

System operator performance

System operator's self-review of its performance
for the year ended 31 August 2015

22 October 2015

Background to the system operator's self-review

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 system operator has completed its annual self-review of its performance, for the year ended 31 August 2015. The self-review is required by the Electricity Industry Participation Code 2010 (Code).¹ The Code also requires the Authority to subsequently review the system operator's performance. Advice from the SRC may assist the Authority in its review.

The purpose of this paper is to provide the SRC with a copy of the system operator's annual self-review, and ask questions that may help to establish whether the SRC has advice to offer the Authority.

The system operator has taken a new approach to its self-review

The system operator has changed its approach to its self-review, building further on changes it made last year. It follows a new structure, with five sections that align with Transpower's strategic goals under its new Strategic Plan. The SRC reviewed the Strategic Plan at its 1 July 2015 meeting.

A high-level outline of the content under each of the five sections is provided in Table 1.

Table 1: High-level outline of sections of system operator self-review

Section No.	Strategic Goal	Broad content
3	Delivering competition with security	• Performance of the power system • Key operational events and challenges
4	Demonstrating value for money	• Performance and self-improvement initiatives • Compliance with the Code and the System Operator Service Provider Agreement • Delivery of the capital expenditure plan and Joint Development Programme
5	Planning for tomorrow	• Approach to preparing the system operator service for the future • Potential changes facing the system operator • Initiatives to utilise HVDC capabilities • Assets commissioned and testing of processes • Technical Advisory Services Contract work carried out
6	Strengthening relationships	• Implementation of findings from 2013 external review • Charter with the Authority • Industry engagement and communication

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.

Section No.	Strategic Goal	Broad content
7	Investing in good people	System operator's focus on having the right skills for the job and safety

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, or the self-review, that they may wish to comment on.

It draws particular attention to the following sections:

- **Section 3.1.1 – Grid upgrade programme:** The final paragraph of this section observes that “The advent over the last several years of an increased number of special protection schemes has complicated management [of the power system].” SRC members may be interested in understanding the extent of this concern and whether the situation would warrant further action from the system operator, such as new tools or policies.
- **Section 4.1 - Performance improvement:** The system operator has commented on the feedback that the SRC provided on the system operator's 2013/14 self-review of its performance.
- **Section 5.2 - Potential changes facing the system operator:** This section addresses, in part, one aspect of that feedback. **Furthermore, the system operator's presentation on edge technologies (agenda item #8 at the 22 October 2015 SRC meeting) may prompt SRC members to identify matters for the system operator's consideration.**
- **Section 6.3 – Industry engagement and communication:** The system operator's industry engagement is an area where the Authority has little insight. Absent other information, the Authority's performance review tends to rely on the system operator's customer satisfaction survey as a representation of customer experiences, and can generally only take those survey results at face value.
- **Appendix 1 - System security and operations:** Section 1 of this appendix provides useful background for discussions on reliability and the National Winter Group.
- **Appendix 9: Results of customer satisfaction survey:** The system operator has recently reviewed the scope and approach to its customer satisfaction survey.

The SRC may wish 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 performance that the SRC would like the system operator to give greater weight to in its dealings with industry?

System Operator Report

Annual Review and Assessment

1 September 2014 to 31 August 2015

TRANSPower



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1 SELF-REVIEW FOR 2014/15

This report to the Electricity Authority (the **Authority**) records Transpower's self-review of its performance as system operator (**System Operator**) for the period 1 September 2014 to 31 August 2015 (the **Review Period**).

Transpower has continued to improve delivery of the system operator service throughout the Review Period. 2014/15 performance highlights include:

- very good management of the power system, with only three under frequency events;
- introduction of roundpower, national frequency keeping and increased HVDC reserve sharing;
- reorganisation of the System Operator team to provide a greater focus on delivering a system operator service that represents value-for-money and reflects the Authority's competition, reliability and efficiency (**CRE**) statutory objective;
- a fresh approach to strategic, business and capital planning, along with identifying and determining our response as a reasonable and prudent system operator to assist the Authority in meeting its CRE objective in terms of environmental changes; and
- improved transparency and information sharing with participants including publishing event reports on key events, meeting with customers to discuss and understand their commercial drivers and needs, hosting industry workshops to ensure industry are kept informed and contribute on key matters and capital projects, and greater transparency on the current system operator service and its likely future direction.

Whilst Transpower has changed its focus to deliver the optimum system operator service at a sustainable cost, it has continued to ensure it manages the power system and energy market efficiently and effectively, delivering competition with security.

Self-assessment: Overall the System Operator has performed strongly through the Review Period. The power system has been managed very well through the Review Period. The System Operator has also established a strong platform for future engagement, development and improvement.

2 INTRODUCTION

Transpower owns and operates the national grid, and is statutorily appointed to perform the role of System Operator. The Authority is tasked with regulating the electricity industry, developing the electricity market structure, and engaging market operations service providers.

Together, in complimentary roles, Transpower and the Authority deliver long-term benefits to New Zealand consumers in the course of operating and developing the broader electricity market, by promoting competition, ensuring reliable supply, and promoting the efficient operation of the New Zealand electricity industry (the joint objective in the Relationship Charter¹ agreed between Transpower, as System Operator, and the Authority).

¹ See Appendix 13.

Each year in accordance with the requirements of the Electricity Industry Participation Code (the **EIPC**) Transpower reviews and assesses its performance as System Operator for the 12 month period ending on 31 August in that year.

Operationally the System Operator has performed very well. The Review Period was characterised by a relatively low number of significant system events. The Penrose fire (October 2014) and three under frequency events (two in November and one in December 2014) were the major operational events. Normal experience is for six to eight under frequency events each year. Significant snow events in June and July 2015, unlike previous years, had limited system impacts.

An extremely busy programme of transmission asset outages (for normal maintenance and for Transpower's capital programme) occurred during the first half of 2015 requiring major effort by planning staff. One outage in May 2015, at Manapouri, resulted in planning issues affecting participants; the System Operator had its actions externally reviewed with the report made available to participants (see Appendix 1).

HVDC control capabilities enabling roundpower, increased interisland reserve sharing and national frequency keeping were introduced, resulting in substantial operational change. However, reduced reserves and frequency keeping ancillary services costs were also realised.

The current Review Period has also seen Transpower introduce improvements to how the System Operator delivers aspects of the system operator service. These improvements will continue through future review periods, supported by the commencement of the renegotiated System Operator Service Provider Agreement (**SOSPA**).

The style of this report builds on changes commenced last year. It follows a new structure, being five sections aligned with Transpower's new strategic plan for the system operator service for the period 1 January 2015 to 30 June 2020 (**Strategic Plan**). The sections focus on delivering competition with security, demonstrating value for money, planning for tomorrow, strengthening relationships with the Authority and market participants and investing in good people. Explicit performance self-assessments are included, where relevant, as well as responses to some² of the Authority's specific recommendations in its Annual Review of the System Operator's Performance for 2013/14.

3 DELIVERING COMPETITION WITH SECURITY

Transpower, as System Operator, delivers both security and the platform for a competitive electricity market. Getting the right balance between these outcomes is critical and is one of Transpower's new strategic goals for the system operator service.

This section gives an overview of the performance of the power system and highlights key operational events and challenges faced by the System Operator during the Review Period. Details of specific system, storm and loss of supply events are provided in Appendix 1.

² The Authority's final draft form of its Annual Review of the System Operator's Performance for 2013/14 was received in the final week of the current Review Period, and accordingly not all of the recommendations set out in Section 7 of that Review have been addressed in this report. The recommendations will all be considered and, as appropriate, addressed in the next review period.

It also covers application of the CRE objective to System Operator actions, policies and procedures, hydrology, gas contingences, security of supply and emergency management, and market system performance and outages.

3.1 POWER SYSTEM STATUS, EVENTS AND CHALLENGES

3.1.1 TRANSPOWER'S GRID UPGRADE PROGRAMME CAME TO AN END

The five-year period of major changes to the national grid was largely complete by the commencement of this Review Period. The introduction of frequency keeping control (**FKC**) provided by delivery of new HVDC controls (which became operational in mid-2014) have changed the way the system is operated in real-time. This became apparent during the Review Period and is ongoing.

FKC was tested and then trialed to establish how national frequency keeping using FKC could be implemented and operated as a standard operational mode. A trial period commenced in October 2014 and ended in March 2015. Results from the trial proved the concept of national frequency keeping and established the operational procedures needed to operate in this mode.

Use of FKC as the principal means of system co-ordinator frequency management commenced immediately following the FKC trial and is now normal operational practice, in conjunction with Multiple Frequency Keeping (**MFK**) operations (which, in practice and following experience from the FKC trial, functions mainly to manage the System Operator's time error principal performance obligation (**PPO**)).

While FKC operations are (now) normal state there are occasions when FKC operations are not possible (including absence of bipole availability). Suspending and restarting FKC operations (requiring establishment or ending of single island frequency keeping) is a manual and complex process adding, when required, complexity and risk to system co-ordinator workloads. A project was commenced during the Review Period to reduce manual actions and automate some dispatch activities.

FKC operations have changed the system co-ordinator dispatch philosophy from one where co-ordinators 'dispatched' the HVDC to set transfer levels and managed separate island frequencies around the assigned transfer level. The current philosophy encourages coordinators to adjust generator dispatch around actual HVDC transfer levels, which changes according to the operations of FKC control and governor response (and to a lesser extent, MFK operations).

FKC operations have enabled significant reductions in the cost of frequency keeping ancillary services (see Appendix 5).

Roundpower operations, also introduced in the Review Period, have increased the extent to which the HVDC is utilised for managing events and the extent to which reserve sharing can be relied upon. This, in turn, has reduced instantaneous reserves (**IR**) costs.

There is evidence of increased ability of the power system to withstand events. This was reflected by the reduced number of major system events and the relative ease with which events were managed in real time. Only three material under frequency events were experienced in the Review Period, two in November and one in December (see Appendix 1).

There is a need to consider testing regimes for providers of services such as IR where, because of reduced system events, establishing on-going operational capability is no longer demonstrated in the ordinary course of operations. The System Operator is developing a

testing regime for all of the providers of IR – currently not all ancillary services are subject to test regimes.

Significant grid upgrades and reinforcements, notably the HVDC, North island grid upgrade, North Auckland and Northland cable and Wairakei ring works, combined with high levels of generation capacity, have enabled operations at times of peak loads to demand less system co-ordinator intervention, with more asset of greater reliability in service. However, in some respects due to concurrent grid and generation changes, the power system has become more complex to manage. The advent over the last several years of an increased number of special protection schemes (in many cases as alternatives to transmission investments) has complicated management.

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3.1.2 MANAGING outages

In the second half of the Review Period system co-ordinators and planning engineers were heavily engaged in management of transmission and communication asset outages associated with Transpower's RCP1 capital delivery programme. This work programme increased asset outages up to 300% above normal, resulting in significant workload increases. While demanding at certain times of the day (especially as outages were commencing or ending for the day) this workload was successfully accomplished, meeting system security, market and asset owner objectives.

Throughout the Review Period the System Operator met with customers to discuss outage planning and the impact of outages on their businesses – particularly on their trading and risk management. This increased understanding has assisted the System Operator in managing asset outages to ensure security while minimising commercial impacts on participants.

3.1.3 COMMISSIONING ACTIVITIES

Generator commissionings during the Review Period were few, essentially only Meridian's Mill Creek, though a steady programme of normal generator asset testing continued. See Section 5.6 for further discussion on generator commissioning activities.

A new approach to managing outages employing market node constraints, where required for security purposes, commenced during the year. System co-ordinators have previously used discretion to bring on or constrain generation required to manage security requirements arising after outages have commenced. While using discretion has the same power system effect as a market node constraint (both used only when a normal security constraints ineffective) the benefit is the ability to provide notice to the market and its being reflected in advance schedules.

3.1.4 NATIONAL CO-ORDINATION CENTRE REVIEW

A management review of National Co-ordination Centre (**NCC**) staffing levels was completed. The objective was to assess ongoing personnel requirements following completion of Transpower's major asset build programme and the expected improvements to power system management. Initially it was felt the review would enable a reduction in shift staff required during weekday day shifts. Redesigned roles were trialed and it was found it would not be prudent to reduce day shift numbers before improvements to co-ordinator tool sets and back-up processes had been made.



Self-assessment: The System Operator met its operational expectations – maintaining system security while meeting the PPOs – while also delivering operational support to the grid owner and other asset owners. Major events were well managed and restoration achieved in a timely manner.

3.2 COMPETITION, RELIABILITY AND EFFICIENCY OBJECTIVE

In June 2014, Transpower and the Authority agreed a Relationship Charter³ (the **Charter**) for the system operator service, which included a joint objective, being:

“We will deliver long term benefits to New Zealand consumers in the course of operating and developing the broader electricity market by:

- promoting competition, for example by removing technical barriers to entry and participation in the wholesale market;*
- ensuring reliable supply, for example by efficiently balancing risk and the costs of risk reduction and by taking advantage of new technologies as they become commercial; and*
- promoting efficient operation of the NZ electricity industry, for example by delivering an efficient and effective system operator service and by developing and implementing improvements in the market.”*

The joint objective arises from the Authority’s CRE objective in section 15 of the Act.

During the Review Period Transpower has determined its current approach to applying the CRE objective to System Operator operational policies and procedures, and has commenced doing so. By the end of the Review Period, Transpower has reviewed 30 of its operational policies and procedures to take into account the CRE objective. A goal in Transpower’s business plan for 2015/16 is to have applied the CRE objective to 25% of its 211⁴ relevant operational policies and procedures.

In performing its role as a reasonable and prudent System Operator, Transpower already accounted for market costs and benefits, reliability and promoting a level playing field when developing operational policies and procedures. By explicitly applying the CRE objective, Transpower:

- is considering the degree to which existing policies and procedures should be re-balanced in light of all three limbs of the CRE objective; and
- in doing so, is identifying future matters the System Operator may need to seek guidance on as to the degree to which the Authority and/or industry are prepared for competition and/or efficiency to displace the current level of reliability/security secured for the service (to the extent one cannot achieve the sought outcome while retaining the current reliability/security levels).

Transpower is realistic that applying the CRE objective to the system operator service is a work in progress and will require constant agility and refinement.

³ See Appendix 13

⁴ This refers to 211 policy or procedural documents, some of which contain policies or procedures relating to one or more subject matters. For example the Policy Statement is considered to be 1 of the 211 policy and procedural documents, but contains policies on a number of matters such as dispatch, security, conflicts of interest, and compliance etc.

Self-assessment: The System Operator is progressing well to incorporate the CRE objective into its business.

For next review period: To further improve the manner in which the System Operator delivers a service with an efficient balance between risk, reliability and resilience, it has identified the need to:

- apply the CRE objective to at least 25% of its policies and procedures;
- release at least \$1 million of market benefits through the application of the CRE objective and/or implementing new capital investments;
- update the risk management methodology for the system operator service to incorporate a barrier risk model – the ‘Bowtie risk model’; and
- develop a report on resiliency for System Operator systems and a strategy for a new black start/system restoration strategy.

3.3 HYDROLOGY

Hydrology (particularly inflows into hydro-generation catchments) is closely monitored by the System Operator given hydro-generation comprises a significant proportion of our electricity generation in New Zealand.

Hydrology during the Review Period was about average (inflows into major controllable hydro catchments⁵ were 102% of average for the year). North Island hydrology was below average (inflows were 88% of average), while South Island hydrology was above average (inflows were 106% of average).

