

2010/11



TRANSPower



Contents

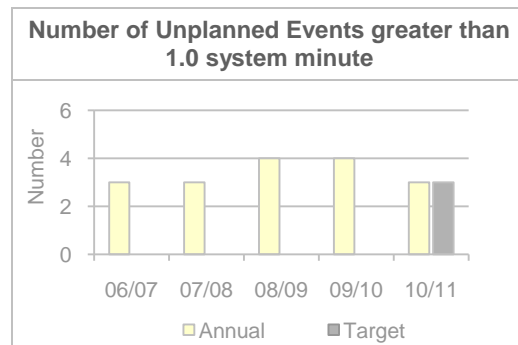
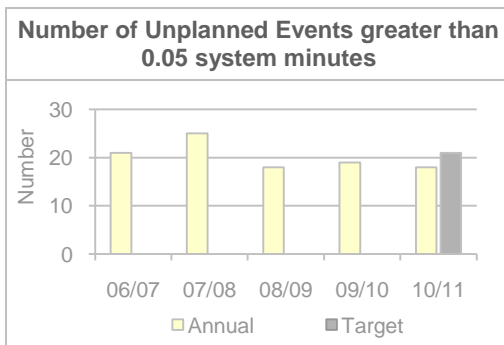
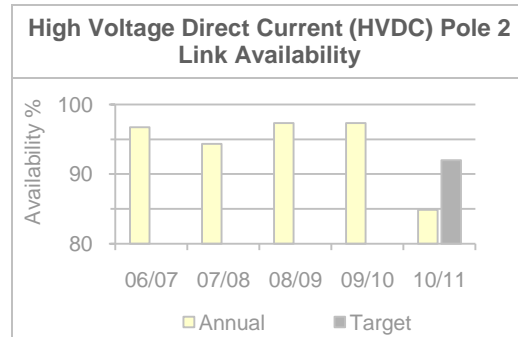
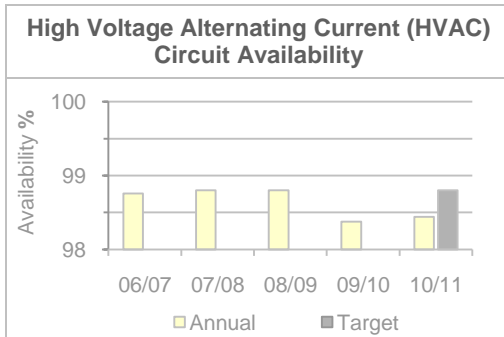
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Cover image: HVDC line clearance removal project. The 350 kV transmission line has been removed from the existing tower and placed on a temporary pole using a crane. The crew are preparing to remove the tower using a crane and will then place the new tower on new concrete foundations. The two linemen in the centre of the tower are removing the bolts to enable that section of the tower to be lifted free. All the work carried out is live line.

Highlights

Targets for HVAC and HVDC availability and unplanned events causing loss of supply as set out in the Transpower 2010/11 Statement of Corporate Intent and the actual performance for 2010/11 are summarised :-

	Actual	Target
High Voltage Alternating Current (HVAC) Circuit Availability¹	98.4%	98.8%
High Voltage Direct Current (HVDC) Link Availability		
- Pole 2	84.9%	92.0%
Number of loss of supply events greater than 0.05 System Minutes²	18	≤ 21
Number of loss of supply events greater than one System Minutes²	3	≤ 3
Operating Statistics		
Energy Injected into the Grid	39,985 GWh	
Energy Supplied from the Grid	38,470 GWh	
Energy Transferred by HVDC link (both directions)	2,629 GWh	
System Maximum Demand	6,570 MW	



¹ The definition of the HVAC availability target was revised in 2010/11 to exclude the "non-availability" of assets that are removed from service at the request of the system operator. The revised definition aligns with new Commerce Commission measures for regulatory monitoring of quality performance.

² From 2010/11, two new performance measures and targets replace the old measure for Supply Interruptions in system minutes. The measure for events greater than 0.05 system minutes includes the events greater than 1.0 system minutes.

From the Chief Executive

This is Transpower New Zealand Limited's 20th annual Quality Performance Report. It sets out operational performance data that enables Transpower's stakeholders to make an assessment of the company's performance against measures incorporated in the company's 2010/11 Statement of Corporate Intent.

As in previous years, the 2010/11 report details High Voltage Alternating Current (HVAC) and High Voltage Direct Current (HVDC) availability, performance at specific points of supply on the grid, and accounts for any significant losses of supply. The report also includes performance information that the company is required to disclose as per the Electricity Information Disclosure Requirements for the 12 months to 30 June 2011.

Although Transpower did not meet all of the performance measures set out in the 2010/11 Statement of Corporate Intent, the overall performance of the grid was very good. This year two new targets replaced the previous target for unplanned supply interruptions, and both of these new targets were met. There were 18 events greater than 0.05 system minutes compared to a target of less than or equal to 21, and there were three events greater than 1.0 system minute compared to the target of less than or equal to three. HVAC availability of 98.4% was below the target of 98.8% principally due to a number of 110 kV reconductoring projects being brought forward. HVDC Pole 2 has performed well, but operating restrictions related to reconductoring the north island section of the HVDC transmission line held the annual energy availability to 84.9% and the target of 92.0% was not met.

The number of interruptions and the total non-supply for the 2010/11 year has reduced markedly when compared to the previous three years. The Christchurch earthquakes in September 2010 and February 2011, to which the transmission system responded extremely well, caused two of the events over 1.0 system minute (5.3 system minutes in total). There was no interruption to supply from the Transpower network to the local networks following any of the other earthquakes and aftershocks. The third event over 1.0 system minute was caused by a flashover at the Glenbrook switchyard and was the result of bird activity (3.4 system minutes). Of the 18 events greater than 0.05 system minutes, four were caused by faults on the small 50 kV Te Kaha-Waiotahi circuit.

The total energy injected onto the grid during 2010/11 increased by 1.0 percent to 39,985 GWh compared to 39,576 GWh for the previous year. Most of this was due to an increase in the offtake at the Tiwai smelter, which has increased each year after a sustained period of load reduction during 2008/09. There has been almost no change in the total loads taken by distribution companies and direct connected customers for the last three years, although there have been load shifts within the country. The system peak load of 6570 MW was recorded at 6:00 pm on 09 August 2010, and was 0.4 percent lower than the peak of 6596 MW recorded for 2009/10. The system peak has consistently reduced over the last 4 years, in part because of Transpower's Regional Coincident Peak Demand³ initiative, but also because of the current economic climate.

South Island hydro generation was at a similar level to 2009/10 and the net energy transfer across the HVDC link from South to North was also at a similar level. A total of 2540 GWh was transmitted northwards across the link compared with the previous year's total of 2616 GWh, but southwards transfer was only 91 GWh compared to 150 GWh in 2009/10.

A wide range of initiatives is in progress to achieve sustained improvements in performance and reductions in interruptions. These include:

- Comprehensive review and improvement of Transpower's overall asset management framework, with an objective of achieving compliance with the internationally recognised BSI publication PAS55:2008 – *Asset Management*.
- Development of improved asset management information systems. A major programme is now underway to renew and enhance existing asset management information systems. The new systems will improve all aspects of the capture,

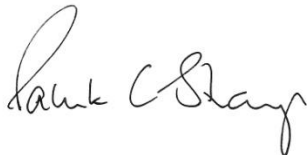
³ Refer to <http://www.ea.govt.nz/industry/transmission/transmission-pricing/transmission-pricing-methodology/>

storage, display and use of asset management information to support decision-making.

- Development of a formal Asset Risk Management system, and an Asset Health Index system to provide a high-level overview of asset condition and prioritise asset replacement programmes.
- Review of maintenance contracting arrangements. New contracts will be in place by mid-2012, with a strong focus on achieving greater consistency of practice, closer integration of the contractor workforce and improvements in organisational learning and continuous improvement.
- Enhancing contractor competency. Development of competency standards for maintenance contractors continues as additional competency requirements are identified. The remaining standards will be completed by December 2011. Curriculum materials are now available for a wide range of contractor skill areas and new and refresher training of the contractor workforce is underway. Training sites have been developed at Bunnythorpe and Western Road substations to provide realistic off-network training opportunities.
- Strategic replacement of ageing asset fleets. Fleet replacement plans are now in place to manage the increasing risks of equipment failure in the ageing grid. Some of these plans extend over 15-20 years.

International benchmarking is an important technique for evaluating the performance of the National Grid. Transpower participates in such benchmarking every two years, and a study for the year ended 30 June 2011 is underway.

The Quality Performance Report is an important element of Transpower's ongoing commitment to provide a comprehensive information base for customers and stakeholders. A range of other publications is available via www.transpower.co.nz including the Annual Report, Annual Planning Report, Asset Management Plan, System Security Forecast, and the Statement of Corporate Intent.



Patrick Strange / Chief Executive

1 Management and Operation of the Transpower System

The transmission assets owned and operated by Transpower are summarised below. The HVAC systems in the North and South Islands form an integrated system, joined by an HVDC link, and managed from two national control centres in Hamilton and Wellington, and three regional operating centres in Otahuhu, Haywards, and Islington.

The management of the system is facilitated by Transpower's communications network, which comprises ultra-high frequency (UHF) and microwave radio links, fibre optic links, and telephone networks supplemented by leased circuits.

Transpower contracts the grid's operational, maintenance and construction field work to specialist contractors. Transpower staff set and manage these contracts to strict standards.

Table 1: Transpower's Operational Power System Assets as at 30 June 2011

Asset	Specification
Length of HVAC and HVDC transmission lines	11,658 route-km
Number of substations (includes cable stations)	181
HVAC transmission line voltages – kV	220, 110, 66, 50, 33
HVDC transmission line voltages – kV	350, 270
HVDC link capacity	
- Pole 1 (for limited operation only)	270 MW
- Pole 2	700 MW
Length of each Cook Strait cable	40 km

2 Unplanned Interruptions to Supply

An important measure of Transpower's performance is the energy not supplied because of unplanned interruptions originating in the Transpower system. Transpower records interruptions to supply (i.e. non-supply of electricity, or power cuts) in system minutes. A system minute is defined as the energy in megawatt-minutes not supplied from the system to consumers divided by the system maximum demand in megawatts for the year in question. The system maximum demand figure for 2010/11 was 6570 MW.

An example to demonstrate the non-supply of one system minute would be to imagine Hamilton City (population approximately 134,000) losing supply during winter at peak demand (around dinnertime) for about 40 minutes.

In 2010/11, unplanned interruptions to supply originating in the Transpower system amounted to 11.6 system minutes. This is almost 50% lower than the 22.2 system minutes recorded for 2009/10.

In 2010/11, there were three significant unplanned events (events greater than 1.0 system minute). These were:

- Two significant events were caused by the Canterbury earthquakes in September 2010 and February 2011. During the earthquakes the transmission system responded extremely well, and damage was relatively minor. There was no interruption to supply from the Transpower network to the local networks following any of the other earthquakes or aftershocks.
- The third significant event was the result of a flashover on a 33 kV bus insulator in the outdoor switchyard supplying the Glenbrook steel mill. This substation is a high maintenance site mainly because of atmospheric pollution: this particular event was caused by bird droppings on an insulator. At the time of the fault in December 2010 Transpower was already progressing plans to convert this to an indoor substation, and this is scheduled for completion by late 2012.

Table 11 on page 32 lists the significant unplanned interruptions originating on the Transpower system since 1987.

Figure 1 shows performance in terms of the unplanned supply interruptions for the last six years. Events resulting in supply interruptions amounting to more than one system minute are categorised as significant, and the remainder are categorised as underlying.

Figure 2 shows monthly performance in terms of underlying unplanned supply interruptions for the 2010/11 year compared to the average of the previous five years. This wide monthly variation is to be expected given the relatively random nature of interruption-to-supply events. Interruptions are generally less frequent in the winter months when there are fewer circuit and transformer outages for maintenance.

Figure 3 illustrates both the number and impact of significant unplanned non-supply events for 2010/11 and the preceding five years.

Figure 4 shows the numbers of unplanned events greater than 0.05 system minutes for 2010/11 and the preceding five years. (This includes events greater than 1.0 system minutes.)

During 2010/11 there were 18 unplanned events resulting in greater than 0.05 system minutes. Of these 18 events, three were greater than 1.0 system minutes. These 18 events are listed in Table 2 (see page 7). There were a further 71 events that each resulted in less than 0.05 system minutes.

