System Operator Annual Review and Assessment 2010/11

1 September 2010 to 31 August 2011

SYSTEM OPERATOR

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1. INTRODUCTION

1.1 IMPACT OF THE INDUSTRY REFORMS

The 2010-2011 year commenced against a backdrop of the wider electricity industry reforms, which impacted the System Operator in a variety of ways.

One of the most obvious changes was the acquisition of new emergency management and security of supply obligations. The System Operator has been working hard to embed these new obligations within its business and some useful progress has been made, particularly in the key area of information provision.

The System Operator has also put considerable effort into developing a positive relationship with new Electricity Authority. A joint work planning team has been created to identify items that are relevant to both parties, and/or of significant industry interest, and to enable prioritisation and planned implementation of those items, while recognising the individual business needs of each party.

The System Operator has also worked closely with the Authority to progress the seven “new matters” mandated by Section 42 of the Electricity Act, most notably in relation to the Financial Transmission Rights, Scarcity Pricing and two demand side initiatives. We have also continued to make considered submissions on a number of other Authority led initiatives.

The System Operator has also progressed a number of other significant projects during the year, most notably the Automatic Under Frequency Load Shedding (AUFLS) and Under Frequency Management projects. In addition, we initiated a programme to define our upgrading requirements for SCADA functionality, a project which is expected to be completed over the next five years. We also implemented the Simultaneous Feasibility Test software in March 2011, which we considered a significant achievement that will have a number of benefits for the electricity sector. We have also been heavily engaged in preparation for the commissioning and ongoing operation of the new HVDC link, Pole 3.

1.2 SYSTEM SECURITY AND OPERATIONS – BUSINESS AS USUAL

From an operational perspective, the System Operator has successfully managed the numerous challenges facing it during the past year, in most cases with minimal impact on system operations. These challenges include the continued system management issues in the Kinleith region; the 26th March 2011 grid outage that resulted in the dispatch of high price generation at Genesis Energy’s Huntly station; and the 20th March 2011 market system outage which required the System Operator to rely on its standby tools for just over five hours.

While this last event did not compromise power system security, it did compromise optimal dispatch and led to the failure of some data services over a number of hours. As a result of this and other events, the System Operator has undertaken several reviews looking at the management of Transpower’s critical facilities. A number of recommended improvements to the management and oversight of such facilities are being undertaken.

There were also a number of significant events affecting our communities that impacted on the system during the year. Foremost of these were the three major Christchurch earthquakes on 4th September 2010, 22nd February 2011 and 13th June 2011. As crippling as these events were to the affected communities, none of them caused major power system management issues.

Other challenges successfully managed during the year were the Rowing World Championships at Lake Karapiro in November 2010 and the series of severe storms that swept the country in mid July 2011 and then again in mid August 2011. The latter event resulted in a number of significant trippings of circuits and transformers, particularly in the Wellington region, and led to some loss of supply events. Electricity consumption also reached record peaks during this period.

Of the approximately 1.5 million dispatch instructions that were issued during the year, only 15 of these resulted in self-reported breaches (down from 43 the previous year). There were also three alleged System Operator breaches notified by other participants during the period. However, none of these were upheld by the Electricity Authority.

1.3 OTHER NOTABLE ACHIEVEMENTS

Although System Operator staff are not exposed to the same safety risks as those in the field, we have still made a valuable contribution to Transpower's safety culture through the implementation of our own staff safety training programme. This programme is aimed at developing good safety practices within the workplace and at home, by way of a series of training seminars on topics relevant to our working environment.

The System Operator reviewed our Business Continuity Plan and Disaster Recovery Plan during the year and in March 2011 conducted a business continuity simulation. This involved staff from the System Operator business continuity team and representatives from our Information Services and Technology and People and Performance teams, who demonstrated an excellent level of knowledge during the simulation. Some areas for further development of the business continuity plan were identified and these will be progressed over the coming year.

The System Operator continued to support Transpower's graduate programmes by recruiting an additional engineering graduate and by sponsoring and managing Transpower's business graduate programme (which targets general analytical as distinct from engineering skills). These graduates, each on a two year rotation programme, spend time within various operational groups within System Operator gaining exposure to a range of engineering and business disciplines. Two secondments to generator companies were also arranged during the year. The graduate programmes are an important means of supporting the System Operator's ongoing engineering and business capabilities.

During the year, Transpower entered into a strategic relationship with Sarawak Energy Berhad (SEB). SEB is a corporate entity in Malaysia responsible for the generation, transmission and distribution of electricity in the state of Sarawak, Malaysia. SEB is aggressively developing its generation expansion program to tap into potentially 20,000 MW of hydro reserve. As Transpower and SEB operate a similar size AC power system with similar characteristics, we consider this relationship will be beneficial for both parties by allowing for sharing of experience and expertise and retaining the skills within the respective organisations.

A significant task in the formulation of the System Operator's business plan and Capex plan over the past year has been to compile a programme that incorporates all projects that have a System Operator component. This has included:

- all projects that are System Operator-led and therefore 100% funded by the Electricity Authority; and
- all projects that have a System Operator allocation of funding (under the Avoidable Cost Allocation Methodology (ACAM)) but are not led by the System Operator.

The latter has proven to be more time-consuming than anticipated. The System Operator has had to identify such projects from the Transpower Revenue Reset programme and arrive at an estimated allocation. As a result, these projects (and their System Operator component), which are not under the control of the System Operator, may change over the next three years.

Finally, the past year has also seen the integration of the former Transpower subsidiary, Energy Market Services (EMS), within Transpower. We have already noticed the benefits that the unique culture and skills of this successful business has brought to the System Operator.

1.4 Towards the Future

One of the key challenges facing the System Operator in the coming year will be to maintain our successful record for managing system operations, while progressing the large number of new projects planned for implementation over the next two to three years. As part of this, we will need to continue to improve on our ability to react quickly and adapt to changes in the power system. We believe we are well placed to deliver on these objectives.

2. System Security and Operations

This section highlights the key operational issues that the System Operator faced during the year. Specific details about the system events that occurred during the review period are set out in Appendix 1.

2.1 Power System

2.1.1 Upper North Island transmission constraints

2.1.1.1 *Kinleith*

One of the major power system management events was the continuation (from the previous year) of the system management issues in the Kinleith region. In October, the System Operator regularly issued Warning and Grid Emergency Notices (notifying the potential for Hamilton_Whakamaru contingency overloads and the intended use of Kinleith_Tarukenga splits). High Waikato River flows and a lack of generation north of Hamilton prevailed. The Kinleith overload scheme tripped during October, drawing significant attention to problems in the area. This tripping resulted in a loss of supply to the Kinleith paper mill and to the Tokoroa area (around 86 MW).

While the System Operator, the Grid Owner and various participants worked to address system management problems in the region, the problem reappeared at various times during the review period, including in late November and also:

- in December when, with reduced generation over the holiday period, management issues in the Kinleith area resulted in a number of Grid Emergencies being declared to reconfigure the grid. The same low demand conditions also meant wind was scheduled off (due to price) on 2 days, the 24th and 25th;
- in January when, on several days, Grid Emergencies were declared to activate the Kinleith splits. High water flows in the Waikato continued through most of the month resulting in the regular need to apply the splits, especially when Auckland area generators reduced energy offers in the face of generally low prices (a consequence of continued abundant water flows in the Waikato); and
- on the 16th and 17th August, when a combination of transmission constraints and high demand in Auckland required the use of the KIN system splits.

2.1.1.2 *Others*

System Operator procedure calls for wind to be the first option when it is necessary to constrain off generation (at periods of low demand and low prices). All North Island wind was constrained off on January 30th and 31st, together with some Waikato hydro. These situations drew attention to resource consent limitations affecting generators; these became apparent at Huntly Unit 5 and Waikaremoana during the period. On two occasions generators claimed an inability to comply with dispatch instructions (to reduce generation) as to do so would breach applicable resource consent requirements. Wind was also constrained off on 16th and 17th October.

System Security and Operations

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2.1.2 USE OF DISCRETION

From time to time the System Operator determines it is necessary, for the avoidance of a system security situation (i.e. the real prospect of system demand management), that out of merit order generation is dispatched on. This requires system co-ordinators to dispatch outside the dispatch schedule prepared by the optimised market dispatch system. While such occasions are relatively rare they do affect market participants. Generally such situations are of limited duration and in regions where the effects are limited. Occasionally the use of discretion to bring on generation has material effects on the market.

Late in January, system management issues caused by the combination of high river flows, low prices and reduced generation offers in the upper North Island became especially difficult to manage. On the 24th and 25th of January co-ordination staff exercised discretion for long periods of the day to bring on Huntly and Southdown generation to avoid load management in the face of constraints arising from the use of the Kinleith splits and some coincident circuit outages. Some high prices for constrained on generation resulted.

Understandably, the high prices resulted in industry and Regulator concern. Considerable effort went into the development and testing of a constraint targeting the bringing on of generation north of Hamilton to avoid the use of co-ordinator discretion and to have the Scheduling, Pricing and Dispatch Software (SPD) dispatch needed generation. Development of the constraint proved very difficult, given the potential for operation of the constraint to affect prices in the Waikato and other areas. However, the constraint operated satisfactorily after it went into operational use from January 28th.

A procedure was developed and implemented in March for advising participants when out-of-merit-order generation was being constrained on for system security reasons. The Customer Advice Notices apply in respect of Otahuhu, Southdown, Huntly or Whirinaki units.

