Meeting Date: 24 October 2018

SYSTEM OPERATOR PERFORMANCE: 1 JULY 2017 – 30 JUNE 2018

SECURITY AND RELIABILITY COUNCIL

The purpose of this paper is to provide the SRC with a copy of the system operator's annual self-review and give an indication of the preliminary content of the Authority's corresponding review.

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

Background to annual reviews of the system operator's performance

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

- the performance of the electricity system and the system operator
- reliability of supply issues.

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]

The system operator has completed its self-review of its performance for the 2017-18 financial year, and the Authority is currently drafting its corresponding review (collectively, the reviews).

The purpose of this paper is to provide the SRC with a copy of the system operator's annual self-review (attached as Appendix A) and give an indication of the preliminary content of the Authority's corresponding review (included in Appendix B). The SRC's advice to the Authority on this matter is valuable, even if it does not identify any significant opportunities for improving the assessment of performance.

The reviews are structured around the system operator's strategic goals

The system operator's self-review is structured around five sections that align with Transpower's strategic goals under its System Operator Service Strategic Plan 2017-22 (strategic plan), which are:

- demonstrating value for money
- playing an active role in shaping the industry's future
- delivering competition with security
- improving our asset and infrastructure management
- developing our organisational effectiveness.

The Authority has adopted this structure for its review, as it will make it easier for readers to track discussion between the two documents, and also means the Authority can consider the extent to which the system operator is achieving its strategic goals.

SRC feedback is valuable

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 system operator's or the Authority's reviews.

An indication of the preliminary content of the Authority's review is included in Appendix B.

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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.

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.

However, 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.

Questions for the SRC to consider

The SRC may wish to consider the following questions.

Q1. **Does the SRC wish to highlight any specific aspects of the system operator's performance as strengths or having markedly improved?**

Q2. **Does the SRC have any concerns about the performance of the system operator?**

Q3. **Are there any aspects of the system operator's functions that the SRC would 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?**

Attachments

The following items are included as attachments to this paper:

- System operator annual self-review and assessment: 1 July 2017 – 30 June 2018 (Appendix A)
- Indication of preliminary content of Authority's annual review of system operator performance, for the period 1 July 2017 – 30 June 2018 (Appendix B).

Appendix A: System operator annual self-review and assessment: 1 July 2017 – 30 June 2018

Keeping the energy flowing

TRANSPOWER

System Operator

Annual Self Review and Assessment

1 July 2017– 30 June 2018

Transpower New Zealand Ltd The National Grid

Foreword

John Clarke

GM OPERATIONS

Welcome to our annual Self Review of our performance as system operator. We've revised the format of our report this year.

It's shorter, with a stronger focus on how we've performed in our role to manage the power system and dispatch the electricity market.

This year, we've identified and addressed the lessons from two key events.

Firstly, lessons from our preparations for the dry winter in 2017 to improve our readiness for the future. This event was the first test of new industry protocols that were adopted following the 2008 dry winter – the process worked well, but we identified scope to improve. Secondly, we've completed our review of the March 2017 South Island automatic under-frequency load shedding (AUFLS) event. This investigation identified a number of corrective actions we can take as the system operator, which focus on the management of high-pressure complex power system events, including how we communicate during the event and timely reporting afterwards. We valued the feedback we received from the Authority and other stakeholders over the course of that review. We'll be using our industry forums and restoration exercises to share the lessons we've learnt with the wider industry.

The year has seen a strong focus on initiatives to improve and develop electricity market arrangements. As system operator we are committed to our strategic goal of demonstrating value for money; we've worked with industry and the Authority to develop the proposal for Real Time Pricing (RTP), which has also helped educate industry participants on the key concepts of our market and its supporting systems. We look forward to the approval to proceed with RTP in the future as a key market development initiative. In working with industry we've put significant effort into supporting arrangements to enable Efficient Procurement of Extended Reserves. We've also successfully developed an industry-supported replacement for the obsolete GENCO dispatch system, through our dispatch service enhancement project.

This will enable greater market participation by modernising the way instructions are able to be sent out to generators, reserve providers, aggregators and the like.

It is clear that how we produce and use electricity is changing. There is much discussion and evidence of how new technologies will impact on our ability to manage the power systems with greater consumer involvement. We are likely to require new approaches and wider coordination. We are very aware of the significant system issues faced in other power systems, with growing proportions of intermittent and renewable generation. One of our five strategic goals for the system operator service is to play an active role in shaping the industry's future so over the past year, we studied the system implications of having up to 20 per cent of our annual electricity coming from solar PV. We've also studied what impact the combination of consumer batteries, electric vehicles and solar PV may have on the system, and will share the results in the coming year.

Transpower's *Te Mauri Hiko* white paper on the potential for electrification to meet our climate goals provides a fresh insight into how the power system could develop and grow, aiding the debate on New Zealand's energy future. Our further work on the impact of new technologies and consumer response on system operation will be set in the context of the scenarios identified in the white paper. The white paper also assists us in taking a longer-term view of security of supply and how we inform stakeholders of the nature of the challenge we face under different future generation mix and demand scenarios.

Thinking about our strategic goal of developing our organisational effectiveness led us to consider how the operating role might evolve. This year we developed a vision for the delivery of the power system and grid operating services Transpower provides and the change drivers we could see out to 2030. This vision has identified that through greater integration with automation we can provide a more responsive service, to match the drive to better utilise the power system as a whole with new technologies and consumer interaction.

As an early step in the envisaged five-to-seven-year evolution of the real-time operating role, in May we created a single Operations Division within Transpower, incorporating all real-time system and grid operating functions. In the years ahead, we will develop and grow both our organisational capability and systems capability, to deliver the vision for integrated operations.

A key part of this will be working with our stakeholders to demonstrate we can achieve our goals while remaining impartial in our role as system operator and grid owner. I look forward to demonstrating that we can meet this challenge in evolving the way the New Zealand power system is operated to meet the future expectations of consumers.

John Clarke
GM OPERATIONS

Assessment of our performance

We assess our performance over the 2017-2018 period as solid. We satisfied our agreed performance targets and made good progress on our longer term strategic goal initiatives. We delivered most aspects of our service to a high standard.

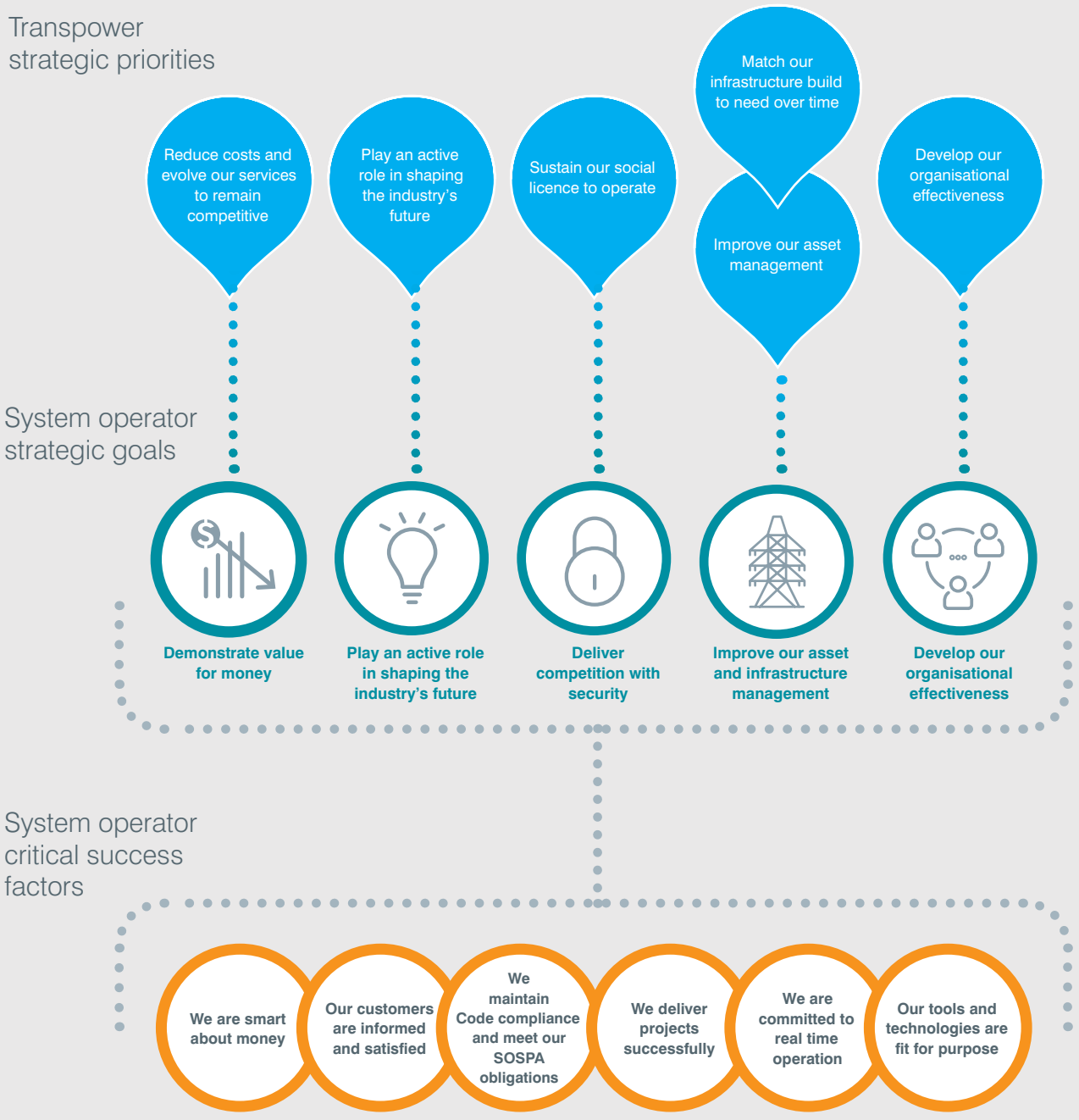
Our customer satisfaction rating rose to 93 per cent this year, no breaches of the principal performance obligations (PPOs) occurred and our self-reported breaches decreased by 40 per cent compared to the previous year.

