

Audit of TransGrid Service Standards Performance Reporting 2006

PERFORMANCE RESULTS FOR 2006

- Final Report
- 15 March 2007



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1. Introduction

Sinclair Knight Merz (SKM) has been appointed by the Australian Energy Regulator (AER) (formally the ACCC) to conduct an audit of the January to December 2006 performance report of TransGrid under the AER / ACCC Performance Incentives (PI) Scheme.

This review has included an examination of the accuracy and adequacy of the recording system for TransGrid, together with an assessment of the application of force majeure and other exclusions.

Other issues that have been investigated and reported on include:

- whether the reporting complies with the requirements of TransGrid's revenue cap decision and the AER Service Standards Guidelines;
- adequacy of recording systems and a review of any changes since previous audits;
- comparison of the actual results achieved relative to the targets set in the revenue cap decisions; and
- an independent validation, or otherwise, of the calculations and the S-factors.

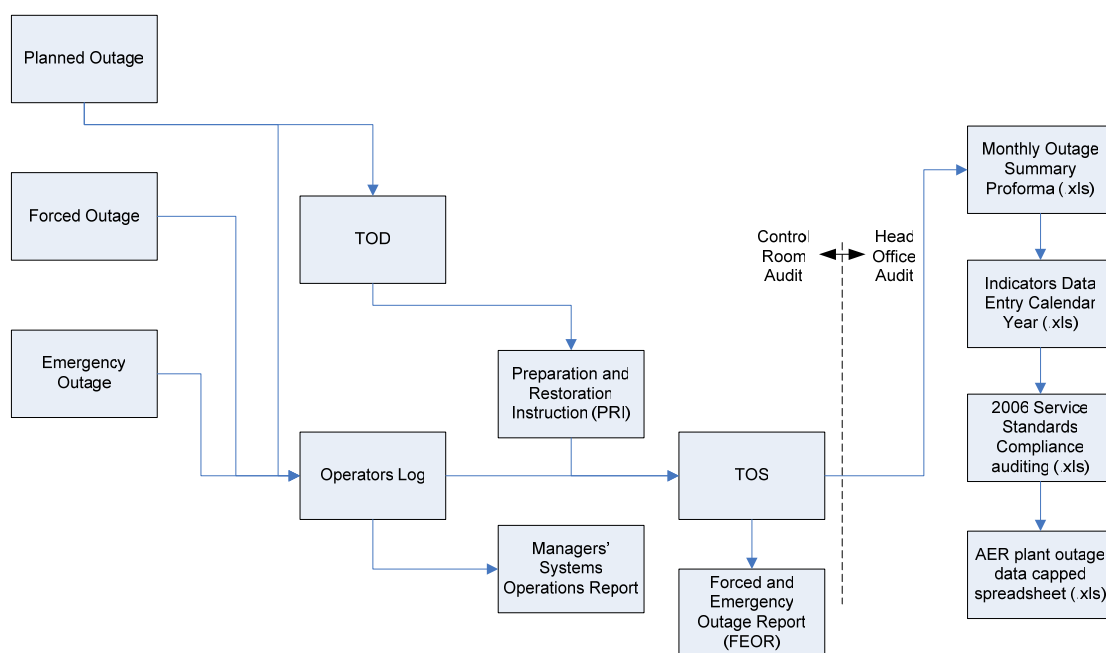


2. Recording System

SKM recommended in its audit of TransGrid's 2003, 2004 and 2005 reporting that the existing manual reporting system be developed and refined by TransGrid to reduce the risk of manual errors. TransGrid are in the process of developing a new recording system "THEOS". THEOS will incorporate a number of significant operational systems that will reduce the risk of manual errors. TransGrid estimate the new system will be operational from the beginning of 2008. The existing system for the calculation of S factor will continue to be used until this time.

2.1 Existing recording process

An overview of the existing TransGrid Performance Indicator reporting system is shown in Figure 1.



■ **Figure 1 TransGrid's PI Reporting System**

2.2 Performance Indicator Reporting System

TransGrid's Performance Indicator (PI) Reporting System is comprised of a number of components. These are:

- Transmission Outage Diary – TOD (Electronic)
- Preparation and Restoration Instructions (Paper)



- Operators Log (Paper and Electronic)
- Transmission Outage Statistics – TOS (Electronic)
- Excel Spreadsheets for PI calculation (Electronic)

The process for recording an outage depends on whether the outage is planned, forced or an emergency.