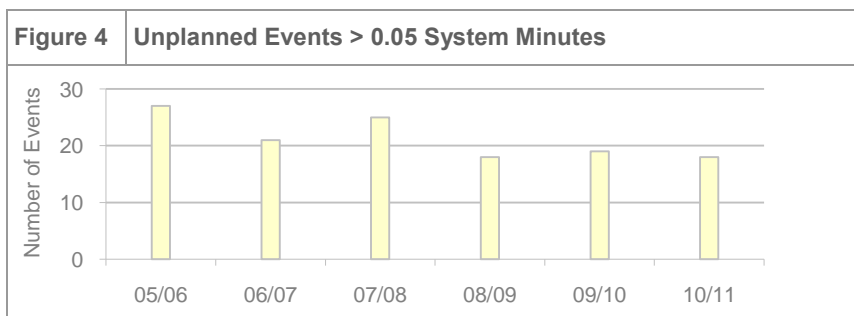
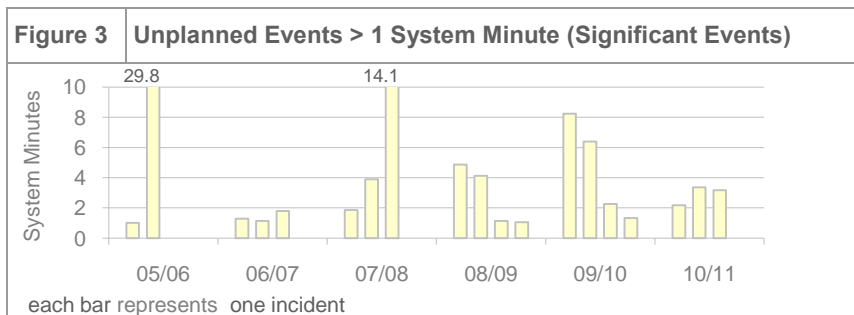
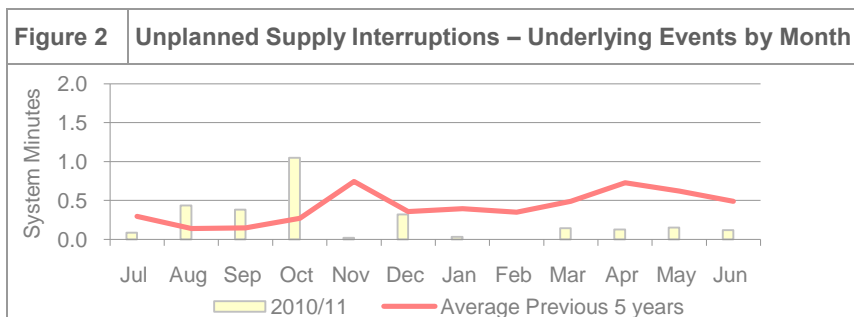
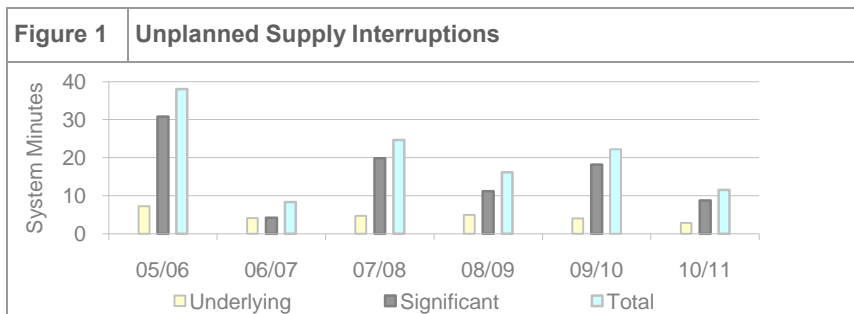


Table 2: Unplanned Events greater than 0.05 system minutes – 2010/11

Date	System Minutes	Event Description
16/07/10	0.08	Kinleith - Two 11kV supply transformers were inadvertently tripped by a protection technician
20/08/10	0.17	Te Awamutu - The Karapiro-Te Awamutu circuit tripped for a transient line fault.
20/08/10	0.20	Hawera - A bird strike caused a 33 kV bus fault
04/09/10	2.17	Papanui, Springston, Hororata - Several transformers and transmission circuits tripped during the earthquake.
16/09/10	0.24	Te Kaha - The Te Kaha-Waiotahi circuit tripped three times during a storm.
18/09/10	0.05	Hokitika, Greymouth, Kumara - The double circuits from Otira to Hokitika and Kumara tripped during strong winds.
27/10/10	0.63	Kinleith - Both Arapuni- Kinleith circuits tripped due to overloading.
30/10/10	0.40	Hinuera - The supply transformers tripped when a 33 kV circuit breaker exploded.
02/12/10	3.37	Glenbrook - A 33 kV bus fault was caused by bird droppings on a bus insulator.
19/12/10	0.05	Te Kaha - The Te Kaha-Waiotahi circuit tripped during strong winds and rain.
20/12/10	0.11	Te Kaha – During a storm, a landslip forced a tree onto the Te Kaha-Waiotahi circuit.
25/12/10	0.10	Carrington St. - The supply bus was tripped incorrectly by protection during a feeder fault.
28/12/10	0.06	Te Kaha - Te Kaha-Waiotahi circuit tripped three times during a storm.
22/02/11	3.16	Bromley - Two transformers tripped during a major earthquake.
29/03/11	0.08	Waiotahi - The Edgecumbe-Waiotahi circuit tripped for a transient line fault .
12/04/11	0.06	West Coast - The Atarau-Reefton-Inangahua circuit tripped for a transient fault during a planned outage of nearby equipment.
01/05/11	0.09	Albury, Tekapo A - The Albury-Timaru circuit and Tekapo generation tripped for a transient line fault.
08/06/11	0.05	Whirinaki - An 11 kV supply transformer was inadvertently tripped during switching.

3 Causes of Supply Interruptions

Table 3 gives an analysis of supply interruptions originating in the Transpower system for the last five years broken down into the following categories:

Unplanned

- Environment - lightning, storms, earthquakes, high wind, snow, ice, tree contact, bird contact or fouling, etc.
- Equipment related – caused by inadequate design, installation, or maintenance, or by ageing/wear and tear.
- Human – initiated by an action by Transpower staff or contractors (although inadequate design or other factors may be an underlying cause).
- Not known. (Mainly transient line faults with no positive cause or evidence found.)
- Miscellaneous – unplanned causes not covered by the above and including non-Transpower human interference.

Planned

- Planned - outages planned for maintenance, replacement or refurbishment, as well as for new construction.

The interruptions are measured in system minutes and are categorised as being significant or underlying events. Significant events are those resulting in more than 1.0 system minute, and underlying events are the remainder.

Interruptions to supply that resulted when Transpower equipment tripped but the cause was attributed to connected customers are excluded from Table 3.

The data in Table 3 is presented graphically in Figure 5, Figure 6 and Figure 7.

Table 3: Causes of Supply Interruptions

Cause of Interruption	Annual Performance (System Minutes)					Significant Events (System Minutes)					Underlying Events (System Minutes)				
	06/07	07/08	08/09	09/10	10/11	06/07	07/08	08/09	09/10	10/11	06/07	07/08	08/09	09/10	10/11
TP Unplanned															
Environment	1.0	1.1	0.9	3.4	10.0*	0.0	0.0	0.0	2.3	8.7*	1.0	1.1	0.9	1.1	1.3
Equipment	3.4	22.4	10.4	6.8	0.2	1.3	19.9	9.0	6.4		2.1	2.5	1.4	0.5	0.2
Human	3.2	0.9	3.8	3.2	0.3	2.9	0.0	2.2	1.3	0.0	0.3	0.9	1.6	1.8	0.3
Miscellaneous	0.0	0.0	0.0	8.2	0.7	0.0			8.2		0.0	0.0	0.0	0.0	0.7
Not Known	0.7	0.2	1.0	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.7	0.2	1.0	0.6	0.4
Total	8.4	24.6	16.1	22.2	11.6	4.2	19.9	11.2	18.2	8.7	4.1	4.7	4.9	4.0	2.9
TP Planned	3.3	3.3	2.0	1.2	3.6	1.0	1.3	1.0	0.0	2.5	2.2	2.1	0.9	1.2	1.1
Total Transpower	11.6	28.0	18.1	23.5	15.2	5.3	21.1	12.2	18.2	11.2	6.4	6.8	5.9	5.3	4.0

Notes Minor differences between totals and breakdowns are due to rounding.

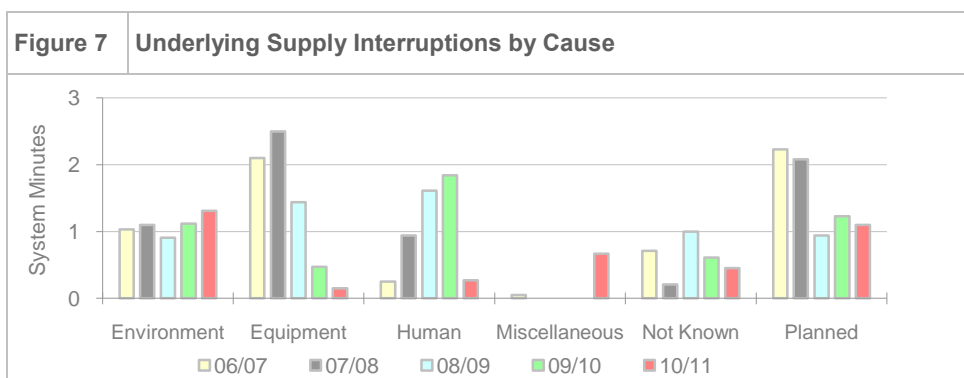
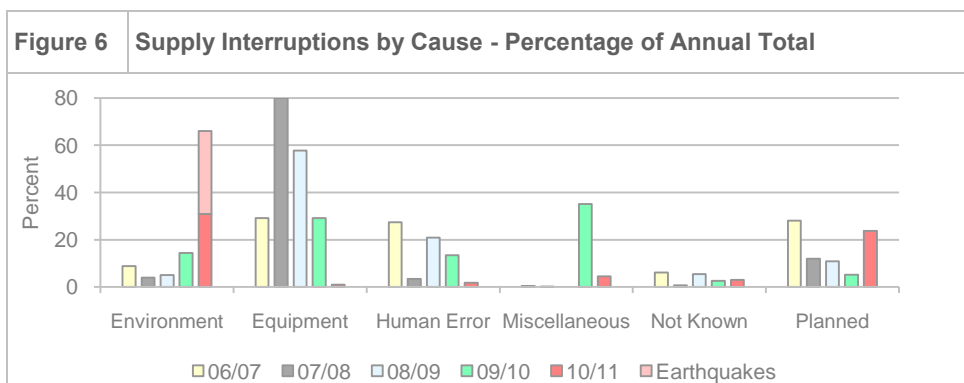
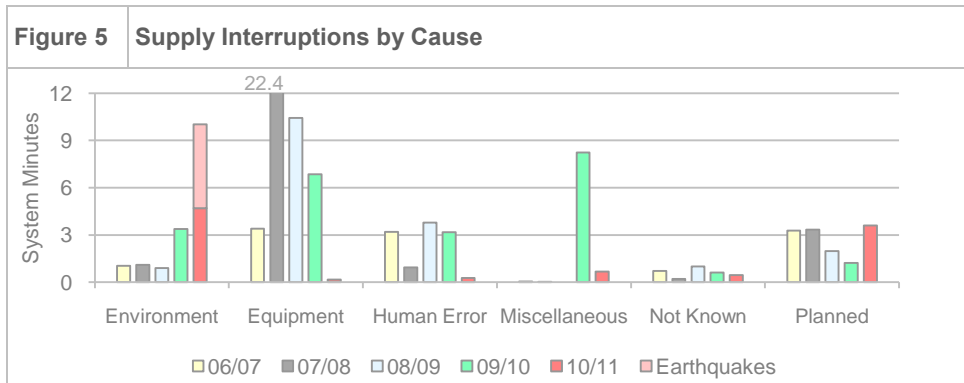
* Includes 5.4 system minutes for two events caused by Christchurch earthquakes, and 3.4 system minutes resulting from the Glenbrook bus fault.

Figure 5 shows the system minutes of non-supply by cause for each of the last five years.

The Canterbury earthquakes and the Glenbrook bus fault dominated supply interruptions in 2010/11. These all appear in the category 'environment'.

Figure 6 shows the same data as percentages of the total annual system minutes of non-supply in Figure 5.

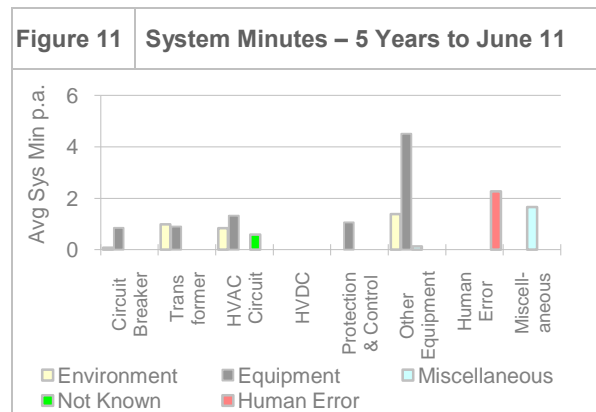
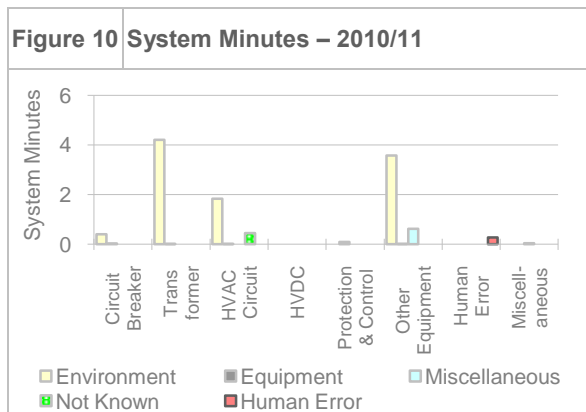
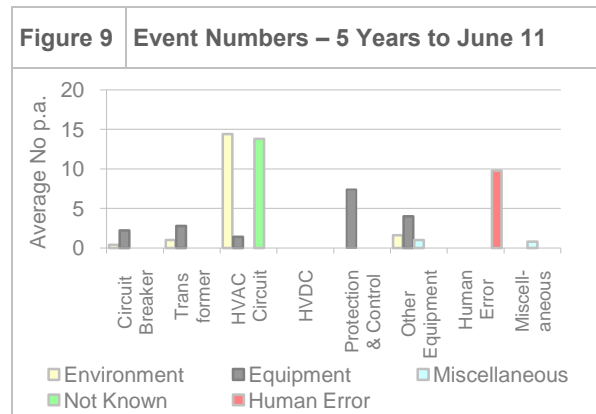
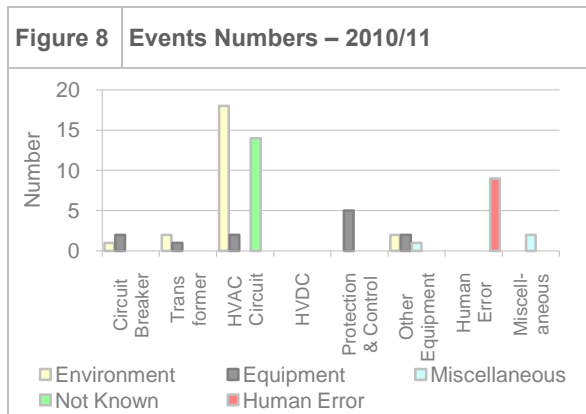
Figure 7 shows the causes of underlying supply interruptions for the last five years. In this graph significant interruptions (greater than one system minute) have been excluded.