Our Business Plan for 2017/18 contained 26 actions or initiatives, to realise six critical success factors (see p.6). We managed to deliver all but two of these: one initiative (an initial investigation for the Distribution Companies Net Load Communications project) was reprioritised for subsequent delivery, and one (concerning Extended Reserves) was adjusted in line with the evolving nature of that project.

We continue to focus on improving delivery of the security of supply functions. A self-reflective review of the March 2017 South Island AUFLS prompted us to undertake several training and process actions, so that we can deliver improved performance should a similar event occur.

Our strategic goals in context

This report presents our past-year performance in terms of the extent to which we've met our own five strategic goals for the system operator service. Those goals exist within a wider context: our six critical success factors, and the strategic priorities of Transpower as a whole. They articulate our goals for fulfilling our obligations to the Authority and meeting the needs of our customers.



Performance metrics

We've agreed six critical success factors and 19 performance metrics with the Authority to measure our performance against. By the end of the financial year, we'd achieved 16 out of the 19 agreed metrics, as set out in the dashboard below.

Metric	Target	Actual	Pass/Fail	Overall result
Our customers are informed and satisfied				
Participant survey result	≥79%	93%	Passed	
Participant survey response rate - online	≥20%	7%	Failed	
Participant survey response rate - first tier	≥80%	100%	Passed	✔ Passed
On-time special event preliminary reports	90% ≤ 10 business days	N/A	Passed	
Edge technology report	≥ 1 / year	1	Passed	
Market insights reports	≥ 5 / year	15	Passed	
We maintain Code compliance and meet our contract obligations				
Market impact of breaches	≤ 1 / year >$50k	0	Passed	✔ Passed
On-time Code/SOSPA deliverables	100%	46	Passed	
We deliver projects successfully				
Service maintenance project delivery	≥ 60% achieved for approved time/budget	33%	Failed	✔ Passed
Market design/service enhancement project delivery	≥ 60% achieved for approved time/budget	100%	Passed	
We are committed to optimal real time operation				
Infeasibility resolution	100% ≤ 2 business days	100%	Passed	
Infeasibility resolution	80% ≤ 1 business day	100%	Passed	✔ Passed
High spring washer resolution	100% ≤ 2 business days	100%	Passed	
High spring washer resolution	80% ≤ 1 business day	100%	Passed	
Our people are engaged and competent				
Staff engagement score	≥68%	68%	Passed	✔ Passed
Our tools and technologies are fit for purpose				
Capability functional fit	73%	67%	Failed	
Technical quality	50%	60%	Passed	✔ Passed
SCADA/MS availability	99.9%	100%	Passed	
On-time schedule publication	99%	100%	Passed	

Performance against our strategic goals

Demonstrate value for money

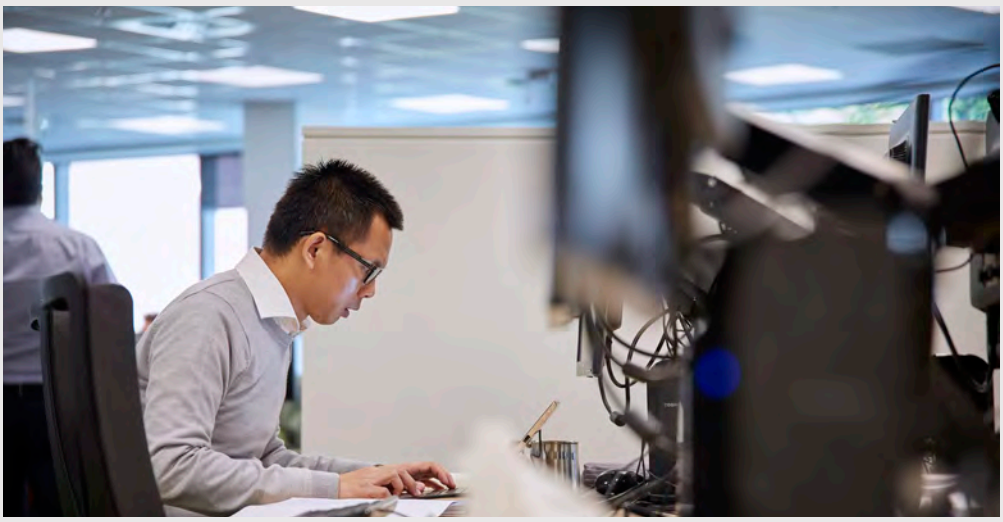
Relevant actions

- **Anticipate changes and be ready to adapt quickly**
- **Optimise grid and power systems operation**
- **Actively manage costs to drive value for money**
- **Manage risks and optimise expenditure**

Critical success factors

Key achievements

Throughout the year, we worked on a number of business plan initiatives and projects that demonstrate we are providing a value-for-money service. We've been putting the bowtie risk management methodology to good use, developing a situational intelligence project, increasing our capacity for special protection schemes and working on a dispatch service enhancement project. We've been investigating the ability of battery energy storage systems to provide ancillary services – particularly instantaneous reserves (IR) – and we've been streamlining our audit processes.



‘Bowtie’ risk management

Over the past year, we’ve expanded our use of the bowtie risk assessment methodology and our understanding of control ownership. The bowtie process involves establishing the risks we face and determining accountability for the controls we use to manage and mitigate these risks; using it has helped our staff to understand why they do what they do, and how that fits into Transpower’s overarching purpose. We are regularly reviewing the delivery of our controls and their effectiveness, to identify where we can make improvements in providing our service. We have achieved real benefit from assessing events through the bowtie lens, to identify failures of controls and how we can address them.

Situational intelligence

Our situational intelligence project will develop new operational interfaces for the control room, to enable improved intelligence and prediction. The investigation stage of this project progressed into the latter part of the review period including selecting a panel of vendors to feed into the capital phase, which we plan to begin early next financial year.

Increased capacity for special protection schemes

We are delivering a project to increase capacity for special protection schemes (SPSs) and plan to complete it next financial year. This project will deliver increased automation in the operational management of SPSs, enabling us to implement additional schemes while reducing our operational risk.

Dispatch service enhancement

We are planning to modernise the market system dispatch interface through our dispatch service enhancement project, which will deploy new protocols. The new interface will enable us to implement alternate dispatch products through future market design changes. The capital phase of the project is under way. We plan to complete the project by 5 July 2019, after which there will be a post-project transition period of approximately 18 months, allowing participants to move to an alternate protocol to manage receipt and acknowledgement of dispatch instructions. We held numerous workshops enabling end-users to become comfortable with the change.

Efficient Procurement of Extended Reserves project

We worked with the Authority and the extended reserves manager (NZX Limited) between June and September 2017, with an eye to improving the efficiency and reliability of the current extended reserve regime. In October 2017, the Authority decided to pause implementation of the programme to investigate and resolve technical and scheme design issues.

