PB ASSOCIATES

REVIEW OF ENERGYAUSTRALIA'S SERVICE STANDARDS COMPLIANCE 2006

An independent review

Prepared for

AUSTRALIAN ENERGY REGULATOR

***PB Associates** Quality System:*

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EXECUTIVE SUMMARY

Each year EnergyAustralia reports its annual service standards performance to the AER based on its revenue cap decision. PB has been engaged by the AER to assess EnergyAustralia's performance results for the 2006 calendar year and the appropriate financial incentive to be applied. PB also assessed the accuracy and appropriateness of EnergyAustralia's recording and reporting systems, and undertook a substantive review of performance calculations and exclusions.

EnergyAustralia reports on eight measures:

1. Transmission circuit availability;
2. Transformer availability;
3. Reactor availability;
4. MVA days of feeder availability;
5. MVA days of 'transmission bulk supply' transformers non- availability;
6. MVAr days of reactive plant non- availability;
7. Loss of supply due to forced transmission asset outages; and
8. Hours that planned outage plans were in place.

One measure – transmission circuit availability – is included in a performance incentive scheme. The 2006 target for this measure is 96.96 per cent. EnergyAustralia claim that it has outperformed this target, achieving 97.74 per cent.

PB found that the transmission circuit availability measure was correctly calculated. No events were excluded from the calculation of this value, although some events met the criteria for exclusion. PB considers that this is appropriate given that no exclusions were made from the data on which the target was calculated.

PB checked the calculation of the s-factor and found it to be in accordance with the Revenue Cap Decision. We recommend that the AER apply an s-factor of 0.39 per cent to EnergyAustralia in respect of the 2006 data.

The remaining seven measures are not included in the incentive scheme. PB found that:

- Measures 2 through 6 are considered to be of acceptable accuracy. Some recall times have been based on the length of the planned outage rather than on the type of work performed, and this has resulted in some events being included that meet the criteria for exclusion. This, however, will not materially affect the accuracy of the indicators.
- Measure 7 – loss of supply – had not been reported accurately because two events related to assets that were not on the list of transmission assets to be included in regulatory reporting and a further five events contained inaccurate outage durations, mainly due to a simplified approach of not accounting for staged restoration of supply. Revised data submitted by EnergyAustralia during PB's review was found to be of acceptable accuracy.
- Measure 8 – hours that planned outage plans were in place – includes only two planned outage events for 2006, resulting in an average of 3109 minutes of load at risk. PB notes that the title of the measure (hours) is inconsistent with units of the calculated value (minutes).

EnergyAustralia has improved the accuracy of its reporting of service performance when compared to 2005. This has been achieved by using SCADA data as the basis of reporting rather than relying solely on information input manually to various databases.

EnergyAustralia is, however, reliant on manual extraction of 'raw' data from its SCADA and other information systems, which is then used to identify outage events and to provide the information required for regulatory reporting. EnergyAustralia's reliance on twice yearly manual extraction of data means that some simplifying assumptions are made when categorising the data into outage events and in the calculation of the performance indicators. PB found that the accuracy of reporting is dependant on accurate labelling of data and diligence in the manual extraction of information from information sources.

For 2006, PB found that the performance data had been manually extracted from the information sources with a high degree of accuracy. PB is of the view that EnergyAustralia has complied with its reporting obligation for all measures.

To improve the robustness of its regulatory reporting, PB would expect to see EnergyAustralia develop a database of outage events compiled at the time of the outage and containing all of the required information to enable the performance indicators to be calculated. The current work to establish a distribution management system will facilitate this by providing a link between SCADA information and the outage management system. EnergyAustralia has not yet determined the changes that will be made to facilitate regulatory reporting for its transmission network, intending to retain the (largely) manual reporting process for the present time.

1. INTRODUCTION

In this section we set out the background to the PB Associates (PB) review, the objectives of the works and the scope of our engagement. We also include a description of the PB approach to the project.

1.1 BACKGROUND TO THE REVIEW

The ACCC released its service standards guideline in November 2003 setting out a performance incentive scheme for transmission network service providers (TNSPs). The guidelines have since been included in the Australian Energy Regulator's (AER's) compendium of regulatory guidelines.

A service standards performance incentive scheme was included in EnergyAustralia's revenue cap decision in April 2005. It included one incentive performance measure and seven non-incentive performance measures.

Each calendar year, EnergyAustralia reports its annual service standards performance to the AER. The AER reviews the reported performance to ensure EnergyAustralia has complied with its revenue cap decision.

1.2 OBJECTIVE AND SCOPE OF WORK

PB has been engaged by the AER to provide advice and assistance in:

- assessing EnergyAustralia's compliance with the service standard scheme set out in its revenue cap determination, when recording and reporting its performance results for the 2006 calendar year;
- establishing the appropriate s-factor and financial incentive based on EnergyAustralia's performance during the 2006 year; and
- assessing the accuracy and appropriateness of recording and reporting systems.

PB should also facilitate a "knowledge transfer" to AER staff.

EnergyAustralia owns and operates both transmission and distribution network assets. This review is concerned only with EnergyAustralia's transmission assets as listed and categorised in Appendix A.

1.3 PB APPROACH TO THE REVIEW

The terms of reference sets out the requirements for the review of recording and reporting systems, including assessing:

- the accuracy of data input;
- reliability of resulting performance data output;
- the appropriateness of the recording processes in terms of collecting service standards performance data; and
- any evident systemic weaknesses in these processes or systems.

PB has undertaken a two day visit to EnergyAustralia. The accuracy and suitability of the systems and processes currently used to measure and report on the measures has been assessed by PB including:

- information management systems and the interrelationships between the systems to support the reliability recording and reporting processes;
- processes used to update the data within these information management systems, to keep them up-to-date and well maintained;
- trigger processes that generate outage records. This included an assessment of SCADA system events, planned and unplanned switching actions, control/ dispatch centre actions etc;
- processes for managing planned outages;
- processes to follow through and complete any open outage records;
- processes of identifying and recording an outage event as an excludable event from the service standards performance incentive scheme;
- identification of any changes to systems and processes over the reporting period which may impact on the reporting accuracy;
- identification of any retrospective data amendments or review processes in place to correct outage records in error; and
- processes in place for continuous improvement and quality control of the reliability reporting systems.

The reported performance data has been verified by audit, including an assessment of the non-incentive performance measures. The s-factor calculation and the appropriateness of exclusions has been examined and adjustments identified.

1.4 REPORTING REQUIREMENTS

The ACCC revenue cap decision sets out eight measures of reliability to be reported by EnergyAustralia:

1. Transmission circuit availability;
2. Transformer availability;
3. Reactor availability;
4. MVA days of feeder availability;
5. MVA days of 'transmission bulk supply' transformers non- availability;
6. MVAr days of reactive plant non- availability;
7. Loss of supply due to forced transmission asset outages; and
8. Hours that planned outage plans were in place.