Despite overall hydrology during the Review Period being average, challenging hydrology conditions existed in the period between December 2014 to March 2015 causing the System Operator to start preparing for the possibility of a ‘dry winter’. During that period inflows across the country were 77% of average, with inflows during February and March 2015 especially low (65% of average). A wet April returned inflows and storage levels in hydro-generation catchment areas to well above average.

3.4 SECURITY OF SUPPLY AND EMERGENCY MANAGEMENT

During the Review Period the System Operator carried out all of its security of supply obligations. This included the System Operator’s management of the initial stages of a potential Extended Emergency Event⁶ as a result of poor hydrological conditions during the first quarter of 2015, by:

- reporting daily security of supply information relevant to the developing situation;
- preparing expected timelines and high-level internal process; and
- regularly discussing with parties who had material influence on the developing situation (i.e. major hydro and thermal generation owners).

⁵ Includes the following lakes – Taupo, Tekapo, Pukaki, Hawea, Manapouri and Te Anau.

⁶ Defined in Section 3 of the Emergency Management Policy

In addition to carrying out its security of supply obligations, the System Operator undertook a number of initiatives to improve security of supply and emergency management, including:

- proposing and implementing methodology changes for Hydro Risk Curve derivation to improve the modelling process;
- assisting the Authority improve management of hydrological data and hydro-generation infrastructure attributes;
- supporting the Authority to provide historical hydro risk information, via the EMI portal, to consumers;
- reviewing the Hydro Risk Curve methodology to increase process efficiency, improve the ability to validate results and provide general process improvement. This review is ongoing, but significant process improvements have already been realised within the Review Period;
- commencing formalisation of internal processes and procedures relating to security of supply – within the Review Period the System Operator has established a draft process for Emergency Management and confirmed an updated approach to potential Extended Emergency Events; and
- commencing a review of the System Operator Rolling Outage Plan (**SOROP**) and Emergency Management Policy (**EMP**) intended for completion in July 2016.

Self-assessment: The System Operator is performing well in this area. It has met all obligations for security of supply. The industry has been kept well-informed and has received clear and regular security of supply information. A number of initiatives have been completed, or commenced, to improve the security of supply service.

3.5 THERMAL DECOMMISSIONING

During the Review Period a number of thermal generation owners announced they will shut down and decommission some thermal generating units. Contact announced its 400MW Otahuhu B power station will be decommissioned on 30 September 2015; Mighty River Power announced its 140 MW Southdown power station will be decommissioned on 1st January 2016; and Genesis announced its two remaining 250 MW Huntly Rankine units will be permanently withdrawn from the market by December 2018.

In response to those announcements the System Operator commenced analysis to ensure both our PPOs and security of supply obligations could continue to be met. The co-ordinated approach across System Operator and other groups in Transpower includes a range of studies focused on implications for power system operation and security of supply. The bulk of the work is to be concluded next review period, with a staged approach being taken by examining the decommissioning of Otahuhu B and Southdown generation first and then the decommissioning of the Rankine units.

3.6 GAS CONTINGENCIES

No gas contingencies were notified during the Review Period.

The System Operator participated in the gas industry's annual critical contingency exercise – Exercise Validation – on 24 June 2015. Participation was limited by the nature of the

exercise – the scenario had minimal impact on major gas-fired generation plants. However, a number of operational matters were noted for attention during the exercise.

Gas supplies through the Maui pipeline were subject to reductions for a period in July 2015 (most notably on 14 July 2015) following an overnight tripping at Pohokura on 13 July 2015. The reduction in pipeline pack on 14 July 2015 coincided with a period of cold weather and high demand, with actual residual generation falling to a low of 45MW. The event was managed through voluntary reductions by major gas users, with the Critical Contingency Operator choosing not to declare a contingent event.

3.7 MARKET SYSTEM

There were no unplanned market system outages exceeding two hours (the agreed threshold for reporting outages) during the Review Period. The System Operator dispatched from its stand-alone dispatch (**SAD**) application three times in the Review Period.

The first use of SAD, on 28 January 2015, was for less than one trading period following a brief fault of a market system application. The second, on 29 January 2015, was for just over two trading periods due to a planned and notified maintenance outage. The final use of SAD, on 21 July 2015, was for just over two trading periods due to a storage disk failure. In all cases standby systems and procedures worked as expected.

This year the System Operator completed Project Aardwolf, established to consider future options for the market system and assess the most efficient capital spend required to support ongoing delivery of the system operator service over the next 10 years. The key result of this work was to recommend an approach for maintaining the current service level using the existing market system, with an objective to reduce complexity and increase the System Operator's ability to maintain the system and respond to changes with greater efficiency and agility. A roadmap of future market systems and system operator support systems (**Roadmap**) was produced to frame and cost this approach, and is discussed in more detail in Section 5.3.

Self-assessment: The System Operator believes it managed the operation of the market system efficiently and effectively, with back-up systems and procedures working as required when called upon. The System Operator demonstrated its commitment to the continued efficient operation of the market system by initiating Project Aardwolf.

3.8 MARKET BENEFITS

The System Operator aims by 2019/20 to be releasing \$5 million per annum in market benefits through the application of the CRE objective and/or implementing new capital investments. Work is being undertaken to determine how such market benefits would be measured. The System Operator's first business goal for measuring market benefits will be established in the 2015/16 financial year, with a release of at least \$1 million of market benefits.

4 DEMONSTRATING VALUE FOR MONEY

Performing the System Operator role is an essential service to market participants and New Zealand consumers, but there are costs. Transpower has a responsibility to demonstrate it performs the system operator service efficiently. Demonstrating its service is value for



money is the second of Transpower's new strategic goals for the system operator service. In doing so Transpower is seeking continuous business improvement by delivering the most efficient system operator service. Details of the System Operator's staffing numbers and fees received under the SOSPA are set out in Appendix 7.

This section outlines the System Operator's work to provide an effective and efficient market operation service. It covers performance and self-improvement initiatives, compliance with the EIPC and the SOSPA, and compilation and delivery of the capital expenditure plan and Joint Development Programme (JDP).

4.1 PERFORMANCE IMPROVEMENTS

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In the Authority's Annual Review of the System Operator's Performance 2013/14 it noted Transpower's self-assessment for the previous review period was fair and well-focused, with a greatly improved focus on analysing how the System Operator performed as opposed to what it performed. The System Operator has sought, in its self-review for this Review Period, to continue to improve in that respect.

While the Authority was impressed with improvements made by the System Operator, it considered there were further areas for improvement, making four recommendations as follows:

Recommendation 1: *The System Operator should consider whether self-breaches can be categorised in more detail and the analysis included in future self-assessments.*

The System Operator is presently categorising and trending events and breaches as discussed in Section 4.5.1. However, it is challenging at this stage to define further categories to report against other than those addressed in Appendix 4. This recommendation will be further considered and addressed through the next review period.

Recommendation 2: *Future self-assessments should specify whether requests have been received relating to harmonic levels, voltage flicker levels, and negative sequence voltage and, if so, how they were dealt with.*

This recommendation is addressed in Section 3 of Appendix 3.

Recommendation 3: *Future self-assessments should specify whether frequency time error was eliminated at least once every day and if not, why not.*

This recommendation is addressed in Section 1 of Appendix 3.

Recommendation 4: *The System Operator should consider whether the Security and Reliability Council's suggestions (below) could be included in future self assessments:*

- *identification of international trends and best practice and how this influences the System Operator's future direction;*
- *demonstrating the efficiency of the System Operator (including the System Operator's interactions with asset owners) and, if possible, how this compares internationally; and*
- *identification of any actual or projected staffing shortfalls (such as an aging workforce, or the availability of suitably qualified personnel).*

This recommendation will be considered and addressed in its entirety during the next review period. During the current Review Period the System Operator has created a scan of the New Zealand and international environment (see section 5.2) to identify potential changes facing the System Operator. This has, in turn, influenced the Roadmap and will be taken into account when determining the next Strategic Plan. This addresses in part the recommendation suggested by the Security and Reliability Council.

Self-assessment: The System Operator has addressed two of the Authority's recommendations in this self-review report. Recommendations 1 and 4 will be addressed in the next review period.

4.2 SELF-IMPROVEMENT INITIATIVES

Transpower is conscious of the need to continuously improve the manner in which it provides the system operator service.

4.2.1 ENSURING THE RIGHT CAPABILITIES AND SKILLS IN THE RIGHT TEAMS

A number of initiatives have commenced during the Review Period to ensure the System Operator has the right skills in the right teams to improve its delivery of the system operator service. This has included a structural review, as well as a number of initiatives aimed at baselining, measuring and developing capabilities of our staff (see Section 7).

In the structural review, Transpower sought to determine the best structure to deliver the system operator service in an effective and efficient manner, enabling constructive inter-group collaboration and cooperation. The structural change supported the new strategic aims of the System Operator and provided the System Operator team with increased focus on its key business initiatives, how each team member fits in and can contribute, and the importance of assisting the Authority to meet its CRE objective. The new structure included a focused Programme and Projects Team, tasked with ensuring the efficient delivery of capital projects.

4.2.2 A FRESH APPROACH TO STRATEGIC AND BUSINESS PLANNING

Transpower adopted a fresh approach to strategic and business planning and developed a five-year Strategic Plan for the system operator service (commencing in the middle of the Review Period) and a new business plan (coming into effect at the end of the Review Period). These plans were well received by the Authority, and the Strategic Plan was also shared with and well received by industry. As discussed further in Section 5.1 these plans provide concise and clear direction for the short-to-medium term development of the system operator service.

4.2.3 DETERMINING FUTURE SYSTEMS DEVELOPMENT

During the Review Period the System Operator completed Project Aardwolf, which was established to consider future options for the market system and assess the most efficient capital spend to support the ongoing delivery of the system operator service over the next 10 years. This project resulted in adoption of a systems development strategy which will:

- maintain the current service level;

- use the existing market system; and
- develop a Roadmap (see Section 5.3).

4.2.4 SYSTEM OPERATOR WEBSITE

Several improvements to the System Operator website were released on Wednesday 11 February. These improvements enabled electricity industry stakeholders to view more real time power system information and provided an improved experience for users of touch-screen and smartphone devices.

A number of changes were made including:

- updating the home page to include real time 5-minute data on HVDC transfer and links to new HVDC transfer, generation and load graphs;
- publishing all Excursion Notices on the site;
- enabling visitors to subscribe to Customer Advice Notices (**CANs**), Formal Notices and Excursion Notices pages, meaning interested stakeholders can receive auto-generated emails whenever new notices are published; and
- creating a new mobile data page summarising load, generation and HVDC transfer data and the latest notices.

Self-assessment: The System Operator has introduced a number of self-improvement initiatives in the Review Period and will continue to make additional improvements.

For next review period: Additional improvements identified include:

- documenting the operating model between Transpower's Information Services and Technology (**IST**) and System Operations Divisions;
- ensuring System Operator capital investments are aligned with its Strategic Plan;
- ensuring 90% of capital investments commissioned in the 2015/16 financial year are delivered on or below budget, with intended functionality and appropriate testing.

4.3 CAPITAL EXPENDITURE PLAN AND JOINT DEVELOPMENT PROGRAMME

The Capital Expenditure Plan (**Capex Plan**) for the Review Period was compiled while working closely with Transpower's IST division, and in consultation with the Authority.

A new process was utilised in compiling the Capex Plan, with robust challenge sessions held both at General Manager and subject matter expert levels. The intent of the new process was to produce a fit-for-purpose Capex Plan representing value-for-money and enabling Transpower to maintain a reasonable and prudent system operator service. The Capex Plan, which demonstrated reduced capital spend from that planned for the same years in the previous Capex Plan, was well received by the Authority.

Many projects contained within the Capex Plan also feature on the JDP, which the System Operator and Authority collaboratively develop and agree annually. The Authority and Transpower have worked hard throughout the Review Period to improve how the organisations work together to plan and manage the JDP. This has included reviewing and re-publishing fit-for-purpose guidelines for the Joint Work Planning Team that oversees the

JDP, publishing an update of the JDP mid-year (which has always been a goal, but never previously achieved) and publishing the new JDP early in the financial year (in August 2014) to provide greater transparency to industry.

Self-assessment: The System Operator has performed well in compiling and communicating with the Authority on the Capex Plan, and is working constructively and effectively with the Authority to continue to improve the manner in which the organisations engage and communicate in relation to the JDP and Capex Plan.

4.4 PROJECT DELIVERY

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The capital projects to be delivered by the System Operator are set out in the Capex Plan. Projects range from those explicitly supporting Authority market initiatives to changing System Operator tool-sets (applications) or infrastructure (communications systems and servers). These projects contribute enhancements to market design or support system security and market availability.

In the Review Period the System Operator worked on 11 major projects, commissioning five of those (80% of which were commissioned on time, and 100% on budget). Projects are summarised in Appendix 12. Towards the end of the Review Period it became apparent there will be challenges to overcome when delivering in-flight capital projects in the next review period as a result of delays to the delivery of Transpower's PRISM (SCADA update) project. The System Operator is working hard to be agile, commercial and robust in the manner in which it meets these challenges and is seeking to minimise the impact from these project delays as much as possible.

On 1 October 2014 the System Operator established a Programme and Projects Team focused on ensuring the efficient delivery of capital projects to support efforts to demonstrate value-for-money. The Programme and Projects team works closely with Transpower's IST Division on project delivery and works hard to communicate in a transparent manner with the Authority in relation to Transpower-initiated and Authority market design projects alike.

The Programme and Projects Team have implemented a number of improvements to project disciplines and project reporting and undertook initiatives such as compiling a project management manual which accumulates all relevant material required by System Operator project manager into one place. These improvements delivered material benefits in the way projects have been, and will in future be, managed.

Self-assessment: Delivering capital projects will not always go smoothly. The System Operator increased its project delivery performance to ensure the most efficient and effective delivery of capital projects as possible. In future the System Operator expects to deliver 90% of its capital projects on time and on budget⁷.

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

4.5 COMPLIANCE

4.5.1 PRINCIPAL PERFORMANCE OBLIGATIONS AND EIPC BREACHES

The System Operator met the EIPC mandated PPOs during the Review Period. 30 self-reported breaches were reported compared with 18 in the previous review period (see Appendix 4).

During the Review Period the System Operator was tested through the introduction of new functionalities on the power system. The ability to incorporate these changes has been challenging, and errors have occurred, thereby accounting for the increase in breaches.

The System Operator was the subject of three formal investigations, encompassing five of the self-reported breaches. These investigations related to the identification, modelling and communication of risks to the power system.

Investigations into breaches, or groups of breaches, has seen the System Operator responding promptly to the needs of participants.

The development of trend identification and analysis is providing further insight into potential issues for the System Operator. This has increased the level of scrutiny the System Operator applies to itself and breaches, enabling related issues to be addressed through coordinated investigations. An analytical focus on errors has allowed for closer examination of procedure and an overall improvement to the reliability of our processes.

Particular attention has been paid to the provision of correct information to participants and other service providers. A focus on capturing and analysing information has enabled improved error prevention and earlier issue identification.

Self-assessment: The increased number of breaches recorded coincides with the introduction of new functionalities on the power system and the completion of in-depth reviews of events and breaches from an end-to-end process perspective. The System Operator believes the level of scrutiny being applied is robust and should be maintained.

4.5.2 DISPENSATIONS AND EXEMPTIONS

The dispensation process functioned efficiently during the Review Period with 78 dispensations processed/reviewed. Of those, 20 related to assets assessed as compliant after equipment upgrades (to address previously non-compliant asset capabilities) and five were due to asset divestments. A reduction in the number of dispensations granted is expected to continue through the next review period due to continued decommissioning of assets, and further upgrades being planned by asset owners.

The System Operator did not apply for any exemptions during the Review Period.

Self-assessment: The dispensation process operated effectively and efficiently during the Review Period.