2.1.3 OUTAGES

The Grid Owner undertook a high level of grid maintenance and capital works during the review period. The complexity of many outages resulted in a number of scheduling difficulties. For example, outages to re-conductor the Bunnythorpe_Marton_Wanganui circuits were extremely difficult to arrange because of the complexity of the industry arrangements (e.g. load management agreements) required to be in place to enable work to proceed.

On Saturday 26th March, during a long-planned grid outage in the Hamilton region, generation at Genesis Energy's Huntly station was dispatched at $20,000 prices. This caused considerable industry 'comment' and resulted in a market review being undertaken by the Electricity Authority. Operationally, the outage was managed as expected and no system security issues arose. The dispatch which resulted in the historically high prices was in normal merit order.

2.1.4 NEW PLANT

The Contact Energy gas turbine peaker plants at Stratford were commissioned during the review period. The commissioning process began in November and proceeded through into May.

2.1.5 SOLAR FLARES

A large number of advisories were received, especially in 2011, regarding the electromagnetic effects of solar flare activity. Such activity is entering an expected phase of high activity. The System Operator updated its procedures for managing system assets during such high risk periods and provided additional materials for co-ordination staff, to understand the effects and management of electromagnetic radiation.

2.2 COMMUNITY

2.2.1 EARTHQUAKES

Several major events affecting our communities impacted the system during the year. The first, and most notable, was the 4th September 2010 Christchurch earthquake. While this caused widespread damage to the community, Transpower's assets were largely undamaged and System Operator services were unaffected. Interrupted services were restored within several hours. Loss of supply was mainly caused by significant damage within local distribution networks. A material on-going reduction in Canterbury load was evidenced.

That earthquake was followed by other earthquake events including on February 22nd 2011 (especially damaging to the community) and on June 13th 2011. In both cases there were short term outages of some system equipment and additional loss of supply caused by damage within distribution company networks. Transpower assets were returned to service very quickly and again no System Operator services were affected.

As crippling as these events were to the affected communities, none of the three major earthquake events caused major power system management issues and the System Operator was able to continue with business as usual.

2.2.2 ROWING WORLD CHAMPIONSHIPS

This major event in November at Lake Karapiro was managed without impact on lake levels and surface conditions. This was a challenging fortnight for system management (as well as lake level and flow management) as Waikato River flows were very high, there were issues arising from low prices and reduced upper North Island generation offers and there was the continuing need to maintain security in the Kinleith region in the face of constraints on the Hamilton_Whakamaru circuits.

The championships went off well, with river flows being managed by Mighty River Power without causing organisers evident problems. Kinleith was on "N' security for some periods to allow Mighty River Power to manage flows without spilling in a manner likely to cause lake surface impacts.

2.2.3 STORMS

A series of storms across the country in the week of 7 – 14 July 2011 brought extreme weather conditions to large parts of the country. During the period, there were around 110 trippings of various kinds, roughly equivalent to the historical average number of trippings for the entire month of July[1]. Notwithstanding the widespread footprint and severity of the storms and the accompanying heavy snow falls, customer service impacts were few. One brief loss of supply occurred on the West Coast on 13th July.

In August 2011 an intense winter storm occurred in the week of August 15th. On that date significant and numerous outages of circuits and transformers occurred in the lower North Island, particularly in the Wellington region. Some loss of supply events occurred in various parts of Wellington as a southerly front crossed the region on the 15th bringing heavy snow, ice and embedded thunderstorms. Relatively few trippings occurred on the 16th as the weather event continued, notwithstanding continuing heavy snowfalls in the Wellington region. Loss of supply events occurred in other parts of the country, including in Taranaki, Manawatu, Waikato and North Canterbury.

Electricity consumption reached record peaks during the week (7048.8MW on 15th August).

[1] While this was a notable event, it fell well short of the record for storm related trippings during a storm on 12 June 2006. A major snowstorm in the South Island and poor weather in the North resulted in 248 trippings occurring in a 24 hour period.

2.3 Market System

The System Operator was affected by a number of events during the period that negatively affected its market dispatch systems. In a number of cases these events required the System Operator to rely on its standby tools for lengthy periods of time (in one instance, for 223 minutes), a situation which is detrimental to participants.

The most significant event was precipitated by failures of facilities supporting the market systems. One event, on 20th April 2011 occurred during a routine (2 weekly) test of the back-up power supplies in Transpower House, Wellington when one of two uninterruptible power supply units failed. This affected several of the market system servers in the Wellington computer centre resulting in the lengthy interruption to the market systems.

At no time during the event was power system security compromised. However, optimal dispatch was compromised and publishing of some data services failed. The System Operator used back-up systems during the interruption.

As a consequence of this and other events, several reviews have been carried out regarding management of Transpower's critical facilities. A number of recommended improvements to management and oversight of such facilities are being undertaken.

2.4 Principal Performance Obligations

The System Operator met its Principal Performance Obligations (PPOs) for the reporting period.

Further details of the System Operator's compliance with its Principal Performance Obligations are set out in Appendix 2.

2.5 Security of Supply And Emergency Management

The System Operator acquired a number of functions in relation to security of supply and emergency management as part of the November 2010 electricity sector reforms. These functions are set out in the policies inherited from the Electricity Commission and the Electricity Industry Participation Code (Code).

The provision of information is a key requirement of these policies. Information is now published weekly on our website. Since taking over the security of supply and emergency management functions, the System Operator has also commenced a review of the Emergency Management Plan and is currently preparing the annual Security of Supply Assessment.

No emergencies arose in the period to 31st August 2011.

2.6 Short Term Security Issues

As in previous years, the System Operator led Upper North Island and Upper South Island stakeholder groups to ensure a co-ordinated response to managing the region within power system capability limits over the 10/11 summer period and the 2011 winter period. The System Operator undertook a study to assess the ability of the grid to meet the forecast and prudent peak demand based on stakeholder agreed generator and transmission scenarios. No issues were identified and the groups maintained a watching brief.

3. Stakeholder Engagement

This section outlines the various ways in which the System Operator has engaged with the Electricity Authority and the wider industry during the review period.

3.1 Joint Development Programme

Clause 7.7 of the Code requires the System Operator and the Authority to agree and publish a Joint Development Programme. This programme coordinates and prioritises items on the Authority's industry development work plan relevant to the System Operator, and the items on the System Operator's capital expenditure programme that are of significant industry interest or could impact upon delivery of important industry initiatives. The Joint Development Programme is a key input into the Authority's work plan.

The Authority and the System Operator have undergone a significant process of identifying items relevant to both parties and/or of significant industry interest and prioritising and planning implementation of those items with respect to each other. A Joint Work Planning Team has been developed for the specific purpose of agreeing, maintaining, and communicating a work plan that reflects industry development needs and priorities, whilst enabling both Electricity Authority and System Operator individual business needs.

Significant effort has also been made by the System Operator this year to compile an ambitious and realistic Capex Plan, in consultation with the Electricity Authority. This plan consists of 61 projects to be delivered or commenced within the Capex period. The System Operator continues to refine its project management processes and build project skills and expertise to enable it to deliver on its Capex commitments. To date, the plan is on track.

3.2 Contributions and Submissions On Electricity Authority Initiatives

The establishment of the Electricity Authority in November 2010 saw a strong focus of consultations on the Authority's foundation documents and the seven "new matters" mandated by Section 42 of the Electricity Act. The System Operator has been involved to varying degrees in the proposed design of these key initiatives, most notably in relation to Financial Transmission Rights (FTRs), Scarcity Pricing and the two demand side projects. The System Operator, in conjunction with the Electricity Authority, has invested substantial time in the development of the proposals for these initiatives for inclusion in the consultation papers.

The System Operator provided submissions to the consultation papers on these key development areas and additionally to a number of papers on other industry initiatives.

The full list of consultation papers that the System Operator has made submissions on is set out in Appendix 3.

3.3 Industry Engagement

3.3.1 Workshops and Newsletters

Five System Operator newsletters were issued during the review period. The focus of these were informing our customers of changes to our business tools and providing updates on the investigation work currently being completed by the System Operator.

There were two industry workshops held during the review period – one relating to AUFLS which was held in April 2011 in Wellington. The second was held at venues in Auckland, Christchurch and Wellington and its purpose was to update the industry on the Under Frequency Management Project.

3.3.2 System Operator Website

The System Operator maintains a website through which it distributes information to registered participants and the public at large (www.systemoperator.co.nz). Over the past year, the System Operator has increasingly used the website as its primary means of distributing information. This includes, for example, copies of relevant parts of its operational procedures, newsletters, operational reports, industry data, and reporting. Further information about the usage and content of the website is set out in Appendix 4

3.3.3 Sarawak Energy Memorandum

During the year, Transpower entered into a memorandum with Sarawak Energy Berhad (SEB). SEB is a corporate entity in Malaysia responsible for the generation, transmission and distribution of electricity in the state of Sarawak, Malaysia. The utility is at present serving about 1000 MW of peak load demand and the load demand is expected to increase through the development of energy intensive industry in aluminium smelter and solar panel manufacturing. To meet the demand, SEB is aggressively developing its generation expansion program to tap into potentially 20,000 MW of hydro reserve. Part of this generation is to be exported to Peninsular Malaysia via the 500 kV HVDC undersea cable.

Transpower and SEB operate a similar size AC power system with similar characteristics. Transpower therefore considers it beneficial for both parties to collaborate to support the development of our respective technical skills by sharing our experience and expertise and retaining the skills within the organisations. From Transpower's perspective, the collaboration can provide the avenue for Transpower to:

- Learn from other utility's technical experience thereby enhancing our technical competence and confidence;
- Increase our international or regional profile;
- Give opportunities and professional exposure to technical personnel as work incentives as strategy for skill retention within Transpower.