EnergyAustralia has a Network Management System Procedure[1] in place to describe the data and information used and the process to produce the measures for the Service Standards Performance 2006 report. The document was issued on 23 January specifically for use by staff in compiling the report. The results reported by EnergyAustralia are shown in Figure 1-1 below.

Figure 1-1 2006 Performance measures and results reported by EnergyAustralia[2]

Table 1 – Performance measures and results

	Measure	Unit	2006 Performance	
			Without exclusions	With exclusions
1	*Transmission circuit availability*	%	97.74	97.74
2	*Transformer availability*	%	98.71	98.71
3	*Reactor availability*	%	98.60	98.60
4	*MVA days of feeder availability*	%	98.55	98.55
5	*MVA days of 'transmission bulk supply' transformers non-availability*	%	99.57	99.57
6	*MVAr days of reactive plant non-availability*	%	99.05	99.05
7	*Loss of supply due to forced transmission asset outages*		Tabulated separately	Tabulated separately
8	*Hours that planned outage plans were in place*	Hours	3108.9	3108.9

One measure – transmission circuit availability – is included in a performance incentive scheme. The 2006 target for this measure is 96.96 per cent. EnergyAustralia submit that it has outperformed this target, achieving 97.74 per cent.

1.5 STRUCTURE OF THIS REPORT

This report has been structured to address the terms of reference including the following sections:

SECTION 2 – Reporting processes;

SECTION 3 – Accuracy of data input;

SECTION 4 – Reliability of resulting performance data output; and

SECTION 5 – Systemic weaknesses identified in processes or systems.

1 Network Management System procedure Document No. Sec11 Version 1.0 issued 23 January 2007 – EnergyAustralia's Service Standards Performance 2006.

2 EnergyAustralia – Transmission Service Standards, Reliability in 2006, 1 February 2007.

2. RECORDING PROCESSES

This section of the report contains discussion and assessment of the appropriateness of the recording processes in terms of collecting service standards performance data.

2.1 OVERVIEW OF RECORDING PROCESS

EnergyAustralia has implemented a performance data collection system using various IT and manual systems and processes. Outage information is collated from these systems into a single Microsoft excel spreadsheet 'Outage Data for 2006' for reporting to the AER.

The key system used by EnergyAustralia is the supervisory control and data acquisition system (SCADA), which provides a real time view of the transmission network and remote control of circuit breakers and other key equipment. SCADA records are used as the basis for identifying an unplanned outage event for regulatory reporting. All of the equipment that is subject to reporting is monitored via the SCADA systems.[3]

The data collection process is different for those parts of the network managed by the Sydney and Wallsend control centres. Wallsend manages the Newcastle/Hunter region while Sydney manages the remainder of the network. The data collection system is also different for planned outages when compared to unplanned (forced) outages.

Unplanned Outages

When a fault occurs on the transmission system, protection systems open the appropriate circuit breaker/s to isolate the faulted feeder or plant item. The opening of the circuit breaker/s is automatically recorded by the SCADA system. The time of opening is recorded in an event log in hrs:mins:sec together with the date of operation.

In Sydney, a standard form 'Faults, Outages and Defects' is completed for each unplanned outage on the day by control centre staff. The System Operator transfers the relevant information to a lotus notes database called the 'Interruptions Information Database'. All distribution and transmission network unplanned outages are recorded daily.

Sydney uses the event log from the SCADA system to identify outages to be reported to AER. Each transmission element that is subject to reporting has an identifier, such as feeder 95Z. Each 6-months, the SCADA event log is searched for each identifier, outage events are identified and matched to the Interruptions Information Database from which outage details are transferred to the spreadsheet 'Outage Data for 2006'.

In Wallsend, a standard form 'Emergency Switching Sheet' is completed by the system operator for each outage event. Each unplanned outage so recorded is added to the 'Line Impedance Data' (LID) database (daily). The LID application is unique to Wallsend.

Wallsend uses the LID database to identify outages to be reported to AER. Each transmission element that is subject to reporting has an identifier, such as Tomago TX1. LID is searched for each identifier and the outage events identified are transferred to the spreadsheet 'Outage Data for 2006'.

Outage events that result in a loss of supply[4] are marked in the 'Interruption Information Database' or the LID database. This mark is used to identify loss of supply events, which are transferred to the spreadsheet 'Outage Data for 2006'.

[3] Two SCADA systems cover the network controlled at Sydney and a third at Wallsend.

[4] Loss of supply mean that end-use consumers are without a supply of electricity.

Planned Outages

The Sydney control centre generally receives requests for outages of the transmission system via e-mail. Some are received verbally. When it is received, the outage request information is manually entered into the outage planning spreadsheet (Subout2006.xls). Details recorded in the spreadsheet include items required to be out of service, recall time, length of outage (in days only) and the name of the person requesting the outage. As planned outages can be rescheduled or pre-switched on the prior day, the dates appearing in the planning spreadsheet may differ to the actual outage times.

A 'Mains and Apparatus Disconnect/Reconnect' instruction is raised and forwarded to the System Operator in the Control Centre and to field staff. Actual switching times (approximate) are recorded on the instruction by the System Operator.

As for unplanned outages, Sydney uses the event log from the SCADA system to identify outages to be reported to AER. Each 6-months, the SCADA event log is searched for each transmission network element identifier, outage events are identified and matched to the 'Mains and Apparatus Disconnect/Reconnect' instruction from which outage details are transferred to the spreadsheet 'Outage Data for 2006'. Outage events that do not have a corresponding entry in the 'Interruption Information Database' are also assumed to be planned outages.

At Wallsend, field staff (or control centre staff on behalf of TransGrid) enters requests for planned outages into an 'outage request' module of LID. The outage scheduling officer inputs all planned outages into a Lotus Notes calendar, which is viewable by all staff. A switching instruction is raised and forwarded to the System Operator in the Control Centre and to field staff.

Wallsend uses the planned outage information recorded in its lotus notes calendar to identify planned outages to be reported to AER. Details of the outages are taken from the lotus notes calendar. In 2006, Wallsend initiated a process of recording the actual switching times on a hard copy of the calendar record. This information is used to determine the outage duration. In a small number of instances, the switching record cannot be found or is not correctly completed. In such instances, SCADA historical load data held in Genload is searched and outage times for each event identified as when the load on the network element falls to zero.

