Security and Reliability Council

System operator performance

Reviewing the system operator's performance for the year ended 30 June 2016

5 October 2016

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 (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 2015-16, 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 cover a shortened period for 2015-16

Under the Code that was effective prior to 19 May 2016, the reviews were required to cover the 12 month period ending 31 August every year. The Authority amended the Code from 19 May 2016 to require that the reviews cover the 12 month period ending 30 June every year. This has the advantages of aligning the performance assessment period with the Authority's financial year, the joint system operator/Authority work plan year and the system operator's annual business plan.

Because the reviews for the 2014-15 year covered the period up to 31 August 2015, the reviews for 2015-16 cover a ten-month period (which is shorter than the usual 12 month period). This ensures a smooth transition with no gaps or overlaps in the performance assessment periods.

Future reviews will cover the 12 month period ending 30 June each year.

[1] Clause 7.11 of the Code specifies the requirements of both the system operator and the Authority with respect to the annual processes to review the system operator's 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 2016-21 (strategic plan), which are:

- delivering competition with security
- demonstrating value for money
- planning for tomorrow
- strengthening relationships
- investing in good people

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.

Particular areas where the SRC might like to focus its attention

The Authority appreciates feedback from SRC members on any aspects of system operator performance that they may wish to comment on.

An indication of the preliminary content of the Authority's review is included in Appendix B. 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 SRC. However, it provides a useful indication that the initial assessment reaches similar conclusions to the system operator's self-review and what recommendations the Authority is considering making to the system operator as opportunities for improvement.

The SRC may like to consider the following questions.

Q1. Does the SRC wish to highlight any particular 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 industry?

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 September 2015 – 30 June 2016 (Appendix A)
- Indication of preliminary content of Authority's annual review of system operator performance, for the period; 1 September 2015 – 30 June 2016 (Appendix B)

Appendix A: System operator annual self-review and assessment: 1 September 2015 – 30 June 2016

Keeping the energy flowing

SYSTEM OPERATOR ANNUAL REVIEW AND ASSESSMENT

1 SEPTEMBER 2015 – 30 JUNE 2016

TRANSPOWER

Transpower New Zealand Ltd The National Grid

IT'S BEEN AN EXCITING AND CHALLENGING TIME FOR INDUSTRY AND **TRANSPOWER** IN ITS DUAL ROLE AS SYSTEM OPERATOR AND GRID OWNER.

FOREWORD

JOHN CLARKE,
GM SYSTEM OPERATIONS

THE THEME FOR THIS PAST YEAR HAS BEEN **'MANAGING UNCERTAINTY'** AS WE RESPONDED TO THE ANNOUNCEMENTS FROM SEVERAL GENERATION COMPANIES REGARDING THEIR PLANS TO CLOSE VARIOUS THERMAL GENERATION PLANTS AROUND NEW ZEALAND.

We provided insights regarding the implications of these closures on the power system, and security of supply. By publishing regular reports on the impact of these planned generator closures throughout late 2015 and early 2021, we aimed to drive discussions across the industry to address the potential future challenges we face together.

There were some robust discussions at industry teleconferences we hosted following publication of each report we issued. In April 2016 Transpower welcomed the announcement by Genesis Energy, supported by a number of other generation companies, to keep the Huntly power station in operation.

A key milestone this year was the signing of the system operator service provider agreement (SOSPA) between Transpower and the Electricity Authority (Authority), on 22 February 2016. This new contract came into effect on 1 July 2016 and reflects the positive working relationship we already have with the Authority. We are pleased to continue to support the Authority's competition, reliability and efficiency focus and look forward to delivering our work which supports the objective of providing long-term benefits for consumers, for years to come.

Amongst this change there have been some constants. Throughout the 2015-16 year, as a business we continued to focus on the five strategic goals:

1. Delivering competition with security
2. Demonstrating value for money
3. Planning for tomorrow
4. Strengthening relationships
5. Investing in good people

This focus was reflected in several initiatives, outlined in more detail later in this document. Internally, Transpower's corporate transformation has meant an increased focus on working more effectively and efficiently. In support of this, we have been working with our Information Services and Technology colleagues to improve various processes involved with delivering the system operator service for New Zealand.

Through this work, and other initiatives outlined in this document, Transpower as system operator has delivered on its objectives for the 2015-16 year. We look forward to continued collaboration and success with our industry peers.

2015/16 ACHIEVEMENTS

- **Insights into Thermal Generator Decommissioning**

  Between September 2015 and April 2016 following the announcements from several generation companies regarding plans to close various thermal generation plants around New Zealand, Transpower, in its roles as system operator and grid owner, developed and published a series of reports looking at the technical and market impact on New Zealand's power system and the grid. These reports were a collaborative effort between Transpower's System Operations and Grid Divisions and also included input from industry stakeholders.

- **Reserves and Frequency Management (RFM) programme**

  We continued our work on a series of projects in the RFM programme which intend to deliver savings for electricity consumers from more efficient power system operations at a national level, rather than by separate arrangements for South and North Islands. The programme hosted several industry forums and maintained ongoing industry engagement and input to several RFM projects. Both the Authority and Transpower have been recognised for this work with a nomination for the 'Innovation in Energy' awards for the 2016 Deloitte Energy Excellence Awards.

- **System Operations – Information Services and Technology Operating model**

  Throughout the year we undertook an internal transformational programme between Transpower's Information Services and Technology and System Operations Divisions. The work involved the design and implementation of an improved operating model between the two groups to provide greater clarity and process improvements and support a more effective delivery of the system operator service.

- **Signing of the new System Operator Service Provider Agreement (SOSPA)**

  In February Transpower signed a new SOSPA with the Authority. This agreement reflects the Authority's increasing focus on competition, reliability and efficiency and provides increased transparency over service and performance measures. It also reflects the positive working relationship we already have with one of our key stakeholders, and our joint focus on delivering for the long-term benefit of New Zealand consumers.

2015/16 ACHIEVEMENTS CONTINUED

- **Core Grid Restoration Exercise**

  Transpower coordinated and led a Core Grid Restoration exercise in Hamilton in June 2016. The exercise was to better understand existing restoration plans, confirm industry capability, identify any gaps in current planning, improvement opportunities and build a platform for future collaboration. Feedback from participants was very positive. The lessons from the exercise will be shared with industry and the Authority in the new financial year.

- **Solar PV project**

  This project looks to understand potential impacts of solar PV on our ability to meet the principal performance obligations (PPOs). The increasing availability and variety of emerging technologies have prompted us to consider the need to procure new or additional ancillary services and how our services could change in order to facilitate participants accessing the grid.

- **Emergency Management Policy and Rolling Outage Plan update**

  In June 2016 we updated and simplified the emergency management policy (EMP) and system operator rolling outage plan (SOROP) following input from industry through a consultation process.

- **Website Improvements**

  In November 2015 we published a new ancillary services 'one stop shop' page and some 'clean and green' mobile data reporting to the system operator section of the Transpower website, improving access for this information to customers.

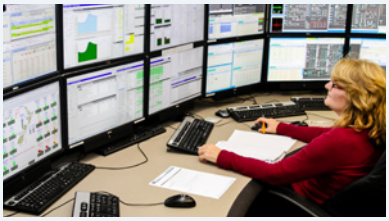
- **2016 National Winter Group Report**

  In May 2016 we released our annual National Winter Group report in which we concluded the power system should be able to meet the peak winter demand in a normal secure state. Our plans for winter 2016 reflected the planned HVDC filter outage taking place in June and confirmed we had the ability to adapt our plans for this outage if circumstances change. The format and content of this report will undergo review in the next year.

STRATEGIC GOALS 2015/16 HIGHLIGHTS

Delivering competition with security

PAGE 05



- Power system status, events and challenges
- Hydrology, security of supply and emergency management
- The market system and market benefits

Demonstrating value for money

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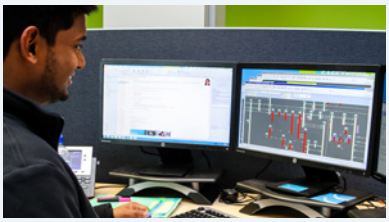
- Business performance
- Joint work plan and project delivery
- Compliance
- Ancillary services

Planning for tomorrow

PAGE 18



- Deciding our direction
- Renewables; future impacts for the industry

Strengthening relationships

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- Engagement and workshops
- Communication

Investing in good people

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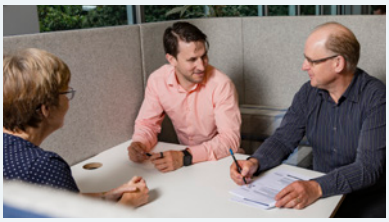

- Having the right skills for the job
- Transpower initiatives

Appendices

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STRATEGIC GOAL #1

Delivering competition with security

Delivering competition with security

POWER SYSTEM STATUS, EVENTS AND CHALLENGES

The power system experienced a wide variety of planned and unexpected events that had the potential to impact its secure operation. We have addressed and managed these challenges to ensure a reliable system for participants and the consumer (see Appendix 1).

MANAGING THE POWER SYSTEM

System coordinators and planning engineers were heavily engaged over the last year managing transmission and communication/protection asset outages associated with the capital delivery programme for year one of Transpower's Regulatory Control Period from 1 July 2015 to 30 June 2020 (RCP2). This workload was successfully accomplished, while continuing to meet system security, market and asset owner objectives.

Some 6249 outages were undertaken, 796 for live line work and 903 for planned power switching operations. The coordination and incorporation of changes were particularly challenging.

Transpower's Grid Performance, Information Services and Technology and System Operations Divisions worked closely together to achieve the best delivery of outages and increase the efficiency of the outage planning process.

We also worked closely with Transpower's Grid Development Division to assist in investigation, design and implementation of special protection schemes (SPSs), designed to enhance transmission system capability and defer larger capital investments.

COMMISSIONING ACTIVITIES

Generation

No significant new generation assets were commissioned in the review period, though routine testing of assets across the industry continued.

Grid Assets

- Completion of Penrose 220 kV bus re-configuration: The final stage of the North of Auckland and Northland grid upgrade was completed in October 2015. Commissioning was delayed following the October 2014 Penrose substation fire.
- Bunnythorpe – Haywards A and B line re-conductoring: Work started on this multi-stage project, with the first sections of re-conductored line being commissioned in December 2015. This project is scheduled for completion in 2019.
- Hangatiki – Te Awamutu circuit: Preparation for the new Hangatiki – Te Awamutu circuit commenced in September 2015. New termination equipment was commissioned at Te Awamutu and Hangatiki substations with protection and synchronising check equipment also being installed at Karapiro, Ongarue, and Arapuni. Commissioning of the new circuit is scheduled for July 2016.
- Wilton and Timaru bus reconfigurations: The two projects to rationalise th 110 kV bus configurations at Wilton substation in the North Island and Timaru substation in the South Island. Both projects have multiple stages and started in February 2016 with completion scheduled for August 2016.

Delivering competition with security

UNDER FREQUENCY EVENT MANAGEMENT

In the last year we undertook a review of our management practice for under frequency events and our long-standing practice of suspending scheduling and dispatch of reserves by setting reserve adjustment factors (RAFs) to zero post event. From 1 July 2016 reserves will continue to be scheduled and dispatched, and our post event process changed to actively seek reserve as part of recovering the system. Participants and the Authority were included in discussions prior to a final decision to implement this change which will bring improvements to power system operations and availability of the reserve market.

In addition, changes to the Tiwai reduction line restorations process took effect on 1 May 2016. These changes to dispatch management are expected to reduce manual errors and reduce potential impacts to industry participants, improving power system and market efficiency.

HVDC CAPABILITIES: ROUNDPOWER AND FREQUENCY KEEPING CONTROL

The Security Tools project completed in September 2015 has reduced the amount of manual intervention required for operation of roundpower mode and frequency keeping control (FKC). The changes enabled use of FKC in conjunction with augmented (partially automated) dispatch formulation. We have performed trials using different parameters for augmented dispatch formulation as well as different quantities of multiple frequency keeping (MFK) to identify any operational implications. A report was produced of the results and provided to the Authority. Some of this work was carried out under TASC[1] 55, with the results being an input to the Authority's normal frequency management strategy.

Following publication of the FKC technical report, four of the seven recommendations have been completed; two more are in progress and work on the final recommendation will commence following the Authority's release of its normal frequency management strategy.

The interim national market for instantaneous reserve (NMIR) was activated in October 2015, reducing the quantity of reserves purchased when FKC is in operation. The complete NMIR project, to enable further FKC benefits, is in the build stage (by Transpower) with completion expected in October 2016.

Self-assessment: FKC operation continues to result in a significant reduction in ancillary service costs, with further benefits still to be realised. Operational refinements and investigation work during the review period provide a solid foundation for ongoing operations as well as further reducing operational and market costs.

GAS CONTINGENCIES

There was one gas contingency declared on 24 May 2016 when a critical gas contingency was notified (between 18:30 and 23:00), due to a loss of Pohokura production.

1 State technical advisory services contract.

Delivering competition with security

HYDROLOGY, SECURITY OF SUPPLY AND EMERGENCY MANAGEMENT

SECURITY OF SUPPLY

Hydrology during the review period was a little above the historical average, with inflows into major controllable hydro catchments[2] at 103% of average for the year. North Island hydrology was below average (inflows were 94% of average), while South Island hydrology was above average (inflows were 107% of average).

The system operator is required to carry out several security of supply obligations as part of the Code. These obligations were fulfilled, including publishing the annual assessment in January 2016 and an updated report in February 2016.

In addition we reviewed and updated the system operator rolling outage plan (SOROP), and the emergency management policy (EMP). Both documents were better organised to improve clarity and were well received by the industry.

Thermal decommissioning announcements during the review period meant it was necessary to reflect these changes in the security of supply analysis. More detail on this work is provided in the thermal decommissioning section of this report.

Self-assessment: In a time of generation uncertainty, in addition to completing our obligations for security of supply this year we have provided the industry with further meaningful insights and information to assist industry planning.

THERMAL DECOMMISSIONING

On 30 September 2015 Contact Energy decommissioned its 400 MW Otahuhu B power station, and on 1 January 2016 Mighty River Power (now Mercury Energy) decommissioned its 140 MW Southdown power station. Genesis Energy announced its intention to permanently withdraw its two remaining 250 MW Huntly Rankine units by December 2018, later revised to December 2022.

In conjunction with several teams across Transpower we undertook analysis to determine what impacts the decommissioning will have on power system operation and security of supply. Our report modelling was performed using the original date of December 2018 as it occurred prior to the revised decommissioning date.

Engineering

- We performed analysis that considered upper North Island power system limits and possible courses of action, including changes to voltage support contracts. The final outcome was a decision to include a new upper North Island voltage constraint in the market model in November 2015, which is intended to ensure operation of a secure system during winter 2016. Further analysis addressed the decommissioning of Huntly Rankine units and security of the system to the end of 2020 and was published in April 2016.
- We updated the system security forecast (SSF) in November 2015 and May 2016 including information about upper North Island power system limits to the end of 2017, and accounted for decommissioning of Otahuhu B and Southdown. The report is available on the SSF page of our website.

Security of Supply

- We updated the 2016 hydro risk curves; see our website.
- We produced a security of supply assessment focused on understanding security of supply implications out to 2019, taking into account the decommissioning of Otahuhu B, Southdown and the proposed closure of the two Huntly Rankine units. A report was published on 9 December 2015 and updated on 29 February 2016.

2 Includes lakes Taupo, Tekapo, Pukaki, Hawea, Manapouri and Te Anau.

Delivering competition with security

Communications

- We hosted a number of industry forums and teleconferences to keep the industry informed of the thermal decommissioning work we had undertaken.
- We presented our findings on thermal closures to the Authority's system operations committee (SOC) and security and reliability council (SRC).
- We wrote a series of reports looking at the technical and market impact on New Zealand's power system and the grid on our website.

Self-assessment: We have undertaken significant and well received work on the likely changes to power system operations arising from actual and announced thermal generation closures in the North Island. This work has been valuable to both regulators and industry.