The Electricity Industry Participation Code 2010 (Code) requires us to review the technical requirements for extended reserve. In March 2018, the Authority requested that we undertake that review with an expanded scope, including a stocktake of current and future distributor capability to implement the technical requirements schedule, and a risk assessment for implementation.

We completed a validation of the technical requirements in May, and conducted interviews for the capability stocktake with North Island-based distributors in June. We plan to report our findings to the Authority in August/September 2018.

Other initiatives

We worked on a number of work packages to provide technical advisory services (TAS) to the Authority. These included support on the improvements to the load forecast, market design for real-time pricing, further work to support normal frequency management and initial assessment of battery storage technology as IR providers.

The work we delivered to the Authority on the load forecast, and real-time pricing in particular, was very well received. TAS delivery continues to be an area of focus for Transpower. We have learnt some valuable lessons from the work we have carried out in this regard to date.

OUTAGES ASSESSED

2016/17	2017/18	% change
7,162	6,934	3% ↓

Ancillary services

In December 2017, Transpower updated Contact's IR contract to enable IR offers to be submitted for their Whirinaki power plant. This followed successful testing of the actual capability and performance of the generator.

To address the dry-year situation, we procured additional over-frequency reserves in the North Island to enable the HVDC to run at higher transfer levels southward.

We used the results of our analysis of the performance of interruptible load (IL) IR during under-frequency events (UFE) to refine our modelling in our reserves management tool (RMT). The changes improve the scheduling of IR, which is a balance between costs and security. As well as demonstrating value for money, this is an embodiment of our strategic goal of delivering competition with security.

Investigation into batteries providing IR

We have been assisting the Authority with the development of battery energy storage systems (BESSs) providing ancillary services, particularly IR. None of the three technologies that make up IR seems to accommodate a BESS being able to inject energy into the grid to compensate for a drop in system frequency. In 2017, Mercury Energy proposed an amendment to the Code to change the definition of IR to accommodate BESS capability. The Authority raised a TAS statement of work for us to consider the regulatory, engineering and systems implications of this. We recommended two approaches: in the short term, BESS mimicking IL in terms of performance requirements and, in the long term, introduction of a new reserve offer type.

Mercury proceeded with procurement and commissioning of a 1 MW-scale BESS at their Southdown site. We expect this proof-of-concept technology demonstrator will inform us, and the Authority, as we develop more detailed regulatory and performance requirements in the next fiscal year. There is a high level of interest in this from the industry.

Business assurance audits

This year we completed and provided five business assurance audits to the Authority as part of our SOSPA obligations:

1. manage an electrical island
2. build and maintain reactive profiles (voltage)
3. perform a preliminary outage assessment
4. security of supply process
5. manage inputs to the RMT.

Internal review teams and external audit providers carried out this year's audits. This dual responsibility ensured that we gained both independent oversight and internal understanding of what we do.

The review of the Security of Supply process showed that our work to improve in this area has paid dividends but that there are still some areas for us to work on. We will continue to devote additional resource to this area to address these opportunities for improvement.

Software audits

We performed software audits of all updates to key market system solvers in accordance with our Code and our SOSPA obligations. Our auditor provides records of these direct to the Authority.

We are extending the scope of our software audit to include scheduling, pricing and dispatch (SPD) dead bus logic and RMT Asset Owner Performance Obligation reporting, in line with the auditor's recommendations. We have drafted a new version of the SPD formulation; the Authority and the auditor Robinson Bowmaker Paul are reviewing this. We expect a final version in quarter one of next year.

Robinson Bowmaker Paul also asked us to make four changes to our RMT audit scope and testing process. We have completed three of these, and expect to complete the fourth for inclusion in the next audit of the RMT.

Financial Performance

As a regulated entity, Transpower is required to publicly disclose financial information under the Transpower Information Disclosure Determination [2014] NZCC 5. We will publish an addendum to our self-review providing details about our financial performance as system operator at the same time as we publicly disclose the information under the Determination (in late October 2018).

Play an active role in shaping the industry's future

Relevant actions

- **Explore new ways of working with industry**
- **Add value as a thought leader and innovator**
- **Understand new technologies and evolve to respond**
- **Evolve market and security of supply arrangements**

Critical success factors

Key achievements

This year, our Te Mauri Hiko work has been a major focus for us. In this context, we've been looking at the possibilities emerging technologies open up. We've been working on our outage planning processes, including development of a tool to provide time-based visualisation of planned outages on geospatial and network maps.

We've continued to strive to engage as effectively as we can with industry, including through our new 'Market Insights' webpage. We've been working hard to make sure our customers understand what we do and how they can benefit – this year we've offered special training on the National Market for Instantaneous Reserves (NMIR) and the RMT.

WEBSITE VISITS

2016/17	2017/18	% change
36,807	43,791	19% ↑

Te Mauri Hiko – Energy Futures

In May 2018, Transpower publicly launched its *Te Mauri Hiko – Energy Futures* work, with a white paper focussed on New Zealand's energy future. We anticipate revolutionary change, largely involving increased electrification, a greater dependence on electricity (as opposed to coal, gas and oil) and multiple new grid connections from increasingly intermittent energy sources. The resilience and reliability of our system will be crucial.

Government, regulators and industry will need to work together to create customised solutions for New Zealand's future needs.

With this in mind, in our system operator role we are consciously considering the products and services we might need to deliver to facilitate the coming revolution. Among others, one important question we can help to answer is how we will manage future dry years. As a start, we are improving our operational agility, so we can react with shorter lead times.

Emerging technologies

We have led various studies into emerging technologies and our future ability to operate a stable power system. We want to enable industry participant and consumer choice, while remaining mindful of the impact new technologies may have on our ability to meet our PPOs.

Below are some of the steps taken in the past year.

- We published our 2016/17 investigation into the effects a significant increase in electricity generated from solar PV panels would have on the power system.

  We found that the existing New Zealand power system is an enabler: the core transmission network can accommodate significant solar PV in addition to the existing generation mix and demand for electricity.

  We plan to undertake a further review when solar PV approaches 1000 MW – that is, about 16 times what we have today, accounting for about 5 per cent of electricity.
- We began to investigate various energy storage (including electric vehicles) and solar PV usage scenarios on the power system's performance.

Next year, our focus will be on:

- sharing the results of our energy storage investigation
- investigating a potential significant increase in wind generation
- investigating the impact of the scenarios set out in *Te Mauri Hiko*.

Government, regulators and industry will need to work together to create customised solutions for New Zealand's future needs. With this in mind, in our system operator role we are consciously considering the products and services we might need to deliver to facilitate the coming revolution.

Outage management

In 2017/2018, we worked on our outage planning process with Transpower's other divisions. Opportunities for improvement in this area include improving information in our Integrated Outage Notification System on outage scheduling data and protection advice, and clarifying outage planning and data management processes.

We commenced a review of our Outage Planning Policy. We began this work to check that our approach to outage planning enables us to manage any perceived or actual conflicts of interest. The objective of this policy is to allow Transpower (as both system operator and grid owner) and other asset owners to meet their Code obligations related to outage planning in a manner that is consistent, repeatable and assists in giving effect to the Authority's statutory objective to promote competition, efficiency and reliability in the electricity industry. We have developed a set of high level principles and are working through how these may be applied to outage planning and if we need to make any changes to existing processes. We then plan to consult with industry on our recommendations.

HVDC 2020 outages

Transpower is planning to reconductor the Oteranga Bay to Haywards A (Churton Park) section of the HVDC line and replace Pole 2's valve based electronics between January and April 2020. This work will require around three months of monopole HVDC outages, as well as four bi-pole outages. We have discussed these planned outages with industry participants, and have been assessing their potential impact on the market and system security including ways in which we can minimise that impact. The outages will entail restrictions on energy transfer, reserve sharing, frequency keeping and round power operation. Options for minimising impact include disabling reserve sharing and disabling frequency keeping control. We continue to consult with industry participants on these options.

Outage planning visualisation tool

Our tool to provide time-based visualisation of planned outages on geospatial and network maps went live at the end of June 2018. The tool provides visualisation of outages 30 days in advance, along with weather risk information, to improve our outage planning and operational risk management. The current 30-day timeframe means that the audience is limited to those engaged in short-term planning and real-time staff. We are investigating the potential to enhance the tool by allowing users to view a larger data set, making it useful for outage scheduling and long-range planning.

