates on operation of TCC operation for winter (May/Jun)
Relationship management - Smaller industry participants	
<i>To address specific issues with affected industry participants. These meetings will be focused on the needs of smaller industry participants and will be attended by relevant system operator employees, based on the issues being discussed.</i>	
2 meetings (one in each half of the year)	
1 st half	<ul style="list-style-type: none"> GIC/First Gas SoS regular two-monthly meetings One-on-one meetings between GM operations and various generators, EDBs, and other market participants
2 nd half	<ul style="list-style-type: none"> Operations Planning Engineers meeting with participants (Jan) An increasing number of commissioning meetings with potential solar/wind/battery providers. These include some providers with little or no knowledge of the power system or the needs to be a participant.
Training	
<i>To increase understanding of the key technical tools and concepts that materially impact market outcomes.</i>	
2 training courses (one in each half of the year)	
1 st half	<ul style="list-style-type: none"> ACS customer portal roll-out (Jul, Sep, Nov)
2 nd half	<ul style="list-style-type: none"> Regular RMT course open to the industry (Jun)

Figure 2: Delivery against the 2020/21 Education and Engagement Plan