4 Unplanned Supply Interruptions by Source and Cause

Figures 8 to 11 provide a further breakdown that takes into account the source (i.e. the item of equipment or initiating agent) of the non-supply event as well as the cause. Note that one event may involve several interruptions; for example, a circuit fault on the Coleridge-Otira circuits caused interruptions at five different points of supply.

Figure 8 shows the numbers of events causing interruptions in 2010/11 and Figure 9 shows the five-year average number of events. Figure 10 and Figure 11 show a similar analysis for the system minutes of non-supply.



The following paragraphs provide brief summaries of performance grouped by the source of the non-supply events - circuit breakers, transformers, HVAC circuits, HVDC link, protection and control, other equipment, human element events and miscellaneous.

Circuit Breakers

There were three events caused by circuit breaker faults in 2010/11. The largest of these was at Hinuera when a 33 kV CB exploded probably because of bird borne debris, resulting in 0.4 system minutes of non-supply.

Transformers

Two of the three transformer related interruptions were the result of transformers tripping during the Canterbury earthquakes. These two were events greater than one system minute.

HVAC Circuits

Generally, outages due to environmental causes dominate circuit performance; the most usual reason being lightning or suspecting lightning, although snow and high winds cause a number of outages. Outages categorised as "not known" are usually transient faults that

cause a circuit to trip but for which no positive cause or evidence has been found. These may be caused by environmental factors, or possibly by faulty hardware causing intermittent faults.

The number of events caused by transmission line faults in 2010/11 was a little higher than the five-year average. The circuit causing the largest number of events was the Te Kaha-Waiotahi circuit, which caused 18 out of 34 lines-related loss of supply events.

The largest single event in this category was a tripping of the Karapiro-Te Awamutu circuit, which caused 0.17 system minutes of non-supply, but the multiple events on the Te Kaha-Waiotahi circuit totalled almost 0.6 system minutes.

HVDC Link

In the last five years there has been only one event originating on the HVDC link which caused supply interruptions (other than to interruptible load). There were no events during 2010/11.

Protection and Control

This category includes interruptions caused by equipment faults on protection, SCADA, and control equipment. The most common causes of events in this category are protection and SCADA mal-operations.

The number of non-supply events in this group in 2010/11 is lower than the five-year average for this group, and the system minutes not supplied was also much lower than the five-year average.

Other Equipment

The "Other Equipment" category includes interruptions caused by faults on other equipment not included in the categories above, for example, disconnectors, current transformers, and bus work. The most common causes of events in this category are bus insulator and bus connector faults and disconnector problems.

The number of events in this category was a little lower than the five-year average, and the system minutes not supplied was also lower than the five-year average. The largest event in 2010/11 was a 33 kV bus fault at Glenbrook caused by an insulator flashover that resulted in 3.4 system minutes of non-supply.

Human Error Incidents

"Human Error Incidents" are those caused by Transpower staff and contractors in the course of operating, maintaining, and developing the grid. Events caused by external parties, including the public, are included in the miscellaneous category.

For 2010/11, the number of Transpower human error incidents was only slightly below the five-year average, but the non-supply from this cause was much lower.

The largest event in this category in 2010/11 was the result of a protection setting error that resulted in both supply banks at Carrington St tripping for a feeder fault. This caused 0.1 system minutes of non-supply.

Miscellaneous

This category covers a range of events including interference by third parties. In 2010/11 there were two minor events totalling 0.04 system minutes. The five-year average is dominated by the tripping of the Henderson-Otahuhu circuit in 2009/10 when a container hoist contacted the blue phase conductor causing widespread interruptions in Auckland and Northland.

5 Unplanned Interruptions to Generator Connections

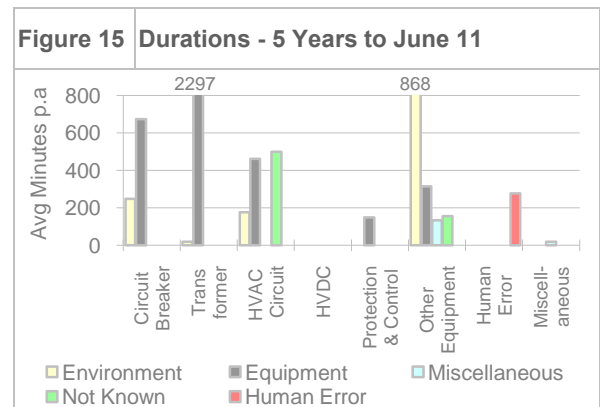
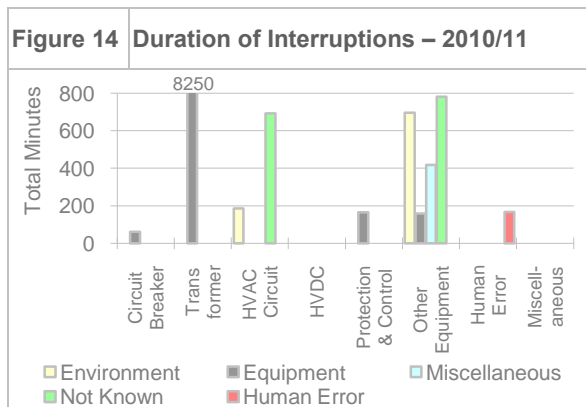
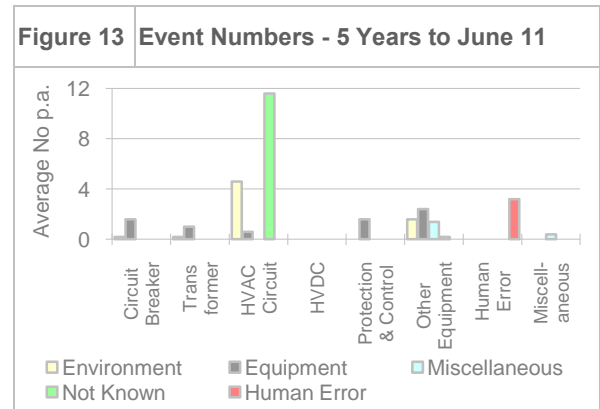
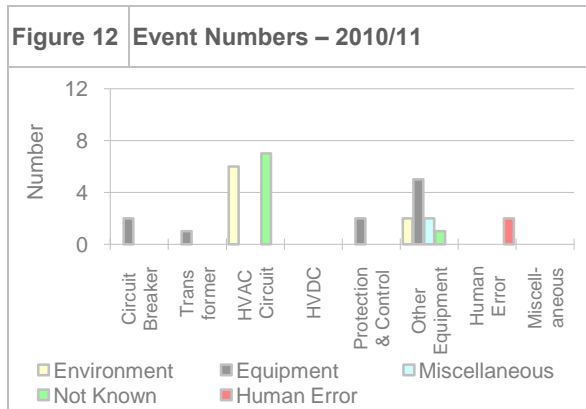
This section summarises the performance of the Transpower assets connecting generator customers to the grid. Generally, interruptions to generators do not result in interruptions to end-consumers except for possibly some load management such as water heating switching.

Figures 12 to 15 provide a summary of the unplanned interruptions to direct connected generators by equipment type and cause. The categories used are the same as those used for Figures 8 to 11.

Figure 12 and Figure 13 show the numbers of events causing unplanned interruptions to connection for direct connected generators for the 2010/11 year, and the five-year average respectively. The figures show that in 2010/11 events due to HVAC circuit trippings decreased and the numbers due to 'Other' equipment have increased. The numbers in the other categories are similar to the five-year average.

Half of the HVAC circuit events involved the Balclutha-Halfway Bush circuit, which suffered from a number of transient faults for which the cause was not found. This circuit provides an N-security connection to the generator at Berwick, so a line fault always results in an interruption.

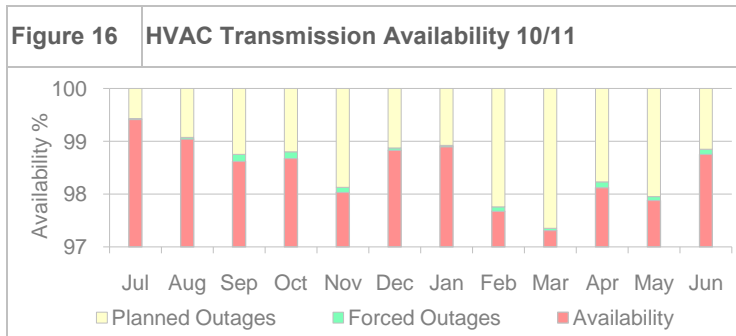
Figure 14 and Figure 15 show the total duration in minutes for unplanned interruptions to connection for direct connected generators. The total duration for 2010/11 is substantially higher than the five-year average. However one outage of a 220/16 kV transformer at Benmore accounted for the long duration for transformers in 2010/11. Two separate bus faults at Maraetai caused by bird droppings resulted in a total of 696 minutes of interruptions at Maraetai and Waipapa, and a problem closing a circuit breaker at Huntly caused a generator interruption of 781 minutes; these are shown in the 'Other' equipment category.



6 HVAC Transmission Performance

HVAC Transmission Circuit Availability

Figure 16 shows the monthly HVAC transmission circuit availability for 2010/11. The overall availability of HVAC circuits after allowing for forced⁴ and planned outages⁵ was 98.4 percent, and was below the target of 98.8 percent. This was primarily due to a number of line reconductoring projects that required outages lasting several months.

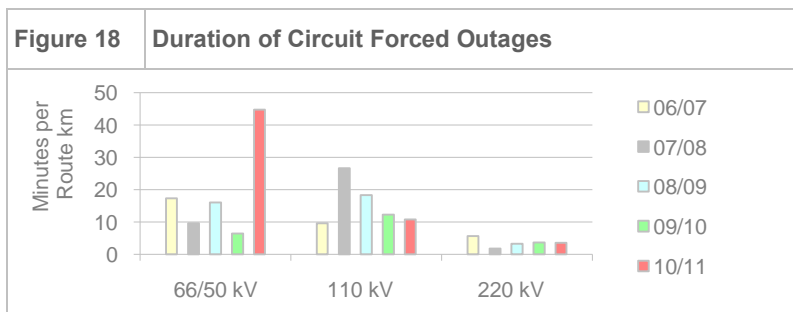
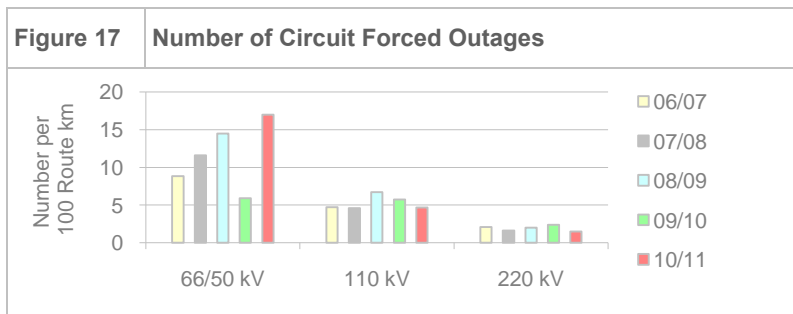


Circuit Forced Outages

Figure 17 and Figure 18 summarise all circuit forced outages for any reason including faults on other equipment.

Figure 17 shows the total number of forced outages per 100 route-km by voltage. The number of circuit forced outages in 2010/11 was lower than in 2009/10 for the 220 kV and 110 kV groups, but there was a large increase in the number for the 66/50 kV group.

Figure 18 shows HVAC circuit performance measured by outage duration per route-km. Generally, performance has been improved, except for the 66/50 kV group which is dominated by the 70 forced outages of the Te Kaha Waiotahi circuit.