Industry engagement and communications

Effective engagement with industry continues to be one of our priorities. With this aim in mind, this year:

- we ran an asset owner engineering forum on topics, including real-time operations, to cover frequency and voltage, periodic testing of assets and updates to the asset capability statements database[1]
- we provided regular updates to industry through the monthly 'Transpower Customer Update' newsletter, which reaches about 260 subscribers and has an open rate of around 40 per cent
- we began to publish weekly market information on the 'Market Insights' page of our website,[2] and are aiming to grow the audience base for this page in the coming year
- we continued to actively contribute to market developments and initiatives via our submissions to relevant consultations (most often, those the Authority releases)
- we provided a 'system operator observer' to assist the Authority's Market Development Advisory Group with their discussions

[1] See https://www.transpower.co.nz/system-operator/stakeholder-interaction/industry-workshops
[2] https://www.transpower.co.nz/system-operator/market-insights

- we ran a workshop for customers in the Kawerau area on the security implications of outages, and the potential impact of outages on generation
- we continue to be involved in industry initiatives such as the Ministry of Business, Innovation and Employment's Smart Grid and Green Grid forums, and wholesale information and trading system (WITS) user groups and trader forums.
- we presented on a number of system operator topics at Transpower stakeholder forums.

Customer education

We are continuously investigating ways in which we can further educate our customers, to inform their decision making. Below are some examples of this work in the past year.

- We dealt with queries about the NMIR.

  Some of our customers had queries concerning market results after our implementation of the NMIR. We offered to meet these participants in person to explain, and many took us up on the offer. We arranged interactive Q&A meetings during which we worked through explanatory examples. This initiative proved to be mutually beneficial, providing clarity for participants and a useful insight for us into customers' concerns and operations.

  "Thank you for taking the time to visit us and help embed our understanding of the NMIR. I also was very pleased to see the engagement and discussions after the formal meeting that occurred in our Control Room afterwards."

- We continued our RMT training

  Our RMT training course is available to external participants. The goal is to demystify an aspect of system operations; in this case a complex supplementary tool that performs a key role in both the provision of security and the efficiency of the market. Internal and external participants receive the same training and materials. This year, external participants were satisfied with the course; one, for example, told us that the ***"RMT presentation was very well put together and very useful"***. We are looking to extend our offerings in this area.

Customer satisfaction survey

Every year, we conduct a customer satisfaction survey. This year, key indicators were consistent with previous years; we exceeded our key performance indicator for overall satisfaction (customers who rated our service as 'very good' or 'good') of 79 per cent, achieving 93 percent.

Year	Very good	Good	Neutral	Poor
2017/18	40%	53%	7%	-
2016/17	18%	63%	16%	3%

We scored highest in:

- having the required skills and knowledge to perform our service
- being able to perform the service dependably and accurately
- engagement with participants.

More than 70 per cent of respondents selected the following two statements when asked *"Based on your experience in the past 12 months, how do you rate Transpower's ability to remain impartial as the system operator?"*:

- Interactions with participants are consistent and fair
- Professional and reliable in maintaining the confidentiality of participant information.

By engaging with customers face to face, we have determined some ways in which we think we can improve in the coming year. We plan to:

- achieve a greater survey participation rate by better targeting those who interact frequently with our service
- communicate with our customers more effectively on outage planning and coordination
- hold expanded participant education sessions (in response to the positive feedback customers have given us on our education sessions).

Deliver competition with security

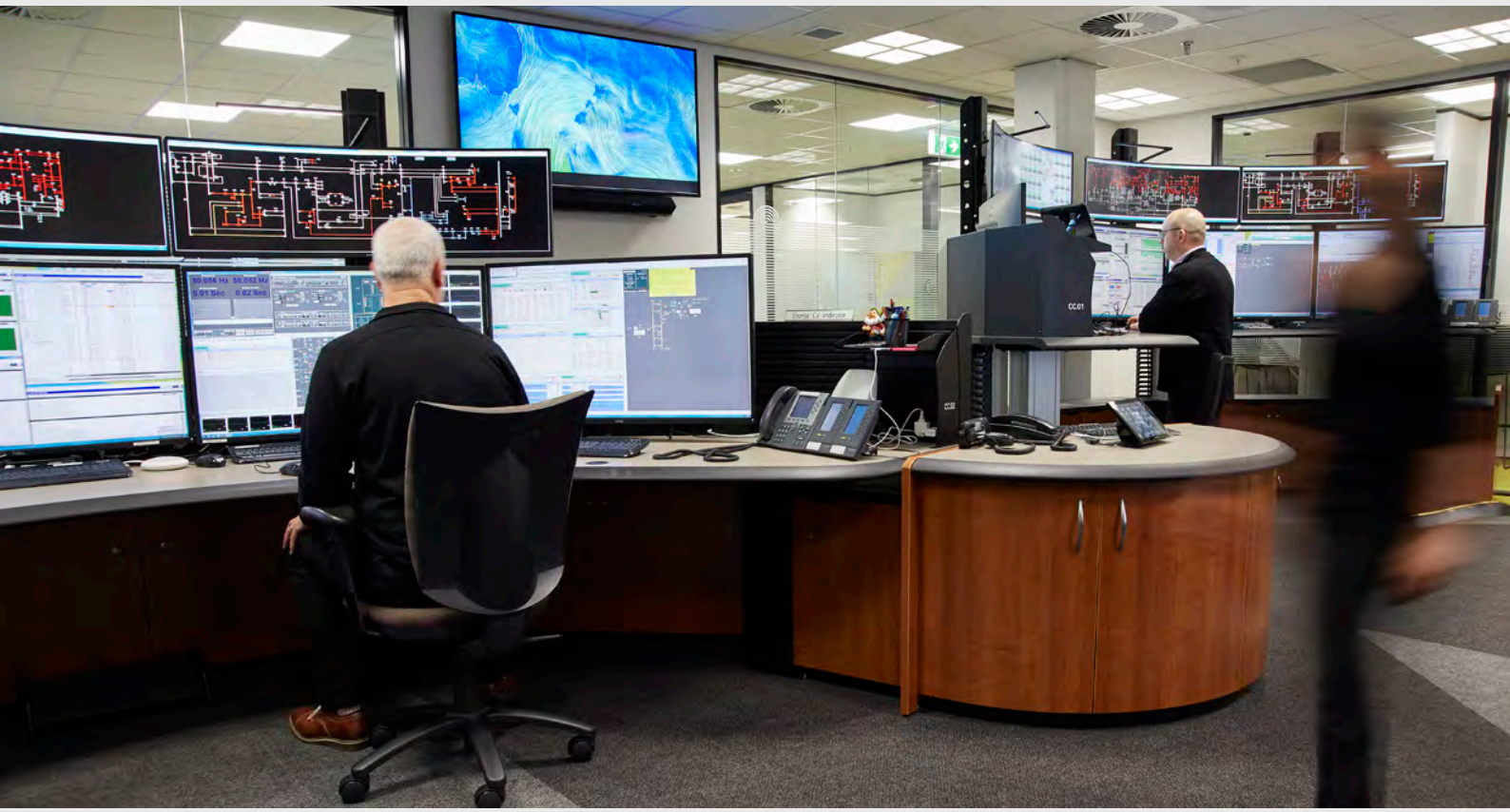
Relevant actions

- **Evolve power system performance standards**
- **Deliver fit for purpose security**
- **Provide information to support efficient market**
- **Reduce barriers to market entry**

Critical success factors

Key achievements

In 2017/18, dry conditions continued, and we focussed on streamlining our performance in the security of supply area. We successfully carried out a black start test and held two system restoration industry workshops. In November, a flood in our Wellington headquarters presented us with a particular challenge.



Response to operational events

The 2017/18 review year was relatively quiet; no particularly significant issues arose.

The year presented us with several weather-related system events, but none had ongoing or profound impacts. The Central North Island experienced heavy snow on 13 July; a widespread storm hit the Upper South Island on 8 November; Cyclone Gita affected the Lower North Island and Upper South Island on 20 February; and lightning storms hit Taranaki on 9 April and again on 18 May.

We managed these events according to our pre-event planning processes (e.g. recalling grid-related works from outage or not commencing planned work, reclassifying at-risk double circuits and making preparations for calling in additional staff during expected periods of high activity).

One particular event of note occurred at 02:43 02:43 on 8 November, when the two in-service Upper South Island (USI) 220 kV circuits tripped simultaneously. Shortly thereafter, the 66 kV/110 kV West Coast network also tripped, as it could not support the total USI load. Approximately 80 MW of load was lost in North Canterbury, Nelson, Marlborough and the West Coast. We declared a grid emergency to reconfigure the grid for restoration, using our existing contingency plans. We issued final restoration instructions at 05:19.