BLACK START AND SYSTEM RESTORATION

As part of the ongoing improvement of our planning for restoring the power system following an island-wide event we:

- carried out a full station shutdown test of Genesis Energy's Tokaanu Power station on 21 February 2016. The test successfully demonstrated the capability of Tokaanu to black start and energise a part of the North Island network
- updated Transpower's North Island core grid[3] restoration plans to take account of the North Island thermal de-commissionings
- held an industry desk-top exercise on 8 June 2016 to better understand current capabilities of participants to restore the North Island core grid. The exercise was attended by all North Island generators and distributors which would be involved in a core grid restoration.

Insights into restoration times and operational realities helped those involved to understand their roles and resiliencies and dependencies.[4]
Once we have shared what was learned from the exercise with the participants (and shared with the wider industry, where applicable), we plan to conduct similar exercises for our North Island regional restoration plans, before moving to the South Island.

Self-assessment: Transpower has worked closely with North Island industry participants to make significant progress in understanding the capability of industry as a whole to achieve a restoration of the North Island core grid.

3 The core grid is the 220kv grid backbone from Otahuhu to Haywards.

4 Genesis Energy, Mighty River Power, Contact Energy, Trustpower, Counties Power, Powerco, The Lines Company, Vector, WEL Networks, Wellington Electricity and NZ Steel.

Delivering competition with security

THE MARKET SYSTEM AND MARKET BENEFITS

Transpower continued to improve the stability of the market system and pave the way for future operational and capital development efficiency.

We reviewed and revised our capital delivery methodology to incorporate the new SOSPA goals for improved performance and efficiency. This effort, termed Aardwolf II, created revised governance arrangements, and processes for evaluating the value of projects, both before initiation and after delivery.

In September 2015 we implemented tools to automate some elements of the management of new HVDC controls, reducing coordinator workloads and substantially reducing the risk of operational manual error.

In March 2016 we commissioned supervisory control and data acquisition/energy management system (SCADA/EMS) version 2.6 upgrade through Transpower's PRISM[5] project. This upgrade, jointly funded by transmission charges and the Authority, enables Transpower to operate these critical systems on an up-to-date supported platform. The project also converged the separate network models used by SCADA/EMS and the market system into one. The upgrade has enabled closer collaboration and reduced the risk of model error, from misalignment of the two models.

In April 2016 we commissioned a new enterprise service bus (ESB), improving supportability and management of the ESB, an application which operationally links many market system components. The new ESB has improved Transpower's ability to manage system or data issues and reduced inter-site switch over times, to the benefit of participants (see Appendix 2).

Apart from capital delivery, we continued to seek improved market efficiency through participant education. Four market event reviews were published to assist participants' understanding of how the power system and market behaves.

Self-assessment: This year we continued to improve the efficiency and reliability of the market systems by introducing new capability through automating HVDC controls, upgrading the SCADA platform and installing a new ESB. These initiatives have reaped market benefits, as have improvements in our capital delivery methodology, and provided the framework to ensure further benefits in future years.

5 Project to refresh infrastructure for SCADA and market systems.

STRATEGIC GOAL #2

Demonstrating value for money

Demonstrating value for money

RECOMMENDATIONS FOR IMPROVEMENT AND BUSINESS PERFORMANCE

In its review of our 2014/15 annual self-review the Authority made three improvement recommendations for future reporting periods. This section lists each of the recommendations and outlines work undertaken to address them.

- **Recommendation 1:** Continue to progress alignment with the joint objective, and strive to meet the key performance indicators (KPIs):
  - Progress on this recommendation is shown in the table on the following page.

- **Recommendation 2:** Investigate greater use of procedural oversight (such as process controls like peer review) in manually-intensive procedures in order to reduce instances of human error.
  - Peer review and supervisory actions are incorporated in many planning and real time activities and formal procedures. At least two new planning-time procedures were established during the review period which incorporated peer review actions (including RAS[6] contingency solution save cases and development of voltage profiles). The investigation and aggregation of trends through analysis of events and breaches has also helped target areas and potentially problematic procedures.

- **Recommendation 3:** Continue to identify opportunities for constructive engagement with stakeholders.
  - More detail on progress for this recommendation is in Appendices 3,4, and 5.

Self-assessment: We have addressed all of the Authority's recommendations.

6 Remote access service.

Demonstrating value for money

System operator key business initiatives

The table below summarises our performance against KPIs in the 2015/16 financial year. These KPIs are from Transpower's system operator service business plan.

	# of KPIs	Completed on time	Missed or Late	Comments
Assisting the Authority to meet its competition, reliability and efficiency objective (the CRE objective)	2	2	–	Both KPIs were completed on, or ahead of, schedule. These KPIs formed part of the at risk fee criteria for 2015/16.
Developing an efficient balance between risk, reliability and resilience	3	3	–	All KPIs were completed, with the core grid restoration exercise held in Hamilton on 8 June.
Seeking opportunities to add value through the provision of information to support an efficient market	3	3	–	All KPIs were completed, with no major pricing incidents caused by the system operator and event reports published within the specified timeframe.
Improvements to deliver a system operator service that meets or exceeds expectations and represents value for money	6	6	–	All six KPIs were completed, with improvements made in the capital planning and delivery space.
A transparent business and requirements roadmap for investments required to deliver the system operator service	2	2	–	Both KPIs were completed, with a roadmap now in place. This roadmap will be reviewed on an annual basis.
Building capability, and promoting a professional, responsive service culture	5	5	–	All five KPIs were completed, with engagement improving to over 60% and a number of capability improvements in place.
Engaging with and understanding the Authority, market participants and consumers	5	5	–	All five KPIs were completed, with the third 'Getting to Know the Industry' presentation held in June.
Maximising opportunities arising from being part of the wider Transpower business	12	7	5	Of the 12 KPI's, seven were completed on, or ahead, of schedule. Of the remaining five missed or late, one was completed, though later than initially planned, and another agreed not to be completed as it had been addressed by existing documentation.
Totals	**38**	**33**	**5**	

Demonstrating value for money

CAPITAL EXPENDITURE PLAN AND JOINT DEVELOPMENT PROGRAMME

Throughout the review period Transpower worked closely with the Authority on the continued development and maintenance of the joint development programme (JDP). We held monthly meetings to review project status and to assess dependencies and risks.

Transpower's annual capital expenditure plan to support the system operator service was updated to align with the fixed fee obligations under the new SOSPA through an internal project (Aardwolf). This project enabled us to develop techniques for use in subsequent years, which will improve focus on managing our systems, and identifying initiatives required to maintain our service.

Self-assessment: We have performed well in jointly managing the capital expenditure plan and JDP with the Authority. We have worked constructively and effectively with the Authority to continue improving the manner in which the two organisations engage and communicate in relation to the JDP and capital expenditure plan.

JOINT WORK PLANNING TEAM

The Joint Work Planning Team (JWPT) was established to support a close working relationship between the Authority and Transpower in relation to development and planning activities for projects and the JDP. Throughout the year, several new initiatives were developed to support this group to successfully manage projects. Included were changes to the integrated process life cycle (IPLC) were included which focused on ensuring a more effective and efficient process between Transpower and the Authority. A change management process was established with consistent templates along with improvements to technical advisory services contract (TASC) reporting.

PROJECT DELIVERY

CAPITAL PROJECT DELIVERY

Transpower's capital portfolio of work supporting the system operator service was set out in our capital expenditure plan. The plan included projects supporting the Authority's market design as well as initiatives to ensure our applications, tools, processes, systems and infrastructure are supported and updated to maintain the system operator service.

During the review period, we worked on 19 major projects, commissioning 15 of these. Key projects are summarised in Appendix 2.

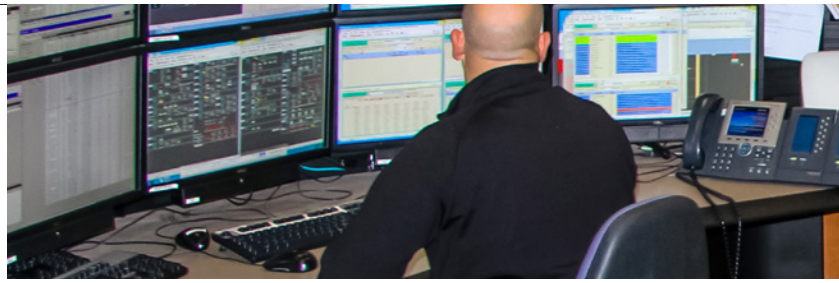
We successfully worked through with the Authority impacts on the portfolio of work, from delays to our project to refresh infrastructure for SCADA and market systems (PRISM). The delays resulted in numerous agreed changes being made to the portfolio, with multiple dependant projects affected. Transpower's focus was managing these delays and minimising associated impacts of time and cost extension, while providing regular, clear communications to the Authority around these issues.

A significant reduction in industry reserve costs during the review period (see ancillary services cost allocation review section) was enabled in part by the interim national instantaneous reserves sharing and security tools implementation for new HVDC controls projects. These projects enabled sharing of reserves between islands and simplified operational procedures for the HVDC.

Enhancement and refinement of project delivery capabilities and processes continued between Transpower's System Operations and Information Services and Technology Divisions. This work focused on efficient and effective project delivery, increasing our focus on cost and time to deliver, and aligning with the new SOSPA obligations.

Self-assessment: We continue to focus on our capabilities and delivering projects to time and budget. Issues encountered during the review period were resolved effectively through open and clear communications with the Authority.

Demonstrating value for money



TECHNICAL ADVISORY SERVICES CONTRACT

The TASC, which outlines how services are provided, was extended to 30 June 2016. From that date technical advisory services are provided under the new SOSPA.

TASC utilisation during the review period was 113%, an increase on the 88% utilisation in the previous review period. This increase reflects a more consistent usage of the TASC over the reporting period and a period of particularly high usage in February and March. The higher utilisation rate also reflects the agreed reduction in the TASC baseline from 2 FTEs to 1 FTE from January to June 2016; this resulted in full utilisation for the period being equivalent to 1.4 FTEs, compared to 2 FTEs in previous reporting periods.

During 2015/16 work was carried out on eight TASC statement of works (SOWs) (see Appendix 6), of which seven were completed by 30 June 2016. 83% of TASC SOWs were completed on time and within budget. The only exception was a report associated with the review of instantaneous reserve markets (TASC 59) where commencement was delayed due to slower than expected approvals.

Better forecasting, coupled with monthly review of TASC work progress resulted in a more even distribution of TASC work over the period and largely mitigated the risk of underspend.

Self-assessment: We have increased our project delivery performance to ensure the most efficient and effective delivery of capital projects as possible. We expect to deliver 90% of future capital projects on time and on budget[7].

COMPLIANCE

PRINCIPAL PERFORMANCE OBLIGATIONS AND CODE BREACHES

Throughout 2015/16 all Code principal performance obligations (PPOs) were met. 14 self-reported breaches were reported, compared to 18 in 2013/14 and 30 in 2014/15. An increased focus on error prevention, rather than after-the-fact response, has successfully reduced the number of breaches. The prevention techniques have delivered improved procedural clarity, peer review and quality communications between the many teams involved. Breach details are outlined in Appendix 8.

To address events and breaches during the review period a number of different approaches were used, including:

- event and breach trend analysis
- target manual errors
- proactive preventative messaging
- delivering the response as a project
- an emphasis on management accountability.

A particular focus on manual errors, and the root cause of such errors, could not definitively highlight any consistent areas of concern. When an issue was identified a collaborative effort targeted the trend, process, group of events or breaches, to identify and address the root cause. This focus has improved awareness of the need to even more accurately record and address manual error events. The reduction in manual errors is a trend we aim to continue.

Other areas which drew our focus included SCADA data, GENCO[8] events, short notice outages, monthly processing and the load forecast.

Self-assessment: Prevention of, rather than reaction to, errors has enabled long term benefits by reducing the impact on participants, and the number of errors occurring. This approach has identified areas to address prior to the areas becoming problems or breaches. This approach will continue into future reporting periods.

7 Such time and budget being that specified in the Capex Plan or later changed through the relevant change process.

8 Generator/Interruptible load provider communication to receive and acknowledge electronic dispatch instructions.

Demonstrating value for money

DISPENSATIONS AND EXEMPTIONS

During the review period 29 dispensations were processed or reviewed. These dispensations related to:

- 20 different assets assessed after equipment upgrades to address previously non-compliant asset capabilities
- five assets which were divested.

We did not apply for any exemptions during the review period.

Self-assessment: The dispensation process operated effectively and efficiently during the review period.

COMPLIANCE REQUIREMENTS UNDER THE CODE

We have successfully performed our review and audit obligations under the Code, notably:

- undertaking a monthly self-review and reporting the results to the Authority
- publishing SSF updates in November 2015 and May 2016, and commencing a full review of the SSF to be published at the end of 2016
- commencing a review of the procurement plan (to conclude in the next period)
- reviews of the SOROP and EMP
- audits for the scheduling, pricing and dispatch (SPD) software, and reserve management tool (RMT) software (see Appendix 9).

In carrying out our reviews of operational policies and procedures, as required under the Code, we have incorporated changes to technology, regulatory requirements and operational changes to the power system, to ensure relevance and accuracy.

Self-assessment: We have successfully performed our Code compliance requirements.

SPECIFIC COMPLIANCE UNDER THE SOSPA

We complied with our obligations under the SOSPA during the review period, including:

- working with the Authority on our business planning, capital planning, project delivery and JDP processes
- agreeing with the Authority to roll-over existing arrangements for auditable software. No new auditable software has been identified.

Demonstrating value for money

CODE CHANGES, SUBMISSIONS AND CONSULTATION

We did not propose any Code amendments during the review period.

Submissions were made on a number of Authority consultation papers, including on the following matters (generally as Transpower NZ Ltd, in conjunction with Transpower as the grid owner):

- demand response guiding regulatory principles
- generator fault ride-through
- 2016/17 appropriations and work priorities and EECA work programme
- proposed code amendments relating to the system operator and alignment with the statutory objective
- availability cost allocation under national market for instantaneous reserves
- options for real time pricing.

We will continue to actively engage with the Authority on consultations particularly as they relate to Code amendments.

ANCILLARY SERVICES

PROCUREMENT PLAN REVIEW

We concluded the 2014/2015 procurement plan review in December 2015 and recommended to the Authority that no changes be made. This was primarily because the review had taken longer than anticipated to complete (due to the suspension in order to allow for incorporation of changes arising from the RFM programme) and the next review was about to commence. The refinements identified in the 2014/15 review are being incorporated within the 2016 review. As technical requirements for the NMIR are now known, we also expect to reflect NMIR changes in the 2016 review.

Our 2016 review of the procurement plan was completed during the review period. A proposed draft was provided to industry for comment on 24 May 2016. One submission was received (from Meridian Energy).