2.2 IDENTIFICATION OF EXCLUDABLE EVENTS

The Service Standards Guideline identifies events that may be excluded from measures 1, 2, 3 (circuit availability of feeders, transformers and reactive plant) and 7 (loss of supply). The EnergyAustralia document *EnergyAustralia's Service Standards Performance 2006* (Document No. Sec11) identifies events that may be excluded from measures 4, 5 and 6 (MVA days of feeder availability, MVA days of bulk supply transformer availability and MVAr days of reactive plant availability).

The 'Outage Data for 2006' spreadsheet provides a column that can be marked 'yes' if the outage event involved defective/failed equipment or a planned outage with a recall to service time of greater than one day. This aligns with the allowable exclusions for measures 4, 5 and 6. The process of identifying these exclusions relies on information recorded in the 'Subout 2006' spreadsheet, the 'Interruptions Information Database' and, at Wallsend, the LID database.

The 'Outage Data for 2006' spreadsheet does not provide a column that can be marked to indicate a force majeure event. The Manager Network Security considers whether outage events meet the exclusion criterion for force majeure when preparing the spreadsheet, but the process is not rigorously applied. In 2006, no events were excluded due to force majeure.

2.3 ENERGYAUSTRALIA REVIEW OF DATA

The data assembled in the 'Outage Data for 2006' spreadsheet is checked by the Manager Network Security prior to forwarding to the AER. In particular, the start and end times, the reasons for exclusions (such as recall times) were checked.

2.4 GENERATION OF REGULATORY REPORT

Once populated with information about planned and unplanned outages, the 'Outage Data for 2006' spreadsheet is modified to calculate the performance indicators and is provided to the AER annually.

The calculated values are then transcribed into the reporting template spreadsheet provided by the AER. The reporting template then calculates the s-factor and the revenue impact.

2.5 CHANGES TO SYSTEMS AND PROCESSES DURING REPORTING PERIOD

The reporting system was altered in 2006 in response to comments made by SKM in their assessment of performance for 2005; that the manual systems need to be significantly improved to remove the potential for manual errors.

Previously at Sydney, EnergyAustralia used its interruptions database as the prime record of unplanned outages. This was found to be subject to incorrect identification and recording of events. In 2006, Sydney used SCADA data as the prime record of an outage event.

Previously at Wallsend, SCADA historical load data held in Genload was used to determine outage times for each planned interruption event (outage duration is taken as when the load on the network element falls to zero). In 2006, Wallsend initiated a process of recording the actual switching times on a hard copy of the calendar record. This information is used to determine the outage duration. In a small number of instances, the switching record cannot be found or is not correctly completed. In such instances, SCADA historical load data held in Genload is used to determine the outage duration.

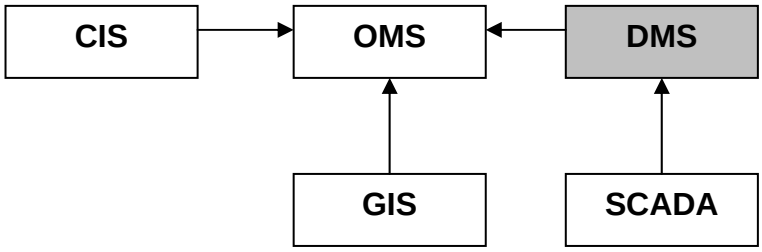
2.6 FUTURE CHANGES TO SYSTEMS AND PROCESSES

Currently, EnergyAustralia has the following systems:

- Supervisory control and data acquisition (SCADA) – provides a real time view of the transmission network and remote control of circuit breakers and other key equipment. SCADA records are used as the basis for identifying an outage event;
- Outage Management System (OMS) – used to record the dispatch of work to field personnel, mainly for distribution system outages;
- Customer Information System (CIS) – used to record distribution customer information;
- Graphical Information System (GIS) – contains a geographical view of the network.

EnergyAustralia is currently implementing a new distribution network management system (DMS) that is aimed at improving the collation of network information from its systems. Currently, EnergyAustralia's systems do not record the connectivity of distribution customers to the network. The DMS will provide a connectivity model using network information from the GIS and customer information from the CIS. The OMS will be able to use this information when recording outages of network elements. Figure 2-1 shows the new DMS arrangement.

Figure 2-1 Integration of new DMS system



Importantly, the DMS will replace the two SCADA systems currently used, bringing EnergyAustralia to a modern platform capable of providing improved regulatory reporting. EnergyAustralia has not yet determined the changes that will be made to facilitate regulatory reporting for its transmission network, intending to retain the (largely) manual reporting process for the present time.

3. ACCURACY OF DATA INPUT

This section of the report describes the activities undertaken and resulting conclusions regarding the accuracy of data input and reporting for the performance indicators reported by EnergyAustralia.

3.1 GENERAL CHECKS

3.1.1 Treatment of network amendments

The equipment that is subject to reporting is listed (see appendix A) and is not subject to change within the regulatory period, that is, any new transmission equipment is not added to the list of reportable transmission assets until the start of the next regulatory period.

EnergyAustralia advise that no system alterations affected reporting about the listed equipment in 2006.

3.1.2 Inclusion of all outages

Because SCADA data is now used at Sydney to identify outages, PB is of the view that it is very likely that all outages have been included in the reporting. This is because all of the equipment that is subject to reporting at Sydney is monitored via EnergyAustralia's SCADA systems. The use of the LID database at Wallsend also appears to provide a reliable source of outage information.

The accuracy of reporting is, however, reliant on manual extraction of 'raw' data from SCADA and other information systems, which is then used to identify outage events and to provide the information required for regulatory reporting. EnergyAustralia's reliance on twice yearly manual extraction of data means that some simplifying assumptions are made when categorising the data into outage events and in the calculation of the performance indicators. These are discussed in the following sections for each performance indicator.

PB also found that the accuracy of reporting is dependant on accurate labelling of data and diligence in the manual extraction of information from information sources. For instance, the LID data base must be searched separately for each network identifier introducing the potential for human error. PB checked that all network elements had a corresponding entry in the 'Outage Data for 2006' spreadsheet. While all network elements were included, some did not have outages reported. A spot check of these against the Interruptions Information Database at Sydney and the LID database at Wallsend confirmed these entries were correct, that no outages had occurred in 2006 on these network elements.

Overall, PB found that the 2006 performance data had been manually extracted from the information sources with a high degree of accuracy.

3.1.3 Audit of data

PB audited the data provided by EnergyAustralia for measures 1 through 6 for the month of November. One month was chosen at random, so as to provide a check that all outages had actually been captured by the data extraction process.

EnergyAustralia provided an extract of data from its SCADA systems for all of the equipment for which performance is reported. PB assembled the data for November into

outage events and compared this with the number of reported events. No errors were found in the number of outage events reported.