It is intended to achieve these objectives through initiatives such as:

- Technical training;
- Technical exchange programme;
- Development of operational strategies or procedures;
- Joint technical projects in areas of comment interest such as HVDC, hydro generation and Real Time Digital Simulations

3.3.4 Customer satisfaction survey

The System Operator has once again engaged an independent consultant to conduct a customer satisfaction survey to assess participant's views on the System Operator's service standards. Interviews are planned to commence during the last week of October 2011. The survey will follow the same format as in previous years.

4. Projects And Development

This section outlines the various projects the System Operator has been involved in during the review period.

4.1 TASC

The System Operator entered into the Technical Advisory Services Contract with the Electricity Commission in September 2009. The TASC is a consultancy arrangement for the provision of advice that relates directly to the System Operator's role and expertise. During the review period, the System Operator provided advice to the Electricity Authority on the following projects[2]:

[2] Some of these projects were started in the reporting period and continue into the next.

4.1.1 Automatic Generation Control (TASC001, TASC006, TASC009)

At the request of the Electricity Authority, the System Operator investigated an alternative approach to Automatic Generation Control (AGC) based on block dispatch and alternative offer arrangements, including its technical feasibility. A prototype was investigated and priced under the TASC arrangements. The prototype was then progressed as a capital project and a report provided to the Technical Stakeholders Group in August 2011 to determine the final solution with the industry.

4.1.2 Extended Control – development of post event compliance (TASC002)

This TASC project investigated extending the use of low cost interruptible load (IL) utilising frequency sensitive relays. This project related to assessing and introducing a different post compliance assessment methodology to encourage more competition into the IL market.

The report was finalised and sent to the Authority in February. It concluded that the compliance assessment methodology created some issues in relation to the existing System Operator rule obligations and equitability among asset owners which required further investigation and consultation. Such investigation was included in the Under-Frequency Management work stream (TASC010).

4.1.3 Under-Frequency Management Project (TASC010)

This objective of this project was to investigate and propose strategies that offer the most reliable and cost effective under-frequency management regime whilst maintaining compliance with the System Operator's Principle Performance Obligations. Asset Owner Performance Obligations (AOPOs), instantaneous reserves arrangements, and AUFLS all formed part of this work stream.

The work is ongoing at 31st August 2011. However, the results from both AUFLS and the Reserve Review were published and are summarised below.

4.1.3.1 *AUFLS*

The results of the technical review completed in 2010 concluded that the overall design of the AUFLS scheme provides the System Operator with insufficient confidence that it will be effective to prevent the system from collapsing from large risks that are not currently identified. Furthermore, there is concern that the current AUFLS scheme could result in over-frequency and potential system collapse from defined risks.

To address the issues identified in the technical review, the System Operator has been working through the process of identifying technical options and undertaking cost-benefit analysis on those technical options. In addition, following a number of participants raising concerns regarding inefficiencies with the current AUFLS provision method (which can result in limiting participation in the instantaneous reserves market), the System Operator has also been investigating opportunities to improve AUFLS provision efficiency.

As a part of the review, the System Operator conducted a discussion of AUFLS provision options, including a dynamic procurement option, with industry at workshops held in April 2011. From the workshop discussion, there did not appear to be any widespread desire for dynamic market arrangements nor a lack of firm proposals as to how such market arrangements would ensure the provision of AUFLS load.

The continued use of a mandated AUFLS scheme will be required in the interim. The System Operator, in its report, has outlined options available within the current code that may assist with limiting the over-provision associated with a mandated AUFLS scheme and increase the efficiency of providing AUFLS load.

The technical options, and associated benefit analysis, were presented and discussed with industry at the System Operator workshops in August 2011. Following on from the workshops, the System Operator will consider industry feedback before making a recommendation to the Electricity Authority.

Projects And Development

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4.1.3.2 *Reserve Review*

The purpose of the Under-frequency Management review was to propose strategies and measures that offer the most reliable, secure, and cost effective under-frequency management system to provide greater certainty on system integrity during major under-frequency events, and to operate an efficient market.

The review included the various assumptions used in the System Operator's Reserve Management Tool (RMT) to calculate reserve procurement quantities. The System Operator recommended the following improvements to the modelling within RMT:

- Changing the current 60s simulation in RMT to 10s;
- Modelling the actual delivery times and quantities for IL; and
- Using the actual HVDC transfer limit of 250 MW rather than the modelled 25 MW.

The above changes will have an impact on participants with respect to data resolution and the likely occurrence of more severe under-frequency events. As such, industry endorsement of the changes is critical, and software, code, and ancillary service contract changes are likely to be necessary before the changes can be implemented.

The System Operator has also concluded that a mix of reserves is essential and beneficial for managing system disturbances. Therefore, to retain an appropriate mix of products and ensure provision of one type of reserve is not inadvertently incentivised over another, a transparent approach for all reserve providers for testing and monitoring is desirable.

Further, as the New Zealand power system changes and evolves; more changes in its generation mix are expected. It is expected that with higher HVDC transfer, the frequency will reach its minimum in less than the mandated 6s. The System Operator has therefore recommended further investigation of faster reserve products such as faster operating IL, df/dt operated reserves, faster spinning reserve, and system inertia.

4.1.4 Normal Frequency Review (Tasc004, Tasc011)

There were two projects related to Normal Frequency undertaken in 2010/11:

- Review the normal frequency band; analyse and review the probability standard; and review the frequency keeping MW band; and
- Complete the normal frequency review workstream initiated through the Common Quality Development Plan in relation to normal frequency AOPOs and time error.

The work was completed in August 2011 and conclusions are summarised below.

4.1.4.1 *Normal frequency standards and limits*

The System Operator looked specifically at the appropriateness of the normal frequency band (currently 50 Hz ± 0.2 Hz) and the probability standard, which specifies the number of allowable excursions into the defined frequency bands under the System Operator's PPOs. In addition, the System Operator reviewed the appropriateness of the size of the frequency keeping MW band required of the Frequency Keeper (currently 50 MW).

The System Operator concluded that the normal frequency band is optimal for New Zealand. While widening the normal frequency band may decrease frequency keeping costs, it would increase reserve requirements, potentially resulting in a higher overall cost of electricity supply and could lead to security concerns. The current normal frequency band is already wider than the band in most countries surveyed and therefore considering the unique challenges posed by the relatively small size of the New Zealand transmission system it is unreasonable to widen it further.

4.1.4.2 *Time error*

The Code requires the error between actual time and a synchronous clock connected to the power grid to be no more than five seconds. However, the uses for which time error was originally developed have become obsolete, and there is evidence that artificially raising or lowering the frequency to correct the time error can create a system reliability issue.

The System Operator has recommended consulting New Zealand electricity market participants to determine whether a Code requirement for time error is still necessary. If time error is not used, the System Operator recommends removing the 5-second time error requirement from the Code.

4.1.4.3 *Generator AOPOs in the normal band*

The System Operator reviewed the AOPOs relating to the responsiveness of generating units to frequency deviations within the normal band. Some of the requirements in the Code are unclear or have been misinterpreted. The System Operator has suggested Code changes to provide clear guidelines for asset owners with respect to dead band, droop, and proportional and integral gain settings.

4.1.5 Managing Locational Price Risk (Tasc008, Tasc014)

The System Operator developed an alternative model from the one previously identified for the special case of linear hubs and an initial estimate of time and cost to develop software to communicate relevant information between the System Operator, Grid Owner, and Financial Transmission Rights (FTR) Provider for the proposed inter-island FTR.

The report and a cost for implementation were provided to the Authority in April 2011.

4.1.6 Scarcity Pricing (Tasc012)

The System Operator worked with the Electricity Authority to develop the Scarcity Pricing proposal to a point at which an investigation could be completed by the System Operator detailing indicative timeframes and costs.

A high level cost was provided in July 2011 for the purposes of a cost benefit analysis. A consultation paper was published by the Authority in July 2011.

4.1.7 Dispatchable Demand (Tasc013)

The System Operator performed a high level investigation on an initial proposal for Dispatchable Demand for the purpose of providing initial costs and timeframes. These were provided to the Authority in June 2011.

4.2 System Operator Initiatives

4.2.1 Simultaneous Feasibility Test Software

The Market Systems Project developed the Simultaneous Feasibility Test software (SFT) and enabled SFT Check in the Market Systems. The SFT Constraint Builder module of the SFT Software creates security constraints automatically and was not enabled as part of the original project.

The use of the automatic constraint creation module in the existing market to create constraints required operator interface modification and significant tailoring to the existing market environment to enable participants and the System Operator to fully realise its benefits.

SFT automated constraint generation was enabled in late March 2011, after a six-month period of testing and consultation with the industry.

It was delivered within budget and without any ongoing software issues requiring future rectification. The System Operator considers this to have been a significant achievement during the 2010/11 year and believes this software will have a number of benefits for the electricity sector.

4.3 Section 42 Initiatives

4.3.1 Demand Side Bidding and Forecasting

The Demand Side Bidding and Forecasting project entered the capital phase in February 2011. Detailed software design commenced in July 2011, at the same time as the final consultation took place. As such, there was a significant risk that the final consultation and gazetted Code would materially change the costs and timeframes on which the original design was based. At 31st August, the project is progressing with an estimated completion date of June 2012. However, some of the issues arising from consultation are still being worked through with the Authority to minimise impact on cost and implementation timeframe.