4.5.3 COMPLIANCE REQUIREMENTS UNDER THE EIPC

The System Operator has successfully performed its review and audit obligations under the EIPC, including:

- undertaking a monthly self-review and reporting the results to the Authority;

- undertaking two System Security Forecast (**SSF**) updates in December 2014 and June 2015 and commencing a review of the SSF to be published at the end of 2015;
- completing a five-yearly Credible Event Review;
- commencing a review of the Policy Statement; and
- procuring audits for the scheduling, pricing and dispatch (**SPD**) software, and reserves management tool (**RMT**) software (see Appendix 6 for audit details).

The System Operator also initiated a review of the SOROP and EMP. It was considered prudent to review these documents together due to their inter-relationship. The review is intended for completion by July 2016.

In carrying out reviews to its operational policies and procedures, required to be reviewed under the EIPC, the System Operator has ensured technological, regulatory and operational changes to the power systems are regularly incorporated to ensure relevance and accuracy.

Self-assessment: The System Operator has successfully performed its compliance requirements under the EIPC.

4.5.4 SPECIFIC COMPLIANCE UNDER THE SOSPA

The System Operator has complied with its obligations under the SOSPA during the Review Period, including:

- working with the Authority on the System Operator's business planning, capital planning and JDP processes (see sections 4.3 and 5.1.1); and
- agreeing with the Authority to roll-over existing arrangements for auditable software. No new auditable software has been identified.

4.5.5 EIPC CHANGES AND PROPOSED SUBMISSIONS

The System Operator did not propose any EIPC amendments during the Review Period. Submissions were made on a number of Authority consultation papers (listed in Appendix 8).

5 PLANNING FOR TOMORROW

The System Operator operates in an environment where grid, generation, load, communications and IST technologies are ever-evolving. It must anticipate, enable and lead such changes through its service and infrastructure. Planning for tomorrow is Transpower's third new strategic goal for the system operator service.

Not only does Transpower need clarity on its own Roadmap to retain fit-for-purpose market dispatch systems aligned to the current and future business requirements for the delivery of the system operator service, it also needs to account for international learnings and trends and be consistent with the CRE objective.

This section describes Transpower's approach to looking at the future system operator service, delivery of the Roadmap, initiatives to utilise HVDC capabilities, assets commissioned and technical advisory services contract (**TASC**) work carried out in the Review Period.

Self-assessment: The System Operator has significantly improved its planning for tomorrow during the Review Period.

For next review period: To further improve the manner in which the System Operator plans for tomorrow, it has identified the need to:

- compile and share with the Authority a Roadmap which provides a strategy to retain fit-for-purpose market systems with (where it is economic to do so) reduced system complexity and improved resilience, and enables greater flexibility to respond to changing market development priorities and needs; and
- ensure System Operator capital investments follow the Roadmap and reflect the Strategic Plan.

5.1 LOOKING TO THE FUTURE - OUR APPROACH

It is essential the System Operator continues to respond to an ever-evolving environment to ensure the continual delivery of an optimum level of service. It achieves this by understanding the needs of market participants and consumers, and through understanding technological and behavioural trends in power system and market operation in New Zealand and internationally.

In the Review Period the System Operator adopted a fresh approach to scanning the New Zealand and international environment. As a result it took a wide and comprehensive view of the industry and operating environment, producing a more effective and resourceful System Operator Environment Scan (**Environment Scan**). This is discussed further in section 5.2.

The Environment Scan is one of the inputs for Transmission Tomorrow – Transpower’s view of where it is heading in the next 20 to 30 years. It was also one of the inputs for Project Aardwolf, in which the market system options and capital spend required to continue to provide the system operator service over the next ten years were assessed and a draft Roadmap produced.

5.1.1 STRATEGIC PLAN AND BUSINESS PLAN

In the first six months of the Review Period, Transpower reformulated its Strategic Plan for the system operator service. The Strategic Plan was well received by the Authority and draws on Transpower’s wider strategic framework as well as the joint objective for the system operator service set out in the Charter.

The Strategic Plan established the direction for delivering the system operator service and improvements in processes including:

- assisting the Authority meet its statutory CRE objective - our first goal ‘delivering competition with security’;
- demonstrating ‘value for money’ (the second goal) including the wider market benefits from the system operator service;
- emphasis on improved project engagement, planning, transparency and delivery, especially capital projects; and
- a more open and consultative approach with the Authority and industry.

The 2015/16 Business Plan for the system operator service contains eight key business initiatives, which support or build the foundations required to meet the System Operator's strategic goals.

The Authority provided positive feedback on the business plan, particularly in relation to:

- alignment of the System Operator's operations and related policies and procedures with the Authority's statutory CRE objective;
- alignment of the business plan with the Strategic Plan and the Authority's strategy and work programme; and
- the System Operator's planned focus on participant engagement.

Since July 2015, the System Operator has tracked progress against the plan and reported progress to the Authority as part of its monthly performance reporting. On the whole the System Operator is performing well and, although we are in the early stages of the 2015/16 financial year, initial progress suggests the System Operator should achieve most of the key performance indicators associated with the eight key business initiatives.

Self-assessment: The System Operator believes it lifted its performance in relation to strategic and business planning and intends to retain a strong focus on developing, monitoring and reporting against its foundation strategic and business plans.

5.1.2 SYSTEM OPERATOR SERVICE PROVIDER AGREEMENT RENEGOTIATION

In 2012 the Authority sought to renegotiate all market operations service provider agreements, including the SOSPA (which comprises ~55% of the Authority's total operational appropriations). In doing so, the Authority's primary purpose was to ensure the services represented value-for-money. Negotiations commenced in early November 2014 and have continued throughout the Review Period.

It is expected an agreement will be finalised in the next review period, ahead of a 1 July 2016 commencement date. If an agreement is reached, much of the next review period will be used to transition in preparation for the commencement of a new SOSPA in July 2016.

5.1.3 BUSINESS MANAGEMENT

The Business Group will continue to actively engage with other groups cross the System Operator to embed CRE within our policies and procedures. Project delivery will remain a focus, as will continual improvements to the quality and content of monthly reporting. The Business Group is also working towards delivering a coordinated strategy for black start and system restoration plans, and applying the Bow Tie risk methodology⁸ to System Operator risks.

The Business Group is presently leading a System Operator review of the Policy Statement, as per the System Operator's EIPC obligations and as part of the competition, reliability and efficiency key business initiative in our business plan. The review is well underway and the System Operator is on track to provide a draft for consultation to the Authority in November/December 2015.

⁸ The Bow Tie risk methodology diagrammatically shows the link between multiple causes and consequences of a given event or hazard.

The Reserves and Frequency Management (**RFM**) programme remains a key focus of the System Operator and comprises a number of projects at various stages. Work is presently progressing to the schedule agreed between the System Operator and Authority. A number of engagement groups and wider industry forums have been held to date, with good attendance and positive feedback. These forums will continue into the next review period.

Work has recently commenced on developing a joint System Operator – Information Systems and Technology (**IST**) operating model. This model is focused on delivering capital projects as efficiently and cost effectively as possible, ensuring the System Operator continues to deliver value for money.

5.1.4 REAL TIME SYSTEM OPERATIONS AND TRAINING

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The NCC roles review has been ongoing for the past twelve months. This review will be completed and changes implemented during quarter one of the 2015/16 financial year. Any changes made will drive efficiencies as part of the current NCC efficiency review programme.

The NCC team will provide subject matter expertise on a wide range of projects in the coming Review Period including PRISM, Transient Security Assessment Tool (**TSAT**) Online, and the Testing and Training Simulator Environment (**TTSE**) Upgrade, and will also participate in the delivery of the RFM programme of work.

NCC will continue to assist with the capital planning process for 2016/17 and System Operator internal and external monthly reporting. NCC will also apply CRE to all policies and procedures undergoing review, and continue to operate the system in a reasonable and prudent manner.

The National Operations and Technical Training team was relocated to the Customer, People and Environment division on 3 August 2015. However, the team will continue to deliver training and subject matter expertise to the System Operator.

5.1.5 ENGINEERING AND POWER SYSTEM MANAGEMENT

The System Operator's Engineering Group is looking a number of initiatives aimed at releasing financial benefits to the market. These initiatives include investigating and implementing changes to reduce the quantity of reserves required for the HVDC, and reducing off-load times from 15 to 10 minutes.

There are a number of other change initiatives being looked at by the Engineering Group over the coming year aimed at increasing efficiency, and enabling the delivery of a value for money system operator service. These initiatives require active engagement with other parts of Transpower and include improved planning and delivery of outage and commissioning assessments and a review of the requirements for six-monthly SSF updates.

Following the Business Group led review of the Policy Statement, the Engineering Group will revisit the Credible Event documentation to ensure alignment with the Security Policy and incorporation of network changes such as new HVDC functionality.

The Engineering Group is in the planning phase of developing a programme of works to investigate the impacts on power system operation of emerging technologies such as solar PV generation, battery storage, electric vehicles and Smart Grid technologies. The investigation will lead into work to identify measures and solutions required to ensure these new technologies do not significantly affect power system operation. The overall

programme is expected to take around 18 to 24 months, and links into the Environment Scan work (see section 5.2) and ultimately our Strategic Plan – planning for tomorrow.

The Engineering Group will continue to focus on providing expert advice and analysis for power system events, System Operator projects, outage planning, and compliance issues.

5.1.6 MARKETS

The Market Group will continue to promote incorporation of CRE and market value in the System Operator processes and systems. To support this, it will continue to rationalise its approach to assessing future needs and improve coordination with Authority staff. It will also increase analytical capability during the next review period through the implementation of new analytical tools and training. This includes expanding its use of the Authority developed vSPD tool. These initiatives will enable more efficient and insightful analysis of market behavior, market events, and system and process effectiveness.

There will be a strong customer focus within the Market Group over the coming year as it seeks to improve understanding of customer's drivers, develop customer response metrics and work closely with the Authority and other third parties to understand the 'plan for tomorrow'.

The Operations Team will provide support for final pricing and pricing queries, ancillary service procurement and evaluation, and security of supply, while providing short to medium term analytics and expertise to the System Operator. One of the key focus areas for the Operations Team will be putting a plan in place to publish event reports within one month of the event occurring.

The Capability Team will focus on business ownership of the market system and coordinate with Transpower's IST Division to ensure operational systems are developed, maintained, and renewed. As part of this focus, the Operations Team will be responsible for compiling a report on the resiliency of market systems and market operations, and will collaborate with the Development Team and Transpower's IST Division to complete the Roadmap.

The Development Team provides subject matter expertise in market design, development and technical optimisation, which supports internal and external investigations, and provides input for responses to industry consultations. The Development Team delivers an informed view of the impacts to system operation from emerging trends and potentially disruptive technology in the medium to long term.

5.2 POTENTIAL CHANGES FACING THE SYSTEM OPERATOR

The first edition of an Environment Scan was produced by the System Operator's Development Team in July 2015. This work took a wide view of the industry and operating environment to address '*which potential environmental changes over the next 10 years does Transpower as system operator need to pay most attention to now?*'

The focus of the Environment Scan was to identify trends driving industry change and assess how they may impact Transpower's provision of the system operator service. The likelihood, urgency, and level of adaptation required by the System Operator for more than thirty emerging trends and potential industry changes was assessed.

The changes the System Operator needs to pay most attention to are those with a high probability and high impact on system operation. In this category the System Operator identified real time settlement pricing, increased levels of intermittent generation (especially

rooftop solar PV) and a range of 'smart grid' technologies and tools which Electricity Distribution Businesses (EDBs), consumers and third parties may use to manage load.

Grid demand could vary more rapidly and less predictably over the day due to the combination of more weather-dependent generation, and more active demand response by end consumers, and EDBs. These developments will drive changes to economic dispatch to maintain security, and impact how demand is balanced at grid exit points.

Other factors discussed in the report include the impact of a lower inertia generation mix on ancillary services, operator awareness, forecasting of wind and solar generation and demand, and the potential need for new communications arrangements to exchange more information with EDBs and market participants. Consumer choice is expected to play an increased role in shaping the industry.

The System Operator will annually update the scan as an important input into the System Operator's strategic and business planning processes. It will also contribute to Transpower's overall strategic planning.

5.3 DELIVERING A MARKET SYSTEMS ROADMAP

During the Review Period the System Operator completed Project Aardwolf, which was established to consider future options for the market system and assess the most efficient capital spend required to support the ongoing delivery of the system operator service over the next 10 years. This work determined an approach for maintaining the current service level using the existing market system, and resulted in the compilation of a high-level Roadmap.

Following this review of expected future needs and the current state of market systems and non-market System Operator support systems, the scope, cost and time estimates of identified initiatives provide the building blocks for ongoing development and refinement of a rolling 10 year Roadmap.

5.4 HVDC CAPABILITIES: ROUNDPOWER AND FREQUENCY KEEPING CONTROL

Roundpower has been in service for over a year. Changes to the market system, developed during the Review Period and to be implemented in September 2015, will reduce the manual processing required to model roundpower and FKC operations.

As discussed in Section 3.1.1, FKC became the standard mode of HVDC frequency control from April 2015.

Operation of FKC has already resulted in considerable benefits through the reduction of frequency keeping costs (projected to fall by \$25 Million per annum), but also changed the way the NCC undertook dispatch.

In June 2015 the System Operator published a report of its FKC trial experiences. This contained a number of recommendations for both the System Operator and the Authority that called for additional work regarding frequency management. This work commenced in the Review Period and will contribute to national markets projects forming part of the RFM programme.

Self-assessment: The System Operator believes that enabling FKC operation has resulted in a significant reduction in frequency keeping costs, with further benefits still to be realised. The FKC trial report provides a solid benchmark against which issues arising from FKC operation and relevant to the RFM programme can be addressed.

5.5 ANCILLARY SERVICES AND BLACKSTART

Aside from ongoing RFM programme work streams associated with ancillary services, two key areas of focus occurred in respect of ancillary services during the Review Period.

First, the System Operator conducted a comprehensive review of its ancillary services cost allocation processes following a series of errors that occurred between February and May 2015. The objective of the review was to provide assurance these errors would not occur again and to identify potential areas for improvement and efficiency for this important System Operator function.

The System Operator is in the process of implementing recommendations from the review, which include:

- clarifying roles, responsibilities and accountabilities of the various teams within Transpower involved in the process;
- agreeing and documenting processes where no formal process currently exists;
- removing unnecessary duplicate process steps; and
- developing a single procedure document which covers the full process.

Once those recommendations are completed, the System Operator will engage an external auditor to carry out an independent audit of the enhanced processes.

Second, the System Operator completed several pieces of work during the Review Period to better understand its capabilities to restore the system following an island-wide black out, including:

- a review of Transpower's current black start arrangements (including with other Transpower divisions). This review was to identify potential risks and the appropriateness of mitigation strategies. The review confirmed Transpower has the people and plans in place to manage a black start event, but recommended further investigation be carried out for certain assets and sites to verify sufficient capability and resilience exists. This work will be completed in the next review period;
- a review of Transpower's black start restoration plans (a normal lifecycle review), which did not identify any changes of perceived priorities or associated logic;
- clarification of black start policy following presentations to the Authority board and the Security and Reliability Council, both of which supported the System Operator's view:
 - the existing 'least delayed' approach under the EIPC is a suitable policy basis for a restoration from black; and
 - an industry-wide exercise simulating an island-wide black-out would offer benefits through enhanced industry coordination and identifying opportunities for improvement;
- working with black start providers to ensure that current black start testing (which is currently primarily limited to functionality of on-site equipment and limited grid owner assets) provides an effective demonstration of capability. This work led to changes to

the standard black start service contract terms which now clarify that a full station shutdown is required as part of a periodic test; and

- commencing planning for an industry-wide desk-top exercise to be held in 2016. The purpose of the exercise is to better understand current capabilities of key black start participants to achieve a system restoration.