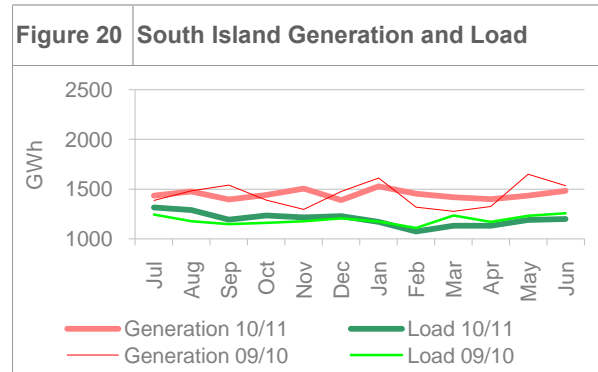
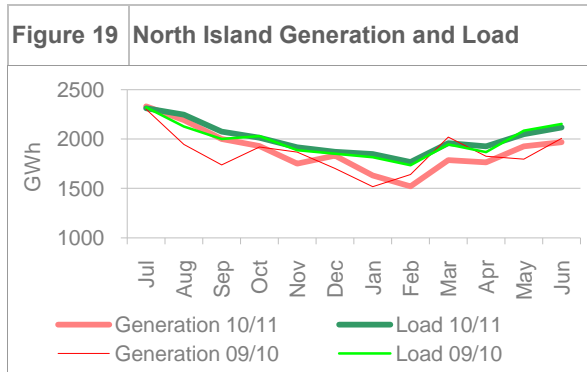
⁴ The term "forced" is generally used in relation to HVAC transmission circuit performance reporting. In the context of this report it is equivalent to the term "unplanned" used for system minute interruptions. This includes outages caused by both protection operations and manual intervention.

⁵ An outage is the removal from service of a transmission asset. An outage does not necessarily result in an interruption to a customer, depending on whether the asset is the only connection between a customer and the grid, or one of a number of parallel paths.

7 Transmission System Utilisation

HVAC System Utilisation

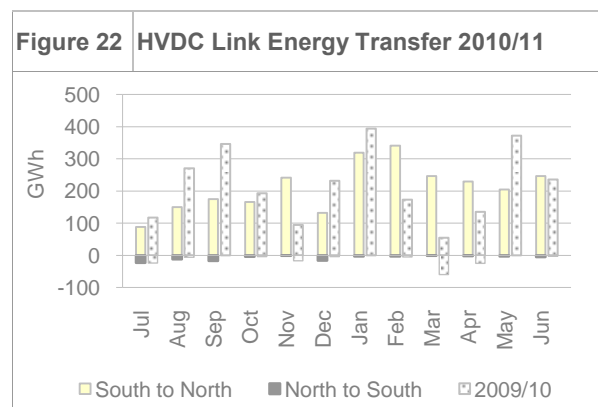
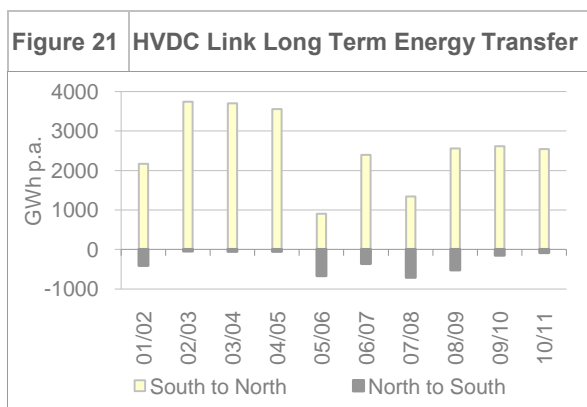
Figure 19 and Figure 20 show monthly North Island and South Island generation and load for 2010/11 and for comparison the previous year's generation and load. South Island generation onto the grid for 2010/11 was 65 GWh or 0.4 percent higher than for 2009/10. North Island generation onto the grid increased by 1.5 percent or 344 GWh.



HVDC Utilisation

The net northward HVDC transfer reduced slightly in comparison to 2009/10. The northwards HVDC transfer for 2010/11 was 2540 GWh (sent from Benmore) compared to 2616 GWh in 2009/10 (Figure 21). The southwards energy transfer decreased from 150 GWh in 2009/10 to 91 GWh in 2010/11. The highest northwards transfers were in January 2011 and February 2011, and the highest southwards transfers were in July 2011 (Figure 22).

HVDC Pole 1 was stood down in September 2007 and was available only in a limited mode during 2010/11. The average utilisation of HVDC Pole 2 for 2010/11 was 42.9 percent, based on 700 MW capacity. Net northwards HVDC link transfers contributed 9.8 percent of the total energy supplied into the North Island grid for the year; almost the same as the 10.0 percent in 2009/10.



8 HVDC Link Availability⁶

Pole 1

Pole 1 was stood down in September 2007 to remove the risk of an in-service failure, and half of the equipment was decommissioned and removed. The remaining half can be made available and is used for limited periods of operation with restricted operating conditions.

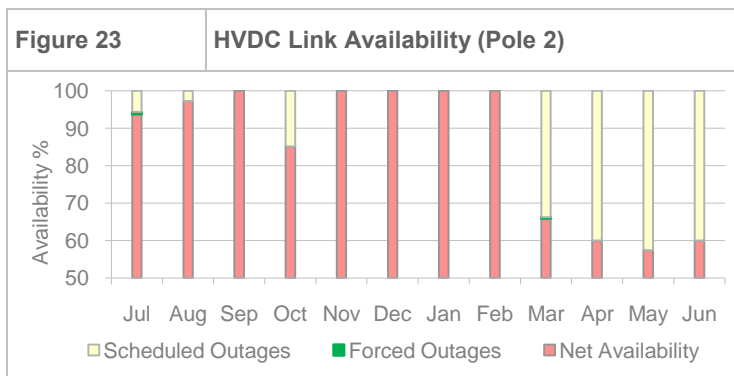
Pole 2

The availability of Pole 2 in 2010/11 was 84.9 percent and was significantly below the target of 92.0 percent. This was because the capacity of Pole 2 was limited to 60% of normal capacity during the reconductoring of the Haywards-Oteranga Bay section of the HVDC line. This work was co-ordinated with the HVDC Pole 3 project and took place between March and September 2011. This reduced the energy availability by 40% for almost four months.

Aside from this restriction, Pole 2 performed very well during the year and Forced Unavailability for the year was only 0.09 percent (0.32 percent in 2009/10). Pole 2 had two forced outages during 2010/11. These were:

- In July 2010 Pole 2 tripped due to a faulty protection card. Pole 2 was unavailable for 4 hours 50 minutes.
- In March 2011 the converter transformer at Benmore had a tap-changer out-of-step alarm, which required a Pole 2 forced outage to correct. This second outage lasted 2 hours 44 minutes.

HVDC Pole 2 monthly availability is shown in Figure 23.



⁶ The term "availability", in relation to HVDC link performance follows the definition of "Energy Availability" used by CIGRE Study Committee 14 Protocol for Reporting the Operational Performance of HVDC Transmission Systems.

9 International Comparison of Transmission Performance

Every two years Transpower participates in an international comparison of performance that covers the operation and maintenance of assets operating at 60 kV and above.

The 2009 study involved 27 transmission utilities from North America, Europe, Asia, Middle East, Australia, and New Zealand. International benchmarking provides the opportunity to compare Transpower's performance with some of the world's best and, more importantly, to identify opportunities for improvement.

As a result of the 2009 benchmarking study and other analyses, Transpower initiated a number of projects to address performance problem areas including the following:

- Increased emphasis on the early detection and remediation of SF₆ leaks on circuit breakers
- Earlier replacement of circuit breakers with known generic problems resulting in frequent SF₆ leaks or mechanical issues
- Installing, or enabling already installed, automatic reclosing of transmission circuits after transient faults on circuits without this facility
- Increased emphasis on preventing technician human error events

The initiatives set out on Pages 3 and 4 of this report are also expected to result in improvements over time to Transpower's benchmarking results.

Transpower is again participating in an international comparison of transmission performance for the year 2010/11. The results of this comparison will be available early in 2012 and are planned to be published in the 2011/12 Quality Performance Report.

10 Supply Performance Summary

Eighty-nine unplanned supply interruptions originated on the Transpower system during 2010/11. This compares to 106 during 2009/10. Figure 24 shows the number and duration of these unplanned interruptions.

The interruption durations are grouped into five-minute blocks, up to a maximum of 176-180 minutes, which for 2010/11 covers 83 percent of interruptions to supply. A further 17 percent (15 interruptions) are aggregated in the >180 group at the right of the graph.

In Figure 24 the vertical bar indicates the spread of results, from the maximum value to the minimum value, over the period July 2006 to June 2011, with the average value indicated. The 2010/11 and 2009/10 results are shown as line graphs.

Interruptions with durations up to approximately 30 minutes are generally those that can be restored remotely, while those of longer durations are typically those that require an operator to attend or where investigations or remedial action is required before equipment is restored.

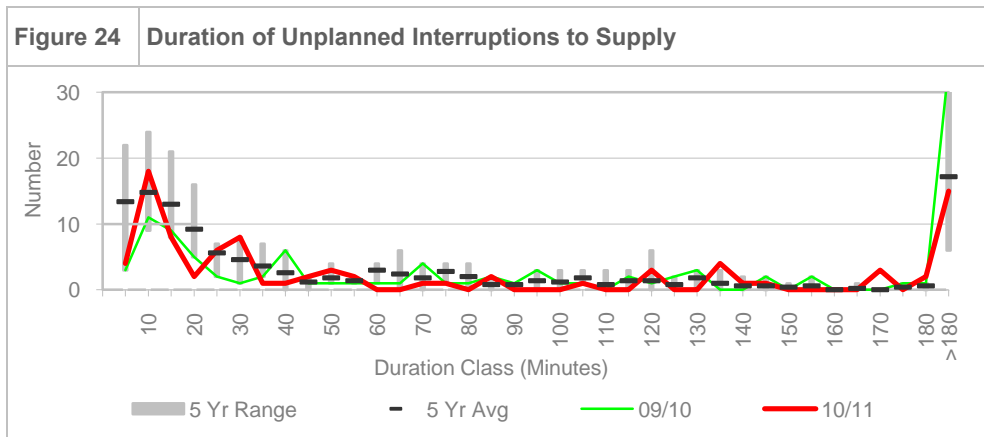
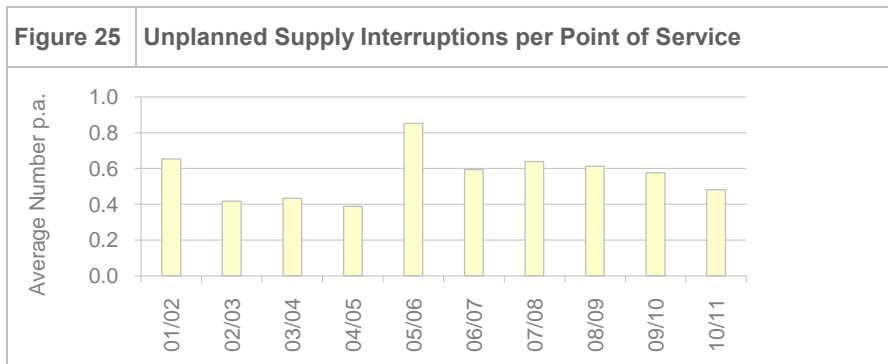


Figure 25 shows the average number of unplanned supply interruptions per point of service⁷ for the last ten years. In 2010/11 there was an average of 0.48 interruptions per point of service. This compares favourably with the performance over the previous five years, which peaked at 0.85 in 2005/06.



11 Point of Service Performance

The tables and graph on the following pages summarise performance at individual points of service⁷. These measures indicate the impact on service of Transpower-caused unplanned interruptions. These include both partial and full interruptions to connection due to a fault or human interference. The measures are aggregated at each point of service, but include interruptions originating anywhere on the Transpower system up to the point of connection⁸. The tables cover points of service for both supply customers and direct-connected generator customers. The points of service listed are those in service as at 30 June 2011.

Supply Customers

Tables 4 to 7 summarise unplanned interruptions to supply originating in the Transpower system including interference caused by the public. The tables show the number of interruptions, and the unserved energy expressed as a percentage of the total energy that would have been supplied during the year had there not been any supply interruptions.

Data is shown separately for each supply voltage at the station of supply. If two customers are supplied from a station at the same voltage then these are shown separately as Station (A) and Station (B). Tables 4 and 5 present the data for the North Island sorted both alphabetically, and by five-year⁹ average unserved energy, and Tables 6 and 7 for the South Island.

Figure 26 on page 23 shows five year average annual unserved energy resulting from unplanned interruptions for each point of service as a function of the five year average annual off-take at the point of service.

Generator Customers

For direct-connected generator customers, the point of service performance is shown in Tables 8 and 9 as the number of unplanned interruptions to service caused by forced outages and the duration in minutes of the interruptions. The data is shown sorted both alphabetically and by five-year⁹ average annual duration.

⁷ Point of service is a supply bus where a customer takes service from Transpower.

⁸ Point of connection is a point where customer assets are connected to Transpower assets. One point of service will have one or more points of connection.

⁹ For points of service that have not been in service for five years, the figure given is the average for the number of years (or part years) in service.