Asset outages, including of major assets such as the HVDC poles and Huntly U5, occurred at planned times and generally took place without notable system impacts.

Security of supply/emergency management

Like 2016/17, this was another challenging year for the security of supply function. This year, we applied a project-management approach and increased resources to our security of supply workstream, resulting in significant improvements.

Dry conditions this review period meant that emergency management planning was a top priority. We identified a number of areas for future improvement, and focussed our effort on resolving identified issues and increasing the frequency of our regular reporting functions, to respond to heightened industry and regulatory interest in security of supply.

Overall, we have increased our preparedness and effectiveness in terms of security of supply, and our performance is now more closely aligned to industry stakeholders' expectations. We have refined our internal processes and planning documents, more clearly established who is accountable for key activities (including governance), developed timings and triggers for key activities and, where appropriate, built functional documents (or templates) to address future security of supply events (including a communications plan, an advertising campaign procurement plan and reporting templates). We are continuing to focus attention on improvement and development (e.g. by further development of rolling outage planning). We have begun work on developing a security of supply strategy, and are actively thinking about what the security of supply

GWh SERVED (GIGAWATT HOURS)

2016/17	2017/18	% change
39,754	40,055	0.8% ↑

function may look like in the future. We are aiming to improve the usefulness of our key industry metrics or reports (e.g. Hydro Risk Curves (HRCs), Annual Assessment), so that we can provide the most benefit to industry.

SoSFIP review

We reviewed the Security of Supply Forecasting and Information Policy (SoSFIP) for 2017/18, mainly to examine the treatment of contingent storage in the derivation of the HRCs. This is awaiting the Authority's review of the triggers for an Official Conservation Campaign, which treatment of contingent storage has a material impact on. We worked closely with the Authority to produce this document (which we submitted in March 2018), and will continue to collaborate with it up to and during the industry consultation period, which is scheduled for September/October 2018.

Security of supply administration in general

In late February 2018, following industry consultation, we published our security of supply annual assessment. We developed a new format for this year's assessment, aimed at providing a more useful and accessible forecast of security of supply in the next 5–10 years. The new assessment features three possible supply-and-demand scenarios, rather than one set of analysis, offering a richer source of information to industry. We believe this has significantly improved the assessment, and we will be building on the new format in the 2019 iteration.

An update to the demand forecast used in the HRCs and the annual assessment on 22 December 2017 resulted in a significant change to the HRCs. We have reviewed the demand forecast update process and put procedures in place that will ensure that, in future, we can publish major changes to security of supply metrics earlier in the year.

In late 2017, Genesis Energy advised us of its contracted fuel supply, noting the challenges and risks to procuring additional fuel over and above presently contracted quantities. We consequently carried out a comprehensive investigation, including

industry consultation, into the impact of thermal fuel limitations on the HRC input assumptions, which reassured us that our HRC input assumptions are accurately representing the risk associated with thermal fuels. However, we will be adding a secondary validation step to the HRC update process, to ensure that our thermal fuel assumptions are valid.

Outages

We continue to engage with industry on addressing outages that have potential market or security implications. In planning for such events, we follow a process of early notification and planning, to best ensure system security. This year presented some challenges, in the form of outage concurrencies.

The summer months presented a higher than usual level of complexity because of high summer demand, especially when the irrigation load in Southland coincided with low lake levels. We undertook regional transmission studies to understand the risks associated with the dry summer in the region, looking at scenarios involving continued low rain into February and March. In the event, late summer saw some significant weather events which restocked the Southern Lakes.

Our customers have told us that the notice we provide on changes to planned outages is sometimes too short, and that they wish to see outages included in market schedules as early as possible. We will take this feedback into account when we review our processes covering outages.

Credible event review

Our Policy Statement requires us as the system operator to identify losses of key assets (known as credible events) and consider how best to manage them – identifying the events and their possible consequences, and determining the most economical ways to mitigate risks.

Because consequences and mitigations of credible events can vary at each bus, we completed a review in June 2017. We reviewed the classification of core grid interconnecting transformers (ICTs), and published our proposal on reclassification in June 2018. This report proposes some changes to the way we manage risks posed by losses of these ICTs, including using grid reconfiguration to provide greater certainty that planned outages will proceed and reducing the use of market node constraints to bring on generation. The report was well received by the Authority.

Black start testing and system restoration workshops

In November, we successfully carried out black start testing of Contact Energy's plant at Clyde. We included a functionality test of our auto-synchronising relay at Invercargill, using a realistic simulation of synchronising the black-started island back to the main transmission system.

We were pleased with the process and the results, which renewed our confidence in our ability to manage the consequences of a major system islanding event (especially given concerns that arose from the March 2017 AUFLS event: see p.34).

As system operator, we maintain a programme of events aiming to educate industry on the practices and procedures we expect connected parties to follow in the event of widespread system failure requiring restoration. We held two system restoration industry workshops: a Canterbury regional restoration workshop and a South Island core grid joint simulation. The latter used Transpower's training simulators across four locations (Christchurch, Wellington, Hamilton and Auckland) and involved 20 operators from Transpower, Meridian Energy, Contact Energy and New Zealand Aluminium Smelters. This test proved the concept of parallel operations, using one National Grid Operating Centre (NGOC) team to black start Aviemore at the same time that another black starts Clyde (following which the two systems are synchronised), reducing restoration time for Christchurch, for example, by approximately three to four hours.

Overall, we have increased our preparedness and effectiveness in terms of security of supply, and our performance is now more closely aligned to industry stakeholders' expectations.

MW PEAK (MEGAWATT)

2016/17	2017/18	% change
6,512 (8 August 2016)	6,739 (26 June 2018)	3.4% ↑

Improving market outcomes

During the review year, we began an internal investigation to assess whether we could remove some of the complexity from the NMIR without compromising security. Specifically, we are looking at mitigations to the 'sticky point' that exists within the current design and that is a source of market confusion and some frustration. Early results appear promising; we will share them with the Authority and industry in due course.

Following engagement with market participants and WITS, we have initiated a project to publish market node constraints, and to publish improved HVDC constraint information to WITS. This allows traders better visibility and opportunity to mitigate cost constraints, reducing the costs for New Zealand. We expect it to be in place by October 2018.

Business continuity planning (BCP)

Flooding at Waikoukou

By November 2017, all Transpower's Wellington-based staff had moved under one roof from our former office on The Terrace into our new purpose-built building in Boulcott Street called Waikoukou. On Sunday 12 November, a week after the move, a sprinkler failure caused extreme flooding in the building. This provided a comprehensive test of our ability to run our service under adversity.

Our Wellington Coordination Centre required evacuation. Full system management moved to Hamilton. Some Wellington staff worked in Hamilton for two days following the evacuation. Other staff worked from home. On 14 November, we began operating a temporary dispatch facility on Waikoukou level 5, allowing us to resume an 'N-1' service. Normal service resumed on the afternoon of 20 November.

We learnt several lessons from the flooding incident, including:

- the need for staff working from home to ensure they have necessary equipment (most, but not all staff had taken their laptops home)
- the importance of home 'workstation' ergonomics
- the required standard of group communication tools (such as Skype) linking large numbers (10 or more) of staff working from home.

As a result, we have made several changes to our business operations.

Throughout the flood disruption, we successfully managed to complete all operational support tasks to the market and real-time operations.

Annual exercise

Our annual business continuity exercise in May 2018, comprised a simulation in which the BCP team worked through their response to a fictional gas explosion in the food court adjoining our building. This tested our business continuity in terms of its application to a potential long-term absence from our new Wellington facilities.

Improve our asset and infrastructure management

Relevant actions

- **Look for opportunities to improve systems and processes**
- **Optimise use of emerging technologies**
- **Strategically review capital programme**
- **Leverage new information and control technologies**

Critical success factors

Key achievements

We have been working hard this year on streamlining the way we do business. We have consolidated some of our key teams, and we're beginning to take a look at the way artificial intelligence (AI) and other new technology may change the way we do things in the future. We continue to work on realigning our operational focus, from reliability to resilience. This year provided us with some great chances to put this strategy into action.

Transformation programme

Transpower's transformation programme is a suite of strategic, cultural and efficiency projects designed to continuously challenge how we manage our business to help us remain competitive in a changing world. In terms of system operations, it is helping us deliver improvements in real-time operations, modelling and planning. We have reorganised our modelling team to reduce the number of handovers and duplicate tasks, and taken some tactical steps to improve our outage planning performance. We are investigating automation of our voltage management process, aiming to improve efficiency, consistency and accuracy.