Planned outage

An outage for an item of equipment is requested via TOD. (TOD is a forward looking plan and does not maintain a history of outages.) The request generates a Request For Access (RFA) form that is sent to System Control. System Control prepares a Preparation and Restoration Instruction (PRI) for the outage which is used to control the process of removing the equipment from service and returning it to service. The PRI is a paper form and is used to record times of equipment switching. The PRI form is then manually entered into the TOS database by the control room operator at the end of each shift.

Forced Outage

An item of equipment is removed from service due to a protection operation. The operator will record the event in the Operators Log and manually enter it into TOS. The outage is flagged in TOS as a Forced Outage. This automatically generates a Forced and Emergency Outage Report (FEOR).

Emergency Outage

An emergency outage occurs following a request from emergency services or others to de-energise the system due to an emergency arising on or near items of equipment. The event is recorded in the Operators Log and manually entered into TOS. The outage is flagged in TOS as an Emergency Outage. This automatically generates a Forced and Emergency Outage Report (FEOR).

TransGrid's PI Reporting System is based around the TOS. The outage statistics in TOS are entered by TransGrid's operators in the three TransGrid control rooms (Central – Wallgrove, Northern – Newcastle and Southern – Yass). TOS started as a VAX based system in 1992, and was migrated onto a PC platform in 2000.

PI Reporting System is performed in a separate system to TOS. Details of individual outage events are manually transferred from TOS reports each month into a "Monthly Outage Summary" spreadsheet by staff in the Performance & Compliance section. Filtering of excluded events take place at this time, with excluded events omitted from the monthly outage summary spreadsheets,



from which performance statistics and S Factors are derived. Forced / Emergency Outage Report (FEOR) reports are consulted to determine whether events are to be excluded, as are details on TOS, system diagrams, and knowledge of ownership of various pieces of equipment.

Some manual intervention is required to derive the PI reporting from TOS, as TOS only records outages on the equipment that has actually been switched. Therefore, if an outage on a circuit breaker is recorded in TOS, it is necessary to review system diagrams to determine whether a transmission circuit or transformer will also be taken out of service as a consequence. Performance & Compliance staff assess each outage recorded in TOS to determine which relevant items are affected in the PI Reporting System.

PI reporting is derived from a series of spreadsheets linked to the 12 monthly outage summary spreadsheets. These are mostly automatic following the manual input of the TOS data, with manual adjustments for capping outages at 168 hours and numbers of plant items.

2.3 Outage Details

For planned outages, the PRI is used to record the times of outage. Two times are recorded on the PRI. The first time is the time when the operator is given clearance from the field staff to operate the equipment. The second time is the time that the operator advises the Network Controller (NEMMCO) that the equipment has been operated. The two times can differ from anywhere up to 15 minutes depending on the level of activity in the control room. The actual operation time of the equipment (available in SCADA) is not recorded and is between the two times recorded. One of the times recorded on the PRI (usually the clearance time from field staff) is manually entered into TOS as the in / out time.

Forced and emergency¹ outages are recorded in TOS as they occur and the operation times are taken from the operators SCADA interface.

2.4 Categorisation and Exclusions

Outages entered into TOS are categorised as “TransGrid reason” or “non-TransGrid reason” by the operators. Network performance staff check the categorisations when they manually enter the data into the PI reporting spreadsheets, and make adjustments as required. This sometimes requires reference to FEOR reports to identify the cause and responsible party.

Outages on equipment not owned by TransGrid are excluded. These are generally distribution network lines where TransGrid owns the circuit breaker² and a Distribution Network Service

¹ TransGrid defines a forced outage as an automatic protection operation, and emergency outages as forced switching under control of operators.



Provider (DNSP) owns the line. There are also instances when EnergyAustralia transmission lines are taken out of service due to TransGrid maintenance or outages on circuit breakers. TransGrid exclude such events as they do not own the line and EnergyAustralia exclude them as a third party outages caused by TransGrid. This effectively means a number of transmission line outages are not captured by the scheme.³

2.5 Audit walk-through of the existing system

2.5.1 Spot checks on the reporting system

As TransGrid's recording system is a predominately a manual system, SKM carried out number of checks through the complete recording process. This process consisted of checking the head office systems and the system at the Wallgrove control centre.

During the head office audit SKM discovered a discrepancy in the monthly outages summary spreadsheet for April where an outage at Cooma had been counted twice in the spreadsheet but only appeared once in the TOS database. SKM is satisfied this is an isolated error and the overall results are free from material error.

To gain confidence that TransGrid's control room captured all of the outage data, SKM carried out spot checks between the TOS database and the SCADA system. The results are shown in Table 1. It should be noted that at present TransGrid does not have full SCADA coverage of its network.