4.3.2 Scarcity Pricing, Dispatchable Demand and Financial Transmission Rights

A significant amount of the year has been taken up in policy design work by the Authority. As such, the System Operator has not had a stable design for the Scarcity Pricing, Dispatchable Demand and FTR initiatives to enable it to undertake more than rudimentary planning. Rule changes for these initiatives will be finalised in September and October 2011, at which point, detailed design, planning, and cost estimation can be progressed.

At 31st August 2011, the following indicative timeframes for implementation have been communicated to the Authority:

FTRs	December 2012
Scarcity Pricing	June 2013
Dispatchable Demand	June 2015

These may need to be revised once Code changes have been finalised.

4.4 Pole 3 Commissioning

The System Operator is heavily engaged in preparing for the commissioning and ongoing operation of the new HVDC link. This not only includes work relating to the commissioning of the new Pole 3, but also the consequential changes required to Poles 1 and 2.

4.5 Systems Development

During the first half of the reporting period, there were two managed change releases to the market system:

- Interim Pricing was implemented on 22nd September 2010; and
- SFT and part of the Performance Enhancements Project changes were implemented on 6 December 2011. The balance of the Performance Enhancements were implemented on 4th August 2011.

The number of changes to the market system has reduced from the previous year when the System Operator focused on settling the new system after implementation in June 2009.

Following the SFT implementation, effort has been on concentrated on undertaking investigations and starting the capital projects scheduled for implementation in the 2011/12 period and beyond.

Ongoing improvements to the market system will be undertaken as part of the Market System Enhancements project. This is currently budgeted for in 2011/12, 2012/13 and 2013/14. This project is in the investigation stage at present.

4.6 CODE CHANGES PROPOSED BY THE SYSTEM OPERATOR

In addition to changes suggested to the Policy Statement and Procurement Plan following the annual reviews of these documents (as set out in further detail in section 5.2 below), the System Operator also made two other recommendations for changes to the Electricity Industry Participation Code during the review period:

- Following an allegation by an industry participant during the year that the System Operator was required to pay constrained on payments relating to a modelling error on the basis that this was for a "non-security purpose", the System Operator submitted a code change proposal to clarify the constrained on provisions in clauses 13.202 – 13.212 of the Code. The System Operator has determined that there are a number of issues with the wording of the current code provisions relating to constrained on/off payments which make these provisions unclear. This concern was reflected by the Electricity Authority when it advised (in relation to a self reported breach of rule 1.3.4.7 of schedule G6 of part G of the Electricity Governance Rules (EGRs) by the System Operator) that:

  "the provision in the Code concerning constrained on compensation is defective and therefore the obligation on the System Operator to pay for non-security constrained on compensation is unclear".

  The System Operator has requested the Electricity Authority consider this Code change as a matter of urgency.

- The System Operator has also requested the Electricity Authority to consider Code changes relating to the commissioning process in its current review of costs associated with commissioning. These changes relate to allowing a departure from dispatch instructions during certain commissioning tests and the notice requirements relating offering a generator for the first time.

5. COMPLIANCE

5.1 OVERVIEW

5.1.1 CODE BREACHES

During the 2010/11 year, the System Operator met all its principal performance obligations and had an almost three-fold reduction in Code breaches. The total number of Code breaches in 2009/10 was 43 and this reduced to 15 in the 2010/2011 year. This is, in fact, the second lowest number of breaches incurred by the System Operator since the introduction of the EGRs in 2004.

The most significant area in which breaches have reduced (23 in 2009/2010 to 4 in 2010/2011) is in the area of grid information modelling. The introduction of the new market system has significantly decreased the amount of manual requirements in real time associated with grid changes.

Further information regarding the System Operator's compliance statistics are set out in Appendix 5.

5.1.2 DISPENSATIONS AND EXEMPTIONS

The most significant dispensation transactions this year resulted from Tekapo asset swap, where the previous owner cancelled all the dispensations held against those assets and the new owner applied for replacements. An agreed process between the System Operator and the respective asset owners had 'like-for-like' dispensations expedited within Code requirements to minimise technical non-compliances and costs.

The System Operator did not apply for any exemptions from the Code during the review period.

5.2 Specific Compliance Requirements Under The Code

The System Operator has complied with all its reporting obligations under the Code, including:

- undertaking a monthly self review and reporting the results of each such review to the Electricity Authority. Following a request by the Electricity Authority this year, the monthly reporting has changed to a "by exception" report along with commentary on any system and operational issues experienced during the month;
- publishing a System Security Forecast (SSF) every two years (the most recent one was published in December 2010) and reviewing the need to revise the latest SSF every six months;
- reviewing the Policy Statement, which came into force on 1st September 2011. The changes included:
  - the System Operator's management of constraints after the introduction of SFT;
  - Changes to address participant concerns over the provision of constraint information after the introduction of SFT;
  - Minor administrative changes.

  There were no departures from the Policy Statement during the review period;
- reviewing and implementing the Procurement Plan, which comes into force on 1st December 2011. Further details about the plan (including a report on ancillary service provider performance) are set out in Appendix 6;
- procuring audits of its Scheduling, Pricing and Dispatch (SPD) software and RMT software. Further details of the audits are set out in Appendix 7.

5.3 Specific Compliance Requirements under SOSPA

The System Operator has complied with all its obligations under the System Operator Service Provider Agreement (SOSPA), including:

- working with the Authority on the System Operator's business planning, capex planning and joint development programming processes (as outlined in section 3.1 above);
- commencing an update of the functional analysis under the SOSPA to reflect the System Operator's current activities (including security of supply obligations and technical advice provided under TASC). This work was still ongoing as at 31 August;
- reviewing the System Operator auditable software and audit process to determine whether there should be any changes. In this regard, the System Operator and the Electricity Authority held a workshop last year to go through all of the System Operator's software that had an impact on price. It was agreed that the currently audited software (ie SPD and RMT) should continue to be the only audited software for the time being, although SFT may be a potential candidate for audit for the future.
- reviewing its Disaster Recovery Plan. This review is nearing completion, after which it will be submitted to the Electricity Authority for approval. There has been a general update of the document primarily to reflect technology changes that have occurred since the current version of the plan was approved by the Electricity Commission in 2005.

  Two new fall back venues were established in Wellington in the first quarter of 2011. These replace the previous venue that was located in the Pole 2 building at Haywards Substation. The fall back venues are intended to provide a work space and key resources for members of the System Operator business continuity team in the event that Transpower House becomes unavailable due to a disaster (aside from control centre staff given they have a permanent presence in both Wellington and Hamilton).

A System Operator Business Continuity simulation was carried out on 30th March 2011 to test the System Operator Business Continuity Plan and the set up of the Wellington fall back venues. The simulation involved members of the System Operator business continuity team and representatives from Transpower's Information Services and Technology and People and Performance teams. Staff demonstrated an excellent level of knowledge during the simulation. The simulation review concluded that the fall back venues are suitable for a short-term response. However, their location (in the Wellington CBD and Haywards Substation) could potentially make access difficult if transport is disrupted in a disaster. Some areas for further development of the business continuity plan were identified and these will be progressed over the coming year.

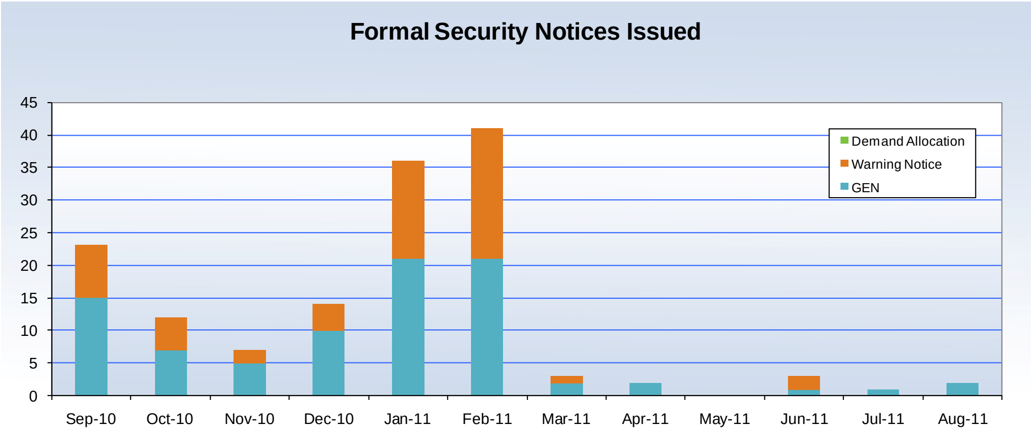
Further details about the System Operator's staffing numbers and the fees charged under the SOSPA are set out in Appendix 8.

APPENDIX 1: SYSTEM SECURITY AND OPERATIONS

1. SECURITY NOTICES

A total of 144 formal security notices were issued between 1st September 2010 and 31st August 2011.

Notice Type	Number of Notices Issued*
GEN	87
WRN - Warning Notice	57



2. SUMMARY OF GRID EMERGENCY NOTICES

The following table shows the number of Grid Emergency Notices issued during the reporting period. Multiple notices were issued for some grid emergencies.