This review year, we implemented technologies to improve our ability to monitor and rapidly deploy our critical market systems, increasing system resilience and reducing our necessary maintenance and development effort.

Operations, Process and Technology Improvements team

As part of the consolidation of all of Transpower's real-time operational staff to a common management structure (see p.31), we have made the same change to the non-Information Services and Technology (IST) experts who support the real-time operational tools. These experts are now grouped within the new Operations, Process and Technology Improvements team. This change will ensure that our restructure benefits the technological aspects of our service, as well as the the operational and process aspects of what we do. The new team will play a crucial role in the evolution of the real-time tools and delivery of our IST 10-year development road maps.

Investigating evolving technologies

We expect that, in the future, we will use AI for improved forecasting (both for demand and solar) and tuning of complicated engineering models (e.g. reactive profiles). To date, we've successfully used some AI to automate our modelling of generator governor models. To fully unlock the potential of this technology, we are aware we will need a new skillset.

We have improved our video conferencing capabilities across the organisation, and adopted new information sharing technologies, including shared notebooks, documents and collaborative sites.

Review of our capital expenditure investment roadmap

As part of a comprehensive annual process, we continue to update our capital expenditure investment roadmap. In reviewing our current and future capability needs, we take account of changes in our operating environment, service obligations and internal strategies. Through comparison with our current capabilities, we identify where and when we need to invest to maintain our service, enable industry development and support the Authority's 'Competition, Reliability and Efficiency' objective. Because the rate of change within our industry is accelerating, our roadmap changes significantly every year. We provided the latest version to the Authority in June 2018.

A focus on operational resilience

For some time, Transpower has been moving away from a strategy of aiming for 100 per cent reliable critical systems at all costs and instead focussing on system resilience. Our SCADA and market systems were designed to have – and have demonstrated – very high availability. However, as with any systems,

GRID EMERGENCIES DECLARED

2016/17	2017/18	% change
15	8	47% ↓

problems arise, and there are times that service outages are necessary.

The pursuit of minor increases in a level of reliability that is already very high becomes very expensive. The reality is that our system can never be made completely free from the risk of failure, or the need to be periodically taken out of service for updating.

In light of this, we have increasingly focussed instead on the resilience of our systems: high (but not total) reliability combined with an optimal ability to diagnose problems and fix them swiftly. Our work reflects this strategy in several ways.

The complexity of our market system at application, database and architectural levels has meant that, in the past, it has been difficult and expensive to diagnose problems when they arise. Our IST and Operations Division personnel are addressing this issue.

- We have already simplified the server farm on which the system operates. We have also beefed up our critical services support by investing in appropriate diagnostic (dashboard) tools and skilled personnel.
- This year, we embarked on a major capital programme to simplify the application and database layers. We expect to achieve a materially improved ability to diagnose and resolve periodic problems that arise with the system.
- This year, we developed and adopted an upgrade strategy for our SCADA system, shared across our grid and system operator services. The strategy replaces the previous upgrade path of periodic (five-to-seven-year) major version upgrades; it will essentially mean a continuous stream of component upgrades. We expect this approach to reduce project risk and resource requirements, and allow us earlier access to some of the latest SCADA applications.

CASE STUDY

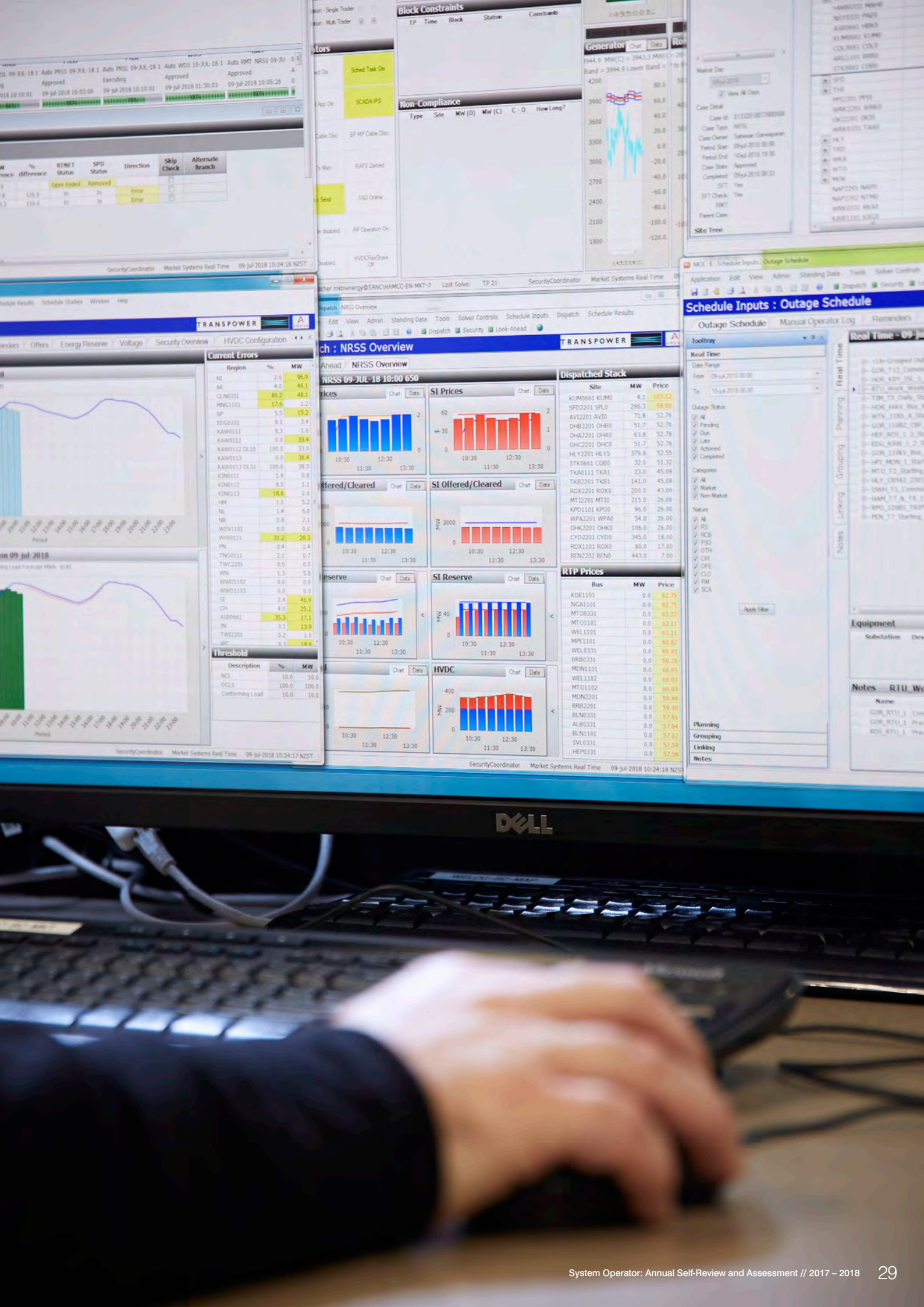
An example of demonstrating resilience

On 16 September 2017 at 08:29, SCADA users realised they were unable to issue commands from SCADA. Shortly thereafter they realised SCADA monitoring was operating but control was not. The market dispatch system was operating normally.

Weather conditions across the country were settled, and little outage work was under way; these conditions meant the impact of the problem was significantly less than it could have been.

Personnel responsible for system operations, grid operations and IST, including skilled SCADA architecture and application experts, quickly responded to the incident. They found the cause to be a previously unseen software application problem.

Full SCADA control was restored at 11:09. Throughout the incident, the market system and connected security applications had continued to receive updated SCADA data, and normal dispatch service continued – meaning market participants were essentially unaffected.


Block Constraints
Non-Compliance
Generator
Schedule Inputs : Outage Schedule
Outage Schedule
Manual Operator Log
TRANSPOWER
Current Errors
Threshold
NRSS Overview
NRSS 09-JUL-18 10:00 650
SI Prices
SI Offered/Cleared
SI Reserve
HVDC
Dispatched Stack
RTP Prices
Equipment
Notes
DELL

Develop our organisational effectiveness

Relevant actions

- **Refine business operating models**
- **Enhance core risk management competencies**
- **Embrace diversity and inclusion initiatives**
- **Develop awareness and agility skills**

Critical success factors

Key achievements

This year we created a new Operations Division to allow us to better prepare for the way we'll deliver our services in the future. Our vision for that future is encapsulated within our 2030 Real-time Operating Vision (see p.33). We've worked hard on developing and delivering effective training in multiple contexts this year, and we've taken some important steps towards making sure our business is as diverse and inclusive as it can be.