ANCILLARY SERVICES COST ALLOCATION REVIEW

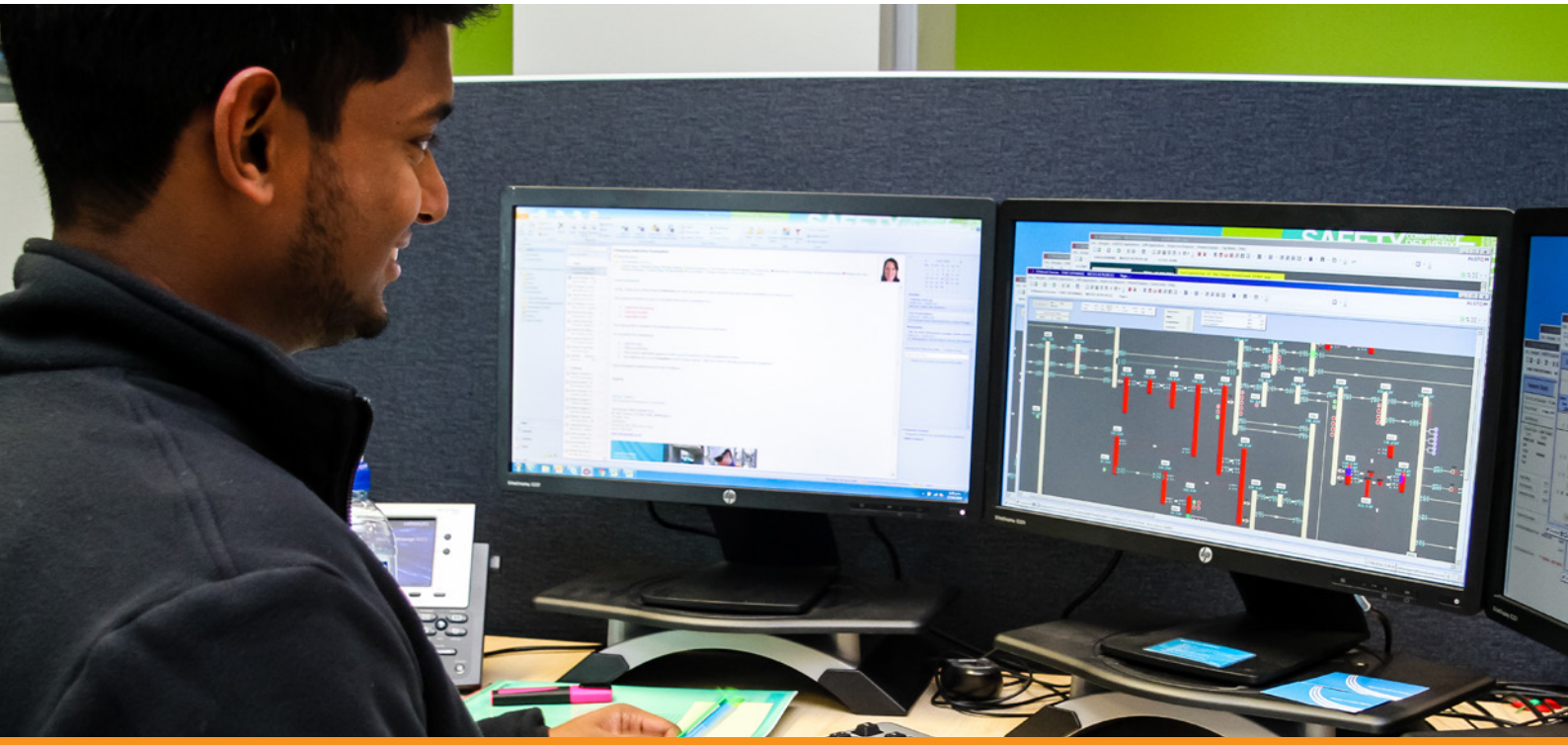
We implemented the findings of a review of our ancillary services cost allocation process during the review period. A key deliverable from the review was the development of a single end-to-end procedure document covering the roles, responsibilities and actions of all Transpower parties involved in the process.

This process was reviewed by an external auditor who confirmed the newly developed systems and procedure document had significantly enhanced our ability to consistently meet our Code obligations.

Total ancillary service costs for the review period were $19,832,848, continuing the downward trend from the equivalent 2014/2015 review period. Details of the specific ancillary services are in Appendix 10.

Self-assessment: Our performance in respect of ancillary services has been prudent and forward-focussed. We implemented all changes arising from a review of the cost allocation process, which resulted in more demonstrably robust systems and processes.

STRATEGIC GOAL #3



Planning for tomorrow

OUR DIRECTION

We continue to see success as being considered a valued provider to the Authority and market participants, as well as returning strategic and commercial value to Transpower.

This is built on our five strategic goals.

- Delivering competition with security.
- Demonstrating value for money.
- Planning for tomorrow.
- Strengthening relationships.
- Investing in good people.

STRATEGIC PLAN AND BUSINESS PLAN

Our 2016-2021 strategic plan was provided to the Authority in June 2016. This has a five year horizon and is largely based on its predecessor. Our business plan sets out key improvement strategies over the coming year. The major elements of the plan are:

- assisting the Authority meet its statutory objective
- improving the system operator service operating models to ensure efficiency in capital delivery
- anticipating and responding rapidly to environment changes to ensure continuous delivery of an optimal system operator service
- engaging with and understanding the needs of the Authority, market participants and customers
- building people capability and simplifying work practices, promoting excellence in people performance and system operations.

SYSTEM OPERATOR SERVICE PROVIDER AGREEMENT RENEGOTIATION

This new SOSPA is representative of the positive working relationship we have with the Authority and demonstrates a joint focus on delivering the system operator service for the long-term benefit of New Zealand consumers.

The agreement reflects the Authority's focus on competition, reliability and efficiency and provides for increased transparency over service and performance measures. A new fixed fee provides a very slight increase to existing funding. The agreement imposes greater commercial discipline on costs and project management while creating opportunities and risks. It also emphasises the importance of engaging with industry stakeholders. We will be focusing on formal and informal interactions to encourage timely and, effective information sharing.

Key changes in the new SOSPA:

- a fixed fee for the majority of services – any increases above the fixed fee now require industry consultation
- capital expenditure to enhance the services must be consulted on and approved by the Authority
- performance and delivery incentives are to be agreed annually
- new reporting requirements will enable clearer demonstration that services are being delivered effectively, such as performance-related audits and final business cases for capital projects
- high value capital projects will be subject to a benefit realisation review following completion.

Self-assessment: We have lifted our performance in relation to strategic and business planning and intend to retain a strong focus on developing, monitoring and reporting against our strategic and business plans.

Planning for tomorrow

IMPACT OF FUTURE INDUSTRY CHANGE ON SYSTEM OPERATIONS

SYSTEM OPERATOR ENVIRONMENT SCAN

Alongside longer term industry developments addressed in Transpower's Transmission Tomorrow 2016 we completed an environment scan in anticipation of power system changes likely to impact system operations. The report was shared with the Authority in May to facilitate the shaping of ideas on future industry change and development.

This work assessed the likelihood, urgency, and level of adaptation required for more than 30 emerging trends and potential industry changes. It supports future planning and investment required to ensure Transpower has the systems, processes and people in place to deliver the system operator service in an evolving environment.

The changes we need to pay most attention to are those with a high probability of causing a large impact on power system operation over the next ten years. We believe these will be:

- real time settlement pricing
- increased levels of intermittent generation (especially rooftop solar PV)
- the emergence of 'smart grid' technologies
- tools that electricity distribution businesses (EDBs), consumers and third parties may use to manage load.

We are considering these potential impact areas through internal investigations and engagement with industry and market participants. We also undertook an assessment with Transpower's Grid Development Division on the market and power system implications of thermal generator decommissioning.

SOLAR PV

We have begun a Solar PV project which uses various studies to understand potential impacts of solar PV on our ability to meet the PPOs, the need to procure new or additional ancillary services and to play our part in participants accessing the grid.

The project will assess the power system's existing ability to accommodate solar PV and identify options to facilitate PV integration. This work remains a key initiative in the next year. An initial finding at this point indicates power system ramps are unlikely to be impacted by the PV ramping.

Further investigation continues into renewables and possible scenarios the power system could face.

Self-assessment: We have prepared a good foundation from which to assess emerging changes to the industry and the impact they might have on the role of the system operator. Results from the Solar PV project are expected to be reported in the first half of the 2016/17 financial year.

DELIVERING A MARKET SYSTEMS ROADMAP

We have refined our market system roadmap in light of the new SOSPA. This reflects the agreed focus of the Authority work programme as well as the necessary technology changes required to maintain fit-for-purpose information technology services. The roadmap embeds the efficient capital expenditure approach developed under Project Aardwolf and now reflected in the SOSPA fee arrangements.

Current capability and future needs assessments, as well as scope, cost and time estimates of identified initiatives, will allow for a rolling ten-year roadmap.

Self-assessment: Our work to update the roadmap has provided an efficient means by which to share and jointly view the work necessary to maintain fit-for-purpose system operator systems.

STRATEGIC GOAL #4

Strengthening relationships

Strengthening relationships

RELATIONSHIP CHARTER IN ACTION

The relationship charter has provided a foundation for an improved and positive operating relationship between Transpower and the Authority. The many and varied interactions between the two parties have been undertaken professionally and in a spirit of mutual respect and a desire for both parties' objectives to be realised, notwithstanding that some interactions were of an overtly commercial nature. This is exemplified by the new SOSPA, a substantial, complex and commercial arrangement which was signed during the period.

A large number of other agreements (such as capital and work plans) were established during the period reflecting the renewed strength of the parties' interactions and the benefits of the charter. Interaction with the Authority is part of our daily business and our relationship a consideration for all interactions, guided by the charter.

Self-assessment: The charter strongly and positively influences our relationship with the Authority.

INDUSTRY ENGAGEMENT AND COMMUNICATION

GREATER INTERACTION WITH PARTICIPANTS

Transpower places great importance on its interactions with industry both to gain operationally useful knowledge and also to explain the ways and means by which it delivers the system operator service. This section outlines some of those interactions.

WORKSHOPS

Each year we host a series of workshops across New Zealand to provide updates on topical issues and to encourage industry discussion. In 2015 we hosted the following workshops across a number of locations:

- Wednesday 28 October, Wellington
- Friday 30 October, Christchurch
- Monday 2 November, Auckland.

We discussed a range of topics including, the policy statement review, test plans and extended contingent event (ECE) risk, and the implications of competition, reliability, and efficiency (CRE) and what this means for us. The workshops also included an open discussion on how Transpower, in its role as system operator, could be more commercial in its actions.

There was good representation across the three regional workshops with 30-40 attendees at each session. Attendees came from a range of organisations across the generation, distribution and retail sectors.

PARTICIPATION WITH INDUSTRY

Our relationship with industry participants is vital to ensuring successful delivery of the system operator service. Where possible we involve ourselves with industry groups and organisations as well as inform and listen to participants concerning issues on or as part of the power system. Key media for these activities are the utilisation of industry teleconferences as well as holding and participating with industry forums and groups (see Appendix 5).

Strengthening relationships

CUSTOMER SATISFACTION SURVEY

We conduct an annual customer satisfaction survey. The survey for the 2015 financial year went to industry participants in March 2016 with responses requested in April.

The survey finding will be shared with the Authority in July 2016. In short, the survey showed:

- 75% of customers rated our service as "good" or higher in 2015 (67% in 2014)
- 27% of respondents rated our service as "very good"
- the highest two performance ratings were for the 'reliability' (88%) and 'assurance' (75%) service categories
- the lowest performance ratings were for the 'communication' (55%) and 'responsiveness' (58%) service categories.

We received the following customer comments during the survey:

"It's good to see a more customer-focused approach emerging."

"When the SO engages with the industry without any preconceived outcomes, then open discussion takes place."

Year on year trends:

- Compared to 2014, there was nearly a 20 point jump in respondents who believe our service is getting better. No respondents felt service was worsening.
- Since 2014 our performance has improved across these service areas:
  - assurance
  - communication
  - empathy
  - knowing the customer.
- Since 2014 our performance has decreased across these service areas:
  - responsiveness
  - competence
  - access
  - reliability.

Self-assessment: We engaged well with the Authority and industry through the review period. We received positive feedback from the Authority in relation to our improved engagement and transparency, and from industry workshop attendees regarding effective and useful communications.

Strengthening relationships

INDUSTRY EXPERIENCE

INTERNATIONAL KNOWLEDGE

Transpower maintains several avenues for staying aware of international advances and activities relevant to providing the system operator service. Notable activates during the review period were the following:

- development of the transient security assessment tool
- association of power exchanges (APEX) conference
- General Electric (formerly Alstom) grid management solutions Asia Pacific user group
- 2016 General Electric North American User Group
- International training
- International visits.

Further details are in Appendix 11.

LOCAL KNOWLEDGE

Our staff regularly participate in and contribute to forums run by government and industry that consider opportunities afforded by and the implications of new technologies with the sector. These forums include, GREEN Grid research and development; the New Zealand smart grid forum, including associated seminars; and the smart technologies working group, recently formed by the Electricity Networks Association.

GREEN GRID

Transpower supports research performed under the GREEN Grid project[9]. Our ongoing participation in the project has allowed us to:

- contribute to the industry's understanding of new technology and its assimilation into the NZ power system; particularly the development of tools to assist EDBs host distributed generation (namely solar PV) in their networks
- increase our understanding of potential implications of new technology on system operation
- ensure the revision of the Australia and New Zealand standard for inverters will accommodate New Zealand's frequency standard.

Collaboration in such initiatives is a cost-effective means of engaging with both the industry and research institutions.

INDUSTRY PRESENTATIONS

To increase Transpower's understanding and awareness of key industry topics, we host three 'getting to know the industry' sessions (internal to Transpower) each year. The three presentations held during the reporting period were:

- October 2015: Neal Barclay, General Manager Markets and Production at Meridian Energy, presented on the relationship between Meridian Energy and Transpower – what we do well and opportunities for improvement
- April 2016: Barbara Elliston, director of Counties Power, presented on the future role of solar PV in New Zealand
- June 2016 Dr Cristiano Marantes, Head of New Network Solutions and Asset Resilience at Vector, presented on Vector's perspective on renewables.

Self-assessment: We are active participants in a number of international and local organisations that support our capability and assist us being aware of and prepare for changes in power system technologies and operational practices.

9 This project is administered by the EPECentre (Electric Power Engineering Centre) based in the College of Engineering at the University of Canterbury. The GREEN Grid project was established to analyse and model future trends in renewable electricity generation and household demand, requiring an in-depth knowledge of electricity networks and power management. (http://www.epecentre.ac.nz/greengrid/index.shtml)

STRATEGIC GOAL #5

Investing in good people

Investing in
good people

HAVING THE RIGHT SKILLS FOR THE JOB

ENGINEERING PROGRESSION PROGRAMME

Our engineering progression programme provides a pathway for engineers in the System Operations Division's engineering team to develop and progress to senior engineer level. The programme outlines the core competencies and skills required to achieve senior engineer level, while providing engineers with clarity around career progression and supporting staff retention.

The programme commenced in June 2015 with 11 engineers enrolled. The first base-line assessment was completed in 2015, identifying each engineer's current competency levels, and identifying gaps to target in order to progress through the programme. The six team leaders in the engineering group worked collaboratively to provide work opportunities for the engineers to acquire the competencies and skills identified as lacking during the assessment.

MARKET ANALYST PROGRESSION PROGRAMME

Our market team's analyst progression programme was developed to define the competencies required for career progression. It now provides a clear process for staff progression and is intended to reward staff development and encourage staff retention. We assessed and base-lined analysts in the market operations team to place them on the progression programme scale. We have recently introduced a new intermediate market analyst role to reflect and recognise experience gained by analysts who have yet to develop all senior analyst competencies.

SYSTEM COORDINATOR TEAM IMPROVEMENTS

Two material changes were introduced to the real time system coordinator team.

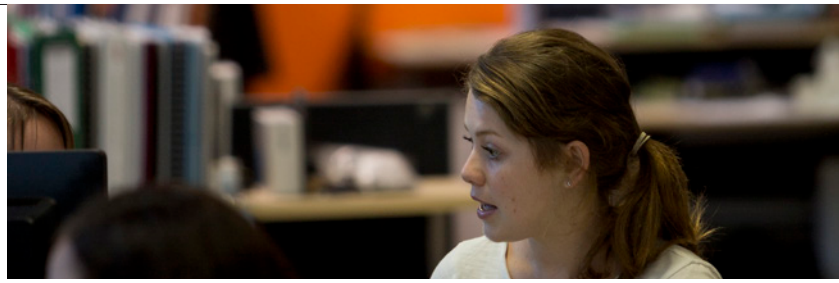
In October 2015 a new role of senior system coordinator was introduced for experienced security-trained coordinator. The role designates coordinators, with strong operational experience, combined with subject matter expertise and mentoring skills, who can be deployed as senior leaders within the control room environment. Six appointments were made (noting senior system coordinators perform rostered energy and security shift duties).