Month	Issued GEN
September 10	15
October 10	7
November 10	5
December 10	10
January 11	21
February 11	21
March 11	2
April 11	2
May 11	0
June 11	1
July 11	1
August 11	2

2.1 EVENTS LEADING TO DECLARATION OF GRID EMERGENCIES

The vast majority (>85%) of grid emergency declarations in the past year have involved managing the system around the 110 kV connection between Waikato and the Bay of Plenty. It is believed that work done on implementing temporary system splits at Arapuni or Kinleith should reduce the number of such grid emergencies declared in the upcoming year. The remainder of the grid emergencies were split between reconfiguring grids to avoid post-contingency violation on circuits; restoration of load or security following forced outages; and managing loading on grid assets to avoid exceeding stated capability under normal power system conditions.

The following table lists the grid emergencies during the reporting period.

Grid Emergencies Date	Time	Summary Details	Island
04/09/10	04:35	A Grid Emergency was declared after multiple trippings caused by the Canterbury earthquake. This was necessary to prevent overloading in the Canterbury 66 kV network after the loss of all three Islington 220 / 66 kV inter-connecting transformers.	South
18/09/10	00:33	A Grid Emergency was declared to manage restoration of load after an unplanned outage of Hokitika Otira 1 and Kumara Otira 1 during a concurrent emergency outage of Dobson Greymouth 1 caused a loss of connection to Greymouth, Kumara, and Hokitika Substations.	South
06/09/10	17:10	Grid Emergencies were declared for insufficient generation offers in the Upper North Island and insufficient transmission capacity in the Waikato region. The grid was re-configured at KIN to alleviate the situation.	North
18/09/10	08:56		
20/09/10	18:42		
21/09/10	08:37		
22/09/10	07:17		
23/09/10	07:47		
24/09/10	07:54		
25/09/10	09:23		
26/09/10	08:53		
27/09/10	07:43		
28/09/10	07:43		
29/09/10	07:43		
30/09/10	07:43		
05/10/10	17:32		
08/10/10	09:20	Grid Emergencies were declared for insufficient generation offers in the Upper North Island and insufficient transmission capacity in the Waikato region. The grid was re-configured at KIN to alleviate the situation.	North
26/10/10	07:04		
27/10/10	07:15		
29/10/10	07:37		
02/11/10	07:39		
02/11/10	12:41		
03/11/10	07:17		
04/11/10	09:00		
02/12/10	08:40		
21/12/10	16:45		
22/12/10	07:49		
23/12/10	09:12		
24/12/10	07:50		
27/12/10	10:15		
28/12/10	10:00		
29/12/10	09:05		
30/12/10	08:25		
31/12/10	07:45		
04/01/11	09:44		
05/01/11	08:21		
06/01/11	8:11		

Grid Emergencies Date	Time	Summary Details	Island
07/01/11	09:24		
08/01/11	19:26		
11/01/11	15:00		
12/01/11	08:55		
13/01/11	08:11		
14/01/11	08:59		
17/01/11	08:44		
18/01/11	09:53		
21/01/11	09:29		
23/01/11	07:39		
24/01/11	07:02		
25/01/11	06:30		
26/01/11	06:35		
27/01/11	06:42		
28/01/11	06:45		
29/01/11	0:700		
30/01/11	07:00		
31/01/11	08:00		
01/02/11	07:17		
02/02/11	07:00		
03/02/11	07:00		
04/02/11	07:00		
05/02/11	07:30		
06/02/11	07:30		
07/02/11	07:00		
07/02/11	17:30		
08/02/11	07:00		
09/02/11	07:10	Grid Emergencies were declared for insufficient generation offers in the Upper North Island and insufficient transmission capacity in the Waikato region. The grid was re-configured at KIN to alleviate the situation.	North
10/02/11	07:00		
11/02/11	07:00		
12/02/11	07:30		
14/02/11	07:00		
15/02/11	07:00		
16/02/11	07:00		
17/02/11	18:00		
18/02/11	18:00		
20/02/11	18:00		
11/03/11	08:05		
24/06/11	19:27		
16/08/11	18:38		
17/08/11	18:25		
27/10/10	11:34	A Grid Emergency was declared to allow for grid re-configuration around Kinleith Substation to assist with restoration of supply following a loss of connection.	North
03/11/10	08:16	A Grid Emergency was declared to allow reduced reserves being dispatched to cover the North Island contingent event risk due to insufficient generation and reserve offers in the North Island.	North
29-Dec-10	03:27	A Grid Emergency was declared to allow the temporary reconfiguration of the Upper South Island transmission system	South

Grid Emergencies Date	Time	Summary Details	Island
		after the tripping of reactive plant during a planned outage resulted in high voltages.	
22/02/11	13:04	A Grid Emergency was declared to allow grid reconfiguration and demand management following the Christchurch earthquake of 12:52.	South
23/02/11	08:06	A Grid Emergency was declared to manage the Bay of Plenty after the tripping of the 220 kV Atiamuri – Whakamaru Circuit.	North
26/03/11	10:15	A grid emergency was declared following the tripping of the 110 kV Balclutha – Halfway Bush circuit. This was done to allow load management in the Southland 110 kV system to alleviate potential overloads should a second contingency occur.	South
12/04/11	09:22	A grid emergency was declared for restoration of supply to Greymouth, Kumara, Hokitika and Otira following an unplanned outage of Atarau Reefton Inangahua circuit 1.	South
26/04/11	10:34	ASB T8 was removed from service during a planned outage when it was noted that the System Operator tools were incorrectly modelling the transformer secondary connection. There was concern that the incorrect modelling was masking potentially harmful contingencies.	South
09/07/11	20:59	A grid emergency was declared for restoration of supply to Cambridge, Karapiro, Hinuera and Te Awamutu following the tripping of the 110 kV Hamilton-Cambridge-Karapiro circuits 1 and 2.	North

3. Major System Frequency Events

During the review period there was one major system frequency event. On 17th August 2011 an emergency shutdown of a Tiwai Potline resulted in the South Island frequency rising above 51 Hz before recovering. A major factor in this was that HVDC Pole 2 had stepped down some 10 minutes prior to the shutdown.

3.1 Summary of System Events

System Events Date	Time	Summary Details	Island	Freq (Hz)
04/09/10	04:36	Magnitude 7.1 earthquake hit the Canterbury region, centred near Darfield, focal depth of 10 km. Multiple feeder and transformer trippings occurred with approximately 266 MW of load being lost in a 60 sec period.	South	50.93 Hz
06/09/10	02:51	Stratford Power Limited tripped resulting in a momentary drop in frequency in both Islands.	North South	49.41 Hz 49.52 Hz
04/10/10	11:45	An emergency Tiwai potline off-loading resulted in a momentary rise in frequency in the South Island.	South	50.63 Hz
11/11/10	10:16	Otahuhu B tripped causing a momentary drop in frequency in both the North and South Islands.	North South	49.17 Hz 49.35 Hz
28/11/10	13:14	A Tiwai potline tripping resulted in a momentary rise in frequency in the South Island.	South	50.74 Hz
02/12/10	15:05	Ohau A Power Station tripping resulted in a momentary drop in frequency in the South Island.	South	49.26 Hz
08/12/10	14:11	A tripping at Huntly Power Station resulted in a momentary drop in frequency in the North Island.	North	49.26 Hz
22/01/11	22:24	Maraetai 220 kV bus tripped resulting in a loss of connection to Maraetai and Waipapa Power Stations.	North	49.34 Hz

System Events Date	Time	Summary Details	Island	Freq (Hz)
26/01/11	00:55	A Tiwai potline tripping resulted in a momentary rise in frequency in the South Island.	South	50.85 Hz
22/02/11	12:52	Magnitude 6.3 earthquake hit Christchurch, centred near Lyttelton, focal depth of 5 km. Multiple feeder and transformer trippings occurred with approximately 243 MW of load being lost in a 30 sec period. Trippings included: ▪ Bromley 220 / 66 kV inter-connecting transformers T5 & T6; ▪ Bromley 66 / 11 kV supply transformers T2, T3, & T4 and Addington 66 / 11 kV supply transformer T7; ▪ Network company feeders Addington 42, 62, 142, & 172, Bromley 92, 122, & 142, Islington 222, 242, & 932, Kaiapoi 4, 6, & 7, and Papanui 132 & 202;	South	50.78 Hz
07/03/11	15:16	A fast ramp of generation was carried out by Tokaanu Power Station as part of a planned 'system ride through' test for the commissioning of Stratford generator U21. A momentary drop in frequency in the North Island resulted.	North	49.36 Hz
19/03/11	05:45	Load swings during a planned Tiwai potline shutdown resulted in momentary swings in frequency in the South Island.	South	49.49 Hz 50.99 Hz
09/04/11	22:35	Huntly Unit 5 tripped resulting in a momentary drop in the North and South Island frequencies.	North South	49.21 Hz 49.43 Hz
23/06/11	08:19	A Tiwai potline tripping resulted in a momentary rise in frequency in the South Island.	South	50.63 Hz
25/06/11	04:36 – 04:38	The South Island experienced frequency swings due to planned switching of load at Tiwai.	South	50.54 Hz 49.64 Hz 49.50 Hz 50.73 Hz
13/07/11	12:36	A lightning strike resulted in a double circuit 220 kV tripping of Bunnythorpe-Linton-Wilton 1 and Bunnythorpe- Tararua Central-Linton 1. Approximately 117 MW of wind generation at Tararua Central and Te Rere Hau was directly tripped off, and approximately 32 MW of embedded wind generation at Tararua South tripped (total ~149 MW lost).	North	49.49 Hz
26/07/11	10:05	A sudden drop in output from Manapouri Power Station resulted in a momentary dip in South Island Frequency.	South	49.39 Hz 50.35 Hz
27/07/11	10:31	The starting of HVDC Pole 2 in South transfer resulted in a momentary rise in South Island Frequency.	South	50.50 Hz
10/08/11	13:18	Approximately 202 MW of generation was lost when the Maraetai Power Station 220 kV bus tripped (refer below).	North	49.25 Hz
17/08/11	21:22	An emergency shutdown of a Tiwai potline resulted in a momentary rise in frequency in the South Island.	South	51.26 Hz