New divisional structure and role impartiality

On 30 April, we integrated our outage planning and real-time operations, by bringing our NGOC and its outage works planners under the management of a new operating division, called Operations (formerly System Operations).

Operations now delivers the same system operator services as well as some grid owner services, with the intent that this integration will, in time, deliver improved efficiency and effectiveness. More importantly, we expect that the combined teams will enable us to deliver grid and market services capable of meeting the generation and system supply needs of the future.

Management of planning and real-time services is now centralised within the Operations Division. We will make operational changes as we identify improvement opportunities. NCC (system) operations and NGOC (grid activities, e.g. switching) remain separate operations and we expect no material operational integration between these for several years.

This change has introduced new connections between our grid and system operator roles, in that some staff from these distinct areas now share a manager. This, alongisde the shift of our Wellington personnel from our former Terrace office to Waikoukou caused us to renew our focus on ensuring impartiality between our two roles. We began to update our conflict of interest and role impartiality procedures, and training materials in March 2018, and formally introduced the updated training material across Transpower in June. At the date of writing 85% of permanent employees had completed the training.

We also engaged an external consultant to advise us on whether our policies were fit for purpose. The report (only received in draft at the time of writing) confirmed our policies were appropriate and suggested some areas of improvement where we could better engage with industry to address their impartiality concerns.

Embedding the behaviours

Transpower's recent behavioural transformation programme, Embedding the Behaviours, is now complete. This programme ran for two years. It involved quarterly workshops for people managers and key influencers to embed four key behaviours: **clarity** of purpose, supporting **collaboration**, taking personal **accountability** and enabling workplace **delivery**. Our ongoing challenge is to ensure that we keep these behaviours 'front-of-mind' and meaningful.

Diversity and inclusion

As part of our behavioural transformation, we are focussed on ensuring we maintain an inclusive and positive working environment, as we increasingly diversify our workforce. Our Operations division, with the system operator at its core, is a dedicated supporter of this approach.

In November 2017, we introduced our diversity and inclusion policy, and January saw the shift from a management-led diversity and inclusion leadership group to a new, more representative committee of employees. This group – which includes two Operations division staff – is now playing a more active role in supporting our diversity and inclusion initiatives.

As members of New Zealand's 'Champions for Change' initiative, we have committed to annually reporting our gender and ethnicity data externally. Additionally, we support the New Zealand Institute of Architects/ Engineering New Zealand Diversity Agenda, aimed at increasing the number of women in architecture and engineering by 2020. There are three women on the eight-person senior leadership team within our Operations division. Just 20 per cent of the division are women.

We are also engaged in various initiatives to increase our bicultural competency. Our goal is to enable better engagement with iwi in a business capacity, while also ensuring Transpower is an appealing place for Māori to work.

We are taking a lead role in encouraging more diversity in our industry, for example by introducing two Women in Engineering scholarships and a Māori Engineering Student Scholarship. Through our graduate programme we have recruited five new graduates, including

NUMBER OF BREACHES

2016/17	2017/18	% change
20	12	40% ↓

two female graduates and one Māori graduate. We took part in ShadowTech activities again this year – a programme that encourages more young women into STEM subjects.

Compliance

We did not report any breaches of our PPOs in the 2017/18 year, but self-reported 12 breaches of the Code. (This compares with 20 breaches in the previous 12 months.) The number of errors reduced across the reporting period; we will work to continue this trend.

Our focus this year has been on prevention. We have worked to identify trends between events, to ensure we have the right checks and balances in place to deliver a reliable and consistent service. We link events and breaches with controls in our risk management framework, and inform control owners on the performance and effectiveness of the controls.

One notable breach reported in November concerned the processing of some dispatchable demand (DD) bids. Investigations discovered the root cause to be the interaction between several independent changes made to the market system over the course of several years, combined with a unique pattern of bid submissions. To prevent this situation from reoccurring, Transpower's critical systems analysts liaised with the WITS manager to quickly effect a change to the WITS rollover processing.

Note: This report does not include commentary on the compliance aspects of the events of 2 March 2017 (see p.34), because the event investigation and subsequent compliance investigation were not finalised at the time of writing.

Price errors

We claimed five pricing errors during the review period, and assisted one participant to submit a price error claim themselves. The Authority upheld all of these price errors.

One participant made two price error claims alleging an error concerning system operator data and processes. The Authority did not uphold either of these claims.

International interactions

We hosted several visiting international delegations during the year. In addition:

- two employees visited several North American system operators to compare operations, processes, and tools
- two employees attended the North American SCADA user group conference to learn about product developments and interact with other users
- an employee attended the Association of Power Exchanges (APEx)'s annual conference to ensure that we stay abreast of international developments and enable international networking opportunities
- we hosted the annual meeting of the Australian chapter of the Cigre Electricity Markets & Regulation study committee, which included a workshop on the issues faced by members, including a recent black-out event in South Australia.

Training and development

During the review year, we completed four notable training and development initiatives.

- We ran a control room behaviours training programme to reinforce the behavioural aspects the control-room environment requires. Topics covered included human factors, team work, communication and the control room environment itself. We delivered this training to NGOC and NCC staff.
- We updated our market analyst documentation and training plans, to reflect the core competencies our market analysts need now and into the future. We assessed our market analysts' current competencies, and delivered targeted training and coaching where we identified gaps. This work also recognises the ever-changing employment habits of today's workforce, where shorter tenures are more common.
- We updated our role impartiality training material (see p.31).
- In response to the South Island AUFLS event, and our subsequent investigation, we embarked on a determined programme to retrain operational personnel in the required communications protocol, with a heavy emphasis on simulation training to ensure protocol-standard communications become the norm. We will take this programme to other asset owners later in 2018, to ensure industry-wide adherence to the standard. We also retrained all real-time operational staff in use of the AutoSynch tool; this training will be ongoing as part of periodic refresher training.

We pride ourselves on the quality of our training, which aims to ensure that our people have the skills necessary to manage unexpected events such as the South Island AUFLS event. We are confident that the controls we need to manage such events successfully are now in place.

CASE STUDY

2030 Real-time operating vision

Our operating service has come a long way from a system characterised by manually intensive local operation to today's national system and market control. Our skilled people manage increasingly autonomous systems with evolving services to continually deliver value for New Zealand

To inform our planning and as a companion piece to our 2016 document that set out our vision of New Zealand's electricity industry over the next 5–40 years, Transmission Tomorrow, we have developed an operating vision for 2030. Taking influence from a wide variety of factors, our operating vision is a view of the future that will evolve over time.

In 2030, our real-time operations will:

- allow us, as the grid and system operator of choice, to operate the national grid and power system through an integrated and substantially more automated and predictive operation
- allow us to add value by running a unifying grid and power system
- maintain a national focus, providing a national grid for grid-connected participants and a national electricity market
- provide a flexible suite of asset and market-related services, including into distribution networks, to facilitate safe and effective national operations
- be staffed by highly motivated, technically excellent and highly trained people.

We must continue to improve our service, to focus on the customer. We will enable flexible risk-based decision making to deliver common-sense, timely and defensible decisions. Our systems will become more automated. We will invest in technology improvements where they deliver efficiencies and improvements including:

- digital transformation and deep data analytics
- comprehensive remote monitoring and control
- fast, flexible risk-based decision making
- smart access to IP and technical advice.

Our people continue to be key to our service, and our support roles will evolve with our operating needs. We will use training and advanced simulations to support automated operations.

Within the context of our corporate strategies, *Transmission Tomorrow* and *Te Mauri Hiko,* we will use our operating vision to promote debate within our teams, engage with our stakeholders, inform our transformation plans and validate our technology roadmaps, and ensure our people have the right skills to match our changing needs.

CASE STUDY

South Island AUFLS Event

On 2 March 2017, New Zealand experienced a major power system event that resulted in the South Island power system splitting into two separate systems.

This complex and extended 'high-impact, low-probability' event incorporated an AUFLS activation in the South Island, a UFE in the North Island and a second UFE in the South Island, two minutes after the initial event.

Approximately 120 MW (16 per cent) of electricity used by consumers in the upper part of the South Island was disconnected for up to 90 minutes. This was one of the more complex events experienced on the power system.

The trigger for the incident was the disconnection of two in-service 220 kV transmission circuits during scheduled equipment tests at Transpower's Clyde substation. This disconnection resulted in the forming of two separate unbalanced power systems within the South Island (referred to as electrical 'islands').