In March 2016 we commenced a trial of a new system coordinator roster (intended to enable more efficient use of our coordinator resource) to improve flexibility and incorporate the senior position. The new roster requires all security coordinators to be 'dual trained' – able to work both energy and security desks. It provides greater flexibility for rostering of roles across the two National Coordination Centre (NCC) locations, in Wellington and Hamilton, as operations are no longer constrained by requiring an energy coordinator in each site.

Shift teams are now structured to include a senior system coordinator, a security coordinator and an energy coordinator on each shift. A further energy coordinator is rostered for dayshifts (managing higher day time workloads). This design maximises on-shift experience and means there is always more than one person on shift able to perform each core role (energy and security). This allows team members to better collaborate and assist each other during challenging scenarios and events.

More generally, NCC operations have experienced increased levels of tool reliability, improved overall experience (a reflection of low staff turnover), and high levels of compliance with standard operational procedures and Code requirements.

Investing in good people



TRAINING AND DEVELOPMENT

Project PRISM training for system coordinators and wider system operations staff was undertaken via workshops and online learning between December and March ahead of the staged go-live in the week beginning 16 March 2016.

Coordinator Team training – where coordinators have access to simulators for event management training – had been suspended earlier in the year to accommodate PRISM training. It recommenced in April, with coordinators able to return to the simulators for event management experience, vital given the reduction in the number of events on the power system.

A week long course on system stability was delivered by Dr Prabha Kundar in February 2016 to system engineers (see Appendix 11).

Transient Stability Assessment Tool (TSAT) concept training for coordinators was provided in April-June 2016 ahead of the tool going live in August 2016.

Power System analysis tool, DigSilent, training for engineers was held in June 2016 as part of preparation for the 2016 SSF.

QUARTERLY TEAM LEADER FORUMS

Our team leaders held three forums where leadership and management matters were canvassed through a series of discussions and workshops. External and internal guests as well as specialist trainers have attended the forums. These forums provide management and leadership development for team leaders as well as a means of engaging people managers on issues such as implementation of business initiatives (strategy, behavioural changes, and operational changes).

TRANSPOWER PEOPLE INITIATIVES

Transpower's 2016 leadership conference provided our people leaders with an opportunity to develop their leadership skills, network with other people leaders in Transpower and gain insight to Transpower's 2016/2017 behavioural transformation programme.

This programme is focused on multiple work streams and initiatives, including the development of leadership skills, designed to guide and encourage all employees to behave in ways that will make it easier to deliver our objectives and work together more effectively.

The Way We're Wired work stream is Transpower's initiative relating to four behaviours identified as central to achieving strong business results. These behaviours are: clarity of purpose, supporting collaboration, taking personal accountability and enabling our workplace delivery. These are all critical components of the system operator service.

This initiative has been supported by individual workstyle evaluations and coaching for all people leaders. Both projects continue throughout the next year.

Self-assessment: We have taken substantial steps to focus and improve the leadership skills of our people leaders. Transpower has introduced behavioural change work designed to improve business outcomes. This work will continue into the next year. Our improved competence in these areas will support the relationship with the Authority and improve delivery of the system operator service.

Investing in good people

DIVERSITY

As part of Transpower's behavioural transformation, there has been sustained focus on creating and maintaining a more positive work environment where all our people feel included, welcome and valued. There is a focus on embracing the differences people bring to work, as well as utilising these differences to create high performing teams.

We employ a diverse range of people across many different ethnicities and ages. However, it has been recognised that this diversity is not reflected in the more senior roles within the Division. An example being that of the 17 women in the Division only two are in people leader positions. In response to this we have created a Women in System Operations group as an initiative to enable the System Operation Division to gain a greater benefit from the contributions of the women in the Division. This is part of Transpower-wide drive to improve diversity and inclusion and to build talent for the future.

Self-assessment: We endeavour to achieve a diverse and inclusive workplace. We intend to maintain focus on improvements, especially in the senior roles.

Appendices

Appendix 1
SYSTEM SECURITY AND OPERATIONS

1.1 EVENTS – LOSS OF SUPPLY, STORMS, SYSTEM EVENTS

The following chronology covers loss of supply, storm and system events affecting the power system. While all loss of supply events are important, for the purposes of this report only the most significant events (20 MW or more) within the review period are included.

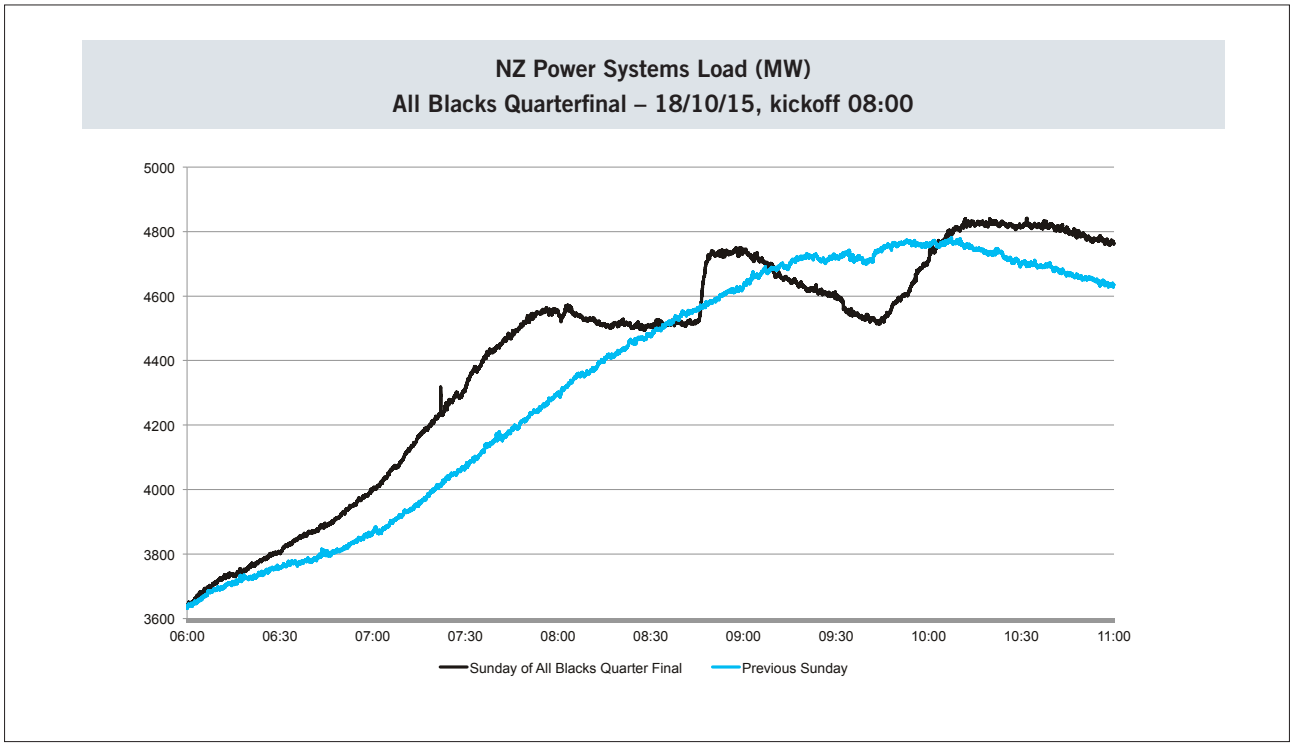
September 2015

Contact's Otahuhu combined cycle gas turbine (CCGT) left the market at midnight on 21 September, ending service to the industry which began in 2000. This departure, combined with the close of Southdown generators at the end of December, prompted the system operator to undertake a review of system impacts and security arising from the closures.

- On 20 September the system operator implemented an important upgrade to the market system. The changes have enabled system coordinators to utilise HVDC control capabilities – notably, roundpower and frequency keeping control - in a significantly more automated manner than was previously the case since roundpower and FKC were trialled in 2014. The automation introduced enabled roundpower and FKC operations in a wider number of circumstances, resulting in greater operational and market efficiency, and increased frequency keeping and reserve sharing benefits.
- Transpower's first major drone incident also occurred when a drone became lodged in a Roxburgh-Islington 220kV circuit near Waimate (the drone was removed without depowering the circuit).

October 2015

While not presenting any system management concerns, the All Blacks' quarter-final, semi- final and final games at the Rugby World Cup resulted in observable changes in national demand compared to forecast. This type of 'load' behaviour is rarely seen in New Zealand. System load for the October quarter-final is in the chart below.



Appendix 1
System security and operations

1.1 EVENTS – LOSS OF SUPPLY, STORMS, SYSTEM EVENTS (continued)

November 2015

- Annual maintenance outages for the HVDC bi-pole occurred between 26 November and 1 December. The outage involved a staggered removal from service and periodic reversion to single island frequency keeping (during the bi-pole outages frequency keeping services reverted to island-based service) with North and South Island bands of 50 MW and 25 MW respectively).

December 2015

- On 11 December an HVDC bi-pole protection trip operated causing the loss of approximately 90 MW of HVDC transfer from the South to the North Island. This caused North Island frequency to fall to 49.39 Hz and South Island frequency to rise to 50.90 Hz. Investigations determined a protection monitoring system module had failed, which, following replacement with an on-site spare, allowed the bi-pole to return to service at 05:30 the same day.

  Although the HVDC control system was repaired quickly, concern remained regarding the cause of failure. Consequently, the system operator determined the HVDC bi-pole should be treated as a contingent risk until issues concerning the failure were sufficiently understood. Following remedial works on 19 December the bi-pole was reclassified to its usual status as an ECE risk.

  Transpower published both market and technical reviews of the events.

January 2016

- The traditional low load, low activity holiday period was experienced in January. This meant:
  - grid assets were fully available due to the normal holiday halt in planned maintenance
  - a combination of lightly loaded circuits and shut down of thermal generation resulted in high overnight system voltages
  - several AC circuits in the North and South Islands were regularly removed from service for voltage management.
- Automated dispatch parameter and MFK tests (initiated in December) continued through January. The tests were to tune our automated dispatch in a variety of load scenarios and with different sized MFK bands.

February 2016

- No material system events occurred during February. Very few weather events were observed, though substantial rains brought good inflows to the most southern storage lakes raising levels to well above average and positioning storage well for the early winter period.
- On 15 February a fire at Islington substation damaged static var compensator SVC9, rendering the equipment unserviceable. Studies indicated system voltages in the upper South Island during subsequent months, with remaining assets in service, would be manageable. An initial review of winter period peaks also showed voltage management would be satisfactory. Ultimately, the equipment returned for service (for reactive support) in early April.
- A successful test of Tokaanu generation station black start capability was held on 21 February. The test required de-synchronising two generators, circuits from Tokaanu to Bunnythorpe, and transformer T9 at Bunnythorpe, and for these to be restarted, synchronised and re-livened. All objectives were satisfactorily completed.

Appendix 1
System security and operations

1.1 EVENTS – LOSS OF SUPPLY, STORMS, SYSTEM EVENTS (continued)

March 2016

- On 24 March at 20:01 all circuits supplying the Southbrook bus tripped removing Southbank and Kaiapoi from service. This caused a loss of supply to Mainpower of 43 MW. The final stage of restoration was authorised at 22:33. At 22:36 all Southbank and Kaiapoi load was lost again when Southbrook feeder 152 was closed during the first restoration. This second event enabled location of the initial fault to be ascertained, and restoration to be actioned more quickly. All Southbrook and Kaiapoi load was restored by 23:06.
- On 16 March Transpower introduced a significantly upgraded SCADA system (see Section 4.3). The new SCADA, including different architecture, operating systems and application software, was implemented with minor interruption to ongoing operations and minimal market impact. Upgraded SCADA tools included the system operator's suite of advanced contingency analysis tools and inputs to the market system. At the same time, the system operator's TSAT application was also introduced into on-line operations (previously used only in off-line situations) which, following completion of coordinator training (July 2016), will be used for improved contingency assessments and improved response to system events.

April 2016

Upgrading and updating of the system operator's market tools suite continued with the last elements of a new electronic service bus (ESB) being implemented on 14 April. This implementation, the last of four stages, went smoothly and caused limited market impact during the outage required for the installation work. Subsequently, on 24 April, the first market system site switch[10] since the completed ESB went live was both quicker and more easily accomplished than with the previous ESB.

Site switch overs require NCC operations to be maintained using stand-alone dispatch (SAD, an emergency dispatch tool) which temporarily stalls market bids and offers. The new ESB allows reduced switchover times (improved on this first time by around 25%), to the benefit of participants.

May 2016

- On 16 May the first power system under frequency event since December 2014 occurred when Genesis Energy's Huntly Unit 5 tripped. North Island frequency fell to 49.08 Hz and South Island to 49.15 Hz. All contracted interruptible load was restored within 38 minutes of the event occurring. This was the first event since changes were made to dispatch of reserves under the RFM programme to allow a greater contribution from the South Island. The response was as expected.
- A number of severe storms resulted in periods in both islands where multiple circuit trippings were experienced and occasions where double circuits were reclassified as single risk due to lightning proximity. Substantial north flows on the HVDC reflected aggregate New Zealand storage which on 20 May was over 126% of average for the time of year. Full southern lakes contrasted with North Island storage levels generally well below average.
- On the 24 May at 18:30 a critical gas contingency was notified, due to a loss of Pohokura production. Production was resumed later in the evening and the emergency ended at 23:00. While gas supply reduced during the period electricity generation was not interrupted.

June 2016

- Warning notices for potential shortages of North Island generation were issued for evening periods on the 2nd and 27th of June. In each case industry generation offer responses or changes in load were sufficient to avoid the need to declare a grid emergency. With winter loads, reduced thermal generation offers and often low levels of wind generation the evening winter peaks have become less easily managed compared to the last several years, reflecting recent changes in upper North Island generation.

[10] The market system is duplicated and operates in two sites, at Wellington and Hamilton. The server at one site is operating on line while the other is being updated and remains a in fully capable, 'stand-by mode' ready if the need arises. Site switch overs have generally taken over 60 minutes to accomplish.

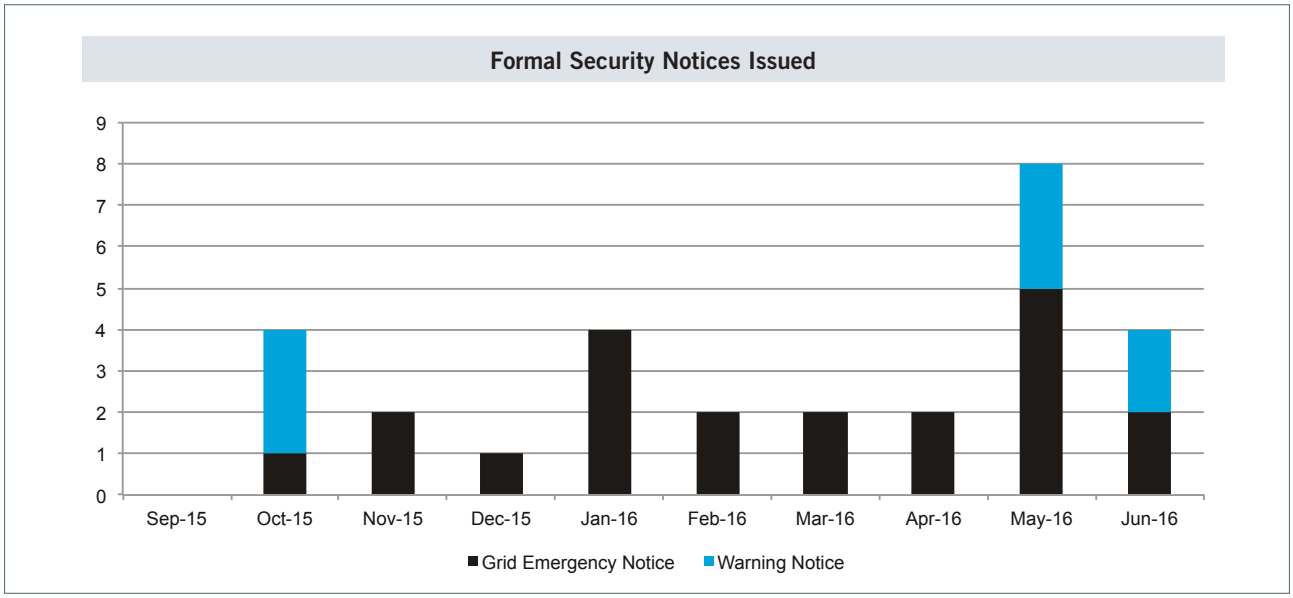
Appendix 1
System security
and operations

1.2 SECURITY NOTICES

A total of 29 formal security notices were issued between 1 September 2015 and 30 June 2016.