Self-assessment: The System Operator considers its performance in the ancillary services area has been prudent and forward-focussed. The System Operator quickly addressed cost allocation errors when they were identified and carried out a review and recommended business improvement opportunities. Significant work was completed regarding black start policy and capability.

For next review period: The recommendations resulting from the System Operator's review on ancillary services' cost allocation errors will continue to be implemented through the new review period. Work will continue on black start co-ordination and capabilities amongst participants.

5.6 COMMISSIONING OF ASSETS

5.6.1 GENERATOR COMMISSIONING

Generator commissionings during the Review Period were few, essentially only Meridian's Mill Creek, though a steady programme of normal generator asset testing continued. However, the System Operator took the opportunity to publish two documents to assist asset owners to manage future generator commissioning projects – A Companion Guide for Commissioning Generation and a Memorandum of Understanding for use between Transpower and the Asset Owner commissioning generation.

5.6.2 AUTO-SYNCHRONISING

Transpower's national auto-synchronising programme, approved in late 2009, was completed during the Review Period. The auto-synchronising facility allows the System Operator to remotely reconnect parts of the grid, should they become islanded due to assets tripping, without interruption to supply.

5.6.3 SPECIAL PROTECTION SCHEMES

The following 'special protection schemes' were commissioned during the Review Period:

- The Oamaru-Bells Pond-Studholme-Waitaki Circuit 2 Overload protection scheme: This special protection scheme was designed to protect the above circuit from overload for a range of contingencies on the parallel 110 and 220 kV networks. It removed the need for pre-contingent load management or generation constraints in the South Canterbury area.
- The Timaru 220/110 kV Inter-connecting Transformer Overload protection scheme: This special protection scheme was designed to protect a Timaru inter-connecting transformer from overload should the parallel bank trip. It removed the need for pre-contingent load management or generation constraints in the South Canterbury area.

- The Timaru 110/33 kV Supply Transformer Overload protection scheme: This special protection scheme was designed to protect the sole remaining Timaru supply transformer from overload should the parallel bank trip while the third bank is out for planned work. It removed the need for pre-contingent load management.
- The Roxburgh 220 kV 'Export' Overload protection scheme: This special protection scheme was designed to facilitate power transfer from the Southland to Otago regions during times of high generation at Manapouri, Clyde, and Roxburgh power stations.

5.6.4 REMOTE TERMINAL UNIT UPGRADES

An intensive programme of upgrades to Transpower's remote terminal units installed in grid substations has commenced⁹. This work is a necessary part of completing the PRISM project (see Appendix 12).

Self-assessment: The System Operator believes it has managed commissioning activities during the Review Period in an efficient and effective manner, meeting its obligation to be a reasonable and prudent system operator.

5.7 TECHNICAL ADVISORY SERVICES CONTRACT

The System Operator provides technical advisory services to the Authority, which support the Authority's or its own work streams. The current TASC agreement (which outlines the basis on which the services are provided) was extended to 31 December 2015.

TASC utilisation during the Review Period was 88%, a significant decrease from the just under 150% utilisation of the previous review period. This decreased utilisation primarily reflected very low TASC usage between October 2014 and January 2015. TASC work increased substantially in April to June 2015, but reduced for the balance of the Review Period as significant TASC work completed in June 2015. TASC work is likely to be high for the remainder of the contract period.

During the Review Period work was carried out on ten TASC statement of works (**SOWs**) (summarised in Appendix 11), of which eight were completed by 31 August 2015. The majority of TASC SOWs (88%) were completed on time and within budget. The only exception was regarding gate closure, which completed a month later than originally agreed due to delayed sign-off of the statement of work. As a result, a variation to the completion date was agreed, with the work completed within this timeframe.

The System Operator also worked with the Authority to refine and further develop the documentation associated with the TASC process to ensure it was fit-for-purpose and drove greater efficiency and communication between the organisations. This culminated in a new TASC Guideline, which provides guidance on how Transpower and the Authority agree, manage and report on TASC-related work, being adopted during the Review Period.

Building on that work, the System Operator implemented improved monthly TASC reporting at the end of the Review Period, focusing on reporting clarity and utilisation forecasting to assist the Authority with planning future TASC work. This has been well received, although the refinement of this reporting remains a work in progress.

⁹ RTUs are devices located at many points of the national grid which collect time stamped asset operational data and send such data to Transpower's SCADA system for use in real time systems, such as the System Operator's market dispatch system.

Self-assessment: The System Operator believes it has completed TASC SOWs in a satisfactory manner, with all deliverables being of high or good quality. TASC SOWs were generally completed on or within the approved budget and on time, except where agreed variances were permitted. Monthly TASC reporting has continued to improve over the Review Period, with improvements well received.

6 STRENGTHENING RELATIONSHIPS

Transpower understands to deliver the system operator service efficiently it needs effective relationships with the Authority as funder and regulator, and the electricity industry as market participants. Strengthening relationships with the Authority and market participants is Transpower's fourth strategic goal under the Strategic Plan.

This section covers the 2013 external review (noted in the previous Annual Self Review), the Charter with the Authority, and industry engagement and communication.

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6.1 IMPLEMENTING IMPROVEMENTS SUGGESTED BY EXTERNAL REVIEW

In early 2013, the Transpower Board initiated an independent review¹⁰ of the System Operator's operations.

The report identified a number of improvement opportunities, including:

- forming a clearer strategic direction for the System Operator (including taking account of the Authority's CRE objective);
- improving the relationship with the Authority and industry; and
- changing Transpower's management and business operations to reflect the new strategic direction for the system operator service.

Transpower addressed each of these areas during the Review Period.

As discussed in Section 5.1.1, Transpower developed a clear and concise Strategic Plan for the system operator service which aligns both with the wider Transpower strategic direction and the Authority's CRE strategic objective.

Sections 6.2 and 6.3 highlight the improvements made over the Review Period in terms of Transpower's engagement, as System Operator, with the Authority and industry.

Finally, Transpower undertook a structural review of its management and operational groups to determine the best structure to deliver the system operator service in an effective and efficient manner, enabling constructive inter-group collaboration and cooperation (see Section 4.2.1).

Self-assessment: The System Operator has progressed the significant improvement opportunities identified in the Martyn Jenkins report, and has done so in a manner that has been complimented by the Authority.

¹⁰ The independent review was carried out by Martyn Jenkins, a consultancy.

6.2 RELATIONSHIP CHARTER

In June 2014, Transpower and the Authority agreed a Charter for the system operator service, which included a joint objective and a number of guiding principles for interaction between the parties.

Transpower has adopted a strong stance in terms of delivering on the Charter and regularly reports internally on activities or work which demonstrates behaviours consistent with the Charter. The Charter has helped facilitate a positive cultural shift in the manner in which the Authority and Transpower interact with each other.

6.3 INDUSTRY ENGAGEMENT AND COMMUNICATION

6.3.1 GREATER INTERACTION WITH PARTICIPANTS

The Review Period has seen a marked increase in non-operational interaction between the System Operator and participants.

The System Operator has continued to provide regular information to participants with its industry newsletters, with more than 130 subscribers to the newsletter by the end of the Review Period.

The System Operator's senior leadership team met with participants during the Review Period to attain a greater understanding of the commercial needs and drivers, the challenges they are facing and how the System Operator could more effectively work with such participants.

Similarly both these meetings and industry participant business presentations the System Operator has organised in the Review Period seek to provide System Operator staff with a greater understanding of participants and how our services impact them.

In the second half of the Review Period the System Operator produced event reports in relation to events where greater participant transparency and education could improve market performance when the market is stressed. These reports have been well received.

6.3.2 WORKSHOPS

Several industry workshops and meetings were held during the Review Period, including:

- **September 2014:** John Clarke presented to Authority staff about what the System Operator does, how it works and its working relationship with the Authority;
- **November 2014:** The System Operator hosted a presentation by Genesis Energy staff to System Operator staff about Genesis Energy's priorities and future challenges;
- **November 2014:** As part of the RFM programme a six-monthly industry forum was hosted at Transpower; and
- **June 2015:** A second six-monthly RFM programme industry forum was hosted at Transpower.

6.3.3 CUSTOMER SATISFACTION SURVEY

The System Operator has commissioned a Customer Survey every year since 2006. The survey measures system operator service quality by asking customers to rate specific

service factors. Additional open-ended questions are included to gain greater insights on specific operational activities and interactions/events.

In late 2014, 18 management and technical personnel from nine industry organisations, including the Authority, were interviewed. Respondents were asked to rate and comment on the effectiveness of System Operator interactions and work with the industry, including:

- market system outages;
- asset outages/system planning;
- compliance issues;
- commissioning and testing of plant; and
- communication on technical/operational and industry issues.

The rating scale for the 'overall service' measure was modified from previous years, meaning direct comparison with previous years' results was not available (though the measures are roughly comparable). In 2014, 100% of customers rated the system operator service as "good" or higher, with 67% of respondents rating service as "very good" or "excellent". This 2014 'benchmark' figure will form the basis of comparison for future surveys. Refer to Appendix 9 for detailed results.

Self-assessment: The System Operator considers it engaged well with the Authority and industry through the Review Period.

The System Operator has received positive feedback from the Authority in relation to its improved engagement and transparency, and from industry workshop attendees in relation to effective and useful communication regarding relevant topic areas.

For next review period: To further improve the manner in which the System Operator is strengthening relationships with the Authority and industry, it has identified the need to:

- engage with the Authority, and (as Transpower considers appropriate) industry, on its Strategic Plan, Capex Plan and Roadmap;
- continue to produce event reports providing it with the opportunity to assist industry to understand the behaviour of the power system and market;
- identify non-confidential data and information, and/or education which could be provided to participants or consumers;
- hold at least three industry participant business presentations – the next workshops are confirmed for October and November 2015;
- publish at least five System Operator industry newsletters;
- complete at least one "building connections" customer video profile; and
- prepare a revised stakeholder engagement plan based on feedback from the 2014/15 customer survey.

7 INVESTING IN GOOD PEOPLE

The market dispatch system – with all its complex technologies – is still operated and developed by people. Transpower considers investing in good people with appropriate skills

in the right roles is critical to managing these complexities. This is the System Operator's fifth strategic goal under its Strategic Plan.

This section covers the focus the System Operator has on having the right skills for the job as well as on safety.

7.1 HAVING THE RIGHT SKILLS FOR THE JOB

The success of the System Operator depends on recruiting and retaining people with the right skills in the right roles. The System Operator is committed to providing employees with appropriate training and ongoing development to ensure they have sufficient expertise in relevant areas including power system complexity, the electricity market and market systems, and the economic impacts of events.

A number of initiatives have commenced during the Review Period including the development of an engineering development programme, baselining and initial assessment of engineering capability, and the implementation of a study version of vSPD for analyst use. In addition, a benchmark has been established to compare future staff turnover with annual turnover from the previous four years.

Self-assessment: The System Operator successfully developed, and implemented, a number of initiatives targeted at developing, recruiting and retaining the skills required to provide an effective and efficient system operator service.

For next review period: There are numerous other initiatives to commence in the next Review Period including:

- Implementing an improved market analyst progression programme;
- developing and implementing guidelines in relation to recruitment, retention and support of staff and new managers; and
- rolling out written communication skills training.

7.2 SAFETY FOCUSED

Safety is a focus in all our considerations, including day-to-day operation and in the adoption of new practices, systems and technologies. We reinforce Transpower's safety messaging to lift the awareness of safety and its implications for system operation. Our commitment to safety is demonstrated by the inclusion of safety outcomes and metrics within our strategic and business plans.

A safety initiative introduced during the Review Period is the completion of safety assessments for all System Operator personnel involved in site visits. This initiative ensures System Operator personnel are equipped with proper PPE and are aware of the safety procedures to be followed on site.

Appendix 1 SYSTEM SECURITY AND OPERATIONS

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.

1.1 SEPTEMBER 2014

- On 13 September 2014, at 23:43, there was a loss of 51MW of industrial load at Kawerau substation, a result of a lightning reportedly striking the Kawerau mill.

1.2 OCTOBER 2014

- At approximately 2:10am on Sunday 5 October 2014, a number of Transpower assets at Penrose substation tripped as a result of a fire in a cable trench containing Vector's distribution power cables.

The fire caused severe damage to distribution cables, resulting in extensive loss of supply in Vector's distribution network. The fire also caused serious damage to transmission equipment control cables passing across the distribution cable trench, leading to the tripping of some transmission equipment.

To allow safe access for fire fighters, Transpower isolated all electrical supplies to the 220 kV and 33 kV switchyards at Penrose. This resulted in an interruption affecting up to 85,000 consumers in the Auckland suburbs of Mt Wellington, Onehunga, Ellerslie, St Johns, Remuera and St Heliers.

Once the fire had been extinguished, Transpower was able to restore part of the 220 kV, and 33 kV, transmission equipment. By around 3:30pm on Sunday, Vector was able to begin progressively restoring supply to affected customers, using temporary power cables to bypass the areas of fire damage. Supply was largely restored by Vector on the morning of Tuesday, 7 October.

Up until 9 October some major transmission assets at Penrose were also out of service while fire damage to control circuits was repaired. During this time the System Operator reconfigured the grid to provide sufficient grid capacity to Penrose and the CBD while assets were out of service. The new grid exit point at Hobson Street, together with a parallel feed from the Penrose 110kV supply (unaffected by the fire), helped to ensure supply into the Auckland CBD could be maintained at n-1 security throughout most of the event. Grid emergencies were declared for grid reconfiguration on October 5, 6, 7 and 8.

The System Operator published a full report on its website, accessed here: <https://www.systemoperator.co.nz/documents/reports>.

- On 28 October 2014, a 220 kV bus fault at Maraetai resulted in the loss of 100 MW of generation from Maraetai and Waipapa. This was the second fault in 19 days, prompting the System Operator to deem the Maraetai 220kV bus a Contingent Event (CE) risk until the Grid Owner completed remedial work.

1.3 NOVEMBER 2014

- On 15 November 2014 HVDC Pole 2 experienced a number of line protection operations while in south transfer mode. At 05:39 one of these resulted in Pole 2 switching to reduced voltage mode causing a momentary drop in South Island frequency to 49.50

Hz. At 05:51, Pole 2 then tripped. Pole 3 did not auto-start as it should have resulting in an under frequency event following a momentary drop in South Island frequency to 48.81 Hz. The corresponding rise in North Island frequency was not as dramatic due to consequential tripping of two wind farms in the lower North Island

- On 27 November 2014 a significant tripping occurred at Manapouri when generating units 1, 3 and 7 tripped due to a cable fault on unit 7, resulting in an under frequency event in both islands (North Island frequency fell to 49.19Hz and South Island frequency fell to 48.62Hz). A large response from the HVDC prevented a South island Automatic Under Frequency Load Shedding (**AUFLS**) event. Following the event, South Island ECE risk cover was increased until the reason for the multiple generator unit tripping was established. Following changes made to generator protection, the additional risk cover was ended on 8 December 2014.

1.4 DECEMBER 2014

- On 8 December 2014, a Maraetai bus fault caused Maraetai and Waipapa generating stations to trip, resulting in a loss of 278 MW of energy. Consequently, North Island frequency fell to 49.20 Hz and South Island frequency to 49.33 Hz, resulting in an under frequency event in the North Island. Instantaneous reserves arrested the fall in frequency.