Automatic controls, including UFE reserves, HVDC response, over-frequency arming and under-frequency load shedding, initially stabilised the two systems. Thereafter, control-room operators acted to further stabilise the systems and then reconnect the two electrical islands and restore disconnected consumers.

The event was a high-pressure situation that tested our performance, and we were found wanting in some areas. Specifically we failed in the following two respects.

- **Use of the AutoSynch tool:** A written procedure for operation of this new tool, which has a very specific functionality, was not followed (or even referred to) at the time of the event. Staff lacked training for this tool, which was also found to be poorly designed. At the time, the synchronisation actions that were taken were effective in bringing the two electrical islands together, but they exposed asset owners to the risk of damage.
- **Inter-control room communications:** The unprecedented nature of the event contributed to poor communications between the system operator and asset owners. We failed to communicate operationally to the standards we expect of ourselves, and set out in the Code. Some communications were unclear, and some were incorrect, leading to confusion. There was a clear failure to observe the required command and control readback protocol that Technical Code C (operational communications) of part 8 of the Code sets out.

In the months following the event, in our dual roles as both system operator and grid owner, we carried out an investigation to determine what had happened, what lessons we and the wider industry could learn from the event, and the actions we needed to take as a result. We have taken comprehensive steps to implement improvements on the basis of the review. The investigation report is available through the Transpower website.[3]

[3] https://www.transpower.co.nz/resources/report-2-march-2017-south-island-aufls-event

TRANSPOWER.CO.NZ

Appendix B: Indication of preliminary content of Authority's annual review of system operator performance, for the period 1 July 2017 – 30 June 2018

Overall, the conclusion of the Authority's review is that the system operator has demonstrated a continued trend of improved performance over the review period.

The system operator delivered numerous outputs of an excellent standard over the review period, particularly in respect to its advice under the Technical Advisory Service (TAS) provisions of the system operator service provider agreement (SOSPA). Highlights were the system operator's work on real time pricing (RTP) and load forecasting.

The system operator's project management capability continued to improve, particularly in the security of supply area.

The Authority values the collaborative working relationship it has with the system operator. The Authority looks forward to continuing to work with the system operator to better support the long-term benefit of consumers.

However, the Authority does have some concerns about the system operator's post-event response to the automatic frequency load shedding (AUFLS) event that occurred on 2 March 2017. The Authority notes that the system operator has started making some positive changes in response to the 2 March AUFLS event review.

To a lesser extent, the Authority was also disappointed with the system operator's security of supply forecasting and information policy (SOSFIP) review and some aspects of the system operator's performance on the dispatch service enhancement (DSE) project.

The SOSPA requires the system operator and Authority to annually agree a set of objective measures for the next financial year, against which the quality of the system operator's provision of the service will be managed. The system operator and Authority agreed on 19 performance metrics to measure the system operator's performance against for the 2017-18 financial year. Of the 19 performance metrics, the system operator met the targets for 15 and did not meet the targets for three. One of the performance metrics was not applicable because the relevant circumstance didn't arise during the financial year.[2]

The system operator has set five strategic goals, which are outlined in its strategic plan. These strategic goals provide the system operator with a clear and positive direction, and the Authority is encouraged by its progress towards the five goals. The Authority's view of the system operator's progress towards each of the strategic goals is set out below.

- **Demonstrating value for money:** The system operator made some excellent contributions to projects over the review period. The system operator's work on RTP was a highlight again. The system operator also made excellent contributions to the load forecast, normal frequency management, and battery storage technology projects. However, some aspects of the system operator's performance in the DSE project were disappointing. The system operator's

[2] One of the performance metrics was that 90% 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.

project management, communication with the Authority, and economic analysis on the DSE project was not of the system operator's usual high standard. However, the Authority was impressed by the system operator's interactions with industry on this project, and the design brief was of high quality. The Authority notes that the DSE project was the first service enhancement project under the new SOSPA and therefore some teething issues are to be expected.

The Authority recognises the progress the system operator made towards meeting the five recommendations in the 2016-17 review of the system operator's performance. However, the Authority considers that further work is needed to meet two of the 2016-17 recommendations. Specifically, the Authority would like to see the system operator think more proactively and strategically about the needs of its security of supply function, and ensure it continues to improve its organisational capability for economic analysis. The Authority has made further recommendations in these respects (see recommendations 1 and 2 below).

- **Playing an active role in shaping the industry's future:** The Authority recognises the initiative the system operator has continued to display in considering how future industry change may impact on system operations, particularly the impact of emerging technologies.

  The working relationship between the system operator and the Authority continued to grow stronger over the review period. The relationship was collaborative, with the system operator willing to listen to criticism and engage constructively.

  The system operator continued to engage constructively with other stakeholders. The system operator ran some valuable industry briefings and provided useful advice to the Market Design Advisory Group (MDAG).

  The system operator's customer satisfaction survey showed that 93% of survey respondents (compared to 81% last year) rated the system operator's service as 'very good' or 'good'. However, the Authority is concerned that there were only 20 respondents to the online survey (compared with 61 respondents last year). The Authority recommends that the system operator consider how it can ensure greater survey participation is achieved in future customer satisfaction surveys (see recommendation 3 below).

- **Delivering competition with security:** The system operator responded competently to power system events during the review period. However, the Authority has some concerns with the system operator's post-event response to the AUFLS event that occurred on 2 March 2017.[3] In particular, the Authority is concerned that:
  - Transpower's initial investigation failed to identify some important matters
  - draft versions of Transpower's report on the event were not transparent or candid

[3] While this event occurred in the previous financial year (2016-17), most of the post-event response occurred in the 2017-18 financial year.

- Transpower took too long to complete its investigation and publish its final report on the event
- Transpower's joint investigation and reporting was not conducive to discovering and describing the system operator's view of the event
- the system operator did not report a breach in relation to the event
- the system operator's chain of reasoning for why there was no causer of the first under-frequency event (a conclusion that the Authority did not share) lacked justification.

Generally, the system operator's performance of its security of supply function improved on the previous year, including some improvement in its security of supply preparedness. Of particular note is that the system operator's project management in this area improved substantially on the previous year. The Authority encourages the system operator to continue to improve how it thinks proactively and strategically about the needs of its security of supply function and acknowledges that the system operator has already started work in this area. As noted above, the Authority has made a recommendation to this effect (see recommendation 1 below).

The system operator has made some improvements to its Security of Supply Annual Assessment (ASA) since last financial year following Authority feedback. However, there are still some improvements needed—for example, more transparency is needed around changes to demand forecasts and the ASA would benefit from the system operator taking a retrospective look at how forecasts have performed.

Aspects of the system operator's SOSFIP review were disappointing. The scope and quality appeared to suffer from insufficient resources. For example, the review failed to address concerns that the Authority had raised on earlier versions of the SOSFIP.

However, the Authority was impressed with the system operator's credible event review, particularly the sensible economic approach it took.

The Authority is pleased with the planning the system operator undertook for emergency management.

- **Improving our asset and infrastructure management:** The system operator continued to realign its operational focus from reliability to resilience. The Authority considers that the system operator's work on this realignment is positive and is an enabler of future benefits. In addition, Transpower's new divisional structure (discussed further below) gives weight to the system operator's operational and infrastructure planning capability.
- **Developing our organisational effectiveness:** In April, Transpower created a new Operations Division that delivers both system operator services and some grid owner services. The Authority understands Transpower's reasoning for this change but notes that Transpower needs to ensure that any potential conflicts of interest (between the system operator and grid owner) are appropriately managed. Transpower should ensure it has processes in place to deal with any conflicts of interest as they arise.

The Authority was impressed by the overall performance of the system operator's staff over the review period. A highlight of the year was the system operator's continued improvement in its project management capability, particularly in the security of supply area.

The quality of the system operator's economic analysis during the review period was mixed. The quantification of benefits in the DSE cost benefit analysis was poor, but the Authority was impressed with the economic approach the system operator applied to the credible event review. As noted above, the Authority has recommended that system operator continue to improve its organisational capability for economic analysis (see recommendation 2 below).

The system operator continued to show a commitment to meeting its compliance obligations in the Code.

The Authority supports the system operator in continuing to align itself with the joint objective, and in responding to the three recommendations included in this review, which are to:

Recommendation 1: ***Ensure that it thinks proactively and strategically when planning the needs of its security of supply function.***

Recommendation 2: ***Ensure that it continues to improve its organisational capability for economic analysis, including cost benefit analysis.***

Recommendation 3: ***Achieve greater participation in customer satisfaction surveys.***