Notice Type	Number of Notices Issued
GEN – Grid emergency notice	21
WRN – Warning notice	8

The following graph shows the number of notices issued in each month of the Review Period:



1.3 SUMMARY OF GRID EMERGENCY NOTICES

The following table shows the number of GENs issued during the review period:

Month	Issued GEN
September 2015	0
October 2015	1
November 2015	2
December 2015	1
January 2016	4
February 2016	2
March 2016	2
April 2016	2
May 2016	5
June 2016	2

Appendix 1
System security and operations

EVENTS LEADING TO DECLARATION OF GRID EMERGENCIES

The grid emergencies declared during the review period were overwhelmingly dominated by managing the Arapuni 110 kV split. This accounted for three quarters of the declared emergencies.

The following table lists the grid emergencies during the Review Period:

Grid Emergencies			
Date	Time	Summary details of why grid emergency was declared	Island
07/10/15	07:37	To allow the Arapuni bus split to be closed to reconnect the south bus to the system following a circuit tripping.	N
07/11/15	15:51	To allow the reconfiguration of the 110 kV network in the Waikato following the tripping of Karapiro generation.	N
24/11/15	17:16	To assist with the restoration of connection to Kumara and Hokitika following a circuit tripping.	S
18/12/15 27/01/16 29/01/16 30/01/16 02/04/16 12/04/16 16/05/16 20/05/16 28/05/16 23/06/16	17:51 14:49 18:35 19:34 16:37 22:58 18:59 21:48 15:30 03:03	To close the 110 kV Arapuni bus split due to an electrical storm in the vicinity.	N
26/01/16	12:15	To close the 110 kV Arapuni bus split due to insufficient generation offers at Arapuni.	N
17/02/16	10:27	To close the 110 kV Arapuni bus split due to an unplanned outage of 220 kV Ohakuri-Wairakei circuit 1.	N
06/02/16 25/03/16	18:35 01:21	To close the 110 kV Arapuni bus split after the tripping of generation on the Arapuni south bus.	N
24/03/16	20:44	To assist with restoration following the loss of supply at Southbrook and Kaiapoi.	S
12/05/16	03:24	To reconfigure the grid in order to clear Bunnythorpe B bus due to an inoperable circuit-breaker needing isolation.	N
15/05/16	07:07	To close the 110 kV Arapuni Bus split following the tripping of 110 kV Arapuni Kinleith Circuit 1.	N
20/06/16	14:14	To allow the grid to be reconfigured following a tripping of 220 kV Henderson-Southdown Circuit 1.	N

Appendix 1
System security and operations

1.4 SYSTEM FREQUENCY EVENTS

Three significant frequency events were experienced in the review period, one in each of December, March, and May. The December and March events were HVDC related, though neither constituted an under frequency events. The May event was caused by the loss of Huntly U5 and fell below 49.2 Hz. Each event was managed effectively.

SUMMARY OF SYSTEM FREQUENCY EVENTS

The following table lists system frequency events during the review period:

System Events				
Date	Time	Summary Details	Island	Freq (Hz)
02/10/15	13:12	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.58
02/12/15	16:04	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.50
11/12/15	00:02	HVDC poles 2 and 3 tripped in north transfer resulting in the momentary drop in frequency in the North Island and consequent momentary rise in frequency in the South Island.	N S	49.39 50.90
21/12/15	12:33	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.54
12/01/16	10:34	Clyde generator unit G1 tripped resulting in a momentary drop in frequency in both the North and South Islands.	S	49.40
10/02/16	15:56	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.59
14/03/16	12:42	An HVDC runback operation resulted in a momentary drop in frequency in the North Island and rise in frequency in the South Island.	N S	49.29 51.15
15/03/16	00:51	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in both the North and South Islands.	N S	50.50 50.78
16/05/16	17:58	Huntly Unit 5 tripped resulting in a momentary drop in frequency in both the North and South islands.	N S	49.08 49.15

Appendix 1
System security and operations

Summary of connection point events

The following table summarises connection point events during the review period:

Connection Point Events				
Date	Time	Summary Details	Generation/ Load interrupted (MW)	Restoration time (minutes)
20/09/15	14:11	110 kV Karapiro – Te Awamutu circuit 1 tripped resulting in a loss of supply to Te Awamutu.	26	69
29/09/15	07:22	Wiri supply transformer T1 tripped during planned switching followed a short time later by T2. This resulted in a loss of supply to Wiri substation.	62	10
06/10/15	11:10	110 kV Central Park – West Wind – Wilton circuits 2 and 3 tripped resulting in a loss of connection to West Wind windfarm.	101	280
07/10/15	07:18	110 kV Arapuni – Kinleith circuit 1 tripped during a planned outage on the parallel circuit resulting in the disconnection of the Arapuni South bus from the system.	63	24
09/10/15	10:38	110 kV Kaikohe – Maungatapere circuits 1 and 2 tripped, resulting in a loss of supply to Kaikohe substation.	23	155
24/11/15	16:16	66 kV Greymouth-Kumara circuit 1 tripped islanding Hokitika substation and Kumara power station due to other grid outages. The island was shut down after a few minutes due to voltage decay.	HKK 14 KUM 7 (gen)	72 57
11/12/15	16:59	Ohakune supply transformer T2 tripped resulting in a loss of supply to Ohakune.	2	4115
24/03/16	20:02	66 kV Ashley-Southbrook circuit 1, Islington-Southbrook circuits 1 and 2, and Southbrook-Waipara circuit 1 tripped resulting in a loss of supply to Kaiapoi and Southbrook substations.	SBK 28 KAI 16	121 142
24/03/16	22:36	66 kV Ashley-Southbrook circuit 1, Islington-Southbrook circuits1 and 2, and Southbrook-Waipara circuit 1 tripped resulting in a loss of supply to Kaiapoi and Southbrook substations.	SBK 19 KAI 19	14 22
02/04/16	08:14	Cromwell T5 and T8 33 kV circuit-breakers tripped resulting in a loss of supply to Cromwell substation.	15	107
12/04/15	11:34	Ongarue T1 tripped resulting in a loss of supply to Ongarue substation.	1.5	545
06/05/16	11:07	Albany 33 kV supply bus tripped resulting in a loss of supply.	80	23
20/05/16	22:39	Hinuera-Karapiro Circuit 1 tripped resulting in a loss of supply to Hinuera substation.	14	106
25/05/16	07:39	Gracefield-Haywards Circuits 1 and 2 tripped resulting in a loss of supply to Gracefield substation.	46	18
15/06/16	13:46	Waverley Supply Transformer T2 tripped resulting in a loss of supply to Waverley.	2	347

Appendix 1
System security
and operations

1.5 VOLTAGE VIOLATIONS 220 KV and 110 KV

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

1.6 CUSTOMER ADVICE NOTICES

A total of 97 customer advisory notices were issued during the review period.

1.7 STABILITY LIMITS

There were no instances of grid stability limits being exceeded during the review period.

1.8 STANDBY RESIDUAL CHECK NOTICES

Standby residual check (SRC) notices are published by the system operator to indicate that there is insufficient generation and instantaneous reserve offered for dispatch to maintain system security and meet forecast demand if the largest single contingent event (CE) were to occur. A total of 715 were issued by the system operator in the review period[11].

[11] In comparison there were 991 SRC notices published in 2014/15, albeit for a longer period.

Appendix 2
SUMMARY OF CAPITAL PROJECTS

A summary of key capital projects carried out by the system operator in the review period is set out below. The commentary records where the project has been delivered on or before the agreed commissioning date, and under or on budget[12].

2.1 NATIONAL MARKET FOR INSTANTANEOUS RESERVES

This project will introduce changes required to create a NMIR, enabling reserves to be procured in one island and cover risk in the other. The NMIR project will enable reserves to be shared more effectively between islands, resulting in reductions in the overall quantity, and therefore cost, of reserves procured nationally.

The capital phase of the NMIR project commenced in August 2015 and is planned to commission in October 2016. The project is presently forecast to deliver under budget.

2.2 INTERIM NATIONAL INSTANTANEOUS RESERVES SHARING

This project developed an interim national IR market, increasing physical sharing of fast instantaneous reserve (FIR) and sustained instantaneous reserve (SIR), between islands by utilising round power and FKC.

The project commissioned in September 2015 and was on time and within budget.

2.3 SECURITY TOOLS IMPLEMENTATION FOR NEW HVDC CONTROLS

The implementation of new HVDC control facilities as part of the HVDC Pole 3 project in December 2013 required a different dispatch philosophy for the system operator. This new philosophy required changes to be made to system operator tools for managing risk, dispatch and controlling real time frequency.

This project provided coordinators with enhanced situational awareness and an increased level of automation for managing HVDC control mode changes, enabling them to operate the power system more securely.

The project commissioned in September 2015 and was on time and within budget.

2.4 SCADA REFRESH (PRISM)

Transpower operates a SCADA/EMS that was developed in North America by Alstom (now General Electric). The SCADA/EMS is the primary tool that manages and monitors our transmission network, and provides critical data to the market system to facilitate dispatch and operation of the electricity market. This SCADA/EMS is required for both Transpower's role as grid owner and as provider of the system operator service. Therefore, the PRISM project was jointly funded by the Commerce Commission and the Authority.

Transpower identified several drivers for commencing PRISM, including the need to:

- move the market system to a supported operating system
- implement supported versions of Transpower's Alstom applications
- replace end-of-life software.

The PRISM project implemented an updated version of Alstom's SCADA/EMS application to ensure Transpower can continue to operate a fully supported SCADA platform until 2020. PRSIM was commissioned in March 2016, a delay from the originally planned date in October 2015, and was slightly over the original budget. Approval for the time and costs extensions was provided by the Authority.

[12] The due date and budget being that specified in the Capital Plan, as agreed between the system operator and the Authority to be amended at any time in writing through a change notification and/or business case.

Appendix 2
Summary of capital projects

2.5 ENTERPRISE SERVICE BUS REPLACEMENT

The enterprise service bus (ESB) replacement project provided a new market system ESB (the means by which the market system delivers data between applications and to third parties), reducing business risk and enhancing system resilience. The existing end of life ESB was decommissioned in mid-2016, at the conclusion of the interface migration to the new ESB.

The project commissioned in April 2016 on time and within budget.

2.6 TSAT ONLINE

This project implements Dynamic Stability Analysis (DSA) Manager-TSAT in the real-time environment to enhance management of system frequency. The project will enable the system operator to actively manage increasing power system complexity.

TSAT online solution delivery was completed in March 2016. Operational use will commence in August 2016, once training and business process development is completed. The project is currently forecast to commission on time and within budget.

2.7 RMTSAT STUDY TOOL

The existing RMT study tool did not integrate effectively with the new RMTSAT product implemented in October 2014. This project delivered a fit-for-purpose RMT Study Tool replacement built on a supported platform, and integrated effectively with the system operator's RMT TSAT product. The new study tool improves analytical and RMT audit efficiency, while reducing operational risk by eliminating the need for manual processes.

The project commissioned in June 2016 and was on time and within budget.

2.8 TRAINING AND TESTING SIMULATOR ENVIRONMENT (TTSE) UPGRADE

This project will deliver an upgrade to the TTSE. The TTSE is used to train system coordinators and, therefore, it is essential it accurately represents the power system. The TTSE upgrade will ensure the current state of the power system is modelled accurately to include new functionally delivered by the HVDC and reactive power controllers (RPC).

The capital phase of the project commenced in February 2016 and is planned to commission in March 2017. The project is presently forecast to commission on time and under budget.

Appendix 3
SYSTEM OPERATOR WEBSITE AND NEWSLETTER

Transpower aims to publish five to six newsletters with system operator content a year, at approximately two-monthly intervals. Four newsletters were published in the review period.

Edition	Subscribers	Open rate[13]	Click rate[14]
October 2015	140	66.4	13.1
December 2015	149	64.3	29.4
March 2016	150	68.8	25.7
May 2016	150	57.8	6.8

By the end of the review period there were 150 subscriptions to the newsletter, an increase of 10 from the start of the period. The increase reflects continuing interest from participants and consumers about system operator activities and the operation of the electricity market and power system.

3.1 WEBSITE CONTENT

In November 2015 several enhancements were made to the system operator website. These enhancements were:

- adding real-time information about the percentage of renewables generating on the power system that is updated every five minutes
- adding historical information on renewables generating on the power system. This is update every Tuesday and contains graphs covering last week, last four weeks and the last 12 months
- a new page filtering out Customer Advice Notices (CANs) related to configuration information on the RMT.

3.2 WEBSITE USAGE

Main Site

The following table shows traffic statistics for the system operator's main website.

Traffic Analysis	1 Nov 2014 to 31 Aug 2015	1 Sep 2015 to 30 Jun 2016
Total visits (Sessions):	27,510	31,818
Total pages viewed:	76,955	83,138
Unique page view:	58,466	66,556
Average visits per day:	91	105
Average visits per week:	635	735
Average visits per month:	3,056	3,535
Average pages viewed per visit:	32.79	2.61
Average pages viewed per day:	254	274

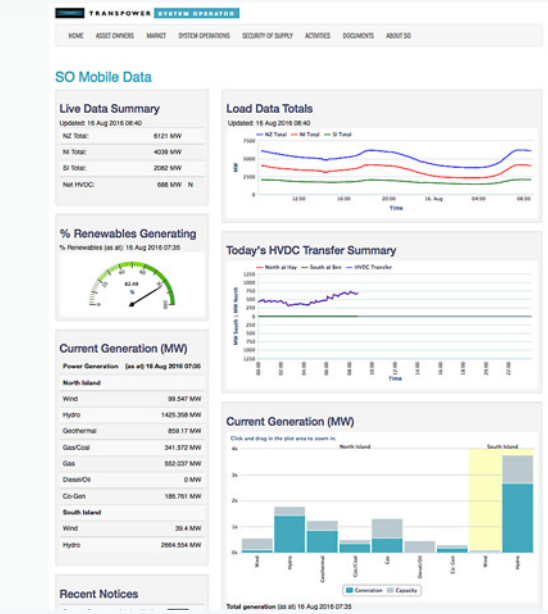
13 Open Rate is the percentage of subscribers that have opened the newsletter
14 Click Rate is the percentage of all hyperlinks in the newsletter that have been opened to source additional information

Appendix 3
System operator
website and newsletter

3.2 WEBSITE USAGE (continued)

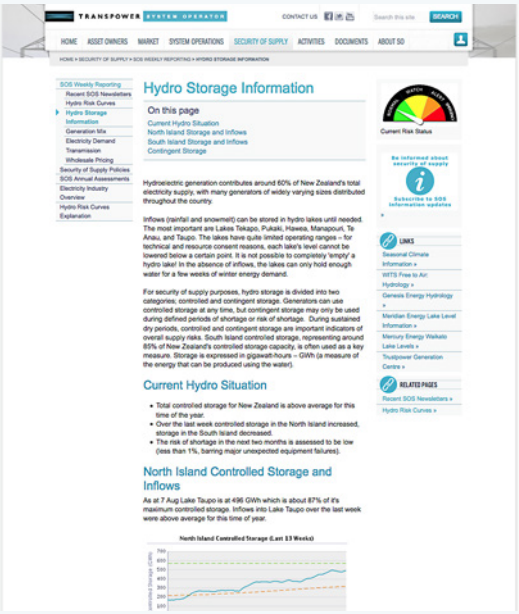
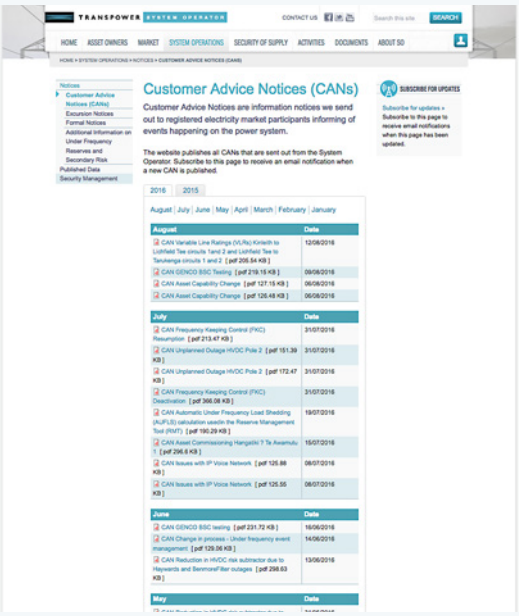
As this reporting period is nine months we have compared the site usage to the previous nine months. Overall usage of the system operator site has increased with our mobile data page and the CAN page having the biggest increase in traffic.