In the two hours following the event, while sufficient reserves were offered and scheduled, there was a shortfall of reserves in real time, due to the time required for reserve plant to ramp up following the restoration of reserve procurement. The shortfall led to real-time price indications in excess of \$200,000 per MWh reflecting constraint violation penalty (**CVP**) pricing for insufficient reserves.

CVP prices are designed to indicate shortages in the market and are not reflective of final prices. For example, the high real time prices led some consumers to reduce off-take, thereby providing assistance to the System Operator as it managed reserve shortages. Although real-time prices remained high they did not flow through to final prices.

The System Operator published a report on its website, accessed here: <https://www.systemoperator.co.nz/documents/reports>.

1.5 JANUARY 2015

- An unplanned outage on 18 January 2015, due to the tripping of Kinleith T2, resulted in lost load of 21.2MW (including the entire Kinleith mill). Although the outage was not prolonged, mill operations did not return to full production for several days.

1.6 FEBRUARY 2015

- There were no material events to report in February 2015.

1.7 MARCH 2015

- The System Operator assisted Transpower's preparations for the arrival of Cyclone Pam (15 and 16 March 2015) by adding an additional co-ordinator to the night shift complement for those evenings to provide support and assistance in the event of significant (number or nature) transmission system outages. In retrospect, the additional support was not needed with relatively few assets tripping during the storm period.

1.8 APRIL 2015

- A planned outage of Arapuni generation between 22 and 27 April 2015 required significant System Operator input. As part of the outage planning process, a number of grid reconfiguration options were considered to alleviate likely constraints on Auckland (and north) generation during the outage. Despite this work, northern generation was constrained at various times during the outage and active management was required to minimise constraints.

The outage resulted in increased transmission flows into the Hamilton 110kV region, causing security constraints to bind for seven trading periods between 22 and 24 April 2015. During these periods, prices peaked at \$3,500/MWh at Wiri, immediately south of the constraint, and fell as low as -\$200/MWh at Otahuhu, immediately north.

These high prices were not forecast in the market schedules leading up to the outage.

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1.9 MAY 2015

- On 17 May 2015 there was a 58MW loss of supply to Waihou, Waikino, and Kopu, due to the operation of Waihou Bus Zone Protection.
- Planning for outages of Manapouri-North Makarewa circuit 3 and Invercargill-Manapouri circuit 2, on 16 May 2015, was complex, given the nature of the outage – Manapouri generation was on a single bus for the duration of the outage. The resulting grid configuration at Manapouri meant the in-service bus was treated as an ECE risk (for voltage stability) for the outage period. This required development of a new voltage stability constraint. The market was only advised of the new constraint four business days prior to the outage.

High levels of local generation (the outage constrained Manapouri generation for the duration), and the short notification period for the new stability constraint, provided insufficient time for participants to understand the new constraint and ECE risk arrangement. This impacted participants' ability to mitigate commercial consequences of the constraint.

As it transpired, the new stability constraint was not effective during the outage; the System Operator relied instead on a discretionary constraint for a few of the relevant trading periods. Price impacts from the discretionary constraint do not appear to have been material.

Planning for this complex outage was only completed during the week of the outage, impacting the System Operator's ability to provide market participants with the necessary information in a timely manner. In response, the System Operator commenced a review of the planning process, which was carried out by an external provider and completed in June 2015. Several improvement initiatives (such as better early identification practices for market-impacting outages; and minimum time requirements for new manual constraints) have been implemented.

The System operator published a report on its website, accessed here: <https://www.systemoperator.co.nz/documents/reports>.

1.10 JUNE 2015

- Very cold and, in some areas (notably Taranaki and Wanganui), wet weather was experienced from 18-25 June 2015. Despite near record low temperatures in the south, the power system coped well, reflecting the good hydro storage conditions at the time. Peak loads were 100-200 MW higher in the North Island and 100 MW higher in the South Island, when compared to the period before the cold weather. Peak demand

reached 6817MW on 23 June 2015 (compared to the record peak of 7272MW on 15 August 2011).

Snowstorms had a severe impact in the West Coast and South Canterbury regions. Heavy snow fall resulted in a number of outages (of varied duration) within those regions over three days, with losses of supply at Albury, Coleridge, Tekapo, Arthurs Pass and Castle Hill, and loss of generation at Tekapo A and Coleridge. Accessing disconnected substations, inspecting tripped circuits, and reaching damaged assets was challenging due to lying snow.

Prices were relatively low during the storm period (a reflection of the good hydro storage) meaning some large thermal generation was not being offered regularly into the market. This resulted in a lower offer stack than expected which meant the System Operator issued a number of standby residual check (**SRC**) notices during the period, to alert industry to potential shortages during peaks.

1.11 JULY 2015

- A heavy snowstorm was experienced on the east coast of the North Island, on 10 July 2015. This resulted in areas of significant snowfall and led to tripping of assets recently divested by Transpower to Eastland Networks. A number of voltage excursions occurred as a result of the storm.
- On 18 July 2015, there was a brief loss of 27MW of supply at Hinuera, after the Hinuera-Karapiro circuit tripped.

1.12 AUGUST 2015

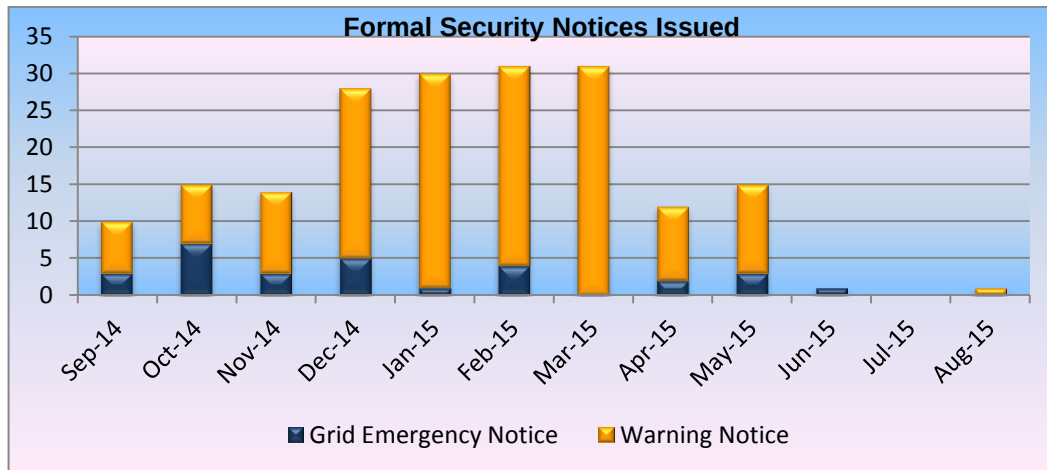
- There were no material events to report in August 2015.

2. SECURITY NOTICES

A total of one hundred and eighty-eight formal security notices were issued between 1 September 2014 and 31 August 2015.

Notice Type	Number of Notices Issued
GEN – Grid Emergency Notice	29
WRN – Warning Notice	159

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



3. SUMMARY OF GRID EMERGENCY NOTICES

The following table shows the number of GENs issued during the Review Period:

Month	Issued GEN
September 2014	3
October 2014	7
November 2014	3
December 2014	5
January 2015	1
February 2015	4
March 2015	0
April 2015	2
May 2015	3
June 2015	1
July 2015	0
August 2015	0

3.1 EVENTS LEADING TO DECLARATION OF GRID EMERGENCIES

Grid emergencies were declared during the Review Period for a wide variety of operational considerations and events. As can be discerned from the following table there is little pattern to be discerned from the ascribed reasons for declaring the emergencies.

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

Grid Emergencies			
Date	Time	Summary Details	Island
3/09/2014	1:38	A grid emergency was declared to allow a 220 kV Islington – Kikiwa Circuit to be removed from service to assist with managing high voltages.	S
19/09/2014	2:41	A grid emergency was declared to close the 110 kV Arapuni Bus split due to an electrical storm in the	N
30/10/2014	4:00		

Grid Emergencies			
Date	Time	Summary Details	Island
5/11/2014	17:40	vicinity.	
17/12/2014	18:22		
8/01/2015	19:06		
27/02/2015	15:27		
19/09/2014	18:00	A grid emergency was declared to close the 110 kV Arapuni Bus split following the tripping of 110 kV Arapuni-Bombay Circuit 1.	N
5/10/2014	18:30	A grid emergency was declared to remove Penrose T6 from service to prevent the overloading of Otahuhu - Penrose circuit 2 for a contingency on Otahuhu - Penrose 6 circuit.	N
6/10/2014	6:36		
7/10/2014	6:36		
8/10/2014	7:09		
6/10/2014	10:30	A grid emergency was declared to allow the closing of the 110 kV Arapuni split to restore security margins following the tripping of Atiamuri - Whakamaru circuit 1.	N
13/10/2014	18:20	Due to an unplanned outage of the Multiple Frequency Keeping tool, the SO reverted to single frequency keeper in both North & South Islands.	N + S
20/05/2015	1:30		
5/11/2014	7:00	A grid emergency was declared due to insufficient generation offers / transmission capacity to meet demand in the Waikato area.	N
8/12/2014	15:41		
5/11/2014	10:25	A grid emergency was declared due to insufficient generation offers in the Upper South Island.	S
1/12/2014	13:00	A grid emergency was declared to close the 110 kV Arapuni Bus split due to insufficient generation offers at Arapuni.	N
7/12/2014	15:45		
20/05/2015	2:16		
11/12/2014	7:00	A grid emergency was declared due to insufficient reserve offers in the South Island.	S
11/02/2015	9:00	A grid emergency was declared to enable the reconfiguration of Huntly due to the number of bus coupler breakers being below the minimum agreed number.	N
19/02/2015	15:54	A grid emergency was declared to allow for load management at Oamaru Substation following the tripping of one of the two supplying circuits.	S
23/02/2015	15:07	A grid reconfiguration was required in Southland after the 110 kV Gore-Roxburgh Circuit was removed from service.	S
11/04/2015	23:15	A grid emergency was declared to allow a 220 kV Pakuranga – Whakamaru Circuit to be removed from service to assist with managing high voltages.	N
17/04/2015	13:50	A Grid Emergency was declared to facilitate demand management at Gore necessary to remove an overload on Edendale-Invercargill circuit 1.	S
17/05/2015	22:31	A Grid Emergency was declared to facilitate load restoration to Kopu, Waikino, & Waihou Substations after the tripping of the Waihou 110 kV bus.	N
29/06/2015	14:41	A Grid Emergency was declared to facilitate load restoration to after the tripping of the Halfway Bush 110 kV bus.	S

4. SYSTEM FREQUENCY EVENTS

As recorded in Section 3.1.1, only three material under frequency events were experienced in the Review Period, two in November and one in December. The November events occurred as a result of a tripping of HVDC Pole 2 and a multi-unit tripping at Manapouri, while the December event was due to a bus fault at Maraetai. Each event was managed effectively with, notably, the Manapouri event benefiting especially from significant HVDC response. System Operator response was, in two cases, to increase reserve cover for the relevant assets while satisfactory explanations for the events were obtained.

4.1 SUMMARY OF SYSTEM FREQUENCY EVENTS

The following table lists the system frequency events during the Review Period:

System Events				
Date	Time	Summary Details	Island	Freq (Hz)
06/09/14	20:41	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.56
05/10/14	22:03	Clyde G2 tripped resulting in a momentary drop in South Island Frequency.	S	49.44
31/10/14	22:36	A sudden reduction in Lower Waitaki generation resulted in a momentary drop in frequency in the South Island.	S	49.43
04/11/14	02:06	A planned shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.51
15/11/14	05:39	HVDC Pole 2 line protection operated resulting in a momentary drop in frequency in the South Island.	S	49.50
15/11/14	05:51	HVDC Pole 2 tripped resulting in a momentary drop in frequency in the South Island.	S	48.81
15/11/14	06:13	HVDC Pole 3 stopped in South transfer as part of normal dispatch resulting in a momentary drop in frequency in the South Island.	S	49.42
25/11/14	22:08	Stratford CCGT tripped resulting in a momentary drop in frequency in the North Island.	N	49.38
26/11/14	11:26	HVDC Pole 2 line protection operated resulting in a momentary drop in frequency in the North Island and a momentary rise in frequency in the South Island.	N S	49.47 50.53
27/11/14	13:32	Three Manapouri generators tripped resulting in a momentary drop in frequency in both the North and South Islands.	N S	49.19 48.62
08/12/14	13:41	The Maraetai 220 kV bus tripped; the subsequent loss of the Maraetai and Waipapa generation resulted in a momentary drop in frequency in both the North and South Islands.	N S	49.20 49.33

System Events				
Date	Time	Summary Details	Island	Freq (Hz)
06/01/15	13:46	Stratford generating units U21 & 22 tripped resulting in a momentary drop in frequency in the North island.	N	49.43
23/02/15	01:51	Generation at Wairakei Power Station tripped resulting in a momentary drop in frequency in the North island.	N	49.50
27/02/15	17:44	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.61
03/03/15	13:31	An HVDC Runback occurred resulting in a momentary rise in frequency in the South Island and a momentary drop in frequency in the North Island.	S N	51.01 49.38
24/03/15	18:36	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.63
05/04/15	09:58	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.69
16/05/15	11:10	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.63
21/06/15	21:51	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.71
22/06/15	06:11	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.61
23/06/15	13:25	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.53
23/06/15	17:51	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.53
13/07/15	17:51	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.59
16/07/15	17:51	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.64
13/08/15	14:17	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.62
22/08/15	05:37	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	S	50.51

4.2 SUMMARY OF CONNECTION POINT EVENTS

The following table summarises the connection point events during the Review Period:

Connection Point Events				
Date	Time	Summary Details	Generation/ Load interrupted (MW)	Restoration time (minutes)
19/09/14	03:49	The Kopu 66 kV bus tripped resulting in a loss of supply to Kopu Substation.	14	145
05/10/14	02:11	A major fire at Penrose Substation resulted in the loss of supply to Penrose 22 & 33 kV grid exit points.	22 kV 14 33 kV 62	880 760
09/10/14	03:05	The Maraetai 220 kV bus tripped, resulting in a loss of connection to Maraetai and Waipapa Power Stations.	WPA 13 MTI 78	123 123
28/10/14	23:38	The Maraetai 220 kV bus tripped, resulting in a loss of connection to Maraetai and Waipapa Power Stations.	WPA 23 MTI 71	144 133
17/11/14	12:13	110 kV Kaikohe - Maungatapere Circuits 1 & 2 tripped resulting in a loss of supply to Kaikohe Substation and the surrounding area.	28	22
29/11/14	23:07	The North Makarewa 33 kV bus tripped resulting in a loss of supply.	23	94
08/12/14	13:41	The Maraetai 220 kV bus tripped, resulting in a loss of connection to Maraetai and Waipapa Power Stations.	WPA 46 MTI 244	167 162
06/02/15	06:24	Supply was lost to Mangahao Substation when 110 kV Bunnythorpe - Mangahao Circuit 1 and the connecting transformer on the other circuit both tripped.	21 gen 15 load	48
16/02/15	08:39	110 kV Oamaru - Bells Pond - Studholme - Waitaki Circuit 2 tripped resulting in a loss of connection to Bells Pond Substation.	7	96
09/04/15	02:12	Albury supply transformer T2 tripped resulting in a loss of connection to Albury Substation.	1.6	488
17/05/15	22:03	Waihou 110 kV bus tripped resulting in a loss of supply to Waihou, Waikino, & Kopu Substations.	WHU 20 WKO 16 KPU 21	114 109 110
19/05/15	14:01	Wanganui 33 kV 'A' Bus tripped.	12	100
25/05/15	07:13	Takapu Road Supply transformer T1 tripped during a planned outage on the parallel T2 bank.	64	12
25/05/15	07:47	Takapu Road Supply transformer T1 tripped during a planned outage on the parallel T2 bank.	68	10
18/06/15	20:58	Coleridge - Otira Circuit 1 tripped resulting in a loss of connection to Coleridge Power Station due to earlier trippings.	12 gen 0 load	1287
18/06/15	21:11	Timaru - Tekapo A Circuit 1 tripped resulting in a loss of supply to Albury and Tekapo A substations and a loss of	ABY 0 MW TKA	33

Connection Point Events				
Date	Time	Summary Details	Generation/ Load interrupted (MW)	Restoration time (minutes)
		connection to Tekapo A generation.	23 MW gen 2 MW load	
18/06/15	22:35	Timaru - Tekapo A Circuit 1 tripped resulting in a loss of supply to Albury and Tekapo A substations and a loss of connection to Tekapo A generation.	ABY 0 MW TKA 17 MW gen 1.5 MW load	716 711
29/06/15	14:31	Halfway Bush 110 kV bus tripped resulting in a loss of supply to the 110 kV feeders and a partial loss of supply to the 33 kV grid exit point.	40	26
18/07/15	12:20	Hinuera - Karapiro Circuit 1 tripped resulting in a loss of supply to Hinuera Substation.	27	118
24/08/15	16:35	National Park Supply Transformer T1 tripped resulting in a loss of supply to National Park.	3.1	630

5. VOLTAGE VIOLATIONS 220 kV & 110 kV

Grid voltages did not exceed the EIPC voltage ranges during the Review Period.