Point of Service Performance - Supply

Table 4: North Island Supply Points of Service – Unplanned Interruptions (listed alphabetically)

Point of Service	09/10 Number	10/11 Number	09/10 Unserved Energy % x100	10/11 Unserved Energy % x100	5 Yr Average Number	5 Yr Avg. Unserved Energy % x100	Point of Service	09/10 Number	10/11 Number	09/10 Unserved Energy % x100	10/11 Unserved Energy % x100	5 Yr Average Number	5 Yr Avg. Unserved Energy % x100
Albany 110 kV	2	0	3.06	0.00	0.4	0.61	Melling 33 kV	0	0	0.00	0.00	0.0	0.00
Albany 33 kV	2	0	2.41	0.00	0.4	0.48	Meremere	1	0	0.64	0.00	0.8	1.79
Bombay 110 kV	1	0	0.72	0.00	0.2	0.14	Motunui	0	0	0.00	0.00	0.2	0.20
Bombay 33 kV	1	0	1.30	0.00	0.6	1.41	Mt Maunganui 33 kV	1	0	0.86	0.00	0.4	0.41
Bream Bay	2	0	0.79	0.00	0.4	0.16	Mt Roskill 110 kV	1	0	0.34	0.00	0.2	0.07
Brunswick	0	0	0.00	0.00	0.0	0.00	Mt Roskill 22 kV	1	0	0.67	0.00	0.2	0.13
Bunnythorpe 33 kV	0	0	0.00	0.00	0.0	0.00	National Park	0	2	0.00	1.27	1.6	1.58
Bunnythorpe 55 kV	0	0	0.00	0.00	0.0	0.00	New Plymouth 33 kV	-	0	-	0.00	0.0	0.00
Cambridge	0	0	0.00	0.00	0.0	0.00	Ohaaki	0	2	0.00	1.43	1.4	0.73
Carrington St	1	1	0.22	0.42	0.4	0.13	Ohakune (A)	0	0	0.00	0.00	0.4	0.35
Central Park 11 kV	1	0	1.59	0.00	0.4	0.37	Ohakune (B)	0	0	0.00	0.00	0.4	0.46
Central Park 33 kV	1	0	1.41	0.00	0.4	0.48	Ongarue	0	0	0.00	0.00	0.6	2.96
Dannevirke	0	1	0.00	0.07	0.6	0.45	Opunake	0	1	0.00	0.49	0.2	0.10
Dargaville	2	0	5.34	0.00	0.4	1.07	Otahuhu 22 kV (A)	1	0	1.14	0.00	0.8	1.07
Edgecumbe	0	0	0.00	0.00	0.0	0.00	Owhata	0	0	0.00	0.00	0.4	1.77
Fernhill	0	0	0.00	0.00	0.0	0.00	Pakuranga	1	0	0.69	0.00	0.2	0.14
Gisborne	0	0	0.00	0.00	0.0	0.00	Paraparumu	0	0	0.00	0.00	0.4	0.56
Glenbrook (A)	1	0	3.03	0.00	0.2	0.61	Pauatahanui	0	0	0.00	0.00	0.6	0.78
Glenbrook (B)	1	2	0.82	5.16	1.0	1.80	Penrose 110 kV	1	0	0.43	0.00	0.2	0.09
Gracefield	1	0	0.23	0.00	0.2	0.05	Penrose 22 kV	1	0	0.55	0.00	0.4	0.65
Greytown	0	0	0.00	0.00	0.2	0.01	Penrose 33 kV (A)	1	0	0.70	0.00	0.4	0.71
Hamilton 11 kV	0	0	0.00	0.00	0.0	0.00	Penrose 33 kV (B)	0	0	0.00	0.00	0.2	0.00
Hamilton 33 kV	0	0	0.00	0.00	0.0	0.00	Redclyffe	0	0	0.00	0.00	0.0	0.00
Hamilton 55 kV	0	0	0.00	0.00	0.0	0.00	Rotorua 11 kV	1	0	0.02	0.00	0.2	0.00
Hangatiki	1	0	1.74	0.00	0.4	0.60	Rotorua 33 kV	0	0	0.00	0.00	0.0	0.00
Hawera (A)	0	1	0.00	1.35	0.6	0.68	Silverdale	2	0	2.89	0.00	1.2	0.78
Hawera (B)	0	0	0.00	0.00	0.0	0.00	Stratford	0	0	0.00	0.00	0.0	0.00
Haywards 11 kV	0	0	0.00	0.00	0.2	0.24	Takanini	1	0	0.52	0.00	0.2	0.10
Haywards 33 kV	0	0	0.00	0.00	0.0	0.00	Takapu Road	0	0	0.00	0.00	0.2	0.27
Henderson	2	0	1.24	0.00	0.4	0.25	Tangiwai 11 kV	0	0	0.00	0.00	0.2	0.08
Hepburn Road	2	0	3.40	0.00	0.4	0.68	Tangiwai 55 kV	0	0	0.00	0.00	0.0	0.00
Hinuera	0	1	0.00	2.15	0.6	0.48	Tarukenga	0	0	0.00	0.00	0.0	0.00
Huirangi	0	1	0.00	0.31	0.2	0.06	Tauramarunui	4	0	0.79	0.00	3.4	1.03
Huntly	0	0	0.00	0.00	0.0	0.00	Tauranga 11 kV	0	0	0.00	0.00	0.2	0.20
Kaikohe	2	0	10.0	0.00	0.4	2.01	Tauranga 33 kV	0	0	0.00	0.00	0.2	0.39
Kaitaia	4	0	11.1	0.00	0.8	2.23	Te Awamutu	4	2	8.98	1.20	2.6	2.89
Kaitimako	0	0	0.00	0.00	0.0	0.00	Te Kaha	9	26	6.54	114.	13.	36.8
Kaiwharawhara	1	0	1.69	0.00	0.8	0.67	Te Kowhai	0	0	0.00	0.00	0.0	0.00
Kawerau (A)	0	0	0.00	0.00	0.2	0.01	Te Matai	0	0	0.00	0.00	0.6	0.21
Kawerau (B)	1	0	2.60	0.00	0.6	4.00	Tokaanu (A)	0	0	0.00	0.00	0.2	0.28
Kensington	2	0	4.55	0.00	0.4	0.91	Tuai	1	3	0.50	1.33	1.4	1.80
Kinleith 11 kV (A)	0	2	0.00	0.81	0.8	0.76	Upper Hutt	0	0	0.00	0.00	0.0	0.00
Kinleith 11 kV (B)	0	1	0.00	1.22	0.4	1.00	Waihou	2	0	0.45	0.00	1.0	0.13
Kinleith 33 kV	1	1	0.44	2.95	1.0	1.50	Waikino	0	0	0.00	0.00	0.0	0.00
Kopu	0	0	0.00	0.00	0.0	0.00	Waiotahi	0	1	0.00	1.86	0.4	0.70
Lichfield	0	0	0.00	0.00	0.2	0.44	Waipawa 33 & 11 kV	0	1	0.00	0.14	1.0	0.48
Linton	0	0	0.00	0.00	0.0	0.00	Wairakei	0	0	0.00	0.00	0.0	0.00
Mangahao	0	0	0.00	0.00	0.2	0.49	Wairoa	1	0	0.07	0.00	0.2	0.01
Mangamaire	0	0	0.00	0.00	0.0	0.00	Wanganui	0	0	0.00	0.00	0.0	0.00
Mangere 110 kV	1	0	0.21	0.00	0.2	0.04	Waverley	0	1	0.00	1.46	0.2	0.29
Mangere 33 kV	1	0	0.61	0.00	0.2	0.12	Wellsford	1	0	3.42	0.00	0.2	0.68
Marton	0	0	0.00	0.00	0.0	0.00	Whakatu	0	0	0.00	0.00	0.2	0.04
Masterton	0	0	0.00	0.00	0.2	0.30	Whirinaki	1	1	0.25	0.11	0.8	2.52
Mataroa	0	0	0.00	0.00	0.4	0.48	Wilton	0	0	0.00	0.00	0.2	0.10
Maungatapere	2	0	3.74	0.00	0.6	0.82	Wiri	1	0	0.69	0.00	0.6	0.20
Maungaturoto	2	0	5.98	0.00	0.4	1.20	Woodville	0	0	0.00	0.00	0.8	1.91
Melling 11kV	1	0	0.14	0.00	0.2	0.03							

New connections averaged for years in service

Table 5: North Island Supply Points of Service – Unplanned Interruptions (listed by five-year average unserved energy)

Point of Service	09/10 Number	10/11 Number	09/10 Unserved Energy % x100	10/11 Unserved Energy % x100	5 Yr Average Number	5 Yr Avg. Unserved Energy % x100	Point of Service	09/10 Number	10/11 Number	09/10 Unserved Energy % x100	10/11 Unserved Energy % x100	5 Yr Average Number	5 Yr Avg. Unserved Energy % x100
Te Kaha	9	26	6.54	114.	13.	36.8	Motunui	0	0	0.00	0.00	0.2	0.20
Kawerau (B)	1	0	2.60	0.00	0.6	4.00	Tauranga 11 kV	0	0	0.00	0.00	0.2	0.20
Ongarue	0	0	0.00	0.00	0.6	2.96	Wiri	1	0	0.69	0.00	0.6	0.20
Te Awamutu	4	2	8.98	1.20	2.6	2.89	Bream Bay	2	0	0.79	0.00	0.4	0.16
Whirinaki	1	1	0.25	0.11	0.8	2.52	Bombay 110 kV	1	0	0.72	0.00	0.2	0.14
Kaitaia	4	0	11.14	0.00	0.8	2.23	Pakuranga	1	0	0.69	0.00	0.2	0.14
Kaikohe	2	0	10.07	0.00	0.4	2.01	Carrington St	1	1	0.22	0.42	0.4	0.13
Woodville	0	0	0.00	0.00	0.8	1.91	Mt Roskill 22 kV	1	0	0.67	0.00	0.2	0.13
Glenbrook (B)	1	2	0.82	5.16	1.0	1.80	Waihou	2	0	0.45	0.00	1.0	0.13
Tuaiti	1	3	0.50	1.33	1.4	1.80	Mangere 33 kV	1	0	0.61	0.00	0.2	0.12
Meremere	1	0	0.64	0.00	0.8	1.79	Opunake	0	1	0.00	0.49	0.2	0.10
Owhata	0	0	0.00	0.00	0.4	1.77	Takanini	1	0	0.52	0.00	0.2	0.10
National Park	0	2	0.00	1.27	1.6	1.58	Wilton	0	0	0.00	0.00	0.2	0.10
Kinleith 33 kV	1	1	0.44	2.95	1.0	1.50	Penrose 110 kV	1	0	0.43	0.00	0.2	0.09
Bombay 33 kV	1	0	1.30	0.00	0.6	1.41	Tangiwai 11 kV	0	0	0.00	0.00	0.2	0.08
Maungaturoto	2	0	5.98	0.00	0.4	1.20	Mt Roskill 110 kV	1	0	0.34	0.00	0.2	0.07
Dargaville	2	0	5.34	0.00	0.4	1.07	Huirangi	0	1	0.00	0.31	0.2	0.06
Otahuhu 22 kV (A)	1	0	1.14	0.00	0.8	1.07	Gracefield	1	0	0.23	0.00	0.2	0.05
Taumarunui	4	0	0.79	0.00	3.4	1.03	Mangere 110 kV	1	0	0.21	0.00	0.2	0.04
Kinleith 11 kV (B)	0	1	0.00	1.22	0.4	1.00	Whakatu	0	0	0.00	0.00	0.2	0.04
Kensington	2	0	4.55	0.00	0.4	0.91	Melling 11kV	1	0	0.14	0.00	0.2	0.03
Maungatapere	2	0	3.74	0.00	0.6	0.82	Greytown	0	0	0.00	0.00	0.2	0.01
Pauatahanui	0	0	0.00	0.00	0.6	0.78	Kawerau (A)	0	0	0.00	0.00	0.2	0.01
Silverdale	2	0	2.89	0.00	1.2	0.78	Wairoa	1	0	0.07	0.00	0.2	0.01
Kinleith 11 kV (A)	0	2	0.00	0.81	0.8	0.76	Brunswick	0	0	0.00	0.00	0.0	0.00
Ohaaki	0	2	0.00	1.43	1.4	0.73	Bunnythorpe 33 kV	0	0	0.00	0.00	0.0	0.00
Penrose 33 kV (A)	1	0	0.70	0.00	0.4	0.71	Bunnythorpe 55 kV	0	0	0.00	0.00	0.0	0.00
Waiotahi	0	1	0.00	1.86	0.4	0.70	Cambridge	0	0	0.00	0.00	0.0	0.00
Hawera (A)	0	1	0.00	1.35	0.6	0.68	Edgecumbe	0	0	0.00	0.00	0.0	0.00
Hepburn Road	2	0	3.40	0.00	0.4	0.68	Fernhill	0	0	0.00	0.00	0.0	0.00
Wellsford	1	0	3.42	0.00	0.2	0.68	Gisborne	0	0	0.00	0.00	0.0	0.00
Kaiwharawhara	1	0	1.69	0.00	0.8	0.67	Hamilton 11 kV	0	0	0.00	0.00	0.0	0.00
Penrose 22 kV	1	0	0.55	0.00	0.4	0.65	Hamilton 33 kV	0	0	0.00	0.00	0.0	0.00
Albany 110 kV	2	0	3.06	0.00	0.4	0.61	Hamilton 55 kV	0	0	0.00	0.00	0.0	0.00
Glenbrook (A)	1	0	3.03	0.00	0.2	0.61	Hawera (B)	0	0	0.00	0.00	0.0	0.00
Hangatiki	1	0	1.74	0.00	0.4	0.60	Haywards 33 kV	0	0	0.00	0.00	0.0	0.00
Paraparaumu	0	0	0.00	0.00	0.4	0.56	Huntly	0	0	0.00	0.00	0.0	0.00
Mangahao	0	0	0.00	0.00	0.2	0.49	Kaitimako	0	0	0.00	0.00	0.0	0.00
Albany 33 kV	2	0	2.41	0.00	0.4	0.48	Kopu	0	0	0.00	0.00	0.0	0.00
Central Park 33 kV	1	0	1.41	0.00	0.4	0.48	Linton	0	0	0.00	0.00	0.0	0.00
Hinuera	0	1	0.00	2.15	0.6	0.48	Mangamaire	0	0	0.00	0.00	0.0	0.00
Mataroa	0	0	0.00	0.00	0.4	0.48	Marton	0	0	0.00	0.00	0.0	0.00
Waipawa 33 & 11 kV	0	1	0.00	0.14	1.0	0.48	Melling 33 kV	0	0	0.00	0.00	0.0	0.00
Ohakune (B)	0	0	0.00	0.00	0.4	0.46	New Plymouth 33 kV	-	0	-	0.00	0.0	0.00
Dannevirke	0	1	0.00	0.07	0.6	0.45	Penrose 33 kV (B)	0	0	0.00	0.00	0.2	0.00
Lichfield	0	0	0.00	0.00	0.2	0.44	Redclyffe	0	0	0.00	0.00	0.0	0.00
Mt Maunganui 33 kV	1	0	0.86	0.00	0.4	0.41	Rotorua 11 kV	1	0	0.02	0.00	0.2	0.00
Tauranga 33 kV	0	0	0.00	0.00	0.2	0.39	Rotorua 33 kV	0	0	0.00	0.00	0.0	0.00
Central Park 11 kV	1	0	1.59	0.00	0.4	0.37	Stratford	0	0	0.00	0.00	0.0	0.00
Ohakune (A)	0	0	0.00	0.00	0.4	0.35	Tangiwai 55 kV	0	0	0.00	0.00	0.0	0.00
Masterton	0	0	0.00	0.00	0.2	0.30	Tarukenga	0	0	0.00	0.00	0.0	0.00
Waverley	0	1	0.00	1.46	0.2	0.29	Te Kowhai	0	0	0.00	0.00	0.0	0.00
Tokaanu (A)	0	0	0.00	0.00	0.2	0.28	Upper Hutt	0	0	0.00	0.00	0.0	0.00
Takapu Road	0	0	0.00	0.00	0.2	0.27	Waikino	0	0	0.00	0.00	0.0	0.00
Henderson	2	0	1.24	0.00	0.4	0.25	Wairakei	0	0	0.00	0.00	0.0	0.00
Haywards 11 kV	0	0	0.00	0.00	0.2	0.24	Wanganui	0	0	0.00	0.00	0.0	0.00
Te Matai	0	0	0.00	0.00	0.6	0.21							
<i>New connections averaged for years in service</i>							OVERALL AVERAGE			0.89	1.23		0.83
							MIDDLE AVERAGE			0.80	0.22		0.44
							<i>Middle Average excludes highest five and lowest five.</i>						