The information published about the impact of thermal decommissioning was also keenly followed by the industry.

Page Name	Page Image	Hits	Change	% of overall views
Home Page		12,812	-12%	15.41
Mobile Data		7,368	+32%	8.86

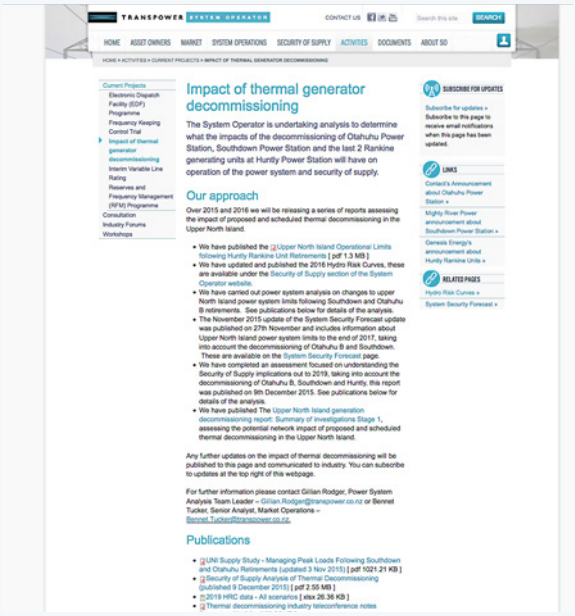
Appendix 3
System operator
website and newsletter

3.2 WEBSITE USAGE (continued)

Page Name	Page Image	Hits	Change	% of overall views
Hydro Storage Information		2,734	-9%	3.29
Customer Advice Notice		2,646	+30%	3.18

Appendix 3
System operator
website and newsletter

3.2 WEBSITE USAGE (continued)

Page Name	Page Image	Hits	Change	% of overall views
Impact of Thermal Decommissioning		2,494	New Page	3.00

Appendix 4
RESULTS OF CUSTOMER SATISFACTION SURVEY

4.1 2015 CUSTOMER SURVEY RESULTS

Every year the system operator conducts a customer satisfaction survey. The customer satisfaction survey for the 2015 calendar year was sent to industry participants on 17 March 2016 and closed on 8 April 2016.

Survey information and methodology

In March 2016 the system operator emailed its customer survey to the email addresses listed on the Electricity Authority's 'participant list' from the public website and some key internal stakeholders. A total of 328 people were emailed the link and 34 responses were received.

Detailed responses

How often do you interact with the system operator?

How often do you interact with the system operator?		
Answer Options	Response Percent	Response Count
Daily	8.8%	3
Weekly	23.5%	8
Monthly	14.7%	5
Quarterly	11.8%	4
Once or twice a year	23.5%	8
Less frequently - every couple of years or so	2.9%	1
Never	5.9%	2
Other (please specify)	8.8%	3
Answered question		34

We use service factors to measure our performance each year. The purpose of this question is to establish how important each of these measures are to you personally, so please select whether each of these measures is of low, medium or high importance to you.

Answer Options	Low importance to me	Medium importance to me	High importance to me	Not applicable to me	Response Count
Having the required skills and knowledge to perform the system operator service	0	4	27	3	34
Being approachable and easy to contact	0	10	21	3	34
Being able to perform the service dependably and accurately	0	2	27	4	33
Conveying trust and confidence	0	10	21	3	34
Keeping our customers informed	0	2	29	3	34
Our readiness and willingness to help	0	6	25	3	34
Managing customer expectations	1	14	16	3	34
Listening to customers	0	8	23	3	34

Appendix 4
Results of customer satisfaction survey

Detailed responses (continued)

Please provide a rating that represents how you think the system operator performed on each of these service factors in the last twelve months.

Answer Options	1: Very Poor	2: Poor	3: Neutral	4: Good	5: Very Good	N/A	Response Count
Having the required skills and knowledge to perform the system operator service	0	0	5	12	14	3	34
Being approachable and easy to contact	0	1	5	11	14	3	34
Being able to perform the service dependably and accurately	0	0	4	14	13	3	34
Conveying trust and confidence	0	0	6	14	11	3	34
Keeping our customers informed	0	0	12	11	8	3	34
Our readiness and willingness to help	0	1	5	12	13	3	34
Managing customer expectations	0	1	10	14	6	3	34
Listening to customers	0	1	8	14	7	3	33
Answered question							34

Please rate our performance on the following operational measures.

Answer Options	1: Very Poor	2: Poor	3: Neutral	4: Good	5: Very Good	N/A	Response Count
How would you rate the system operator's performance in managing market system tool/application outages?	0	1	4	12	3	14	34
How would you rate system operator's performance communicating market system outages or events?	0	0	8	14	3	9	34
How would you rate system operator's performance planning asset outages?	0	1	8	14	1	9	33
How would you rate the system operator's performance relating to dispensations?	0	1	7	5	1	20	34
How would you rate the system operator's performance on contracting for ancillary services?	0	2	9	6	3	14	34
How would you rate the system operator's performance in the communication and management of compliance issues?	0	1	8	8	2	15	34
How would you rate system operator's performance in the commissioning and testing of plant?	0	0	5	7	2	20	34
Answered question							34

Appendix 4
Results of customer satisfaction survey

Detailed responses (continued)

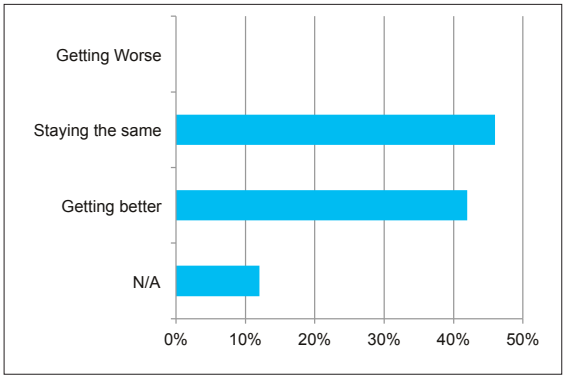
Please rate the following operational measures based on our performance in the last twelve months.

Answer Options	1: Very Poor	2: Poor	3: Neutral	4: Good	5: Very Good	N/A	Response Count
How would you rate the system operator's engagement with participants?	0	0	3	21	4	5	33
How would you rate the system operator's ability to educate participants?	0	0	9	12	4	8	33
How would you rate the system operator's industry notifications/operational communications (CANs/GENs etc)?	0	0	10	13	3	7	33
How would you rate the system operator's market service reports?	1	0	8	9	1	14	33
How would you rate the system operator's website and industry newsletter etc?	0	0	5	19	3	6	33
How would you rate the system operator's consultation on policies, procedures and other formal documentation?	0	0	9	11	5	8	33
How would you rate the quality and content of the system operator's submissions on Electricity Authority consultations?	0	1	11	6	3	12	33
How would you rate system operator's performance for forums, teleconferences, workshops and webinars held during 2015? e.g. November industry workshops, FKC trial, RFM workshops	0	1	1	16	4	11	33
How would you rate the system operator's performance in responding to questions?	0	0	6	10	10	7	33
Answered question							34

Thinking of your experience dealing with system operator in the last twelve months, how would you rate its level of service overall?

1: Very Poor	2: Poor	3: Neutral	4: Good	5: Very Good	N/A	Response Count
0	0	3	16	9	5	33

Thinking overall of your experience with system operator in 2015, would you say things were getting worse, staying the same, or getting better?



Appendix 5
INDUSTRY INTERACTIONS

5.1 INDUSTRY GROUPS AND FORUMS

Participant: Electricity Industry Participants

Subject: Reserves and Frequency Management (RFM) programme

Purpose: The RFM programme continued its projects intended to deliver savings for electricity consumers from more efficient power system operations at a national level, rather than by separate arrangements for South and North Islands. The programme hosted several industry forums and maintained ongoing industry engagement and input to several RFM projects. Both the Authority and Transpower have been recognised for this work with a nomination for the 'Innovation in Energy' awards for the 2016 Deloitte Energy Excellence Awards, to be announced on 10 August 2016.

Participants: Genesis Energy, Meridian Energy, Mighty River Power, Contact Energy and Eastland Generation

Subject: 2016 System Security Forecast (SSF) industry forum

Purpose: The forum was to facilitate dialog with industry participants on topics related to the SSF, such as approach and assumptions, analysis methodology, and report presentation. The forum provided an opportunity to engage with SSF stakeholders to gauge how they use the SSF and what content would best suit their needs.

Participant: Trustpower

Subject: Asset Owner supporting an efficient electricity market

Purpose: At a regular engineering catch-up between the system operator and Trustpower a year or two ago a discussion was had about one of their smaller generator stations with an output of less than 30 MW, and how its protection settings resulted in it not being able to stay connected to the grid during an under-frequency event - it can result in additional reserves being dispatched under certain grid conditions.

In the last year Trustpower completed a protection upgrade at the site, one of the benefits of which being that their generating station now rides through under-frequency events removing the need for the additional reserves to be carried. This illustrates how open discussion between the system operator and asset owners can lead to improvements with flow on benefits for all consumers.

Participants: Nova, Mighty River Power, Trustpower, Genesis,

Subject: Discuss design and use of market node constraints

Purpose: We discussed the use of market node constraints (for identified generation assets) to facilitate transmission outages. The main purpose of the discussions was to discuss reasons for constraints and negotiate the minimum right hand side of the equation.

Participant: Genesis Energy

Subject: Three monthly Transpower/Genesis Energy outage planning and annual planning meeting

Purpose: To actively engage with Genesis Energy regarding Transpower's current outage plan both from an asset and system's perspective. Outage plans (for both Transpower and Genesis Energy) were reviewed out to the end of 2016 and mutual asset outages were lined up where possible. Information was also exchanged about which transmission outages could be difficult from Genesis Energy's perspective and feedback provided on how these could be most helpfully scheduled for both parties.

Appendix 5
Industry interactions

5.1 INDUSTRY GROUPS AND FORUMS (continued)

Participant: Regional Forums- Generators and Distributors

Subject: Outage Protocol Forums

Purpose: Representatives from the System Operations Division presented at Transpower regional outage protocol forums. The purpose of the forums is for Transpower to present to the industry, and discuss issues affecting outage planning. We presented on the impact of the thermal decommissioning on outages and gave an update on the outcomes of the 2013 planned outage coordination process (POCP) review.

Participant: Electricity Industry Participants

Subject: Extended Reserve Workshops

Purpose: The Authority's efficient procurement of extended reserve project continues to progress. The project introduces changes to the way that participants provide automatic under-frequency load shedding (AUFLS), by implementing a proposal to move from two blocks to four in the North Island. We participated in a number of industry workshops which provided valuable input towards developing a robust implementation process.

Participants: North Island distributors and generators

Subject: Core Grid Restoration Exercise

Purpose: To provide insights into restoration times and operational realities helped those involved to understand their roles and resiliencies and dependencies (discussed in section Delivering competition with security).

5.2 INDUSTRY TELECONFERENCES

9th October 2015: this teleconference was to discuss the initial findings from the investigation as presented in a upper North Island (UNI) voltage stability report published in September 2015, concurrent November outages which affected the voltage stability limit, a new voltage constraint equation and testing carried out on the new constraint.

6 November 2015: this was a follow-up to the 9th October meeting, and intended to discuss the findings of the updated UNI Supply Study - Managing Peak Loads Following Southdown and Otahuhu Retirements (updated 3 Nov 2015). Discussion topics included updates to the report summer and winter scenarios and updates to the reports outage scenarios and voltage stability constraint.

17 December 2015: this teleconference was for industry to discuss a report titled Security of Supply Analysis of Thermal Decommissioning. The minutes from this teleconference are available on our website.

17 December 2015: in collaboration with Grid Projects Division we held a teleconference to inform participants of the works occurring for the Benmore Haywards re-conductoring project. Grid Projects Division provided background on the project and we advised what outages were planned and the impact that they were expected to have on system security, HVDC transfers and security of supply based on security of supply analysis at the time. The purpose of the briefing was to ensure the industry was well informed on the impact of the outages, let them know that we were not forecasting any issues at the time, that the work was planned to minimise any impact and assure them that we were continuing to monitor the situation while the outages were in progress.

25 February 2016: in collaboration with Grid Projects we held a teleconference to inform participants of the works occurring for the Livingstone Waitaki re-conductoring project. Grid Projects gave some background on the project and we advised what outages were planned and the impact that they were expected to have on system security, constraints in the region, and to ensure them that there was not a significant affect hydrology or security of supply. The purpose of the briefing was to ensure the industry was well informed on the impact of the outages, expected constraints and the impact on customers.

Appendix 6
SUMMARY OF TASC STATEMENTS OF WORK

A summary of TASC SOWs carried out during the review period is set out below. For each TASC SOW completed, the commentary records whether the SOW has been delivered on or before the agreed due date, and its budget status[15].

6.1 TASC SOW 49: NORMAL FREQUENCY MANAGEMENT STRATEGY

TASC SOW 49 commenced in March 2015 and completed on 7 October 2015. Work was completed a week later than scheduled, due to additional time taken to incorporate and finalise feedback. Work was completed within budget.

The purpose of this SOW was to inform development of future strategy for normal frequency management only. This included developing a benchmark, defining future normal frequency management options, assessing the benefits and costs of moving from the current benchmark, developing an interim solution, and submitting a final recommendation.

6.2 TASC SOW 53: REVIEW OF INSTANTANEOUS RESERVES MARKETS STAGE 2

TASC SOW 53 commenced in September 2015 and was initially scheduled to complete in the next review period in November 2016. However, due to Authority budgetary constraints, work was de-scoped and a revised completion date and budget agreed. Work was completed within the revised timeframe and budget.

The purpose of this SOW was to complete proof of concept engineering studies of specified changes to current IR products. The required deliverables were a presentation of the review findings to the Authority and a close-out report summarising the general findings of the review.

6.3 TASC SOW 54: REAL TIME PRICING INVESTIGATION

TASC SOW 54 commenced in August 2015 and was initially scheduled to be completed in December 2015. However, a variation was agreed for two additional options to be considered as part of the SOW, resulting in a revised completion date (end of January 2016) and budget. Work was completed on time and on budget against the revised scope.

The purpose of this SOW was to evaluate and implement an option to make prices more timely and accurate in a wider range of operating conditions. The intent is to enable market participants to make better investment and operational decisions concerning electricity generation and consumption, which will enhance the responsiveness of demand to spot prices.

6.4 TASC SOW 55: MULTIPLE FREQUENCY KEEPING (MFK) REFINEMENT

TASC SOW 55 commenced in November 2015 and was completed on 29 March 2016. Work was completed on time and under budget.

The purpose of this SOW was to assess the minimum MW band of MFK required to manage frequency when FKC is enabled, and to assess the MFK MW band required to manage frequency when FKC is not enabled. The outputs of this SOW will help enable the broader purpose of the normal frequency management strategy work to provide stable frequency at the lowest long term cost to consumers.

15 The due date and budget being that specified in the TASC Statement of Work, as amended at any time in writing between the system operator and the Authority.