Table 3-1 Number of items audited

Equipment class	Number audited	Total number
Feeders	38	299
Transformers	22	198
Reactive plant	2	30

Table 3-1 shows the number of outage events found in November for each type of equipment class. The accuracy of reporting of each of these outage events was audited. The details of the audit outcomes are included in the sections below, for each measure.

Overall, PB found that the performance data had been manually extracted from the information sources with a high degree of accuracy.

3.2 ASSESSMENT OF MEASURES

3.2.1 Measures 1 and 4 – Transmission circuit availability and MVA days of feeder availability

The reported outage events were audited by PB as follows:

- All reported planned and unplanned outage events ex Sydney for November 2006 were checked against SCADA records.
- All reported planned and unplanned outage events ex Wallsend for November 2006 were checked against the LID database.
- A detailed check of planned outage paperwork (for transmission and distribution assets) was undertaken for 1 and 2 November 2006 to ensure that no reportable transmission outage had been missed.
- A spot check of outage reasons was undertaken to confirm the appropriateness of exclusions.
- A spot check of feeder ratings recorded on the reporting spreadsheet against information recorded on system diagrams was undertaken.

PB found that the data had been manually transcribed from the information sources with a high degree of accuracy. In Sydney, outage times were generally found to be the same as recorded in the SCADA event database. In the period audited (November), PB found four events that had start or end times that differed from SCADA data, but only by a few minutes.[5] In all cases, the time recorded was either not the first circuit breaker to open or the last circuit breaker to close. Table 3-2 shows an example of incorrect reporting times for feeder 90F, for the outage events that occurred on 26-30 November 2006. The impact on the reported indicator, however, is not material.

[5] Feeder 90J, outage of 22 November; feeder 90X, outage of 8-11 November; feeder 92A, outage of 19-23 November; and feeder 92F, outage of 26 – 30 November.

Table 3-2 Example of variation in outage start and end times – feeder 90F

Circuit breaker at:	Trip (Date hh:mm:sec)	Close (Date hh:mm:sec)	Comment
Lane Cove	26 Nov 2:27:31	30 Nov 3:42:41	These time were reported
Mason Park	26 Nov 2:26:54	30 Nov 3:44:58	As the trip at Mason Park occurred first and the close occurred last, these times should have been reported
Difference	00:00:37	00:02:17	A difference of 3 minutes in an outage duration of 174 minutes represents a 1.7 % error for this event

Generally, if a sequence of circuit breaker close and open operations occurred within a few minutes, the interruptions were not counted as separate outage events. PB found one sequence of close and open operations where the circuit breaker was closed for 56 minutes before reopening.[6] PB considers that this should have been counted as two outage events and the total outage duration reduced by 56 minutes. The impact on the reported indicators, however, is not material.

At Wallsend, the duration of some planned feeder outages was taken as the time when the load recorded by SCADA was zero. Because the loads ex Wallsend are recorded each 15 minutes, a maximum error of 30 minutes is introduced (see Figure 3-1). A more accurate result could be obtained by accessing the SCADA event log to determine the actual opening and closing times of the relevant circuit breakers.[7] The SCADA event log records, however, are archived a few days after the event making this an arduous and time consuming task. Alternatively, the accuracy of the outage duration can be improved by taking the start time as the time when the load reduced to zero and the end time as when the load was non-zero. This approach would reduce the maximum error to 15 minutes. PB determined that the number of events ex Wallsend where either the start or finish time was on the quarter hour was 13, giving an approximate error of 195 minutes, assuming the duration is understated by 15 minutes on average. Given that 299 interruption events were recorded with a total duration of 513,000 minutes, the error is not material (approximately 0.04%).

PB had no detailed work plans or other information on which to audit the accuracy of feeder recall[8] times. A spot check of the type of planned work and the associated recall times, however, found that the times recorded appear reasonable.

At Sydney, recall times are recorded, where appropriate, in the subout2006.xls spreadsheet. At Wallsend, recall times were only formally recorded when the outage involved TransGrid assets. For all other events, it was assumed that if a feeder was returned to service within 24 hours that the recall time was less than 24 hours, and that if the outage extended beyond 24 hours that the recall time was longer than 24 hours. As work may be curtailed and a feeder returned to service in a shorter time than the actual outage time, these assumptions may introduce a longer recall time for some projects.

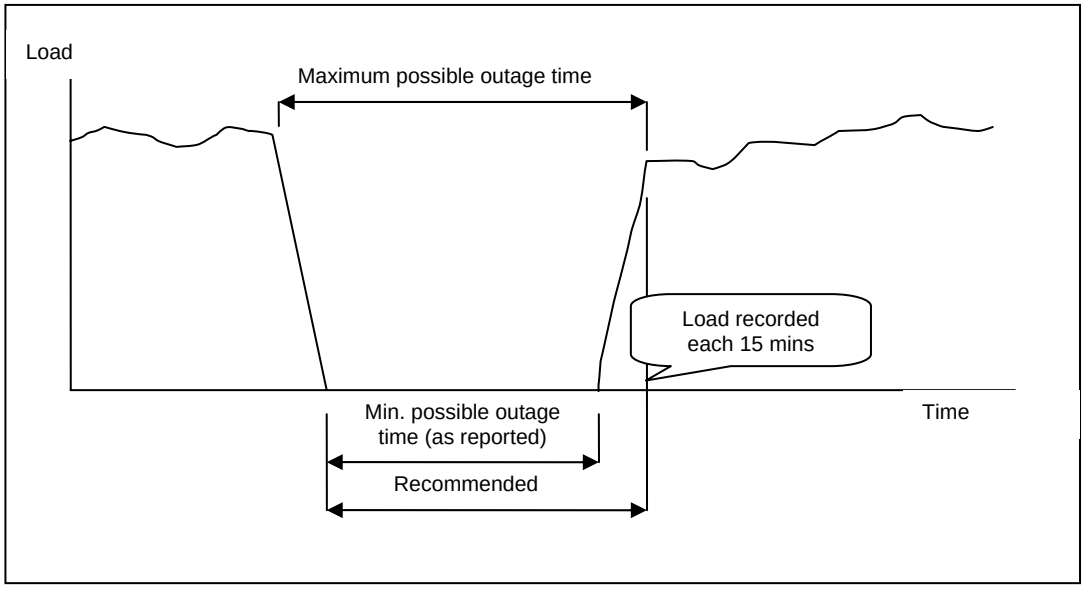
6 Feeder 95E, outage of 6 November to 10 November 2006.

7 PB notes that any planned outage of less than 15 minutes in duration might not be captured by the methodology adopted at Wallsend to identify planned outages. However, planned outages of such duration are rare.

8 "Recall" means the cessation of the work and return of the equipment to service.