6. PARTICIPANT ADVICE NOTICES

A total of 182 CANs were issued during the Review Period. This represents a return to more typical levels after the previous two years where CAN numbers were greatly inflated by notices associated with HVDC commissioning¹¹.

7. STABILITY LIMITS

There were no instances of grid stability limits being exceeded during the Review Period.

8. STANDBY RESIDUAL CHECK NOTICES

SRC notices are published by the System Operator to indicate there is insufficient generation and instantaneous reserve offered for dispatch to maintain system security and meet forecast demand if the largest single CE were to occur. A total of nine hundred and ninety-one notices were issued by the System Operator in the Review Period¹².

¹¹ In comparison there were 370 CANs issued in 2013/14 and 384 in 2012/13.

¹² In comparison there were 2580 SRC notices published in 2013/14.

Appendix 2 SYSTEM OPERATOR WEBSITE

1. CONTENT

In February 2015 several enhancements were made to the System Operator website. These enhancements were:

- publishing all Excursion Notices on the site;
- adding a subscription to CANs, Formal Notices and Excursion Notices pages to allow subscribers to be notified when notices are issued;
- publishing live 5 minute HVDC Data;
- publishing live 5 minute Generation Data by generation type; and
- creating a new mobile-friendly data page that summarises load and generation data, and the latest notices. Following creation of this page the separate mobile site was decommissioned.

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2. USAGE

2.1 MAIN SITE (WWW.SYSTEMOPERATOR.CO.NZ)

The following table shows traffic statistics for the System Operator's main website.

Traffic Analysis	1 Sep 2013 to 31 Aug 2014	1 Sep 2014 to 31 Aug 2015
Total visits (Sessions):	30,994	33,121
Total pages viewed:	115,775	91,995
Unique Page View:	76,352	70,344
Average visits per day:	85	91
Average visits per week:	596	635
Average visits per month:	2583	2760
Average pages viewed per visit:	4	3
Average pages viewed per day:	317	252

When notable events occur on the power system, site utilisation can increase sharply. For example, when high prices were experienced over the period 19 to 25 June the number of views on the mobile summary page was 1013 (compared with the daily average of 16).

The top five most requested website pages were:

Page Name	Home Page	Mobile Data	Hydro Storage Information	Hydro Risk Curves	Formal Notice
Hits	18090	5544	3540	2775	2560
Change	-20%	new page	+67	+74	-20
Page Image					
% of overall views	19.66	6.03	3.85	3.02	2.78

Appendix 3 PRINCIPAL PERFORMANCE OBLIGATIONS

1. TIME ERROR

There were no instances of time error exceeding the +/- 5 second limit during the Review Period.

2. FREQUENCY

The following table summarises frequency excursions during the Review Period;

Frequency Band (Hz)	2014				2015								Annual rate	PPO target
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug		
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		2			1	2	1	1	4	2	2	16	50
50.50 > Freq >= 50.20	420	244	360	165	26	25	47	153	252	308	104	131	2235	
50.20 > Freq > 49.80														
49.80 >= Freq > 49.50	585	351	375	204	24	15	44	174	315	295	141	170	2693	
49.50 >= Freq > 48.75		2	5	2	1	1	1					1	13	60
48.75 >= Freq > 48.00			1										1	6
48.00 >= Freq > 47.00														0.2
47.00 >= Freq > 45.00														0.2

* South Island

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

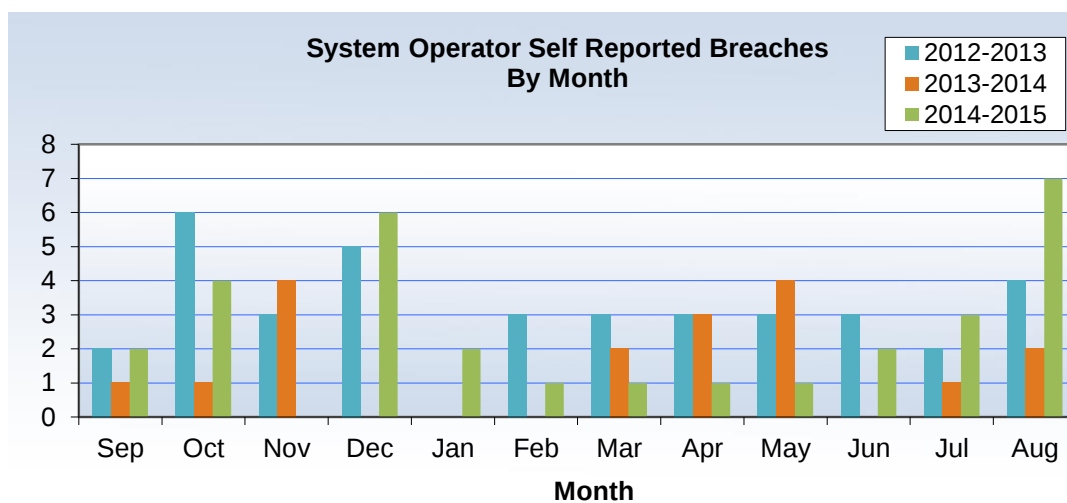
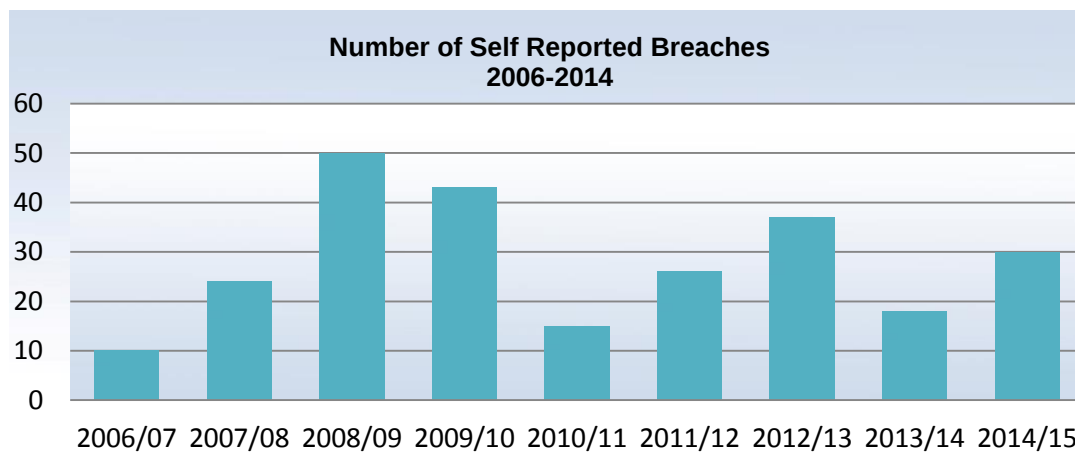
No requests were received relating to harmonic levels, voltage flicker levels and negative sequence voltage.

Appendix 4 COMPLIANCE

1. SYSTEM OPERATOR SELF-REPORTED BREACHES

This section shows EIPC breaches the System Operator self-notified to the Authority. The dates are when breaches were reported, not when breaches occurred.

1.1 BY NUMBER OF BREACHES

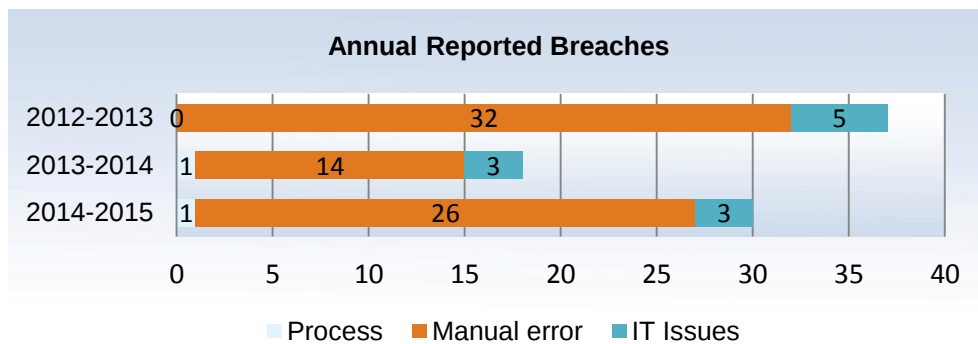


1.2 BY EIPC REFERENCE

EIPC	2012-2013	2013-2014	2014-2015
Part 3.18		1	
Part 8.68	2	3	2
Part 8.69			1
Part 8.70			1
Schedule 8.3, Tech B, 5(1)	1		
Part 13 13.58	1		
Part 13 13.58A	7	3	3

EIPC	2012-2013	2013-2014	2014-2015
Part 13 13.59			3
Part 13 13.61	1		
Part 13 13.62	3	2	3
Part 13 13.63	1		
Part 13 13.64	1		
Part 13 13.69A			4
Part 13 13.70	2		1
Part 13 13.71	1	2	2
Part 13 13.104	1		
Part 13 13.134	1		
Part 13 13.165	1		
Schedule 13.3	2	2	4
Policy Statement 12.5		1	
Policy Statement 30.1A	1		
Policy Statement 30.1B	5	3	3
Policy Statement 32.2	4	1	1
Policy Statement 87.4	1		
Policy Statement 90.1			2
SOSFIP Security of Supply	1		
Total	37	18	30

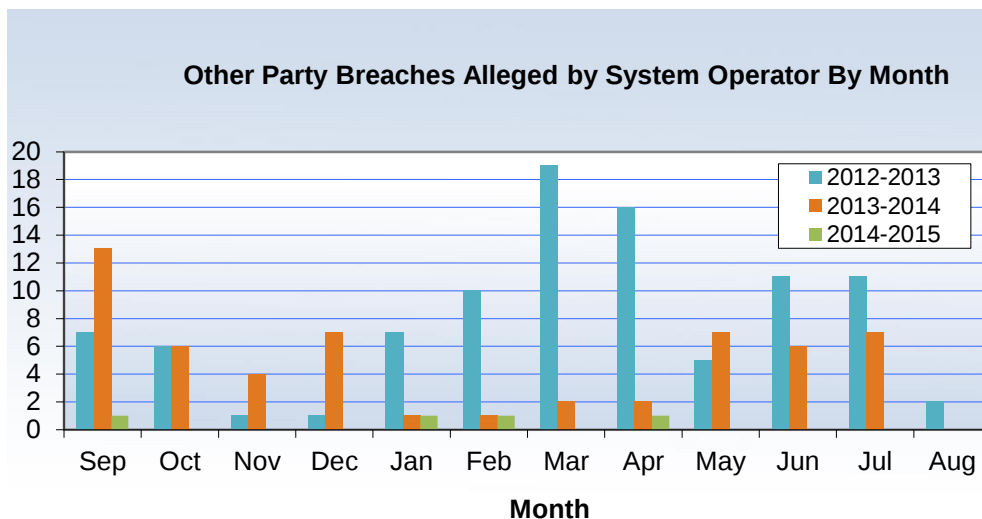
1.3 BY ERROR SOURCE



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.

3. OTHER PARTY BREACHES REPORTED BY THE SYSTEM OPERATOR



Appendix 5 PROCUREMENT PLAN AND ANCILLARY SERVICES

1. PROCUREMENT PLAN REVIEW

The System Operator commenced a review of the Procurement Plan in mid-2014, as required under clause 8.42A of the EIPC. The review quickly identified a small number of minor refinements to the Procurement Plan that would better reflect operating practice. However, since the System Operator considered it was likely that larger, more substantive changes would arise out of the RFM programme, it suspended the Procurement Plan review pending outcomes from that work.

Since the RFM work is still progressing, the System Operator is not yet in a position to confirm any required changes to the Procurement Plan. Therefore, the System Operator has decided the review of the Procurement Plan should be concluded in the first part of the next review period. Changes from the RFM programme can be introduced separately into the Procurement Plan.

The System Operator will confirm the results of its review to the Authority before the end of the calendar year.

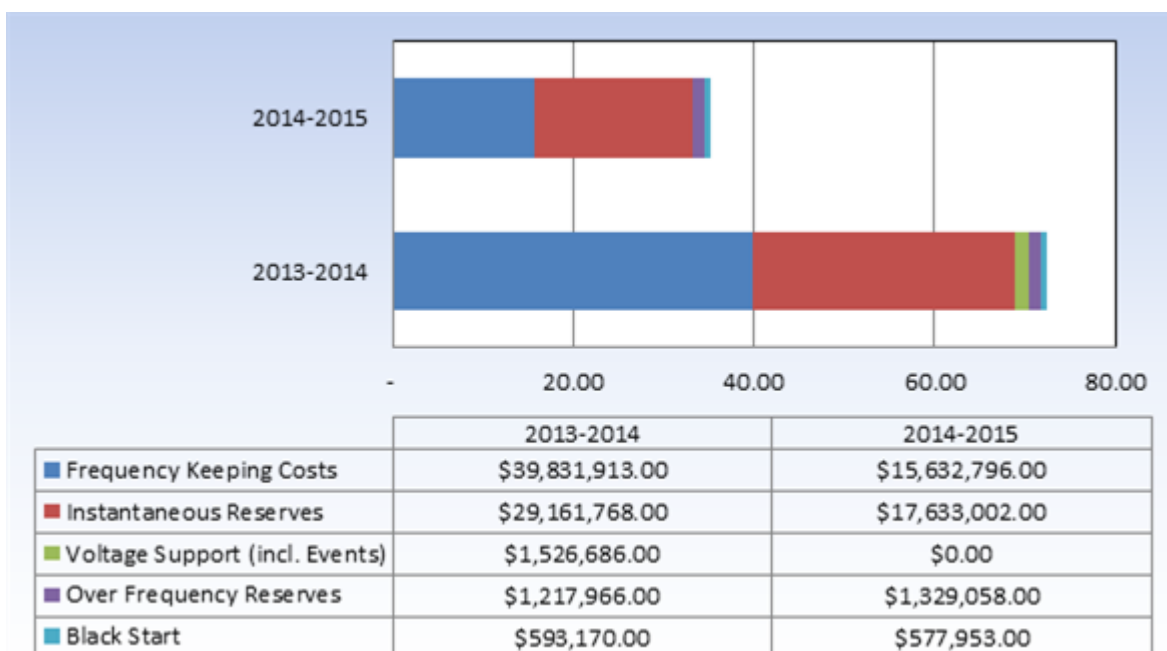
2. CONTRACTED ANCILLARY SERVICES

The following table summarises contracted services as at 31 August 2015:

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)	✓	✓	✓
Counties Power			✓		
EnerNOC			✓		
Genesis Energy	✓ (North Island)	✓ (North Island)	✓		✓
King Country Energy			✓	✓	
Meridian Energy	✓	✓ (South Island)	✓	✓	✓
Mighty River Power	✓ (North Island)	✓ (North Island)	✓	✓	✓
Northpower			✓		
Norske Skog			✓		
Pan Pac			✓		
Powerco			✓		
TrustPower	✓		✓		
Tuaropaki (Mokai)				✓	
Vector			✓		
WEL Networks			✓		
Wellington Electricity Networks			✓		
Winstone Pulp International			✓		

3. ANCILLARY SERVICE PROCUREMENT COSTS

The total ancillary service costs for the Review Period were \$35,172,809, down by more than 50% from \$72,331,503 in the 2013/14 review period. A breakdown of these costs is shown below.