Appendix 6
Summary of TASC statements of work (SOW)

6.5 TASC SOW 56: NORMAL FREQUENCY MANAGEMENT STRATEGY – SYSTEM STABILITY

TASC SOW 56 commenced in December 2015 and was initially scheduled to complete in the next review period in August 2016. However, due to Authority budgetary constraints, work was de-scoped. A revised timeframe and budget was agreed, with work completed within this revised timeframe and budget.

The purpose of this SOW was to assess the minimum aggregate droop at which system stability can be maintained for both large and small scale frequency fluctuations. Following the Authority's review of its budgets it was agreed only phase 1 of the original SOW, a literature review, would remain in scope, with phase 2 to be raised as a separate SOW when budget is available.

6.6 TASC SOW 57: EVALUATING OPTIONS TO IMPROVE HOURS-AHEAD FORECASTS

TASC SOW 57 commenced in February 2016 and was completed on 10 June 2016. Work was completed on time and under budget.

The purpose of this SOW was to investigate and report findings on the system security and cost implications of an hours-ahead market based on an existing price-responsive schedule (PRS).

Appendix 7
PRINCIPAL PERFORMANCE OBLIGATIONS

7.1 TIME ERROR

There were no instances of time error exceeding the ± five second limit during the review period.

7.2 FREQUENCY

The following table summarises frequency excursions during the review period:

Frequency Band (Hz)	2015				2016						Annual Rate	PPO target
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun		
55.00 > Freq >= 53.75												0.2*
53.75 > Freq >= 52.00												2*
52.00 > Freq >= 51.25												7
51.25 > Freq >= 50.50		1		3		1	3				8	50
50.50 > Freq >= 50.20	146	52	52	37	10	18	31	30	42	29	447	
50.20 > Freq > 49.80												
49.80 >= Freq > 49.50	172	128	173	111	84	101	118	125	106	89	1207	
49.50 >= Freq > 48.75				1	1		1		2		5	60
48.75 >= Freq > 48.00												6
48.00 >= Freq > 47.00												0.2
47.00 >= Freq > 45.00												0.2

* South Island

7.3 REQUESTS RECEIVED RELATING TO HARMONIC LEVELS, VOLTAGE FLICKER LEVELS AND NEGATIVE SEQUENCE VOLTAGE

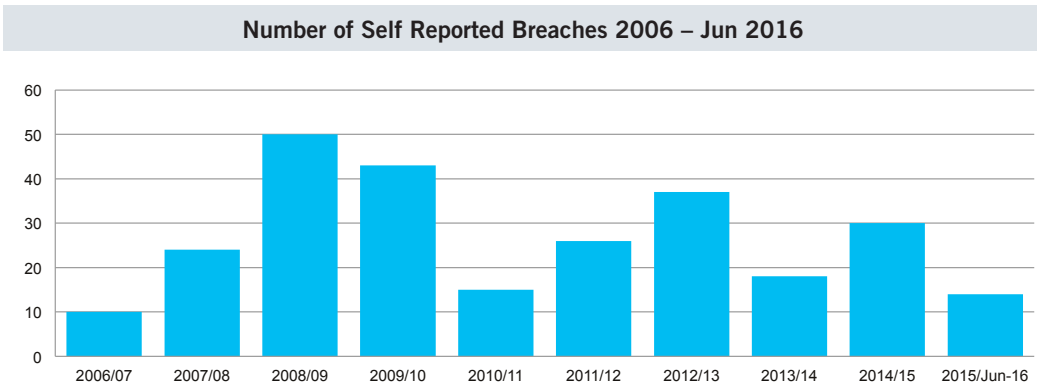
No requests were received relating to harmonic levels, voltage flicker levels and negative sequence voltage.

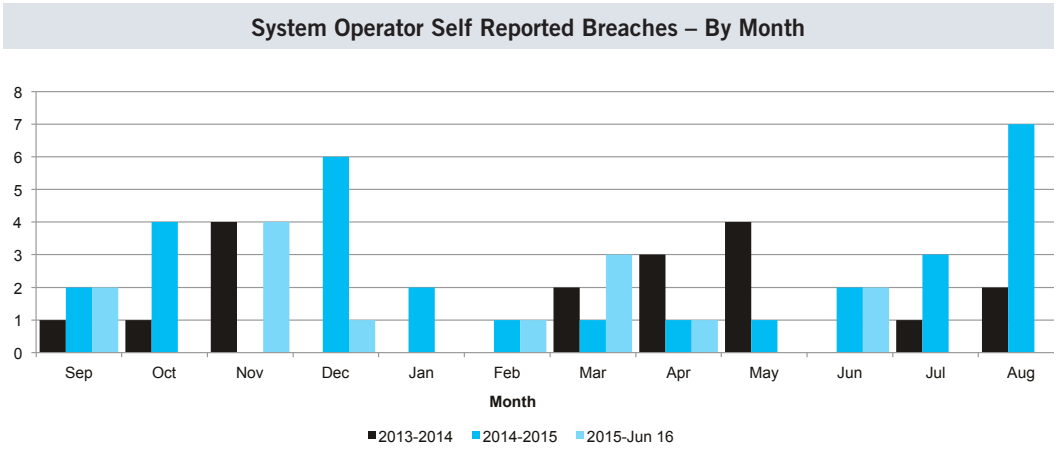
Appendix 8
COMPLIANCE

8.1 SYSTEM OPERATOR SELF-REPORTED BREACHES

This section shows code breaches the system operator self-notified to the Authority. Dates referred to in the graphs below are when breaches were reported, not when breaches occurred.

By number of breaches





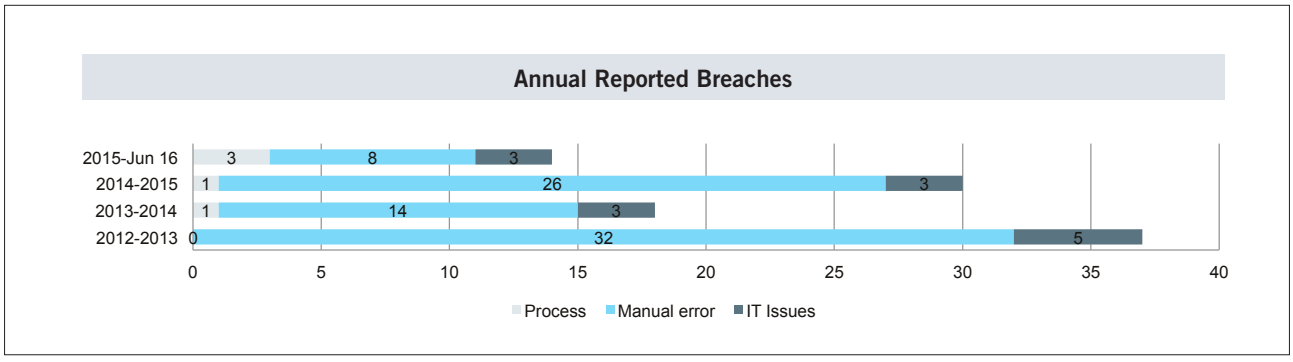
Appendix 8
Compliance

8.1 SYSTEM OPERATOR SELF-REPORTED BREACHES (continued)

Breach by code reference

Code	2013-2014	2014-2015	2015-Jun 16
Part 3.18	1		
Part 8.59			1
Part 8.68	3	2	1
Part 8.69		1	
Part 8.70		1	
Part 13 13.58A	3	3	2
Part 13 13.59		3	
Part 13 13.62	2	3	2
Part 13 13.63			2
Part 13 13.69A		4	2
Part 13 13.70		1	1
Part 13 13.71	2	2	
Part 13 13.138			2
Schedule 13.3	2	4	
Policy Statement 12.5	1		
Policy Statement 30.1B	3	3	1
Policy Statement 32.2	1	1	
Policy Statement 90.1		2	
Total	18	30	14

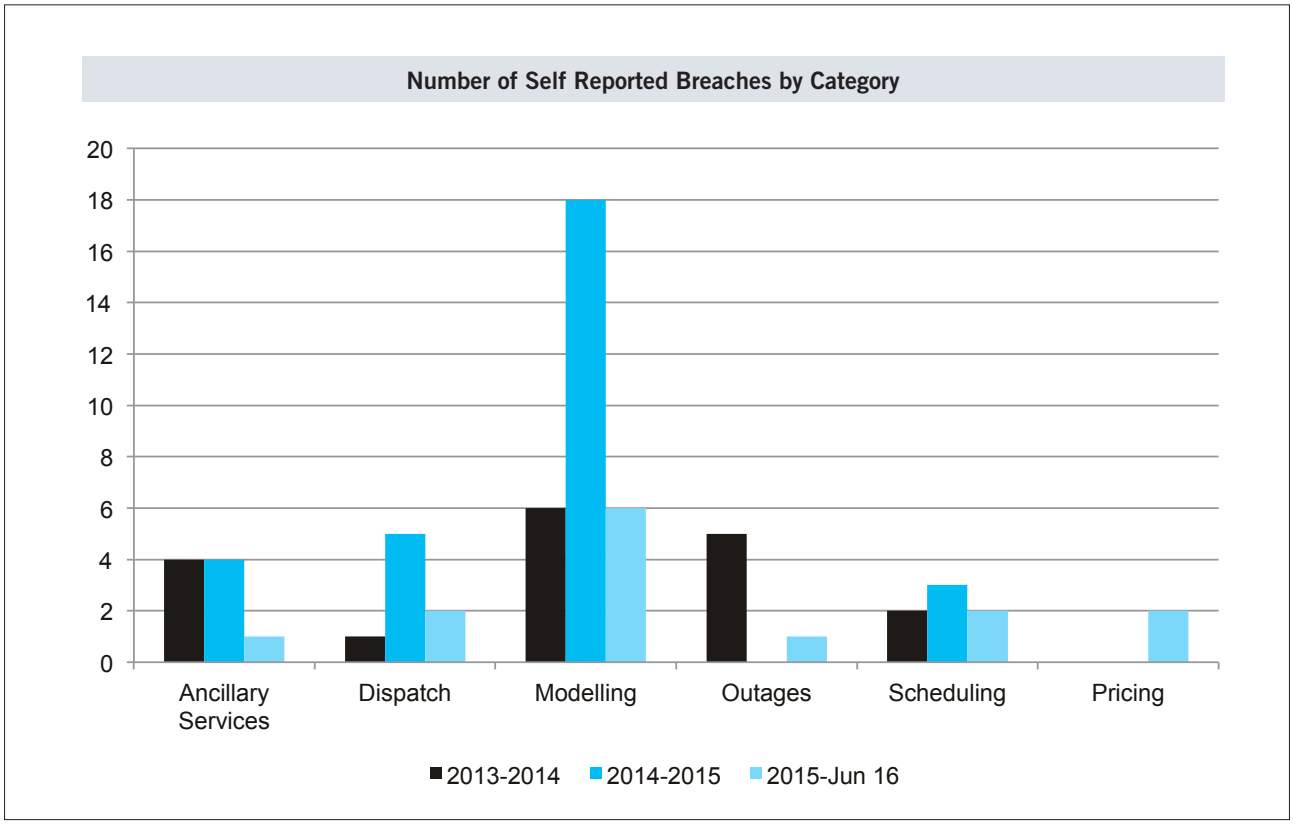
Breach by error source



Appendix 8
Compliance

8.1 SYSTEM OPERATOR SELF-REPORTED BREACHES (continued)

Breach by category



8.2 TRANSPOWER SYSTEM OPERATOR BREACHES ALLEGED BY OTHER PARTIES (INCLUDING THE AUTHORITY)

There were no breaches alleged against the system operator during the review period.

Appendix 9
SOFTWARE AUDITING

9.1 SOFTWARE AUDITING

This section describes audits procured by Transpower during the review period regarding the system operator's auditable software (see clause 3.17 of the Code).

The Authority-approved auditor was PA Consulting.

All audit opinions attained from PA Consulting during the review period determined the model versions audited were compliant with the software specifications within the current SOSPA (2009).

9.2 ANNUAL RMT AND SPD CERTIFICATION

On 31 March 2016 annual audits of the RMT and SPD tool were completed. Audit findings are presented below.

9.3 RESERVE MANAGEMENT TOOL (RMT)

Audit opinions in relation to the RMT software were sought for the following model versions.

4 December 2015

This RMT software update, model version 5.000.004, introduced numerous changes, including:

- activating the asset owner performance obligation (AOPO) dispensation flag for Huntly unit 6
- updating the Aviemore governor models to reflect changes to governor arrangements
- removing the AOPO dispensation flag for the Argyle branch and Tararua wind farm generators
- updating maximum output of Te Rapa cogeneration to 50 MW, to reflect additional capability in cold weather
- updating the Atiamuri tail water depressed (TWD) governor model as a result of frequency response tests by the asset owner
- updating the underlying TSAT engine software
- updating the Huntly units 1 and 2 steam exciter model to fix instability noted during offline tests
- updating the maximum output of Te Mihi station to 91.86 MW.

31 March 2016 (not deployed in production)

This RMT software change, model version 5.000.005, introduced numerous changes, including:

- adding the risk of Mt Stuart and Flat Hill wind farms tripping under low frequency conditions to the model
- changing the fast instantaneous reserve optimisation model for Mill Creek for the purpose of model robustness
- removing the under frequency trip for Branch River/Wairau
- upgrading an underlying software component to address a potential AOPO reporting issue
- uprating Manapouri maximum continuous output to 125 MW
- uprating Benmore maximum continuous output to 95 MW
- changing the first trip frequency for South Island automatic under frequency load shedding (AUFLS) block two
- modifying the Maraetai governor model to reflect governor replacements and tuning at the station
- modifying run-back logic for Huntly unit 6 to assist model convergence.

Version 5.000.005 was not deployed into production due to an issue with the way the market system was interpreting the model specific file change, which creates the relevant input file. This issue was resolved in version 5.000.006 and a revised date of 8 April 2016 was set for deployment.

Appendix 9
Solfware auditing

9.3 RESERVE MANAGEMENT TOOL (RMT) (continued)

8 April 2016 (not deployed in production)

This RMT software change, model version 5.000.006, was a modification of version 5.000.005, with one additional amendment to the model file. The Mt Stuart file entry in version 5.000.005 was moved to the general body of the xml file. In order to ensure the generator was added to the input file by the market system, without being scheduled by SPD, the model file entry needs to be under a separate tag than other generators.

Version 5.000.006 was not deployed into production due to an issue with the identifier for the Mt Stuart generator model in the model file that needed to be changed for consistency. A further audit was procured to look at this change.

8 April 2016

This RMT software change, model version 5.07.000, modified the Mt Stuart model file entry to match the model station name. Version 5.07.000 was deployed into production.

13 April 2016

This RMT software change, model version 5.08.000, introduced numerous changes, including:

- reducing the trigger frequency for South Island AUFLS block two from 46.5 Hz to 46.0 Hz to ensure a consistent solution (this change was made after observing from market results that RMT was switching between two solutions to meet South Island ECE requirements)
- allowing frequency to drop to 46.0 Hz to ensure South Island AUFLS block two and Tiwai AUFLS blocks trip at 46.5 Hz and 46.0 Hz respectively
- scheduling more FIR and SIR, to ensure only South Island AUFLS block two trips at 46.5 Hz.

23 June 2016

This RMT software change model 5.09.00 introduced the following minor changes.

The 3rd party software platform (DSA Manager) that underlies RMTSAT has been updated from version 14 to version 15. This contains a number of fixes and improvements to the calculation techniques used by the platform that could potentially change the calculated NFR and FIR values. However, there is no change to the RMTSAT model formulation, so any changes to RMT results are expected to be small and immaterial.

A tolerance parameter (X_Tol) is now set in the XML rather than hardcoded.

9.4 SCHEDULE PRICE DISPATCH (SPD)

Audit opinions in relation to the SPD software were sought for the following changes.

11 February 2016

The system operator sought an audit opinion in respect to changes to version 39.1.4 of the SPD software arising due to the implementation of Transpower's SCADA upgrade project on 16 March 2016.