Because measure 4 (MVA days of feeder availability) excludes planned outages where the recall time is less than 24 hours, the assumptions made by EnergyAustralia may result in the reporting of some events that should have been excluded.

Figure 3-1 Selection of outage times



Because Wallsend do not record the actual recall time, no estimate can be made of the inaccuracy in reporting introduced. However, only 3 outage events at Wallsend of a total of 299 outage events exceeded 24 hours, giving a maximum possible error of one per cent.

A spot check of reasons for outages revealed that at Wallsend force majeure exclusions were not identified. For instance, Wallsend did not identify outages where the reason was to carry out planned work on TransGrid assets. Such outages meet the criteria for exclusion as "outages shown to be caused by a fault or other event on a 3rd party system".

PB recommends that EnergyAustralia review the reasons for outage events and correctly exclude events that meet the appropriate exclusion criteria.

A spot check of feeder ratings (as used to calculate the MVA for measure 4) against the values recorded on system diagrams found no errors.

3.2.2 Measure 2 – Transformer availability

The reported outage events were audited as follows:

- All reported planned and unplanned outage events ex Sydney for November 2006 were checked against SCADA records.
- All reported planned and unplanned outage events ex Wallsend for November 2006 were checked against the LID database.
- A detailed check of planned outage paperwork was undertaken for 1 and 2 November 2006.

PB found that the data had been manually transcribed from the information sources with a high degree of accuracy. In Sydney, outage times were found to be the same as recorded in the SCADA event database.

The first circuit breaker opening was generally taken as the start of an outage and the first circuit breaker closed as the end of the outage. This approach correctly identifies the start and end of a transformer outage. One instance was found where the circuit breaker on the lower voltage side of a transformer had been opened first, hence off-loading the transformer, and at the end of the outage had been closed last. However, the outage time had been recorded when the 132 kV transformer circuit breaker was opened and closed, a difference of several minutes.[9] The impact of such inconsistencies in reporting, however, is unlikely to be material.

3.2.3 Measure 3 and 6 – Reactor availability and MVAR days of reactive plant non-availability

The reported outage events were audited as follows:

- All reported planned and unplanned outage events ex Sydney for November 2006 were checked against SCADA records.
- All reported planned and unplanned outage events ex Wallsend for November 2006 were checked against the LID database.
- A spot check of plant ratings against those shown on system diagrams was undertaken.

As for the other measures, PB found that that the data had been manually transcribed from the information sources with a high degree of accuracy.

A spot check of plant ratings (as used to calculate the MVA for measure 6) against the values recorded on system diagrams found no errors.

3.2.4 Measure 5 – MVA days of 'transmission bulk supply' transformers non- availability

Transmission bulk supply transformers are also reported in measure 2 – Transformer availability. The reported outage events were audited as follows:

- The transmission bulk supply transformers were compared to the data reported under transformer availability to ensure the data was the same.
- A spot check of plant ratings against those shown on system diagrams was undertaken.

No errors were found.

3.2.5 Measure 7 – Loss of supply due to forced transmission asset outages

Figure 3-2 shows the loss of supply data submitted by EnergyAustralia. All loss of supply events were reported because no reporting thresholds have yet been set. PB notes that the column headed 'Maximum system demand (MVA)' is actually the demand lost (MVA), which is taken from Genload.

[9] Meadowbank Tx1, outage of 4 – 8 November.

Figure 3-2 Loss of Supply Data (measure 7)[10]

Event	Description of the event and its impact on the network and performance	Circuits affected	Cause of the event	Start date (time)	End date (time)	Outage Duration (Hours)	Maximum system demand (MVA)
Loss of Supply to Drummoyne Zone Substation	Feeder fault	Feeders 900, 204, 926, 923 and 924	Lantana bush grew into feeder 900 sealing end at Rozelle STS. Others feeders tripped due to the fault causing a loss of supply.	7/02/2006 (0:06:00)	07/02/2006 (3:16:00)	3:10:00	27.2
Loss of Supply to Burwood Zone Substation				7/02/2006 (0:06:00)	07/02/2006 (1:49:00)	1:43:00	42.6
Loss of Supply to Strathfield Substation				7/02/2006 (0:06:00)	07/02/2006 (1:49:00)	1:43:00	24.7
Loss of supply to bunnerong North busbar 3A	33kV busbar fault	33kV Distribution Feeders 323, 361, 349, 363, 334, 359 & 337	33kV Capacitor circuit breaker fault	16/02/2006 (16:16:00)	16/02/2006 (19:21:00)	3:05:00	43.8
Loss of supply to Marrickville Zone Substation	TX Fault	Feeders 91X/1 & 91X/2. Note: feeder 91Y/1 & 91Y/2 was OOS at the time of incident.	Crow caused flash over on 11kV at TX1	12/05/2006 (10:20:00)	12/05/2006 (11:31:00)	1:11:00	49.5
Loss of supply to Somersby Zone Substation - 11kV Busbar 2A	11kV busbar 2A trip	11kV busbar 2A trip	Staff working inadvertently caused trip	11/09/2006 (18:19:00)	11/09/2006 (18:20:00)	0:01:00	0.6
Loss of supply to Macquarie Park Zone Substation	TX Fault	TX2 Note: TX1 OOS at the time of the incident.	Bird caused flash over on 11kV bushing at TX2	19/11/2006 (18:19:00)	19/11/2006 (18:45:00)	0:26:00	23.8
Loss of supply to Double Bay Zone Substation - TX1 & TX2	TX/feeder trip	Feeders 90R & 262	Staff working on TX inadvertently caused trip	29/11/2006 (14:05:00)	29/11/2006 (14:43:00)	0:38:00	48.3
Loss of supply to Clovelly Zone Substation - TX1 & TX2		Feeders 90R & 262	Staff working on TX inadvertently caused trip	29/11/2006 (14:05:00)	29/11/2006 (16:03:00)	1:58:00	23.1

The reported outage events were audited as follows:

- A spot check of outages not included in the reported data was examined to see whether they resulted in a loss of supply.
- The outage durations were compared with SCADA data.

Two errors were found:

- The end times recorded for the loss of supply event of 7 February do not align with the SCADA event log;
- Double Bay and Clovelly zone substations and associated feeders 90R and 262 are not listed as transmission assets and should not have been reported.

An analysis of the event of 7 February is set out in Appendix B. This shows that the load supplied from the Burwood and Strathfield zone substations was restored at 1:34 am when the circuit breaker controlling feeder 924/1 was closed rather than at 1:49 am as reported. It also shows that load ex Drummoyne was restored in stages with Transformer 1 on load at 2:50 am and all supply restored at 3:15 am. This staged restoration of supply is significantly different to the single outage time reported.