4. ANCILLARY SERVICE PROVIDER PERFORMANCE

4.1 INSTANTANEOUS RESERVES

There were three under frequency events during the Review Period, compared to six the previous year. Of these, one was in the North Island, one in the South Island and one resulted in under frequency events in both islands. This continues the downward trend in the number of under frequency events following HVDC Pole 3 commissioning in December 2013.

The table below summarises assessments of IR 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			
15-Nov-14	5:51	HVDC		48.82	89.9	3	
27-Nov-14	13:30	MAN G1, G3 & G7	49.19	48.62	350.9	13	EnerNOC under-delivery breach
8-Dec-14	13:40	MTI bus (GO)	49.20		264.2	12	

4.2 FREQUENCY KEEPING RESERVES

MFK was introduced into the South Island on 4 August 2014. Contact Energy provided sole frequency keeping services (under a maximum pricing arrangement) in the South Island until Meridian Energy entered the market on 24 October 2014.

The System Operator formally approved entry of Trustpower's Patea station into the MFK market on 10 July 2015. However, as at 31 August 2015 Trustpower had not commenced offering to the market.

During the Review Period, the System Operator observed the contractual performance measure for frequency keeping (i.e. Regulation Instruction Error Ratio) produced erroneous results for some sites, particularly in the South Island. In the System Operator's view these results did not appropriately reflect provider performance. It appeared to be related to the suitability of the metric while the HVDC link was operating in FKC mode. The System Operator intends to review the measure following completion of work looking at options for the future management of frequency. In the meantime, the System Operator suspended application of the measure and has relied upon real-time logging of performance issues by co-ordinators to monitor service provider performance. This logging has not revealed any material issues with the provision of MFK.

4.3 BLACK START

On 19 October 2014 a test of the black start capability of Mighty River Power's Maraetai station was carried out. This involved a full station shutdown. The test successfully saw an isolated section of the North Island grid energised between Maraetai and Otahuhu. Some issues with Maraetai's performance were identified during the test – however, these were rectified and proven in a limited scope retest carried out on 22 February 2015.

The black start test scheduled for Manapouri in 2015 did not proceed. A number of logistical, technical and commercial concerns were identified during planning and could not be resolved in time for a test during the Review Period. The System Operator commenced a review of options for future testing at Manapouri and commenced planning for a North Island test at Genesis' Tokaanu station (planned for February 2016).

4.4 OVER FREQUENCY RESERVE

There were no over frequency events during the Review Period.

During the 2014 ancillary services procurement tender, the System Operator contracted a new Over Frequency Reserve provider in the North Island (Contact Energy, at Te Mihi), replacing one of the incumbents.

Appendix 6 SOFTWARE AUDITING

1. SOFTWARE AUDITING

This section describes software audits Transpower arranged for the System Operator's auditable software during the Review Period (see clause 3.17 of the EIPC).

The Authority-approved auditor was PA Consulting.

All audit opinions received from PA Consulting during Review Period determined the relevant audit's outcome to be satisfactory.

2. ANNUAL RMT AND SPD CERTIFICATION

On 31 March 2015 Transpower procured an annual audit of the RMT and SPD tools. Audit findings are presented below.

3. RMT

Audit opinions in relation to changes to the RMT software were completed as follows:

3.1 30 OCTOBER 2014

In 2014 the old RMT was replaced and deployed on a new software platform (TSAT by Powertech labs) – referred to as “RMT v5.00.000” or “RMTSAT”.

The move to a new platform was necessary as the old RMT Matlab-based model was at end of life. Re-platforming also accommodated planning needs for the upcoming National Reserves Market (**NRM**) by introducing a more flexible software platform. The intention of the software release was to change the underlying software platform, not model functionality, and the audit focussed on the ability of the new version to reproduce, or in some cases improve upon, the results of the previous RMT version.

3.2 4 NOVEMBER 2014

This RMT software change:

- fixed an erroneous upper limit at the Onepu market node;
- re-tuned the models for Tekapo A, Tekapo B, Matahina, Clyde, Roxburgh and Aviemore generators, due to new governors being installed at the stations and/or new test data being received from the asset owners; and
- re-tuned the models for the Patea, Ohakuri, Otahuhu CCGT and Mangahao generators to resolve discrepancies between the RMTSAT and Matlab-based RMT models.

The audit found version 4.200.027 and 5.00.001a of Transpower's RMT software to be compliant with the software specifications contained in the current SOSPA.

3.3 5 FEBRUARY 2015

This RMT software change:

- re-tuned models for Arapuni (ARI0 & ARI1), Waitaki, Benmore, Ohau A and Ohau C, to enable the receipt of new test data from asset owners);

- shifted two units from the old MTI0 model to the new MTI1 model, to account for additional governors at Maraetai (MTI) being tuned for stability;
- tuned the Tekapo A (TKA) governor model to conform to the standard damping value for hydro machines; and
- corrected the corrupted 'FIRLookup.dyn' file, which was caused by an unintentional series of carriage returns and enhanced software code, to detect similar types of corruptions in the future (change 4).

This software version change also upgraded the MDB file (used to create the 'RMT_Model.xml' file) from a Microsoft Access 98 file to a Microsoft Access 2003 file.

Note: The first two changes were also incorporated into a new version of the Matlab-based RMT model, version 4.200.028, the subject of a separate audit opinion.

The audit found version 5.00.002 and 4.200.028 of Transpower's RMT software to be compliant with the software specifications contained in the current SOSPA.

3.4 26 MARCH 2015

This change allowed a fix to be implemented to a software issue causing the maximum number of iterations before converging to a solution to be exceeded under certain system conditions. The convergence issue was unique to the Matlab-based RMT model, so no corresponding change was required to RMTSAT.

The audit found version 4.200.029 of Transpower's RMT software to be compliant with the software specifications contained in the current SOSPA.

3.5 07 JULY 2015

This RMT software change:

- corrected an incorrect parameter (initial head) in the Manapouri (MAN) model;
- fixed an issue where the risk of Huntly unit 5 (HLY5) tripping is double-counted under certain circumstances;
- made a programming change to the Taranaki CCGT (SPL) model, for ease of maintenance and to improve consistency with the Matlab-based RMT model;
- removed an unnecessary block from the Whareroa (WAA) model that resulted in warning messages;
- changed the name of the Cobb node to reflect the transfer of assets to Network Tasman;
- fixed a data error in the Ohau B (OHB) model; and
- changed the inertia value for embedded generation in Vector's network to resolve differences between RMTSAT and RMT-Matlab.

The following changes were made to the RMT XML file, which contains input data for both RMTSAT and RMT-Matlab:

- moved two units of Maraetai (MTI) to a different (pre-existing) model to reflect the tuning of the units' governors; and
- introduced secondary risk for the Mill Creek (MCK) and West Wind (WWD) wind farms to the RMT model to avoid the need for manual processing by power system coordinators.

The audit found version 5.00.003 of Transpower's RMT software to be compliant with the software specifications contained in the current SOSPA.

4. SPD

The System Operator sought one audit opinion in respect to SPD on 26 March 2015.

The SPDv38_4_10 IMML release resulted in a change to the methodology for modelling transmission losses in SPD to allow approximation of quadratic losses using six loss segments for AC lines.

The audit found version 38.4.10 of Transpower's SPD software to be compliant with the software specifications contained in the current SOSPA.

The audit determined all regression tests passed, indicating new functionality introduced in version 38.4.10 had not adversely impacted SPD's existing functionality and had been implemented correctly.

In particularly, it was noted that SPD:

- correctly calculated losses on AC lines and nodal prices when the flow fell part way through the first, second, third, fourth, fifth or sixth segment of the piecewise loss curve; and
- correctly calculated losses on AC lines and nodal prices when the flow fell precisely at the end of the first, second, third, fourth, fifth or sixth segment of the piecewise loss curve.

Appendix 7 SYSTEM OPERATOR SERVICE PROVIDER AGREEMENT

1. PEOPLE

The System Operator FTEs during the Review Period were:

	31/08/2014	31/08/2015	Change
General Manager	3.8	3.0	(0.8)
Business	10.2	11.7	1.5
System Operations	44.2	41.7	(2.6)
Engineering	35.9	28.7	(7.2)
Markets	16.6	17.6	1.0
Total	110.7	102.6*	(8.2)

*This excludes 9.6 vacant positions (including maternity leave and secondments)

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 st September 2014 – 31 st August 2015
System Operator Service Provider Contract Base Fee for the period 1 st September 2014 – 30 th June 2015	\$ 33,074,949
System Operator Service Provider Contract Base Fee for the period 1 st July 2015 – 31 st August 2015	\$ 6,601,503
Total fees paid under the SOSPA	\$ 39,676,452

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 st September 2014 – 31 st August 2015
TASC Advice	\$ 710,731
Development Fee Services	\$ 45,326
Total variable revenue	\$ 756,057

Appendix 8 SUBMISSIONS

The System Operator made submissions to the Authority on the following matters (generally as Transpower New Zealand Ltd, in conjunction with the Transpower Grid Owner):

- Transmission Pricing Review: Transmission Pricing Methodology: Long Run Marginal Cost (LRMC) Charges working paper;
- Transmission pricing methodology: Problem definition relating to interconnection and HVDC assets—working paper;
- 2015/16 Appropriations, Authority Work Programme and EECA Work Programme;
- Spot Market Review
- Shortened Gate Closure and revised Bid and Offer provision; and
- Code Change Omnibus Review 2015.

Appendix 9 RESULTS OF CUSTOMER SATISFACTION SURVEY

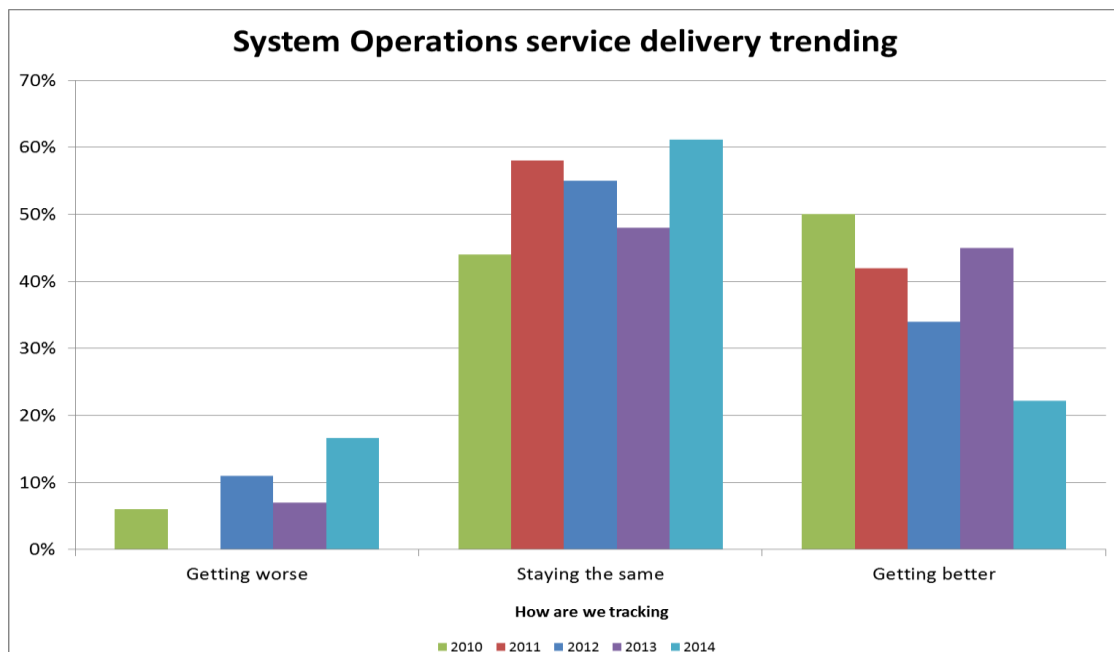
Transpower has commissioned a Customer Survey for the system operator service every year since 2006.

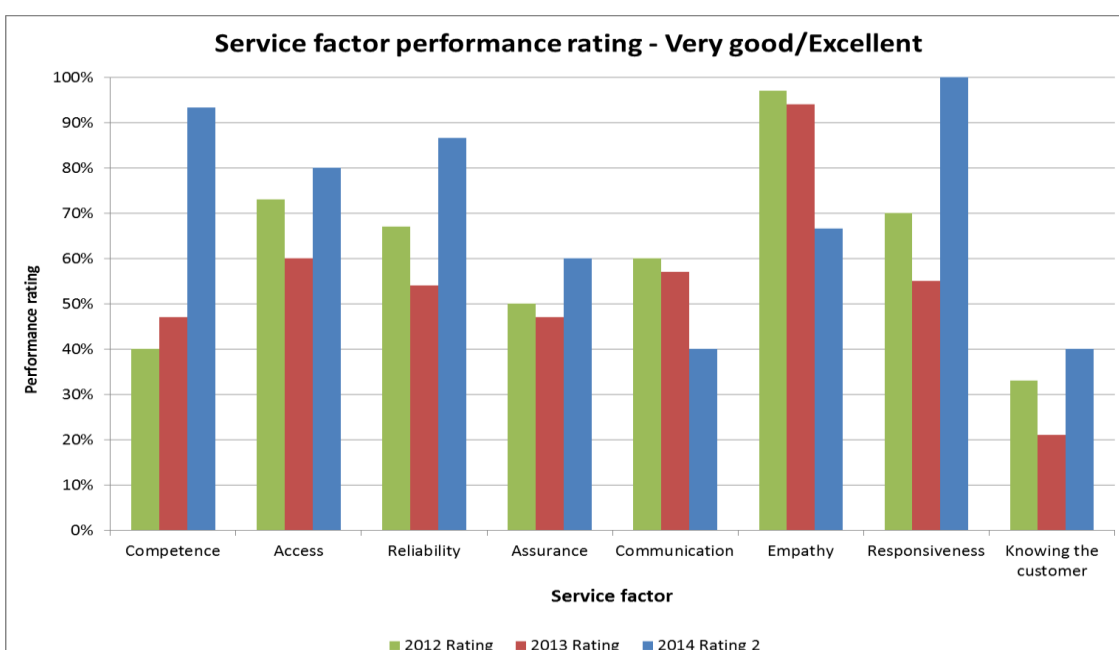
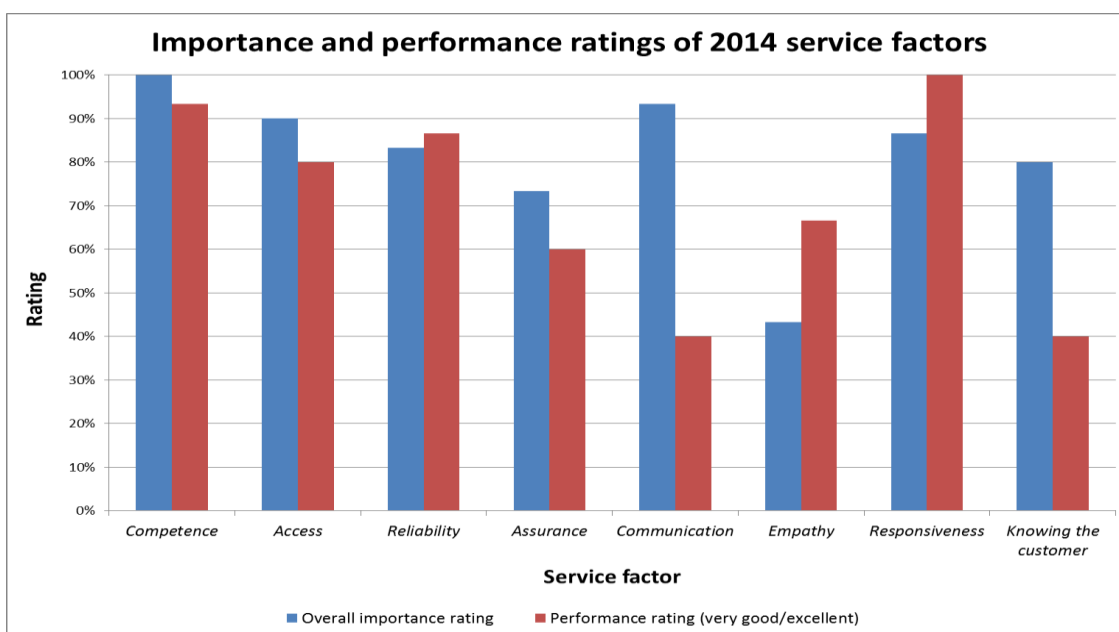
The rating scale for the 'overall service' measure changed during the Review Period, due to changed arrangements for conducting the survey. This has resulted in establishing a new benchmark for the 'overall' rating in 2014. This 2014 'benchmark' will be used as a basis for future survey comparisons.