Table 6: South Island Supply Points of Service – Unplanned Interruptions (listed alphabetically)

Point of Service	09/10 Number	10/11 Number	09/10 Unreserved Energy % x100	10/11 Unreserved Energy % x100	5 Yr Average Number	5 Yr Avg. Unreserved Energy % x100	Point of Service	09/10 Number	10/11 Number	09/10 Unreserved Energy % x100	10/11 Unreserved Energy % x100	5 Yr Average Number	5 Yr Avg. Unreserved Energy % x100
Addington 11 kV	0	0	0.00	0.00	0.2	0.06	Kaikoura	1	0	0.28	0.00	1.4	0.69
Addington 66 kV	0	0	0.00	0.00	0.0	0.00	Kikiwa	0	0	0.00	0.00	1.0	1.85
Albury	0	3	0.00	7.48	2.6	3.60	Kumara	1	4	1.66	4.80	1.0	1.29
Arthurs Pass	1	3	5.52	8.92	5.0	6.89	Middleton	0	0	0.00	0.00	0.0	0.00
Ashburton 33 kV	0	0	0.00	0.00	0.6	0.44	Motueka	0	0	0.00	0.00	0.2	0.43
Ashburton 66 kV	0	1	0.00	0.15	0.4	0.07	Motupipi	1	0	1.72	0.00	1.0	0.95
Ashley	0	0	0.00	0.00	0.0	0.00	Murchison	0	1	0.00	0.30	0.6	0.80
Atarau	0	0	0.00	0.00	1.8	0.70	Naseby	0	0	0.00	0.00	0.0	0.00
Balclutha	0	0	0.00	0.00	0.2	0.00	North Makarewa	0	0	0.00	0.00	0.2	0.09
Bells Pond	-	0	-	0.00	0.0	0.00	Oamaru	6	0	1.16	0.00	1.4	0.69
Black Point	4	1	0.72	0.00	2.0	0.54	Orowaiti	0	0	0.00	0.00	0.8	1.05
Blenheim	0	0	0.00	0.00	0.2	0.35	Otira	2	3	2.32	0.20	2.2	1.90
Bromley 11 kV	0	1	0.00	6.13	0.2	1.23	Palmerston	0	0	0.00	0.00	1.6	0.29
Bromley 66 kV	0	1	0.00	4.59	0.2	0.92	Papanui 11 kV	0	1	0.00	4.44	0.2	0.89
Brydone	0	1	0.00	0.34	0.4	0.16	Papanui 66 kV	0	0	0.00	0.00	0.0	0.00
Castle Hill	0	4	0.00	8.49	5.0	6.18	Reefton	0	0	0.00	0.00	0.4	0.72
Clyde	0	0	0.00	0.00	0.0	0.00	South Dunedin	0	0	0.00	0.00	0.0	0.00
Coleridge	6	0	44.78	0.00	1.8	10.11	Southbrook	0	0	0.00	0.00	0.0	0.00
Cromwell	0	0	0.00	0.00	0.0	0.00	Springston 33 kV	1	1	1.18	3.24	0.6	1.13
Culverden	1	0	0.35	0.00	0.6	0.46	Springston 66 kV	0	0	0.00	0.00	0.0	0.00
Dobson	1	3	0.36	2.27	2.0	1.78	Stoke	0	0	0.00	0.00	0.4	0.42
Edendale	0	0	0.00	0.00	0.0	0.00	Studholme	0	0	0.00	0.00	0.2	0.03
Frankton (A)	1	0	1.31	0.00	0.2	0.26	Tekapo A	0	2	0.00	3.03	2.8	2.19
Frankton (B)	1	0	2.11	0.00	0.3	0.70	Temuka	0	0	0.00	0.00	0.2	0.34
Gore	0	0	0.00	0.00	0.8	0.29	Timaru	0	0	0.00	0.00	0.2	0.38
Greymouth	1	2	0.69	0.56	1.8	1.03	Tiwai	0	0	0.00	0.00	0.0	0.00
Halfway Bush	0	1	0.00	0.00	0.4	0.05	Twizel (A)	0	0	0.00	0.00	0.0	0.00
Hokitika	1	4	1.30	1.54	2.6	2.94	Twizel (B)	0	0	0.00	0.00	0.0	0.00
Hororata 33 kV	0	1	0.00	3.03	0.6	0.78	Twizel (C)	0	0	0.00	0.00	0.0	0.00
Hororata 66 kV	0	0	0.00	0.00	0.2	0.14	Waipara 33 kV	0	0	0.00	0.00	0.2	0.00
Invercargill	0	0	0.00	0.00	0.0	0.00	Waipara 66 kV	0	0	0.00	0.00	0.0	0.00
Islington 33 kV	0	0	0.00	0.00	0.0	0.00	Waitaki	0	0	0.00	0.00	0.0	0.00
Islington 66 kV	0	0	0.00	0.00	0.0	0.00	Westport	0	0	0.00	0.00	1.0	17.19
Kaipoi	0	0	0.00	0.00	0.2	0.01							

New connections averaged for years in service

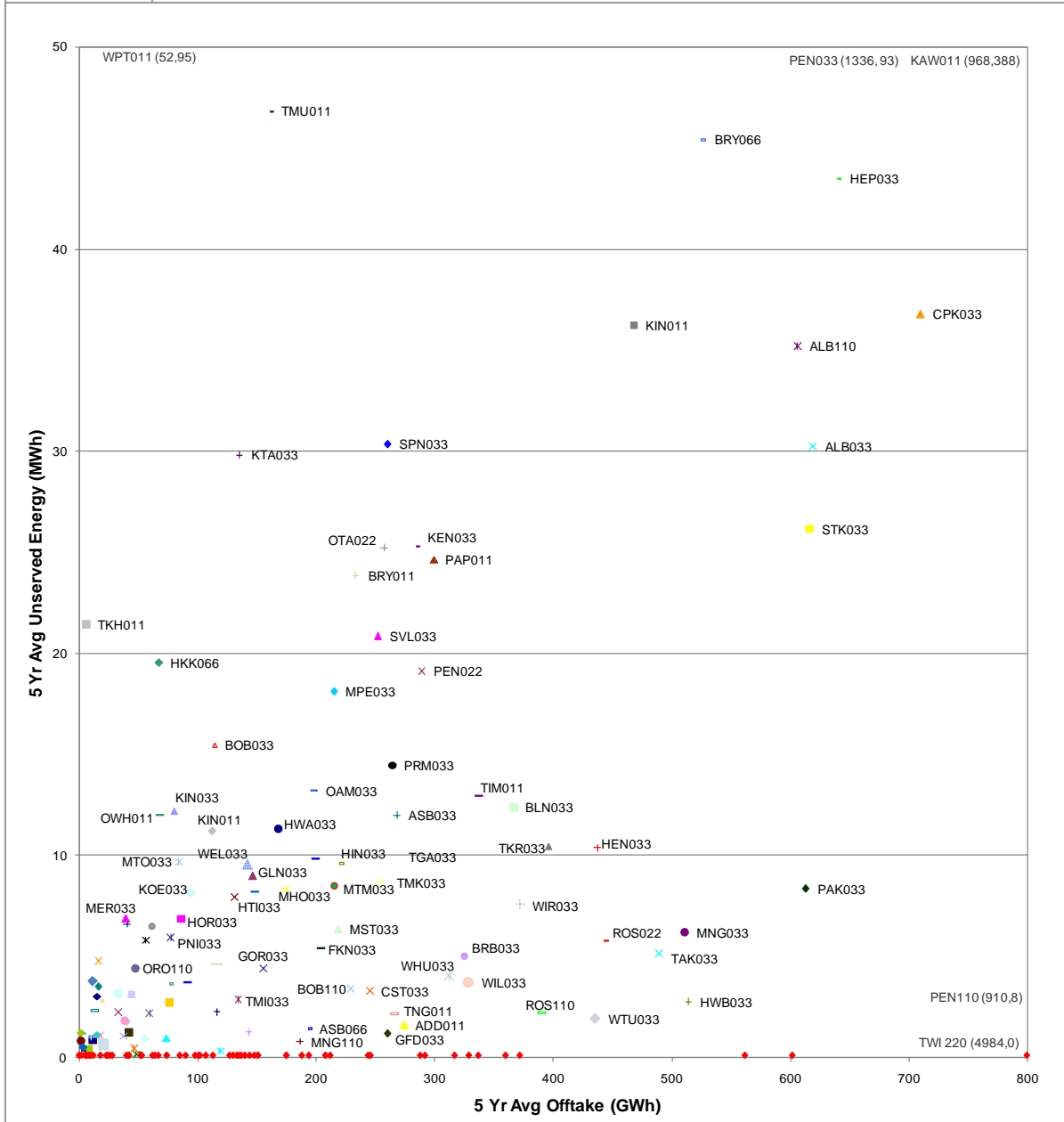
Table 7: South Island Supply Points of Service – Unplanned Interruptions (listed by five-year average unserved energy)