EnergyAustralia provided the following explanation:

"At 0250, 85 distribution substations had their power supply restored. At 0315, supply to the remaining 75 distribution substations was carried out. When the 11kV A & C circuit breakers were closed, TX1 could then supply all the substation load. At this stage, TX2 was still not supplying any load. At 0510, when the 11kV 2A & 2B circuit breakers were closed, normal supply arrangements were established. ie. TX1 & TX2 both supplying load. To simply the recording of the event I did not breakdown the individual restoration steps. I recorded the maximum value of lost load and the duration of customers who received the longest outage."

EnergyAustralia had also ignored staged restoration of supply in the events of 16 February and 19 November. PB considered that this simplification of reporting did not meet the definition of the loss of supply measure, which is MVA load lost times the duration, and resulted in reporting performance significantly worse than actual performance for the indicator.

10 EnergyAustralia – Transmission Service Standards, Reliability in 2006, Appendix B, 1 February 2007.

EnergyAustralia explained that it had submitted its loss of supply data in accordance with its revenue cap determination. EnergyAustralia relied on the "unit of measure" line in the definition when preparing its performance report and reported data for all events because thresholds had not been set for the measure. The AER discussed its reporting requirements under the revenue cap determination with EnergyAustralia and noted that the determination was open to different interpretations. It clarified that EnergyAustralia should submit its loss of supply data so that it complies with the formula for the loss of supply measure in its revenue cap determination rather than the "unit of measure". As a result, EnergyAustralia resubmitted its loss of supply data. The resubmitted data is shown in Table 3-3.

Table 3-3 Resubmitted loss of supply data

Event	Description of the event and its impact on the network and performance	Circuits affected	Cause of the event	Start date	Start time	End date	End time	Outage Duration (Hours)	Un-delivered Energy (MWh)	System Minutes
Loss of Supply to Drummoyne Zone Substation	Feeder fault	Feeders 900, 204, 926, 923 and 924	Lantana bush grew into feeder 900 sealing end at Rozelle STS. Others feeders tripped due to the fault causing a loss of supply.	7 Feb 2006	0:06:00	7 Feb 2006	3:16:00	3:10:00	63.40	0.697
Loss of Supply to Burwood Zone Substation				7 Feb 2006	0:06:00	7 Feb 2006	1:49:00	1:43:00	54.90	0.603
Loss of Supply to Strathfield Substation				7 Feb 2006	0:06:00	7 Feb 2006	1:49:00	1:43:00	40.40	0.444
Loss of supply to bunnerong North busbar 3A	33kV busbar fault	33kV Distribution Feeders 323, 361, 349, 363, 334, 359 & 337	33kV Capacitor circuit breaker fault	16 Feb 2006	16:16:00	16 Feb 2006	19:21:00	3:05:00	12.2	0.134
Loss of supply to Marrickville Zone Substation	TX Fault	Feeders 91X/1 & 91X/2. Note: feeder 91Y/1 & 91Y/2 was OOS at the time of incident.	Crow caused flash over on 11kV at TX1	12 April 2006	10:20:00	12 April 2006	11:31:00	1:11:00	49.4	0.5429
Loss of supply to Somersby Zone Substation - 11kV Busbar 2A	11kV busbar 2A trip	11kV busbar 2A trip	Staff working inadvertently caused trip	11 Sept 2006	18:19:00	11 Sept 2006	18:20:00	0:01:00	0.01	0.0001
Loss of supply to Macquarie Park Zone Substation	TX Fault	TX2 Note: TX1 OOS at the time of the incident.	Bird caused flash over on 11kV bushing at TX2	19 Nov 2006	18:19:00	19 Nov 2006	18:45:00	0:26:00	8.7	0.1

In compiling the resubmitted data, EnergyAustralia used loading information from the Genload database to estimate the load lost in each loss of supply event. Where blocks of load had been restored at different times, EnergyAustralia also took into account the actual outage duration for each load block when determining the Undelivered Energy (MWh). The system minutes associated with each loss of supply event was calculated as the Undelivered Energy times 60 (MWminutes) divided by the maximum system demand (5460 MW) that had occurred up until the time of each event.

PB considers that the resubmitted data is consistent with the definition of the loss of supply measure and is sufficiently accurate.

3.2.6 Measure 8 – Hours that planned outage plans were in place

This indicator measures the number of hours EnergyAustralia put in place contingency plans to shed customer load, at the request of TransGrid or NEMMCO. The measure applies when an outage is planned on TransGrid's transmission network that places the transmission system at risk of being unable to supply all load in the circumstances where a subsequent unplanned outage occurs. In such circumstances, TransGrid or NEMMCO requests EnergyAustralia to nominate where load would need to be shed in the event of the further outage.

Only two events were reported in 2006.

All formal requests for specific planned outages are received via email from TransGrid to a specific e-mail address 'EA_Outages'. All requests are recorded. Contingency plans are provided verbally or via email.

At the time of annual reporting, the hours that planned outages were in place is determined by reference to the 'EnergyAustralia Outages' mailbox. The load at risk is determined by obtaining network loads from Genload over the duration of the outage which would be lost if an unplanned/forced outage occurred on the network. SCADA is used to determine when the contingency plans were in place.

Only two planned outage events occurred in 2006 resulting in an average of 3109 minutes of load at risk.

PB notes that the title of the measure (hours) is inconsistent with the calculated value (minutes).

4. RELIABILITY OF RESULTING PERFORMANCE DATA OUTPUT

This section of the report describes PB's assessment of the reliability of data resulting from the input data.

4.1 CALCULATION OF INDICATORS

The reporting spreadsheet 'Outage Data for 2006' was checked to ensure that all reported events that are contained in the spreadsheet were included in the calculation of the performance indicators. No spreadsheet errors were found.

The spreadsheet correctly calculates and applies the 14 day cap to measures 1 to 6.

Measures 1, 2 and 3 are the same circuit availability sub-measures as defined in the AER's Service Standards Guideline. EnergyAustralia's definitions and calculation of the performance indicators are consistent with the guideline.

Measures 4 to 8 are unique to EnergyAustralia and were offered by EnergyAustralia in the revenue decision as alternative measures to those specified in the AER's Service Standards Guideline. The definitions for these measures are contained in an EnergyAustralia document *EnergyAustralia's Service Standards Performance 2006* (Document No. Sec11). The calculation of indicators is consistent with this document except that inconsistencies were found in nomenclature, where the term 'unavailability' is used where the actual measure is 'availability'. This inconsistency has not affected the calculation of the indicators.

4.2 CALCULATION OF S-FACTOR

Only the circuit availability measure is used in the service incentive scheme that applies to EnergyAustralia.