Transpower continues to provide a very good or excellent System Operator service

- Benchmark figure: 100% of respondents rated our service as "good" or higher, with 67% rating the system operator service as "very good" or "excellent".
- When asked if the system operator service had improved since 2013, the majority of respondents (60%) agreed the system operator service is "staying the same", which, considering the majority of respondents consider the service to be "very good" or "excellent", is a satisfactory result.
- Fewer 2014 respondents believed the system operator service is "getting better", compared to 2013. There was an increase between 2013 and 2014 in the number of respondents who believed Transpower's level of service had declined. These trends need to be considered in light of the overall rating of the system operator service in the relevant survey years.

55





Transpower, in its role as System Operator, has performed well in the following areas:

- The quality of customer relationships has improved. The general perception is that there have been more frequent opportunities for dialogue and involvement in the last year.
- System Operator employees were praised time and again for their helpfulness and easiness to deal with.

Transpower, in its role as System Operator, could improve in the following areas

- The current CANs process is causing some customers concern.
- Customers wish to shape/comment on proposals at an earlier stage.
- The Authority believes there is a need to continue to improve understanding of interactions between Transpower, in its role as System Operator, and the Authority.

Survey ratings suggest that while customers are largely satisfied with Transpower's performance of the system operator service, there is room for improvement.

Appendix 10 INDUSTRY NEWSLETTER STATISTICS

The System Operator's aim is to publish five to six newsletters a year at approximately two-monthly intervals. Five newsletters were published in the Review Period.

Edition	Subscribers	Open rate**	Click rate***
September 2014	114	66.7%	20.2%
November 2014	119	65.3%	23.7%
March 2015	126	65.9%	21.1%
May 2015	125	60.2%	20.3%
August 2015	136	*	*

* No stats available for the August newsletter.

**Open Rate is the percentage of subscribers that have opened the newsletter

***Click Rate is the percentage of all hyperlinks in the newsletter that have been opened to source additional information

By the end of the Review Period there were 136 subscriptions to the newsletter, an increase of 22 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.

Appendix 11 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 where the SOW has been delivered on or before the agreed due date and its budget status¹³.

1. TASC SOW 42: GATE CLOSURE REVIEW

TASC SOW 42 was to provide an estimate of the costs and timeframe to implement tool changes and provide the necessary training to support a move to one-hour gate closure for the electricity market. This work required a qualitative assessment of the effects of moving to a gate closure of less than one hour, including the triggers allowing gate closure to be subsequently reduced to 30 minutes.

On or before due date	Under or on budget
✗	✗

Progress of the structural changes within System Operations delayed sign-off of TASC SOW 42 from August to 7 October 2014. The delay resulted in completion being a month later than initially planned, with total hours slightly above budget.

2. TASC SOW 43: FULL NATIONAL RESERVES MARKET

TASC SOW 43 commenced in August 2014 and closed in March 2015. This work was to develop an issues and options paper on the full national instantaneous reserves market for consultation with the industry. The paper included an outline of proposed draft EIPC changes.

The issues and options paper was published on 9 December 2014, with industry feedback sought by 17 February 2015. Five participants provided feedback, but no further work was required by the Authority, resulting in work being completed significantly under budget.

On or before due date	Under or on budget
✓	✓

3. TASC SOW 45: EXTENDED RESERVES TECHNICAL WORKING GROUP

TASC SOW 45 commenced in July 2014 and was completed on 28 November 2014. Completion was later than agreed; however, an extension was approved by the Authority as required resources were occupied with another Authority work stream (the Extended Reserves Manager (ERM) tender). Work comprised facilitation of the extended reserves technical working group and production of a report outlining the working group's findings.

¹³The 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.

On or before due date	Under or on budget
✓	✓

4. TASC SOW 47: REVIEW OF INSTANTANEOUS RESERVES MARKET

TASC SOW 47 commenced in January 2015 and was completed in July 2015. This work was to review current SIR and FIR market arrangements to determine whether alternative products or procurement methods should be introduced. The review was to also determine whether FIR and SIR should be merged into a single instantaneous reserve market.

On or before due date	Under or on budget
✓	✓

59

5. TASC SOW 48: DEVELOP SOLUTION APPROACH PHASE FOR THE NATIONAL INSTANTANEOUS RESERVES MARKET

TASC SOW 48 commenced in January 2015 and was completed in June 2015. This work was to complete phase 2 of the Integrated Project Lifecycle (IPLC), Develop Solution Approach, for the national market for instantaneous reserves. Solution options were investigated and a preferred option selected, with project costs and timeframes confirmed. Work was completed significantly below the agreed budget.

On or before due date	Under or on budget
✓	✓

6. TASC SOW 49: NORMAL FREQUENCY MANAGEMENT STRATEGY

TASC SOW 49 commenced in March 2015 with work on this TASC continuing through to the next Review Period (completion expected in early September 2015).

This work is to inform development of future strategy for normal frequency management only. This will include 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.

Work is presently on track to meet the agreed deadline and budget.

7. TASC SOW 50: EFFICIENT PROCUREMENT OF EXTENDED RESERVE – STAGE 1: PLANNING

TASC SOW 50 commenced in April 2015 and was completed in June 2015, with all deliverables submitted to the Authority on 17 June. Work was completed below the approved budget. This work was to determine and provide a project plan for implementation of the System Operator's deliverables in the efficient procurement of the extended reserve project.

On or before due date	Under or on budget
✓	✓

8. TASC SOW 51: GENERATION FAULT RIDE THROUGH – REVIEW OF CODE DRAFTING

TASC SOW 51 commenced on 16 April 2015 and was completed on budget in the same month. This work was to review the EIPC drafting for the Authority's proposed amendments relating to generation fault ride through. Additionally, an assessment of two issues relating to generator stability, raised in submissions received on the Authority's first consultation paper, was required.

On or before due date	Under or on budget
✓	✓

9. TASC SOW 52: GENERATOR GOVERNOR RESPONSE – SAMPLE DATA

TASC SOW 52 was commenced and completed during June 2015 on time and on budget. This work was to assemble a data sample set to be used to assess the feasibility of creating SCADA based metrics for measuring governor response. The data sample set will subsequently be used to inform the development of future strategy for normal frequency management.

On or before due date	Under or on budget
✓	✓

10. TASC SOW 54: RTP INVESTIGATION

TASC SOW 54 commenced in August 2015 and is forecast to complete in December 2015. This work is 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.

Appendix 12 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 budget¹⁴.

1. RMT ENGINE REPLACEMENT

The objective of the RMT Engine Replacement project was to replace the current reserve management Matlab/Simulink tool with the TSAT to enable more efficient modelling of the HVDC controls and changes required to implement a national IR market.

The project commenced in September 2014 and was commissioned on time (October 2014) and within budget.

On or before planned commissioning date	Under or on budget
✓	✓

2. SCADA DATA VALIDATION

The main objectives of SCADA Data Validation (SDV) were to increase the accuracy of the SDV data consumed by the market schedules, enable efficient and effective maintenance and analysis of data by the System Operator's Market Operations team, and to improve the ability for system co-ordinators to override poor quality data when required.

The delivery phase commenced in April 2014, with the project commissioned in February 2015, 10 days after the planned date. It was delivered within the approved budget.

On or before planned commissioning date	Under or on budget
✗	✓

3. OUTAGES AND OVERRIDES

The Outages and Overrides project was initiated to improve management of outages and overrides in the market dispatch system, providing automation of voltage violations and group voltage management. These improvements reduce co-ordinator reliance on manual processes and enhance situational awareness in the NCC.

¹⁴The 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.

Delivery of the Outage and Overrides project commenced in May 2014, with the project commissioning on 23 October 2014, five days ahead of the plan. The project was under budget.

On or before planned commissioning date	Under or on budget
✓	✓

4. IMPROVED MARKET MODELLING OF LOSSES

This project was to improve the modelling of losses within the SPD model.

The project commenced in November 2014 and was commissioned on time in March 2015 and significantly (25%) under budget. Development was completed more efficiently than initially expected. .

On or before planned commissioning date	Under or on budget
✓	✓

5. MFK FOR SOUTH ISLAND

This project was initiated to develop the necessary ancillary services arrangements (technical and contractual) to enable MFK to be deployed in the South Island. Commercial arrangements, requiring a comprehensive review of the Procurement Plan and Policy Statement were successfully implemented to enable South Island MFK operations to commence on time in November 2014. The project was commissioned substantially under budget.

On or before planned commissioning date	Under or on budget
✓	✓

6. ESB REPLACEMENT

The ESB Replacement project will provide 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 by replacing the existing, end of life ESB. The existing ESB will be decommissioned at the conclusion of the interface migration to the new ESB, in mid-2016.

The project began its delivery phase in October 2014. The project is currently forecast to be commissioned on time and within budget.

7. INTERIM NATIONAL INSTANTANEOUS RESERVES SHARING

This project is to develop an interim national IR market and increase physical sharing of FIR between islands, utilising the HVDC controls of round power and FKC.

During implementation, a variation was approved to expand the scope to include SIR, which will enable the physical sharing of SIR. Implementation of SIR sharing will increase cost savings to the market as it will reduce the amount of IR required to be procured.

Interim national IR sharing's delivery phase commenced in August 2014 and was expected to be completed in September 2015 within budget.

8. TSAT ONLINE

This project will implement DSA Manager-TSAT in the real-time environment to enable better management of system frequency. It will enable the system operator to actively manage increasing power system complexity.

The project commenced in June 2014 and will be commissioned in April 2016. The project is currently forecast to commission on time and within budget.

9. SECURITY TOOLS IMPLEMENTATION FOR NEW HVDC CONTROLS

The implementation of new HVDC controls (incl. roundpower, FKC and filter run-backs) as part of the HVDC Pole 3 Project in December 2013 required a different dispatch philosophy for the system operator from previous HVDC operations. These changes required changes to system operator tools for managing risk, dispatch and controlling real time frequency.

This project will provide co-ordinators with enhanced situational awareness and more automated means for managing HVDC control mode changes, enabling them to operate the power system more securely. Interim National IR Sharing for SIR will be deployed as part of this project.

The project commenced delivery in December 2014 and is forecast to commission in September 2015, on time and within budget.

10. RMTSAT STUDY TOOL

Following implementation of RMTSAT in October 2014 the current RMT Study Tool does not integrate effectively with the new RMTSAT product. This project will deliver 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 will improve analytical and RMT audit efficiency, while reducing operational risk by eliminating of manual processes.

The investigation phase of the project commenced in April 2015 and was completed on time and within budget in June 2015. Delivery of the capital phase of this project is expected in the next review period.

11. SCADA REFRESH (PRISM)

PRISM is a “**P**roject to **R**efresh **I**nfrastructure for **SCADA** and **M**arket systems”.

Transpower operates a Supervisory Control and Data Acquisition/Energy Management System (SCADA/EMS) developed in North America by Alstom. This SCADA/EMS system is required both for our role as Grid Owner and as provider of the System Operator service. It is the primary tool that manages and monitors our transmission network. It also provides critical data to the Market System to facilitate dispatch and operation of the electricity market. It is jointly funded from Transpower as Grid Owner and from the Authority through the System Operator capital plan.

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

- move the market system to a supported operating system;
- implement supported versions of Transpower’s Alstom Applications; and
- replace end-of-life software.

The project will install an updated version of Alstom’s SCADA/EMS application to ensure we continue to operate a fully supported SCADA platform until 2020. The commissioning data has recently been revised out to March 2016. This will require additional funding which will be sought early in the next review period.

Appendix 13 RELATIONSHIP CHARTER

1. ELECTRICITY AUTHORITY AND TRANSPOWER

Relationship Charter - Electricity Authority and Transpower as provider of the System Operator service

Purpose

This Charter describes our joint objective for the relationship between Transpower as provider of the System Operator service and the Electricity Authority; and the principles that we will follow both to resolve tensions and to pursue our joint objective.

It will clarify the desired relationship between us and provide a consistent basis both for staff interactions across our organisations through time and for any future agreements we enter into.

Context

Both the Electricity Authority's roles and objectives and Transpower's role as the System Operator service provider for the Electricity Authority are stipulated in legislation. While the organisations have other roles and responsibilities, this relationship includes 3 main interactions: in day-to-day operations, market design and compliance.

Tensions in the relationship arise from the Authority's compliance role, where it takes action against Transpower, and as a result of the single-buyer/single-seller situation.

Conversely, both organisations do have some clear objectives in common and there is an opportunity to leverage our joint capabilities better than we currently do towards those objectives.

Joint Objective

We will deliver long term benefits to New Zealand consumers in the course of operating and developing the broader electricity market by:

- Promoting competition, for example by removing technical barriers to entry and participation in the wholesale market;
- Ensuring reliable supply, for example by efficiently balancing risk and the costs of risk reduction and by taking advantage of new technologies as they become commercial; and
- Promoting efficient operation of the NZ electricity industry, for example by delivering an efficient and effective system operator service and by developing and implementing improvements in the market.

Guiding Principles for Engagement

- We will be professional and respectful in our dealings with one another at all times.
- We will avoid surprising one another by being open in our dealings, including in regard to communications with external stakeholders, by basing our discussions on facts and providing relevant information to one another promptly.
- Where tensions arise in the relationship, we will use these principles to ensure our behaviours do not deteriorate.
- We will improve our understanding of one-another's expertise and capability and allocate work to the party best able to carry it out successfully, avoiding duplication where possible.
- We will look for win-win outcomes in work that involves us both.
- We will operate in an environment of mutual trust and act in good faith.

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