System Events Date	Time	Summary Details	Island	Freq (Hz)
29/08/11	00:01	Huntly Unit 4 tripped resulting in a momentary drop in North island frequency.	North	49.30 Hz

3.2 Summary of connection point events

Connection Point Events Date	Time	Summary Details	Generation/ Load interrupted (MW)	Restoration time (minutes)
04/09/10	04:36	HOR T5 & T8 tripped during the Canterbury Earthquake, loss of supply to the HOR 33 kV GXP.	5	227
04/09/10	04:36	SPN T1 & T2 tripped during the Canterbury Earthquake, loss of supply to the SPN 33 kV GXP.	24	193
04/09/10	04:55	PAP Substation was disconnected from the grid to alleviate overloads in the network that resulted from the trippings caused by the Canterbury Earthquake.	35	213
09/09/10	23:24	Te Kaha – Waiotahi 1 tripped causing a loss of connection to Te Kaha.	1	12
16/09/10	13:55	Te Kaha – Waiotahi 1 tripped causing a loss of connection to Te Kaha.	1	200
17/09/10	06:01	Te Kaha – Waiotahi 1 tripped causing a loss of connection to Te Kaha.	1	560
17/09/10	20:36	Te Kaha – Waiotahi 1 tripped causing a loss of connection to Te Kaha.	1	1390
18/09/10	00:20	Kumara – Otira 1 & Hokitika – Otira 2 tripped causing loss of supply to Greymouth, Kumara, and Hokitika as Dobson – Greymouth was out of service.	HKK 11 GYM 7 KUM 0	19 23 23
18/09/10	17:43	Dobson T1, T2 tripped, loss to DOB 33 kV GXP.	5	41
26/09/10	06:16	Dobson – Greymouth 1 and Atarau – Reefton – Inangahua 1 tripped, loss of supply to Dobson.	6	50
27/10/10	11:28	110 kV Arapuni-Kinleith Circuits 1 & 2 tripped causing a loss of connection to Kinleith as a system split had been previously put in place on the Kinleith – Tarukenga Circuits.	86	29
30/10/10	09:58	Hinuera 110 / 33 kV supply transformers T1 & T2 tripped resulting in a loss of connection to Hinuera.	33	115
02/12/10	06:26	Glenbrook 33 kV bus sections B and D tripped resulting in a partial loss of connection.	26	120
20/12/10	9:26	Redclyffe 110 / 33 kV supply transformers tripped resulting in a loss of supply to Redclyffe.	41	55
20/12/10	22:48	50 kV Te Kaha – Waiotahi Circuit 1 tripped resulting in a loss of supply to Te Kaha.	1	1162
25/12/10	05:38	Carrington St 110 / 33 kV supply transformers tripped resulting in a loss of supply to Carrington St.	16	50
09/02/11	07:21	110 kV Balclutha – Berwick – Halfway Bush Circuit 1 tripped resulting in a loss of connection to the Berwick infeed from Waipori Power Station.	32	16

Connection Point Events

Date	Time	Summary Details	Generation/ Load interrupted (MW)	Restoration time (minutes)
26/04/11	12:01	50 kV Te Kaha – Waiotahi Circuit 1 tripped resulting in a loss of supply to Te Kaha. A diesel generator was installed to supply local load until the grid connection could be restored.	1	7478
01/05/11	13:20	110 kV Timaru – Tekapo Circuit 1 tripped resulting in a loss of supply to Tekapo A & Albury Substations and a loss of connection to Tekapo A generation.	TKA 2 load 22 MW (gen) ABY 2.4 load	135 143
26/05/11	11:21	50 kV Te Kaha – Waiotahi Circuit 1 tripped resulting in a loss of supply to Te Kaha. A diesel generator was used to supply local load until the grid connection could be restored.	0.8	1631
10/06/11	09:44	110 kV Timaru – Tekapo Circuit 1 tripped resulting in a loss of supply to Tekapo A & Albury Substations and a loss of connection to Tekapo A generation.	TKA 2 load 23 MW (gen) ABY 3.5 (gen)	23 27
13/06/11	13:01	Magnitude 5.6 Earthquake hit Canterbury region, centred 10 km S-E of Chch, focal depth of 9 km. Multiple feeder and load trippings resulted.	32	
13/06/11	14:21	Magnitude 6.3 Earthquake hit Canterbury region, centred 10 km east of Chch, focal depth of 6 km. Multiple feeder and load trippings resulted.	91	
21/06/11	22:34	Magnitude 5.4 Earthquake hit Canterbury region, centred 10 km S-W of Christchurch, focal depth of 8 km. Multiple feeder and load trippings resulted.	30	
09/07/11	20:55	110 kV Hamilton – Karapiro Circuits 1 & 2 tripped resulting in a loss of supply to Cambridge, Hinuera, Karapiro, & Te Awamutu.	KPO 87 (gen) CBG 21 HIN 20 TMU 23	23 22 33 31
10/7/11	08:18	110 kV Opunake - Stratford Circuits 1 & 2 tripped resulting in a loss of supply to Kapuni and Opunake.	KPI 18 (gen) OPK 5.6	75 13
14/07/11	04:55	110 kV Ohakune-National Park-Ongarue Circuit 1 tripped resulting in a loss of supply to National Park. A backfeed from Ongarue was put in place at 05:25 to restore supply but connection to the grid was not restored until 10:14.	2	319
10/8/11	13:18	The 220 kV bus at Maraetai Power Station tripped resulting in the disconnection of Maraetai and Waipapa power stations from the grid.	MTI 151(gen) WPA 51(gen)	73 73
15/08/11	03:45	110 kV Opunake – Kapuni – Stratford Circuit 2 tripped some 5 mins after Opunake – Stratford Circuit 1 had tripped, resulting in a loss of supply to Opunake and Kapuni Substations.	OPK 4.5 KPI 17 (gen)	479 503
15/08/11	16:15	110 kV Gracefield – Haywards Circuits 1 & 2 tripped resulting in a loss of supply to Gracefield Substation.	54	20

Connection Point Events				
Date	Time	Summary Details	Generation/ Load interrupted (MW)	Restoration time (minutes)
15/08/11	19:13	110 kV Gracefield – Haywards Circuit 2 tripped some 5 mins after Gracefield – Haywards Circuit 1 had tripped resulting in a loss of supply to Gracefield Substation. A subsequent tripping of the circuit 4 minutes into the restoration process caused further delays in restoring supply.	50	62
15/08/11	19:17	220 kV Haywards – Linton Circuit 1 tripped resulting in a loss of supply to Linton Substation as Bunnythorpe – Linton – Wilton Circuit 1 had earlier tripped. A subsequent tripping of the circuit 10 minutes into the restoration process caused further delays in restoring supply.	48	45

4. Voltage Violations 220 kV & 110 kV

Grid voltages exceeded code limits on two occasions during the reporting period, as follows:

- On 19th November 2010 from approximately 10:03-10:07 voltages were recorded in the Waitaki Valley in excess of 244 kV on the 220 kV system and in excess of 125 kV on the 110 kV system. These occurred when the 220 kV Islington_Livingston Circuit was removed from service concurrent with a planned outage on the 220 kV Aviemore_Waitaki Circuit. The lack of response from Waitaki generation to correct the high voltages is under investigation.
- On August 19th 2011 from approximately 12:39-12:42, voltages in the Christchurch 66 kV network exceeded code limits, peaking around 70.5 kV. This occurred during commissioning of the new Islington Area Reactive Power Controller and resulted from a control system issue. This issue has since been addressed.

5. Participant Advice Notices

A total of 214 Customer Advice Notices (CANs) were issued during the review period.

6. Stability Limits

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

7. Standby Residual Check Notices

Standby residual check notices are published by the System Operator to indicate there is insufficient generation and interruptible load offered for dispatch to maintain system security and meet forecast demand if the largest single credible event were to occur. Notices were issued by the System Operator for approximately 1305 affected trading periods in the year to 31st August 2011.

Appendix 2: Principal Performance Obligations

1. Time Error

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

2. Frequency

Frequency excursions for the reporting period remained within the annual frequency performance targets. There was one excursion above 51 Hz reported for the period (this event is discussed in more detail in section 3 of Appendix 1).

Frequency Band (Hz)	2010				2011								Annual rate	PPO target
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug		
55.00 > Freq >= 52.00													**0**	
52.00 > Freq >= 51.25												1	**1**	**7**
51.25 > Freq >= 50.50	1	1	1		1	1	1				1	1	**8**	**50**
50.50 > Freq >= 50.20	71	273	116	217	149	302	357	81	473	99	468	729	**3335**	
50.20 > Freq > 49.80	Normal													
49.80 >= Freq > 49.50	291	68	252	239	149	300	358	67	441	93	485	622	**3365**	
49.50 >= Freq > 48.75	1	1		2	3	1	1		2		2	9	**22**	**60**
48.75 >= Freq > 48.00													**0**	**6**
48.00 >= Freq > 47.00													**0**	**0.2**
47.00 >= Freq > 45.00													**0**	**0.2**

Note 1. The PPO target is 1 in any 60 month period.