The value of the circuit availability measure was correctly transcribed from the reporting spreadsheet 'Outage Data for 2006' to the AER reporting template.

The reporting template allows for input data regarding excludable events. EnergyAustralia has not entered any data for exclusions.

PB notes that the Service Standards Guideline allow that a TNSP may apply to the AER to exclude certain events. That EnergyAustralia has not identified any exclusions is consistent with the guideline.

From the perspective of accuracy in reporting (as discussed in section 3.2.1), PB would recommend that EnergyAustralia review the reasons for outage events and correctly exclude events that meet the appropriate exclusion criteria. However, when using the indicator in an incentive scheme, consideration must also be given to the basis of setting targets. PB understands that no exclusions were made in the historical performance data that was used to set the targets for the service incentive scheme. PB considers, therefore, that it is appropriate that exclusions should not be made in the service performance for 2006.

PB also recognises that the review of 299 events may be a time consuming and arduous task for EnergyAustralia to undertake, given its current dependence on manual record systems, and that it may prefer to not incur the costs and to forgo the potential for increased rewards.

In summary, PB recommends that the calculation of the s-factor be based on the value of circuit availability submitted by EnergyAustralia of 97.74 per cent (without exclusions being applied). The s-factor resulting from this value is 0.39 per cent of revenue.

4.3 COMPLIANCE WITH REPORTING OBLIGATION

In this report, PB found that:

- All reported measures are considered to be of acceptable accuracy.
- EnergyAustralia has established the appropriate s-factor and financial incentive based in its reported performance during the 2006 calendar year.

PB concludes that EnergyAustralia has complied with its reporting obligation for all measures.

5. SYSTEMIC WEAKNESSES IN PROCESSES AND SYSTEMS

This section of the report provides a summary of systemic weaknesses in processes or systems, found during the audit process.

EnergyAustralia is reliant on manual extraction of data

EnergyAustralia's reliance on twice yearly manual extraction of data from information systems containing 'raw' data means that some simplifying assumptions are made in assembling the data into outage events and in the calculation of the performance indicators. This is because the manual extraction and analysis process is time intensive and because additional information about past events is difficult to obtain.

Examples are where overall switching times are used to determine the event duration rather than the times when each network element was restored to service and the assumption that events are planned if an event has not been logged in the 'Interruption Information Database'.

To improve the robustness of the reporting process, PB recommends that EnergyAustralia develop a database of outage events compiled at the time of the outage and containing all of the required information to enable the performance indicators to be calculated. We note that the current work to establish a DMS system will facilitate this development by providing a link between SCADA information and the outage management system. EnergyAustralia has not yet determined the changes that will be made to facilitate regulatory reporting for its transmission network, intending to retain the (largely) manual reporting process for the present time.

A lack of identification of excludable events leads to systemic over-reporting of performance for some indicators.

Because an assessment of the excludability of an event is not made at the time of recording (or appropriate information recorded on which a future decision to excluded can be based), some events that meet the exclusion criteria are reported.

A lack of recording of recall times leads to reporting performance worse than actual, for measures that exclude planned outages with a recall time less than 24 hours (measures 4, 5 and 6).

Inferring recall times from the length of a planned outage leads to overstatement of the number of outages with recall times greater than 24 hours. Some events that should be excluded are therefore reported. While the estimated inaccuracy in reporting in 2006 was less than one per cent (see section 3.2.1), this may vary depending on the number of planned outages that exceed 24 hours in the year.

The accuracy of reporting is dependant on accurate labelling of data and diligence in the manual extraction of information from information sources.

Because information is manually extracted by using, in turn, each identifier assigned to network elements, the accuracy of reporting is highly dependant on the diligence with which the data extract process is undertaken and the experience of the person categorising the data into outage events. While the extraction process appears to have been carried out with a high degree of accuracy in 2006, PB considers that the process is not robust and may not produce similar outcomes in future.

APPENDIX A
List of transmission assets to be included in reporting

Transmission Feeders

Identifier	From	To
202	Drummoyne	Rozelle
203	Mason Park	Drummoyne
204	Mason Park	Drummoyne
860	Kurri	Stroud Road
900	Mason Park	Rozelle
910	Sydney South	Canterbury
911	Sydney South	Canterbury
926	Sydney North	Mason Park
927	Sydney North	Homebush Bay
935	Homebush Bay	Mason Park
951	Ourimbah	West Gosford
956	Gosford	West Gosford
957	Vales Point	Ourimbah
958	Tuggerah	Gosford
962	Waratah Sw Stn	Tomago
963	Tomago	Taree
908/909	Canterbury	Bunnerong
90F	Mason Park	Chullora
90J	Mason Park	Chullora
90T	Green Square	Haymarket
90W/4	Rozelle	Pyrmont
90X	Meadowbank	Mason Park
91A/1	Beaconsfield West	St Peters
91A/2	Chullora	St Peters
91B/1	Beaconsfield West	St Peters
91B/2	Chullora	St Peters
91F	Sydney South	Peakhurst
91J	Sydney South	Peakhurst
91L	Peakhurst	Bunnerong
91M/1	Peakhurst	Beaconsfield

Identifier	From	To
91M/3	Bunnerong	Beaconsfield
91X/1	Beaconsfield West	Marrickville
91X/2	Chullora	Marrickville
91Y/1	Beaconsfield West	Marrickville
91Y/2	Chullora	Marrickville
92A	Sydney North	Lane Cove
92B	Sydney North	Lane Cove
92F	Lane Cove	Mason Park
92J	Lane Cove	Meadowbank
95C	Tuggerah	Ourimbah
95E	Gosford	Somersby
95L	Capral	Kurri
95Z	Somersby	Mt Colah
96A	Newcastle	Kurri
96B	Newcastle	Capral
96F	Stroud	Beresfield
96U	Newcastle	Kurri
96W	Newcastle	Capral
97E	Charmhaven	Munmorah PS
98B	Wyong	Charmhaven
98R	Tomago	Beresfield
99C	Tuggerah	Wyong
99Y	Beresfield	Kurri STS
9NA	Beresfield	Newcastle
9S2	Beaconsfield	Haymarket
9S6/1	Haymarket	Pyrmont
9S9/1	Haymarket	Pyrmont
9SA	Beaconsfield	Campbell St
9SC	Haymarket	Campbell St
9SE	Beaconsfield	Green Square

Transmission Transformers

Substation
Beresfield TX1
Beresfield TX3
Bunnerong TX1A
Bunnerong TX1B
Bunnerong TX1C
Bunnerong TX2
Bunnerong TX3
Bunnerong TX4
Campbell St TX1
Campbell St TX2
Canterbury TX1
Canterbury TX2
Canterbury TX3
Canterbury TX4
Charmhaven TX1
Charmhaven TX2
Drummoyne TX1
Drummoyne TX2
Gosford TX1
Gosford TX2
Gosford TX3
Gosford TX4
Green Square TX1
Green Square TX2
Homebush Bay TX1
Homebush Bay TX2
Kurri TX1
Kurri TX2
Kurri TX3
Macquarie Park TX1