Point of Service	09/10 Number	10/11 Number	09/10 Unserved Energy % x100	10/11 Unserved Energy % x100	5 Yr Average Number	5 Yr Avg. Unserved Energy % x100	Point of Service	09/10 Number	10/11 Number	09/10 Unserved Energy % x100	10/11 Unserved Energy % x100	5 Yr Average Number	5 Yr Avg. Unserved Energy % x100
Westport	0	0	0.00	0.00	1.0	17.19	Palmerston	0	0	0.00	0.00	1.6	0.29
Coleridge	6	0	44.78	0.00	1.8	10.11	Frankton (A)	1	0	1.31	0.00	0.2	0.26
Arthurs Pass	1	3	5.52	8.92	5.0	6.89	Brydone	0	1	0.00	0.34	0.4	0.16
Castle Hill	0	4	0.00	8.49	5.0	6.18	Hororata 66 kV	0	0	0.00	0.00	0.2	0.14
Albury	0	3	0.00	7.48	2.6	3.60	North Makarewa	0	0	0.00	0.00	0.2	0.09
Hokitika	1	4	1.30	1.54	2.6	2.94	Ashburton 66 kV	0	1	0.00	0.15	0.4	0.07
Tekapo A	0	2	0.00	3.03	2.8	2.19	Addington 11 kV	0	0	0.00	0.00	0.2	0.06
Otira	2	3	2.32	0.20	2.2	1.90	Halfway Bush	0	1	0.00	0.00	0.4	0.05
Kikiwa	0	0	0.00	0.00	1.0	1.85	Studholme	0	0	0.00	0.00	0.2	0.03
Dobson	1	3	0.36	2.27	2.0	1.78	Kaiapoi	0	0	0.00	0.00	0.2	0.01
Kumara	1	4	1.66	4.80	1.0	1.29	Addington 66 kV	0	0	0.00	0.00	0.0	0.00
Bromley 11 kV	0	1	0.00	6.13	0.2	1.23	Ashley	0	0	0.00	0.00	0.0	0.00
Springston 33 kV	1	1	1.18	3.24	0.6	1.13	Balclutha	0	0	0.00	0.00	0.2	0.00
Orowaiti	0	0	0.00	0.00	0.8	1.05	Bells Pond	-	0	-	0.00	0.0	0.00
Greymouth	1	2	0.69	0.56	1.8	1.03	Clyde	0	0	0.00	0.00	0.0	0.00
Motupipi	1	0	1.72	0.00	1.0	0.95	Cromwell	0	0	0.00	0.00	0.0	0.00
Bromley 66 kV	0	1	0.00	4.59	0.2	0.92	Edendale	0	0	0.00	0.00	0.0	0.00
Papanui 11 kV	0	1	0.00	4.44	0.2	0.89	Invercargill	0	0	0.00	0.00	0.0	0.00
Murchison	0	1	0.00	0.30	0.6	0.80	Islington 33 kV	0	0	0.00	0.00	0.0	0.00
Hororata 33 kV	0	1	0.00	3.03	0.6	0.78	Islington 66 kV	0	0	0.00	0.00	0.0	0.00
Reefton	0	0	0.00	0.00	0.4	0.72	Middleton	0	0	0.00	0.00	0.0	0.00
Atarau	0	0	0.00	0.00	1.8	0.70	Naseby	0	0	0.00	0.00	0.0	0.00
Frankton (B)	1	0	2.11	0.00	0.3	0.70	Papanui 66 kV	0	0	0.00	0.00	0.0	0.00
Kaikoura	1	0	0.28	0.00	1.4	0.69	South Dunedin	0	0	0.00	0.00	0.0	0.00
Oamaru	6	0	1.16	0.00	1.4	0.69	Southbrook	0	0	0.00	0.00	0.0	0.00
Black Point	4	1	0.72	0.00	2.0	0.54	Springston 66 kV	0	0	0.00	0.00	0.0	0.00
Culverden	1	0	0.35	0.00	0.6	0.46	Tiwai	0	0	0.00	0.00	0.0	0.00
Ashburton 33 kV	0	0	0.00	0.00	0.6	0.44	Twizel (A)	0	0	0.00	0.00	0.0	0.00
Motueka	0	0	0.00	0.00	0.2	0.43	Twizel (B)	0	0	0.00	0.00	0.0	0.00
Stoke	0	0	0.00	0.00	0.4	0.42	Twizel (C)	0	0	0.00	0.00	0.0	0.00
Timaru	0	0	0.00	0.00	0.2	0.38	Waipara 33 kV	0	0	0.00	0.00	0.2	0.00
Blenheim	0	0	0.00	0.00	0.2	0.35	Waipara 66 kV	0	0	0.00	0.00	0.0	0.00
Temuka	0	0	0.00	0.00	0.2	0.34	Waitaki	0	0	0.00	0.00	0.0	0.00
Gore	0	0	0.00	0.00	0.8	0.29							
<i>New connections averaged for years in service</i>						OVERALL AVERAGE			0.99	0.89			1.09
						MIDDLE AVERAGE			0.27	0.61			0.51
						<i>Middle Average excludes highest five and lowest five.</i>							

Point of Service Performance - Supply

Figure 26

Unplanned Interruptions - Five Year Average Unserved Energy vs. Offtake GWh



- ◆ ABY011 ▲ ADD011 × ALB033 × ALB110 ● APS011 + ASB033 ◆ ASB066 □ ATU110 □ BDE011 □ BLN033 → BOB033
- × BOB110 × BPT110 ● BRB033 + BRY011 - BRY066 - CLH011 ◆ COL011 ■ CPK011 ▲ CPK033 × CST033 × CUL033
- DAR011 + DOB033 - DVK011 - FKN033 ◆ GFD033 ◆ GLN033 ▲ GLN033 × GOR033 × GYM066 HAY011 + HEN033
- HEP033 - HIN033 ◆ HKK066 ■ HOR033 ▲ HOR066 × HTI033 × HUI033 ● HWA033 + HWB033 - KEN033 - KIK011
- ◆ KIN011 ■ KIN011 ▲ KIN033 × KKA033 □ KOE033 + KTA033 - KUM066 - KWA011 ◆ LFD110 ■ MCH011 ▲ MER033
- × MHO033 × MLG011 ● MNG033 + MNG110 ■ MNI011 - MOT011 ◆ MPE033 □ MPI066 ▲ MST033 ● MTM033 × MTO033
- MTR033 + NMA033 - NPK033 - OAM033 ◆ OKI011 ■ OKN011 ▲ OKN011 × ONG033 × OPK033 ● ORO110 + OTA022
- OTI011 - OWH011 ◆ PAK033 ■ PAL033 ▲ PAP011 × PEN022 × PNI033 ● PRM033 RFN110 - ROS022 - ROS110
- ◆ SPN033 ■ STK033 ▲ SVL033 × TAK033 + TGA011 - TGA033 - TIM011 ◆ TKA033 ■ TKH011 ■ TKR033 × TKU033
- × TMI033 × TMK033 × TMN055 - TMU011 - TNG011 ◆ TNG011 ◆ TUI011 □ WAI011 ◆ WDV011 ◆ WEL033 × WHI011 × WHU033
- WIL033 + WIR033 - WPT011 - WPW033 ◆ WTU033 □ WVY011 ◆ Others* (60 other POS's with zero unserved energy)

Point of Service Performance - Generators

Table 8: Generator Points of Service – Unplanned Interruptions (listed alphabetically)

Point of Service	09/10 Number	10/11 Number	09/10 Duration (mins)	10/11 Duration (mins)	5 Yr Average Number	5 Yr Average Duration (mins)	Point of Service	09/10 Number	10/11 Number	09/10 Duration (mins)	10/11 Duration (mins)	5 Yr Average Number	5 Yr Average Duration (mins)
Arapuni	0	0	0	0	0.2	1	Ohaaki	0	0	0	0	0.0	0
Aratiatia	0	0	0	0	0.4	16	Ohakuri	0	0	0	0	0.0	0
Argyle	2	1	321	201	3.2	189	Ohau A	0	0	0	0	0.2	1
Atiamuri	0	0	0	0	0.0	0	Ohau B	0	4	0	120	1.2	38
Aviemore	0	1	0	51	0.2	10	Ohau C	0	0	0	0	0.6	38
Benmore 16 kV	2	2	1471	8390	1.2	2325	Otahuhu A 110 kV	0	0	0	0	0.2	23
Benmore 220 kV	0	0	0	0	0.0	0	Otahuhu C 220 kV	0	0	0	0	0.2	184
Berwick	5	6	691	721	6.6	338	Poihipi	1	0	9	0	0.4	7
Clyde	0	0	0	0	0.0	0	Rangipo	0	0	0	0	0.6	37
Cobb	0	0	0	0	0.4	34	Rotorua 110 kV	0	0	0	0	0.2	14
Coleridge	0	0	0	0	0.4	9	Roxburgh 110 kV	0	0	0	0	0.0	0
Glenbrook Generation	0	0	0	0	0.0	0	Roxburgh 220 kV	0	0	0	0	0.0	0
Hawera (A)	0	0	0	0	0.2	7	Southdown	1	0	56	0	0.2	11
Hawera (B)	0	0	0	0	0.2	108	Stratford	2	0	74	0	0.8	340
Huntly	2	1	66	781	0.6	169	Tararua Windfarm C	0	0	0	0	0.0	0
Kaponga	2	1	58	21	1.2	20	Te Apiti Wind Farm	0	1	0	27	1.4	61
Karapiro	0	0	0	0	0.2	40	Tekapo A	0	2	0	158	2.8	137
Kawerau Geo	0	0	0	0	0.0	0	Tekapo B	0	1	0	39	0.4	31
Kinleith	0	1	0	52	0.4	46	Tokaanu	0	0	0	0	0.0	0
Kumara	1	4	38	57	2.2	55	Tuai	0	1	0	11	0.2	2
Manapouri	0	0	0	0	0.0	0	Waipapa	1	2	158	357	1.0	206
Mangahao	0	0	0	0	0.2	18	Wairakei	0	0	0	0	0.2	7
Maraetai	1	2	158	339	1.2	234	Waitaki	1	0	92	0	0.2	18
Matahina (A)	0	0	0	0	0.0	0	West Wind	4	1	3205	106	6.3	2340
Matahina (B)	0	1	0	145	0.2	29	Whakamaru	1	0	25	0	0.4	27
New Plymouth 220 kV	0	0	0	0	0.0	0	Whirinaki	0	0	0	0	0.2	8
Nga Awa Purua	1	0	223	0	0.5	112							

New connections averaged for years in service

Table 9: Generator Points of Service – Unplanned Interruptions (listed by five-year average duration)

Point of Service	09/10 Number	10/11 Number	09/10 Duration (mins)	10/11 Duration (mins)	5 Yr Average Number	5 Yr Average Duration (mins)	Point of Service	09/10 Number	10/11 Number	09/10 Duration (mins)	10/11 Duration (mins)	5 Yr Average Number	5 Yr Average Duration (mins)
West Wind	4	1	3205	106	6.3	2340	Aratiatia	0	0	0	0	0.4	16
Benmore 16 kV	2	2	1471	8390	1.2	2325	Rotorua 110 kV	0	0	0	0	0.2	14
Stratford	2	0	74	0	0.8	340	Southdown	1	0	56	0	0.2	11
Berwick	5	6	691	721	6.6	338	Aviemore	0	1	0	51	0.2	10
Maraetai	1	2	158	339	1.2	234	Coleridge	0	0	0	0	0.4	9
Waipapa	1	2	158	357	1.0	206	Whirinaki	0	0	0	0	0.2	8
Argyle	2	1	321	201	3.2	189	Hawera (A)	0	0	0	0	0.2	7
Otauhu C 220 kV	0	0	0	0	0.2	184	Poihipi	1	0	9	0	0.4	7
Huntly	2	1	66	781	0.6	169	Wairakei	0	0	0	0	0.2	7
Tekapo A	0	2	0	158	2.8	137	Tuai	0	1	0	11	0.2	2
Nga Awa Purua	1	0	223	0	0.5	112	Arapuni	0	0	0	0	0.2	1
Hawera (B)	0	0	0	0	0.2	108	Ohau A	0	0	0	0	0.2	1
Te Apiti Wind Farm	0	1	0	27	1.4	61	Atiamuri	0	0	0	0	0.0	0
Kumara	1	4	38	57	2.2	55	Benmore 220 kV	0	0	0	0	0.0	0
Kinleith	0	1	0	52	0.4	46	Clyde	0	0	0	0	0.0	0
Karapiro	0	0	0	0	0.2	40	Glenbrook Generation	0	0	0	0	0.0	0
Ohau B	0	4	0	120	1.2	38	Kawerau Geo	0	0	0	0	0.0	0
Ohau C	0	0	0	0	0.6	38	Manapouri	0	0	0	0	0.0	0
Rangipo	0	0	0	0	0.6	37	Matahina (A)	0	0	0	0	0.0	0
Cobb	0	0	0	0	0.4	34	New Plymouth 220 kV	0	0	0	0	0.0	0
Tekapo B	0	1	0	39	0.4	31	Ohaaki	0	0	0	0	0.0	0
Matahina (B)	0	1	0	145	0.2	29	Ohakuri	0	0	0	0	0.0	0
Whakamaru	1	0	25	0	0.4	27	Roxburgh 110 kV	0	0	0	0	0.0	0
Otauhu A 110 kV	0	0	0	0	0.2	23	Roxburgh 220 kV	0	0	0	0	0.0	0
Kaponga	2	1	58	21	1.2	20	Tararua Windfarm C	0	0	0	0	0.0	0
Mangahao	0	0	0	0	0.2	18	Tokaanu	0	0	0	0	0.0	0
Waitaki	1	0	92	0	0.2	18							
<i>New connections averaged for years in service</i>							OVERALL AVERAGE			125	218		138
							MIDDLE AVERAGE			24	47		40
							<i>Middle Average excludes highest five and lowest five.</i>						

12 Transpower Individual Price-Quality Path

Five performance measures were introduced by the Commerce Commission in the Commerce Act (Transpower Individual Price-Quality Path) Determination 2010. Targets, caps, and collars have been set for four of these. In 2011/12 Transpower is required to report performance against these targets, and in subsequent years there will be incentive payments and penalties associated with these measures.