Appendix 3: Contributions and Submissions on Authority Initiatives

Submissions or responses in respect of the following matters were made generally in conjunction with the Grid Owner, as Transpower New Zealand Ltd:

- Draft NZ Energy Strategy and draft NZ Energy Efficiency and Conservation Strategy
- Part D review - Proposed new rules
- Customer Compensation Schemes
- Locational Price Risk Management Proposal
- Cost benefit Analysis Interpretation of Authority's statutory objective
- Charter on Advisory Groups
- Consultation charter
- Proposed Appropriations & Work Priorities for 2011/12
- Generation Fault Ride Through
- Capacity offer for Whirinaki
- Scarcity pricing arrangements – proposed design
- Managing locational price risk: Proposed amendments to Code
- Revised Rulings Panel procedures
- Demand-side bidding and forecasting: Proposed amendments to Code
- Dispatchable demand Scarcity pricing arrangements – proposed Code amendments

Appendix 4: System Operator Website

1. Usage

Traffic Analysis	1 Sep 2009 to 31 Aug 2010	1 Sep 2010 to 31 Aug 2011
Total visits:	24,947	31,689
Total pages viewed:	123,838	167,793
Unique Visitors	7,753	11,864
Average visits per day:	69	87
Average visits per week:	481	609
Average visits per month:	2078	2641
Average pages viewed per visit:	4.96	5.29
Average pages viewed per day:	341	459

The most requested page continues to be the Upper and Top South Island Security which received 23% of all hits to the System Operator website.

It is very noticeable that when something happens on the power system the site utilisation increases. For example during the southerly storm 15-17 August the daily visitor numbers peaked at 338 (compared with typical numbers of 90 visitors a day).

The top 5 most popular web site pages were:

Page Name	Upper and Top SI Security	Upper and Top NI Security	Home Page	Power System Overview	Zone Loading
Hits	38,362	17,052	16,665	9,106	5,802
Change	↑ 7,595	↑13,454	↑1,478	↑595	↑2,963
Page Image					
% age of overall Views	22.86	10.16	9.93	5.43	3.46

2. Content

Over the last 12 months the System Operator has continued to add additional website information intended to give participants greater knowledge about the status of the power system and enhance participants' ability to manage local networks.

Resulting from a request for some of our customers we are now publishing all CAN's on the website.

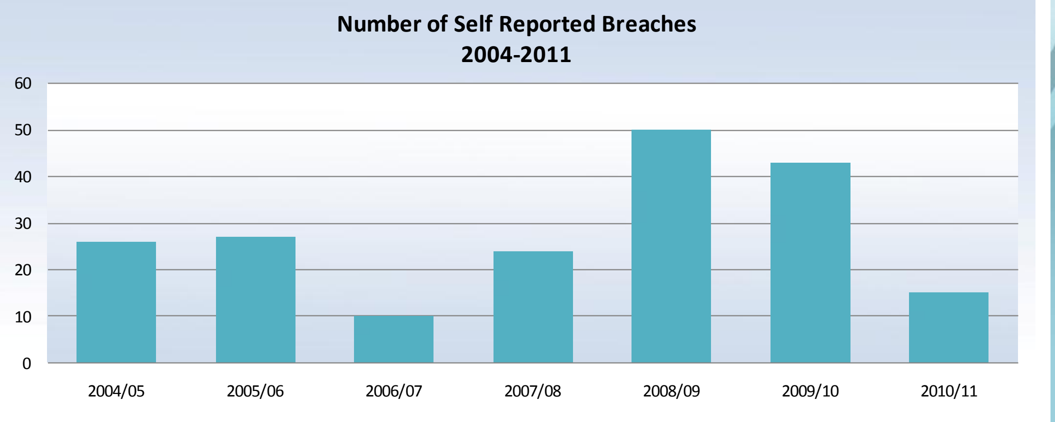
On 1st November 2010 we began publishing the weekly security of supply information on the website. This is also supported by a newsletter that 54 people are current subscribing to.

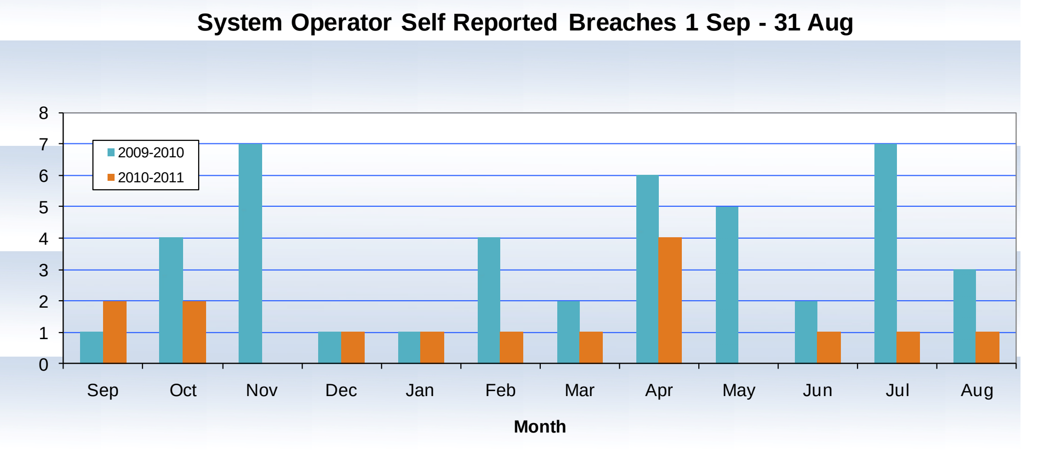
Appendix 5: Compliance

1. System Operator Self-Notified Breaches

The following graph and table represent breaches of the Code by the System Operator which it self-reported to the Electricity Authority during the period. The data is based on the reporting date of the breaches rather than the reporting date of the breaches.

1.1 By number of breaches



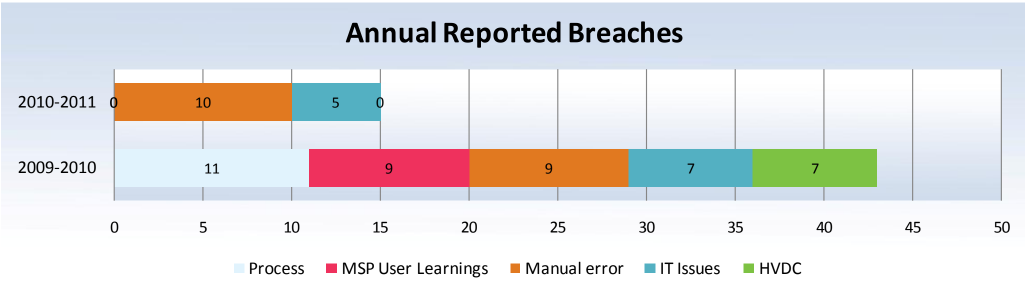


1.2 By Code

Code	2009-2010	2010-2011
Part 8 8.10	5	-
Part 8.70	-	1
Part 13 13.101 (1)(a)	-	2
Part 13 13.104	1	1
Part 13 13.105	3	2
Part 13 13.56	1	-
Part 13 13.62	1	1
Part 13 13.63	2	-
Part 13 13.71	1	-

Code	2009-2010	2010-2011
Part 13 13.72	2	-
Part 13 13.76	1	-
Part 13 13.87	-	1
Part 7 7.2 (1)(b)	1	-
Part 7 8.70	2	-
Policy Statement 32 .2	-	3
Schedule 13.3	23	4
Total	**43**	**15**

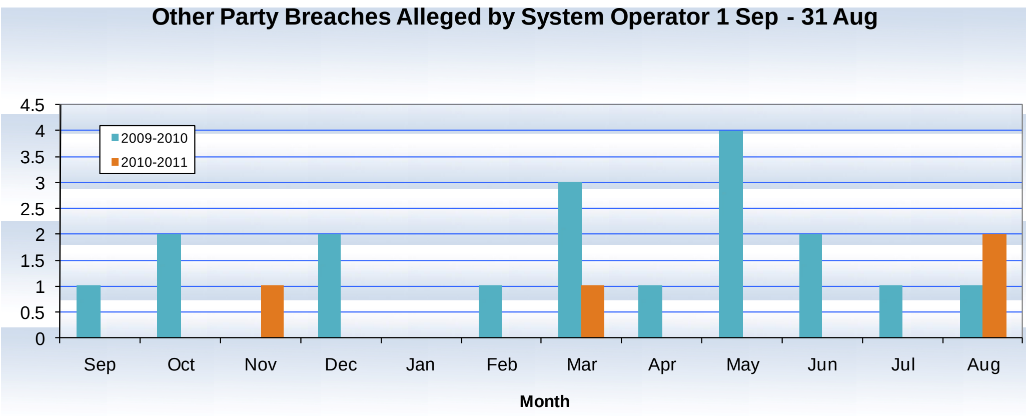
1.3 By error source



2. Alleged System Operator Breaches Reported by Other Parties (including the Electricity Commission)

There were three alleged System Operator breaches notified by other participants during the period (which had not been self-notified by the System Operator). All three alleged breaches were determined by the Electricity Authority not to be breaches by the System Operator.

3. Breaches Alleged by System Operator Against Other Participants



It is noted that there has been a significant reduction in breaches alleged by the System Operator against other participants during the reporting period. This is, at least in part, due to reduced real time visibility in the market system of generator's compliance with dispatch instructions for prior trading periods. The System Operator is currently looking at its ability to undertake post event analysis of generator non-compliance to address this issue.