Substation
Macquarie Park TX2
Marrickville TX1
Marrickville TX3
Marrickville TX4
Meadowbank TX1
Meadowbank TX2
Meadowbank TX3
Ourimbah TX1
Ourimbah TX2
Ourimbah TX3
Peakhurst TX2
Peakhurst TX3
Peakhurst TX4
Pyrmont TX1
Pyrmont TX2
Pyrmont TX3
Rozelle TX1
Rozelle TX2
Somersby TX1
Somersby TX2
St Peters TX1
St Peters TX2
St Peters TX3
St Peters TX4
Tomago TX1
Tomago TX2
Tomago TX3
West Gosford TX11
West Gosford TX13
Wyong TX1
Wyong TX2

Transmission Bulk Supply Transformers

Substation
Beresfield TX1
Beresfield TX3
Bunnerong TX1A
Bunnerong TX1B
Bunnerong TX1C
Bunnerong TX2
Bunnerong TX3
Bunnerong TX4
Canterbury TX1
Canterbury TX2
Canterbury TX3
Canterbury TX4
Gosford TX1
Gosford TX2
Gosford TX3
Gosford TX4
Kurri TX1
Kurri TX2
Kurri TX3
Ourimbah TX1
Ourimbah TX2
Ourimbah TX3
Peakhurst TX2
Peakhurst TX3
Peakhurst TX4
Pyrmont TX1
Pyrmont TX2
Pyrmont TX3
Rozelle TX1
Rozelle TX2
Tomago TX1
Tomago TX2
Tomago TX3

Transmission Reactive Plant

Substation
Bunnerong Cap1
Bunnerong Cap2
Bunnerong Cap3
Bunnerong Cap4
Bunnerong Cap5
Canterbury Cap1
Canterbury Cap2
Canterbury Cap3
Chullora Reactor 1
Chullora Reactor 2
Gosford Cap2
Gosford Cap3
Gosford Cap4
Mason Park Reactor 1
Ourimbah Cap1
Ourimbah Cap2
Peakhurst Cap1
Peakhurst Cap3
Peakhurst Cap4
Pyrmont Cap1
Pyrmont Cap2
Tomago Cap
Kurri Cap

APPENDIX B
Analysis of loss of supply event of 7 February 2006

Date/time	Plant	Action	Comment
7-Feb-06 12:06:41 AM	ROZELLE 900 PYRMONT CB	9002TRIP	Loss of all supply to Drummoyne, Strathfield and Burwood
7-Feb-06 12:06:41 AM	MASON PAR 900 ROZELLE CB	9002TRIP	
7-Feb-06 12:06:41 AM	DRUMMOYNE 9 TX 1 CB 1B	TRIP	
7-Feb-06 12:06:41 AM	DRUMMOYNE 24 TX 2 CB 2A	TRIP	
7-Feb-06 12:06:41 AM	DRUMMOYNE SEC 1-2 132KV CB	TRIP	
7-Feb-06 12:06:41 AM	MASON PAR 923/1 STRATHFIELD TEE CB	9232TRIP	
7-Feb-06 12:06:41 AM	MASON PAR 924/1 STRATHFIELD TEE CB	9242TRIP	
7-Feb-06 12:06:41 AM	DRUMMOYNE 25 TX 2 CB 2B	TRIP	
7-Feb-06 12:06:41 AM	DRUMMOYNE SEC 2-3 132KV CB	TRIP	
7-Feb-06 12:06:41 AM	MASON PAR 204 DRUMMOYNE CB	2042TRIP	
7-Feb-06 12:06:41 AM	DRUMMOYNE 8 TX 1 CB 1A	TRIP	
7-Feb-06 12:27:37 AM	CHULLORA NO.1 REACTOR CB	4912CLOSE	
7-Feb-06 1:34:27 AM	MASON PAR 924/1 STRATHFIELD TEE CB	9242CLOSE	Restore supply ex Strathfield and Burwood
7-Feb-06 1:49:52 AM	MASON PAR 923/1 STRATHFIELD TEE CB	9232CLOSE	
7-Feb-06 2:49:46 AM	MASON PAR 204 DRUMMOYNE CB	2042CLOSE	Energise Drummoyne Tx1
7-Feb-06 2:50:39 AM	DRUMMOYNE 8 TX 1 CB 1A	CLOSE	Restore supply via Drummoyne Tx1 to 85 distribution substations
7-Feb-06 2:50:52 AM	DRUMMOYNE 9 TX 1 CB 1B	CLOSE	
7-Feb-06 2:53:31 AM	ROZELLE 202 DRUMMOYNE CB	2022TRIP	
7-Feb-06 2:54:53 AM	DRUMMOYNE SEC 2-3 132KV CB	CLOSE	Trip thru
7-Feb-06 2:54:53 AM	DRUMMOYNE SEC 2-3 132KV CB	TRIP	
7-Feb-06 3:15:22 AM	DRUMMOYNE 16 A BACK BUS SECTION	CLOSE	Restore all supply (to a further 75 distribution substations).
7-Feb-06 3:15:50 AM	DRUMMOYNE 31 C BUS TIE	CLOSE	
7-Feb-06 3:29:33 AM	DRUMMOYNE SEC 1-2 132KV CB	CLOSE	Trip thru
7-Feb-06 3:29:33 AM	DRUMMOYNE SEC 1-2 132KV CB	TRIP	
7-Feb-06 3:55:56 AM	MASON PAR NO.1 REACTOR CB	4912CLOSE	
7-Feb-06 5:01:55 AM	DRUMMOYNE SEC 2-3 132KV CB	CLOSE	Energise Drummoyne Tx2
7-Feb-06 5:03:29 AM	ROZELLE 202 DRUMMOYNE CB	2022CLOSE	
7-Feb-06 5:06:58 AM	DRUMMOYNE SEC 1-2 132KV CB	CLOSE	Energise DrummoyneNo3 bus
7-Feb-06 5:10:05 AM	DRUMMOYNE 24 TX 2 CB 2A	CLOSE	Restore normal supply via Drummoyne Tx2
7-Feb-06 5:10:16 AM	DRUMMOYNE 25 TX 2 CB 2B	CLOSE	
7-Feb-06 5:10:28 AM	DRUMMOYNE 31 C BUS TIE	TRIP	
7-Feb-06 5:10:38 AM	DRUMMOYNE 16 A BACK BUS SECTION	TRIP	