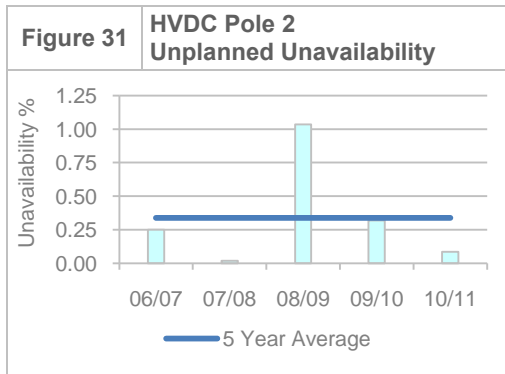
Table 10 Performance Measures from Transpower Individual Price-Quality Path

	Target	Cap (for rewards)	Collar (for penalties)	Weighting
Number of Unplanned Events				
Number > 0.05 System minutes	21	10	31	25%
Number > 1.0 System minutes	3	1	5	25%
Total Interruptions (Planned & Unplanned) system minutes	16.69	4.31	29.07	25%
HVAC Circuits Unplanned Unavailability	0.056%	0.029%	0.083%	25%
HVDC Unplanned Unavailability	*	-	-	-

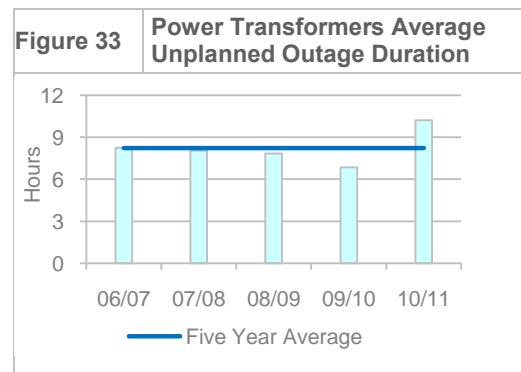
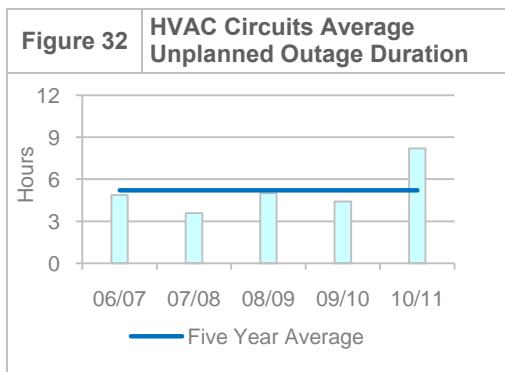
* No target has yet been set for HVDC Unplanned Unavailability, but Transpower is required to report on the measure for 2011/12.

Historical performance for these measures with the targets, caps, and collars is shown in the following figures.





In addition to the performance measures defined in the Individual Price-Quality Path Determination, Transpower has also undertaken to track and report on two other possible measures, viz:- average unplanned outage duration for circuits and transformers. Historical performance for these measures is shown in Figure 31 and Figure 32. For this calculation, outages with long outages are capped at seven days.



Although there were a smaller number of unplanned circuit outages in 2010/11, the average duration is relatively high because of reduced numbers of short outages with a duration of less than one hour.

There were a relatively high number of long transformer outages during 2010/11, and the average outage duration was further increased by two long outages at Bromley as the result of earthquakes on 22 February and 6 March.

13 The Electricity Information Disclosure Requirements¹⁰

(For 12 months ending 30 June 2011, 2010, 2009, and 2008)

Part 4

Energy Delivery Efficiency Performance Measures and Statistics (Disclosure under Requirement 20)	2010/11	2009/10	2008/09	2007/08
1. Energy delivery efficiency performance measures				
(a) Load factor (%)				
<i>Electrical energy entering the transmission system as percentage of maximum demand times hours per year</i>	69.47	68.49	67.02	68.35
(b) Loss ratio (%)				
<i>Transmission losses as percentage of energy entering the system</i>	3.79	3.72	4.02	3.66
(c) Capacity utilisation (%)				
<i>Maximum demand as percentage of total transformer capacity</i>	45.28	46.27	46.93	48.10
2. Statistics				
(a) System length, broken down by voltage (km)				
Total ^a	17,198	17,348 ^e	17,340	17,333
350 kV (HVDC)	611	611	611	611
270 kV (HVDC)	611	611	611	611
0 kV (HVDC earth electrode)	31	31	31	31
220 kV (HVAC)	8,642	8,642 ^e	8,632	8,631
110 kV (HVAC)	6,152	6,302	6,304	6,298
66/50/33/11 kV (HVAC) ^a	1,151	1,151 ^e	1,151	1,151
(b) Circuit length of overhead electric lines, broken down by voltage (km).				
Total ^a	17,108	17,256 ^e	17,255	17,248
350 kV (HVDC)	571	571	571	571
270 kV (HVDC)	571	571	571	571
0 kV (HVDC earth electrode)	31	31	31	31
220 kV (HVAC)	8642	8,642 ^e	8,632	8,631
110 kV (HVAC)	6,142	6,290	6,299	6,293
66/50/33/11 kV (HVAC) ^a	1,151	1,151 ^e	1,151	1,151
NB: HVDC link submarine power cables measure approximately 80km. Broken down by voltage				
350 kV (HVDC)	40	40	40	40
270 kV (HVDC)	40	40	40	40
(c) Total circuit length of underground electric lines (km)				
(110 kV HVAC)	11	11	4	4
(d) Transformer capacity (kVA)	14.51x10 ⁶	14.26x10 ⁶	14.09x10 ⁶	13.80x10 ⁶
(e) Maximum demand (kilowatts) ^{bc} (kW)	6.57x10 ⁶	6.60x10 ⁶	6.61x10 ⁶	6.64x10 ⁶
(f) Total electricity entering the system (before losses) ^{bc} (kWh)	39.98x10 ⁹	39.58x10 ⁹	38.82x10 ⁹	39.72x10 ⁹
(g) Total amount of electricity (in kilowatt hours) supplied from the system (after losses of electricity) during the financial year on behalf of each person that is an electricity generator or an electricity retailer, or both: ^{bcd} (kWh)	38.47x10 ⁹	38.10x10 ⁹	37.26x10 ⁹	38.27x10 ⁹
(h) Total connected customers	53	53	51	49

Notes

- a Excludes 61km of circuits leased from others and operated by Transpower.
- b To 2 decimal places only, higher accuracy used in calculations.
- c For all years, figures for maximum demand kW and kWh injected and supplied include loads on circuits leased by Transpower. The effect of these circuits cannot be measured as metering equipment is not installed at the inter-connection points with Transpower-owned assets, but the difference is estimated to be no more than 0.1% of totals. Loads on Transpower assets leased to others are not included, as Transpower does not collect operational data for these assets.
- d Including sales to direct connected customers
- e Minor corrections to previously disclosed 2009/10 data.

¹⁰ Electricity Information Disclosure Requirements issued 31 March 2004 as amended by the Electricity Information Disclosure Amendment Requirements 2004, 2006, 2007, 2008, 2008 (No2), and 2008 (No3).

The Electricity Information Disclosure Requirements

(For 12 months ending 30 June 2011, 2010, 2009, and 2008)

Part 6

Reliability Performance Measures to be Disclosed by Transpower ^a (Disclosure Under Requirement 21)	2010/11	2009/10	2008/09	2007/08
1. Total number of unplanned interruptions ^b Resulting from 60 loss of supply events in 2010/11	89	106	112	115
2. Electricity customer interruptions in system minutes ^c	15.2	23.5	18.1	28.0
Planned	3.6	1.2	2.0	3.3
Unplanned	11.6	22.2	16.1	24.6
3. Underlying electricity customer interruptions in system minutes ^c Underlying interruptions are those interruptions of one system minute or less duration	4.0	5.3	5.9	6.8
Planned	1.1	1.2	0.9	2.1
Unplanned	2.9	4.0	4.9	4.7
4. Average supply reliability (%) Measured by the energy supplied divided by the sum of the energy supplied and not supplied	99.9957	99.9932	99.9946	99.9919
5. Uneconomic generation due to planned and unplanned transmission system unavailability (%) ^d	-	-	-	-
6. Uneconomic generation due to HVDC system unavailability (%) ^d	-	-	-	-
7. Uneconomic generation due to unplanned transmission system unavailability (%) ^d	-	-	-	-
8. Planned interruption restoration performance (%)	68.6	77.5	76.7	73.1
9. Unplanned interruption response (%)	100.0	99.1	100.0	100.0

Notes

- a The information compiled using estimated information includes Part 6 sections 2, 3 and 4. The methodology used to calculate the estimated information is documented and available from Transpower upon request.
The reliability performance measures given in Part 6 do not include the performance of the 34km of circuit leased to other parties because Transpower does not collect operational data for these assets.
- b Where two supply voltages, or two customers, at the same station are both interrupted this is counted as two interruptions.
- c Any minor differences between the total and the sum of planned and unplanned are due to rounding.
System minutes of interruptions do not include energy made up by backfeed from another point of supply or by embedded generation within a customer's network.
- d Uneconomic generation (Part 6 sections 5, 6 and 7) is not relevant in the market environment because scheduling is now based on offered price, not economic cost. In the market, 'offers to generate' are made after taking constraints into account and it is not possible to predict what a generator would have offered if the constraint was not present. As a result data is not available to allow a calculation and a null entry has been returned.

Maps of High Voltage Transmission System

North Island National Grid and Major Generation Stations



South Island National Grid and Major Generation Stations



Significant Events from 1987 to 2011

Table 11 Significant Events from March 1987 to June 2011

Date	System Minutes	Event description
22/02/11	3.2	Bromley transformers tripped by major earthquake.
2/12/10	3.4	Glenbrook 33 kV bus tripped when a bus insulator flashed over.
4/09/10	2.2	Transformers at Islington, Springston, and Hororata tripped by major earthquake.
22/04/10	1.3	Wilton 110 kV bus fault when maintenance equipment dropped onto bottom bus.
11/03/10	2.3	Kawerau 11 kV bus trip caused by a rat inside switchgear.
25/01/10	6.4	Line faults on Otahuhu Whakamaru C line caused by a tree and a subsequent fire resulted in rolling load cuts in Auckland region.
30/10/09	8.2	A container hoist operating under the Henderson-Otahuhu line caused a line fault and widespread loss of supply in North Auckland and Northland.
17/03/09	1.0	Disconnecter at Timaru opened on load causing 110 kV bus fault.
07/03/09	1.1	Kaitimako-Tauranga-Mt Maunganui protection failed to clear fault causing outages in Bay of Plenty
03/02/09	4.1	Penrose 33 kV supply transformers tripped following a fault on one bank.
01/09/08	4.9	Whirinaki 11 kV cable fault resulted in partial interruption to Pan Pac
12/10/07	14.1	Kawerau paper mill shut down to investigate and rectify arc noises on 11 kV bus
07/10/07	3.9	Part of Westport 11 kV bus exploded following a close-in lightning strike
24/09/07	1.9	Protection relay at Kinleith failed to operate, resulting in interruptions at five points of service
15/10/06	1.1	Kaikohe-Kaitaia line out of service to repair conductor damage caused by quarry operations
14/09/06	1.8	Earth sticks left on Islington 220 kV bus in error caused 220 kV bus fault and supply interruptions.
28/08/06	1.1	At Kawerau, a switching error combined with misleading indication resulted in supply being disconnected
25/08/06	1.3	Glenbrook 33 kV bus tripped when a bus insulator failed
12/06/06	29.8	Earth wire failed at Otahuhu causing 110 kV bus fault and widespread loss of load in Auckland area
11/05/06	1.0	Protection relay maloperation at Tarukenga resulted in a Grid Emergency and forced disconnection of load in the Bay of Plenty
16/03/05	1.1	Tap changer problem caused tripping of both 33 kV supply banks at Hamilton
12/04/01	4.2	Mouse caused flashover on 11 kV bus at Whirinaki
25-6/09/00	4.4	Heavy wind and snow storm on East Coast, North Island
26/07/98	1.5	Edgecumbe supply transformer damaged as a result of a human error
4/06/97	1.1	Hamilton 11 kV supply transformer tripped because of a tap changer fault
29/11/96	2.2	Widespread outage in Auckland area following circuits trippings during lightning storm
19/11/96	1.3	Bird proofing netting blown off Kawerau 110 kV bus in high winds
8/10/96	2.2	Human error caused tripping of Islington 66 kV bus
3/03/96	2.4	HVDC pole tripped incorrectly for fault on other pole - protection design problem
12/07/94	3.9	Kawerau transformer cable bushing fault
13/01/94	3.5	Tree contacted HVDC lines
9/03/93	6.9	HVDC bipole trip due to communication circuit crossover
23/10/92	1.8	Glenbrook transformer tripped due to pollution flashover
28/08/92	11.4	Heavy snow storms in Canterbury
26/07/92	1.1	Albany transformer tripped due to lightning
6/08/91	1.4	Tower failure on Opunake-Stratford line
16/07/91	1.1	Transformer Buchholz operated during transformer maintenance at Penrose
30/05/91	6.1	Bus fault at Wilton during maintenance activities
28/05/91	7.0	Bus fault at Islington due to a circuit breaker dropper failure
26/04/91	1.6	Supply bank cable fault at Kinleith
10/09/90	1.7	Conductor joint failure on Hinuera-Karapiro line
20/01/89	3.5	Non Transpower contractor felled tree onto Otahuhu-Mt Roskill line
9/12/87	*	A 110 kV circuit breaker failed to open correctly at Haywards
29/06/87	*	Circuit breakers at Takapu Road failed to trip for a line fault
2/03/87	*	Bay of Plenty earthquake
* System minute figures for years prior to 1987/88 are not available		