As part of these changes, the modelling software (AIMMS) for SPD has been upgraded from version 3.7 to 3.13.

The audit found that all:

- regression tests passed, indicating the AIMMS solver upgrade in version 39.1.4 did not adversely impact SPD's existing functionality
- test cases produced identical objective value functions and nodal prices when compared with version 38.4.10. In some cases, SPD version 39.1.4 dispatched energy and reserve differently (but equivalently) to version 38.4.10.

Appendix 9
Solfware auditing

9.4 SCHEDULE PRICE DISPATCH (SPD) (continued)

1 April 2016

The system operator sought an audit opinion regarding changes to SPD's software specification – formulation version 10.0 (the Formulation). The Formulation has been updated in two areas.

1. **Reserve pricing**
   - Section 6.2 of the Formulation has been changed to accurately reflect the definition of the reserve price for each island i (i = NI, SI) and class c (c = 6s, 60s).
   - Changes were subsequently made to Section 2.7.2 and Section 3.4.3 to reflect this corrected definition.
   - Reserve test results to date are consistent with the changed formulation and no additional testing is required in this respect.

2. **Generation ramping**
   - Sections 2.1, 2.10.2, 3.7 and 5.3 have been changed to accurately reflect how SPD handles generation ramping. In particular, a new subset of offers titled 'UNITGENERATORS' has been defined in Section 2.1 to address instances where a stations total generation output cannot be represented as one unit for ramping purposes (ie jointly owned units). In this case, the unit is mapped in SPD to multiple market nodes (one for each trader), with one nominated primary node. SPD combines the offers from all market nodes, but uses the ramp rate specified at the primary node for ramping purposes.
   - Sections 3.7 and 5.3 have been amended to simplify how ramping functionality is reflected in SPD.
   - As PA Consulting have not previously tested generation ramping for jointly owned units, we have undertaken additional testing to ensure SPD correctly implements ramping for jointly owned units, as newly specified in Version 10 of the Formulation.

All additional testing passed and it was noted that:

- SPD correctly combines the offers of jointly owned units, and applies the ramp rate specified at the primary node to the joint unit
- SPD correctly calculates the ramping marginal price when ramp rates bind for a jointly owned unit
- SPD correctly combines offers from the jointly owned units and applies the joint ramp rate to the joint unit, as opposed to applying ramp rates individually at each node.

Appendix 10
PROCUREMENT PLAN AND ANCILLARY SERVICES

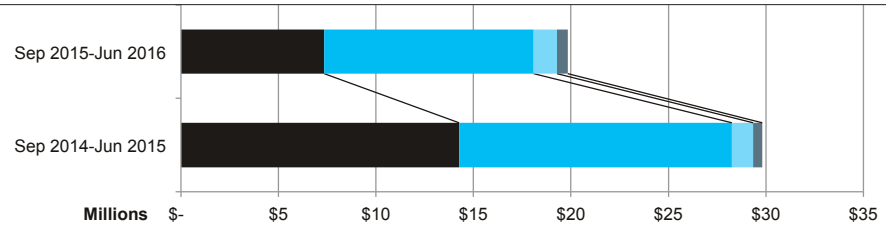
10.1 CONTRACTED ANCILLARY SERVICES

The following table summarises contracted services as at 30 June 2016:

Ancillary Service Agent	Multiple Provider Frequency Keeping	Back Up Single Provider Frequency Keeping	Instantaneous Reserve	Over Frequency Reserve	Black Start
Contact Energy	✔ (North and South Island)	✔ (North and South Island)	✔	✔ (North and South Island)	✔ (South Island)
Counties Power			✔		
EnerNOC			✔		
Genesis Energy	✔ (North Island)	✔ (North Island)			✔ (North Island)
King Country Energy			✔	✔ (North Island)	
Meridian Energy	✔ (South Island)	✔ (South Island)	✔	✔ (South Island)	✔ (South Island)
Mighty River Power	✔ (North Island)	✔ (North Island)	✔	✔ (North Island)	✔ (North Island)
Northpower			✔		
Norske Skog			✔		
Pan Pac			✔		
Powerco			✔		
Trustpower	✔ (North Island)		✔		
Tuaropaki (Mokai)				✔ (North Island)	
Vector			✔		
WEL Networks			✔		
Wellington Electricity Networks			✔		
Winstone Pulp International			✔		

10.2 ANCILLARY SERVICE PROCUREMENT COSTS

The total ancillary service costs for the review period were $19,832,848, continuing the downward trend from the 2014/2015 review period. For comparison purposes the same 10 month period from 2014/15 was used. A breakdown of costs is shown below across those periods.



	Sep 2014-Jun 2015	Sep 2015-Jun 2016
Frequency Keeping Costs	$14,263,492	$7,344,267
Instantaneous Reserve	$13,992,213	$10,755,323
Voltage Support (incl Events)		
Over Frequency Reserve	$1,093,646	$1,188,803
Black Start	$472,980	$544,455

Appendix 10
Procurement plan
and ancillary services

10.3 ANCILLARY SERVICES PERFORMANCE

Instantaneous reserves

There was one under frequency event in the North Island during the review period, compared to three in the previous period. When the event occurred on 16 May 2016, it had been over 17 months since the last event in December 2014. For this reason, the system operator had been working with interruptible load providers regarding testing of their equipment (as provided for under the terms of their ancillary services contracts). Those providers who offered during the event and met their dispatch instructions will not be required to test their equipment. Transpower is working with the other providers to ensure compliance with their contractual requirements prior to December 2016.

The table below summarises assessments of provider performance the system operator carried out for the review period.

Under-frequency Event Summary – Instantaneous Reserve Event Assessments

Date	Time	Event Causer/ Site Initiated at	Lowest Frequency (Hz)		MW Lost	Number of dispatched IR Ancillary Service Agents (ASA)	ASA Performance
			North Island	South Island			
16 May 2016	17:57	Huntly 5	49.09	49.15	366.5	14	All providers met their contractual requirements

Frequency keeping reserves

There were no issues with MFK provider performance during the review period.

During the review period, the system operator developed a testing regime and guidelines for back-up single provider frequency keeping (back-up SFK). Back-up SFK is not used in the daily management of frequency, but is procured should MFK become unavailable. The objective of the testing is to enable generation controllers to retain knowledge of how to perform SFK. The testing regime provides flexibility for providers to carry out testing at a time that suits them, while enabling the system operator to perform necessary grid security checks.

Black start

A successful test of the black start capability of Genesis Energy's Tokaanu station was carried out on 21 February 2016. The test involved a full shutdown of the station, which is now a requirement for all black start provider tests (some previous tests were conducted on the basis of a partial station shutdown).

Appendix 11
INTERNATIONAL INTERACTIONS

11.1 TRANSIENT SECURITY ASSESSMENT TOOL/POWERTECH

During December testing of our new RMT transient security assessment tool (TSAT) study (at Powertech's labs in Vancouver), the opportunity was taken to discuss upcoming Powertech projects, including those relevant to national reserves markets. Powertech is a global provider of power system simulation technology, including to Transpower.

In February, members of our engineering team attended the first online Dynamic Stability Analysis (DSA) tools users' webinar. Such contacts provide useful engineering system operator knowledge in addition to specific tool user information.

11.2 ASSOCIATION OF POWER EXCHANGES (APEX) CONFERENCE

Three delegates attended the APEX conference in Perth (November 2015). This conference included panel participation by Transpower personnel and attendance at conference sessions on a variety of subjects including market integration of renewable technologies across various national grids, the evolving economic and market impact of subsidies, ancillary services, and capacity markets. In addition to establishing and maintaining international relationships with system operator personnel from other jurisdictions, a benefit of conference attendance was our being able to provide re-presentations of conference sessions to Transpower staff by our conference attendees.

11.3 GENERAL ELECTRIC GRID MANAGEMENT SOLUTIONS ASIA PACIFIC USER GROUP

Transpower is a member of SCADA and market system user groups maintained by Transpower's major supplier, General Electric (GE). Transpower hosted a GE SCADA user group conference in November. With attendees from Australia, Asia and North America, providing direct opportunities for exchanging operational information and ideas, and establishing and maintaining linkages with other similar organisations. In addition, information on GE's product development roadmap was provided, which supports Transpower's internal decision-making on future SCADA needs. On a number of occasions during the final months of Transpower's major PRISM project, contacts were made to international users seeking assistance to resolve issues impacting on Transpower's implementation.

11.4 2016 GE (FORMERLY ALSTOM) NORTH AMERICAN USER GROUP

This forum is an opportunity for GE customers from a wide range of backgrounds to meet and interact with GE managers and technical experts. This year the main sessions focussed on the implications for customers resulting from the recent Alstom acquisition by GE and provided comfort the software brand in which Transpower has heavily invested has a clear future under the new ownership. Sessions focussing on specific tools used by Transpower showed GE has a strong commitment to easing the burden of customer upgrades. A session on market clearing and security tool architecture demonstrated significant improvements in flexibility and capacity which will be invaluable if a day-ahead market is adopted in New Zealand.

11.5 INTERNATIONAL TRAINING

Dr Prabha Kundar (Toronto, Canada) was brought to New Zealand in February 2016 to present a multi-day course on power system stability and control. Forty two engineers and operational Transpower staff attended the course.

11.6 INTERNATIONAL VISITS

When Transpower staff travel for conference or technical reasons they generally visit other system operator's to gather information and insights relevant to system operations. Among the visits in the current review period were contacts with Bonneville Power Administration and Washington State (with IT matters being a discussion focus).

Appendix 12
SYSTEM OPERATOR SERVICE PROVIDER AGREEMENT

12.1 PEOPLE

System operator FTEs during the review period were:

	31/08/2015	30/06/2016	Change
General Manager	3.0	2.0	(1.0)
SO Business	11.7	9.6	(2.1)
System Operations	41.7	40.6	(1.1)
SO Engineering	28.7	31.9	3.2
SO Market	17.6	15.0	(2.6)
Total	102.6	99.1*	(3.5)

*This excludes 9.0 vacant positions (including parental leave and secondments)

12.2 BASE CONTRACT

Actual fees received under the base SOSPA during the review period were as follows (note: the table reflects the reforecast of fees carried out after the September 2015 wash-up, and is net of 2013/14 wash-up settled in October, At Risk fee component 2013/14 and Security of Supply Refund 2014/15 issued in August 2015):

Financial review: SOSPA	1 September 2015 – 30 June 2016
System operator service provider contract base fee for the period 1 September 2015 – 30 June 2016	$34,541,724
Total fees paid under the SOSPA	$34,541,724

12.3 ADDITIONAL FEES

The following is a summary of fees invoiced to the Authority for services in addition to those provided under the SOSPA:

Variable Revenue	1 September 2015 – 30 June 2016
TASC Advice	$521,840
Development fee services	$260,438
Total variable revenue	$782,278

Appendix 13
INFORMATION DISCLOSURE

			2015/16 ($000)
Return on Investment			
	Operating surplus/(deficit)	20,525.5	
less	Assets purchased or commissioned	9,963.1	
less	Tax payable	2,583.6	
	Notional cash flows for the year		7,978.8
	Opening fixed assets		(36,821.2)
	Closing fixed assets		34,405.4
plus	Lost assets		
less	Found assets		
	Adjusted closing fixed assets		34,405.4
Regulatory Profit			
	Total revenue		42,925.5
less	Operating expenditure		22,439.1
	Operating surplus/(deficit)		20,525.5
less	Total depreciation		12,378.8
	Regulatory profit/(loss) before tax		8,146.7
less	Tax payable		2,583.6
	Regulatory profit/(loss) after tax		5,563.1
Revenue			
	System operator service provider agreement revenue - operating		25,238.1
	System operator service provider agreement revenue - capital		16,615.0
	Technical services advisory revenue		660.2
	Wash-up		451.3
	Total revenue		42,964.6
Operating Expenditure			
	Operating Costs		17,316.9
	IT Operations		5,122.2
	Total operating expenditure		22,439.1
Capital Expenditure: Commissioned capex			
	Buildings and grounds		(17.7)
	IT market systems		9.395.7
	IT market changes		126.2
	Other		458.8
	Capital Expenditure		–
			9,963.1
Fixed Assets: RAB equivalent values			
	Opening fixed assets		36,821.2
plus	Found assets		–
less	Disposed assets		–
less	Lost assets		–
plus	Assets purchased or commissioned		9,963.1
less	Total depreciation		12,378.8
plus	Adjustment resulting from asset allocation		–
	Closing fixed assets		34,405.4

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Appendix B: Indication of preliminary content of Authority's annual review of system operator performance, for the period; 1 September 2015 – 30 June 2016

Overall, the conclusion of the Authority's review is that, during the review period, the system operator has continued to demonstrate a trend of improving performance.

The system operator has been conducting its work with a growing degree of openness and transparency that is highly valued. The improvement is evident to stakeholders, as shown by the results of the system operator's customer satisfaction survey. It is also reflected in the system operator's positive working relationships with Authority staff at multiple levels.

It is clear to the Authority that the system operator is genuinely adjusting its focus to how its actions can better support the joint objective (promoting competition, reliability and efficiency for the long-term benefit of consumers). The new system operator service provider agreement means that the structures are now in place to support both organisations in pursuing the joint objective.

The system operator's strategic goals provide it with a clear and positive direction, and the Authority is encouraged by its progress towards each:

- **Delivering competition with security:** The Authority has high confidence in the system operator's commitment to system security. A number of thermal retirement announcements during the year resulted in a high workload on security of supply issues. The system operator's work on these issues was commendable: in spite of tight timeframes its communication with the Authority, SRC and industry stakeholders was very successful.

  The system operator's core grid restoration exercise was a positive development; recent events in South Australia demonstrate the need to be prepared for worst-case events. The Authority also values the progress that has now been made on the issue of reserve adjustment factor settings following under-frequency events.

- **Demonstrating value for money:** The system operator maintains a high level of commitment to, and professionalism in, ensuring it complies with its regulatory and contractual requirements. During the review period it showed improvements in areas the Authority raised in previous annual

reviews including the frequency of manual errors, and its approach to consulting on documents incorporated into the Code by reference.

The system operator has shown a commitment to reviewing the extent to which its policies, procedures, and initiatives support the joint objective. It is also working effectively with the Authority to manage, prioritise and deliver projects.

- **Planning for tomorrow:** The Authority recognises the foresight that the system operator has shown, in terms of seeking to identify:
  - how the system operator role can evolve over time to best support competition, reliability and efficiency – as apparent from its strategic plan, and the new system operator service provider agreement
  - various challenges for the system in future, which will require preparation and diligence – as apparent from its solar PV study, environment scan and market systems roadmap.
- **Strengthening relationships:** The relationship charter has been valuable in strengthening the relationship between the Authority and system operator. The two organisations have formed working relationships and escalation pathways that are resulting in good business and project outcomes. Additionally, the Authority considers that the Reserve and Frequency Management forums have continued to be an effective and well-organised approach to engaging and communicating with stakeholders on the technically complex issues involved.
- **Investing in good people:** The system operator's past investments in its staff appear to have been paying dividends, and the Authority recognises the value in continuing to nurture the unique capabilities required of its staff across various disciplines. The Authority notes that system operator staff exercise strong project management disciplines, and the quality of written communication has continued to improve.

The Authority notes that the review period was not absent its challenges. In particular, these included the delays to the PRISM SCADA upgrade, and the time taken to come to agreement on issues around the approach to setting reserve adjustment factors after under-frequency events. However, in an endorsement of the commitment to the joint objective, and growing strength of the working relationship, the system operator and Authority were able to engage constructively on ways to resolve these issues.

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

Recommendation 1:	***Consider whether there would be value in further aligning the annual self-review and system operator service strategic plan, particularly in terms of conducting an assessment against the strategic plan's "intended outcomes"***
Recommendation 2:	***Ensure that the recommendations of the post-project review of the PRISM SCADA upgrade are implemented, and that the Authority is kept up to date on progress on those developments.***
Recommendation 3:	***Work with the Authority to identify what information and indicators on financial performance should be included in future self-reviews.***