APPENDIX 6: PROCUREMENT PLAN AND ANCILLARY SERVICES

1. 2010/2011 PROCUREMENT PLAN

The 2010/11 Procurement Plan came into effect on 1st December 2010. Tendering for ancillary services commenced on 8th October 2009 and was completed prior to the plan operative date. The major changes introduced in the plan were:

- changes to provide the System Operator with more flexibility in procuring ancillary services;
- recording the System Operator's intention to explore options regarding changes to data monitoring resolution requirements;
- providing for flexibility in the testing requirements for over frequency reserve.

2. 2011/12 PROCUREMENT PLAN

The System Operator decided to submit a "no-change" Procurement Plan to the Electricity Authority for the 2011/12 year, with the exception of any minor changes previously identified as being necessary to give effect to the changeover from the Electricity Governance Rules to the Code (for example, changing references from the Commission to the Authority), or were otherwise required to bring the plan up to date. Our rationale for this was:

- for at least the last couple of years, the processes under the plan have been accepted by the industry as largely stable and workable. As a result, the annual reviews of the plan have been a relatively straightforward and non-controversial exercise, with very few issues raised by participants.
- the System Operator had a significant workload planned for the year, with a large number of new industry initiatives being undertaken (of particular relevance, the review into under frequency reserve management, which has the potential to result in some substantive changes to the Procurement Plan for the future).

In preparing the draft, the System Operator consulted with all participants about the proposed approach and the content of the plan. The System Operator received one written submission, which suggested areas of future development for the procurement plan. With that participant's agreement, consideration of these issues was deferred until next year's review given that the changes were not considered urgent and this year's review had otherwise identified only non-substantive changes. We note that next year's review is likely to require consideration of more substantive issues given the number of relevant industry initiatives underway.

The System Operator submitted the 2010/11 draft Procurement Plan on 31st May 2011.

3. CONTRACTED ANCILLARY SERVICES

The following table summarises the contracted services as at 31st August 2011:

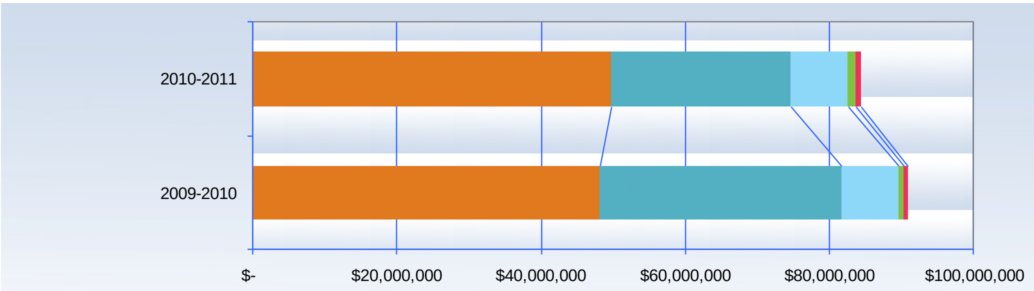
Ancillary Service Agent	(1)FK	(2)IR	(3)OFR	(4)BS	(5)VS
Contact Energy	√	√	√	√	√
CountiesPower		√			
Energy Response		√			
Genesis Power	√	√		√	
KCE Mangahao and Todd Mangahao		√	√		
Meridian Energy	√	√	√	√	
Mighty River Power	√	√	√	√	√
NZ Aluminium Smelters		√			
NZ Steel		√			
Nga Awa Purua			√		
Northpower		√			

Ancillary Service Agent	(1)FK	(2)IR	(3)OFR	(4)BS	(5)VS
Norske Skog		√			
Pan Pac		√			
Powerco		√			
TrustPower		√			
Tuaropaki (Mokai)			√		
Unison		√			
Vector		√			
WEL Networks		√			
Wellington Electricity Networks		√			
Winstone Pulp International		√			

(1) FK - Frequency Keeping
(2) IR - Instantaneous Reserves
(3) OFR - Over Frequency Reserve
(4) BS - Black Start
(5) VS - Voltage Support

4. ANCILLARY SERVICE PROCUREMENT COSTS

The total ancillary service costs for the period were $84,243,121, down from $90,790,400 the previous year. A breakdown of these costs is shown below.



	2009-2010	2010-2011
Frequency Keeping Costs	$48,204,732	$49,685,826
Instantaneous Reserve	$33,480,685	$24,910,335
Voltage Support (incl Events)	$7,956,499	$8,020,527
Over Frequency Reserve	$672,855	$1,089,020
Black Start	$475,629	$537,412

5. ANCILLARY SERVICE PROVIDER PERFORMANCE

5.1 INSTANTANEOUS RESERVES

There were only two under frequency events during the reporting period, one of which involved the tripping of IL. All IL providers performed as expected. The table below summarises the assessments carried out by the System Operator for the period 1st September 2010 to 31st August 2011.

Under Frequency Event Summary - Instantaneous Reserve Event Assessments							
Date	Time	Event Causer/ Site initiated at	Lowest Frequency (Hz) North Island	Lowest Frequency (Hz) South Island	MW Lost	Number of Dispatched IR Ancillary Service Agents (ASA)	Performers (and Non-Performers)
11/11/10	10:15	Contact (OTC)	49.17	49.35	211.8	17	No performance issues
09/04/11	22:34	Genesis (HLY U5)	49.21	49.43	124.2	5	No performance issues

5.2 FREQUENCY KEEPING RESERVES

The System Operator assesses the performance of frequency keeping ancillary services on a monthly basis on outcome-based performance criteria. Performance issues are identified and addressed directly with the ancillary service agent. Towards the end of the reporting period, the System Operator began to observe that the North Island frequency appeared to be experiencing a larger number of deviations than usual. The System Operator is currently investigating whether these deviations are arising as a result of issues with frequency keeping performance or are being caused by some other system issue.

5.3 BLACK START

The System Operator worked with Meridian Energy and New Zealand Aluminium Smelters (NZAS) in the first half of 2011 in preparation for a black start exercise at Manapouri, originally scheduled for late June. It was initially intended that this black start test would see an NZAS pot line "black started" from two Manapouri generators providing a more realistic test than has been possible in the past.

Unfortunately, technical issues identified through the System Operator's risk management processes meant that such a test was not able to be carried out at this time. However, a reduced black start test at Manapouri was successfully completed on 8th August 2011.

5.4 VOLTAGE SUPPORT

During the period 1st September 2009 to 31st August 2010 the System Operator dispatched contracted zone 1 voltage support on 3 occasions.

Appendix 7: Software
SYSTEM OPERATOR
TRANSPOWER NZ LTD

Appendix 7: Software Auditing

1. Software Auditing

The System Operator arranged the following audits of software to meet the requirements of 3.17 of the Code. All necessary audit certificates were provided to the Board.

1.1 Annual RMT and SPD Certification

The System Operator procured an audit of SPD and RMT by PA Consulting on 17th March 2011.

This audit opinion (noting that it was satisfactory) was the annual certification of RMT/SPD for the period of the review, as required in the SOSPA and under section 3.17 of the Code.

1.2 RMT

The System Operator sought an opinion (noting it was satisfactory) from the auditor (PA Consulting) in respect of RMT:

- on 8th September 2010, regarding:
  - A model change for Manapouri coming off TWD operation;
  - A model change for the Tokaanu units; and
  - A model change to North Island AUFLS.
- on 19th October 2010, regarding:
  - Two new wind farms being added to the electricity market at Te Uku near Raglan and at Mahinerangi near Waipori; and
  - Installation of new governors at Matahina
- on 29th March 2011, regarding
  - the upgrade of the Matlab engine of RMT to use the current version of Matlab and Simulink.
- on 8th April 2011, regarding:
  - changes to the modelling of the Atiamuri governors; and
  - inclusion of Mahinerangi Wind Farm's dispensation for tripping on under-frequency in the South Island model.
- on 31st May 2011, regarding:
  - Changes to the modelling of the Tokaanu governors tests carried out by Genesis Energy; and
  - Modelling Unit 2 at Aratiatia as an ungoverned unit.

1.3 SPD

The System Operator sought the following opinion (noting it was not required) from the auditor (PA Consulting) in respect of SPD:

- **SPD TP38_1_14**. Opinion sought for changes implemented in December 2010 to implement SFT. The auditor formed the opinion that because the changes do not affect the market functionality of SPD, no opinion was necessary.

APPENDIX 8: SOSPA

1. PEOPLE

The System Operator FTE's during the reporting period were:

	31/08/2010	31/08/2011	Change
General Manager	2.0	2.0	0.0
Risk & Performance	5.8	6.6	0.8
Development	7.0	6.8	-0.2
System Operations	40.4	40.4	0.0
Investigations	18.0	18.1	0.1
Operations Planning	18.4	18.4	0.0
Market Services	9.4	8.4	-1.0
Total	101.0	100.6	-0.4

2. BASE CONTRACT

Fees charged under the base SOSPA were as follows:

Financial review: SOSPA	**1st September 2010 – 31st August 2011**
System Operator Service Provider Contract Base Fee for the period 1st September 2010 – 30th June 2011	$24,746,400
System Operator Service Provider Contract Base Fee for the period 1st July 2011 – 31st August 2011	$4,979,715
Total fees paid under the SOSPA	$29,726,115

3. ADDITIONAL FEES

The following is a summary of the fees charged to the Electricity Authority for services in addition to those provided under the SOSPA.

Variable Revenue	**1st September 2010 – 31st August 2011**
TASC Advice	$753,865
Technical Investigations	$0
Total variable revenue	$753,865