■ **Table 1 Spot Checks on the TransGrid Reporting system**

Outage Description	TOS Values		SCADA Data		Duration Discrepancy	% of outage time	Comments
	Out Time	In Time	Out Time	In Time			
No 5 Sydney South	1/05/2006 7:57	5/05/2006 17:15	1/05/2006 8:02	5/05/2006 16:46	34.00	0.54%	Entered as No5 Tx should be No1
Line 11	3/05/2006 7:15	3/05/2006 14:36	3/05/2006 7:15	3/05/2006 14:29	7.00	1.61%	
Line 11	4/05/2006 6:31	4/05/2006 15:20	4/05/2006 6:32	4/05/2006 15:20	1.00	0.19%	
Line 11	5/05/2006 6:27	5/05/2006 14:57	5/05/2006 6:30	5/05/2006 14:55	5.00	0.99%	
Line 959	6/05/2006 6:35	6/05/2006 15:45	6/05/2006 6:37	6/05/2006 15:43	4.00	0.73%	

² Circuit breaker outages are not covered by the PI Reporting System, even when they are owned by TransGrid.

³ This situation appears to be relatively unique to TransGrid and EnergyAustralia, where TNSP boundaries occur within substations. With other TNSPs interconnectors will generally be partially owned by the TNSP at either end, and hence both will have a line outage captured by the scheme, so whoever caused the outage will have an event to report.



Outage Description	TOS Values		SCADA Data		Duration Discrepancy	% of outage time	Comments
	Out Time	In Time	Out Time	In Time			
No 5 Sydney South	6/05/2006 8:08	6/05/2006 11:03	6/05/2006 8:19	6/05/2006 11:00	14.00	8.70%	
No 6 Sydney South	6/05/2006 11:08	6/05/2006 14:30	6/05/2006 11:10	6/05/2006 14:28	4.00	2.02%	
Line 11	8/05/2006 6:30	8/05/2006 16:31	8/05/2006 6:31	8/05/2006 16:30	2.00	0.33%	
Line 11	9/05/2006 6:32	9/05/2006 15:28	9/05/2006 6:33	9/05/2006 15:28	1.00	0.19%	
Line 11	11/05/2006 6:11	11/05/2006 16:06	11/05/2006 6:15	11/05/2006 15:56	14.00	2.41%	
No 5 Tx Sydney West	No Entry	No Entry	12/05/2006 7:04	12/05/2006 15:18	-494.00	-100.00%	Outage not entered into TOS
Line 11	15/05/2006 6:33	15/05/2006 10:26	15/05/2006 6:36	15/05/2006 10:25	4.00	1.75%	
Line 11	16/05/2006 9:01	16/05/2006 16:08	16/05/2006 9:02	16/05/2006 16:08	1.00	0.23%	
Line 11	17/05/2006 6:31	17/05/2006 15:39	17/05/2006 6:33	17/05/2006 15:39	2.00	0.37%	
Line 11	18/05/2006 6:23	18/05/2006 16:00	18/05/2006 6:25	18/05/2006 16:01	1.00	0.17%	
CB Catchall Sydney East	18/05/2006 6:35	19/05/2006 13:25	18/05/2006 6:36	19/05/2006 13:11	15.00	0.82%	
Line 14 Sydney North	22/05/2006 6:35	22/05/2006 12:23	22/05/2006 6:35	22/05/2006 12:22	1.00	0.29%	
Line 895	2/08/2006 8:07	2/08/2006 15:45	2/08/2006 8:14	2/08/2006 15:46	6.00	1.33%	
Line 26	8/08/2006 6:22	8/08/2006 16:07	8/08/2006 6:23	8/08/2006 16:07	1.00	0.17%	
Line 26	10/08/2006 6:09	10/08/2006 16:27	10/08/2006 6:06	10/08/2006 16:27	-3.00	-0.48%	
FEOR 17/8/06 No.3 TX SYW	17/08/2006 6:14	17/08/2006 7:25	17/08/2006 6:14	17/08/2006 7:27	-2.00	-2.74%	
FEOR 17/8/06 No.5 TX SYW	17/08/2006 6:14	17/08/2006 7:25	17/08/2006 6:14	17/08/2006 7:25	0.00	0.00%	
Line 914	18/08/2006 23:56	20/08/2006 17:42	18/08/2006 23:56	20/08/2006 17:41	1.00	0.04%	

It can be seen from Table 1 that there are discrepancies between the values recorded in TOS and the SCADA historian. Excluding the outage on No 5 Transformer at Sydney West the discrepancies equate to a 0.60% error. As the Service Standards targets set by the AER are based on the existing recording process that does not rely on SCADA data, SKM does not consider this to be an issue. However if the proposed THEOS system relies on the SCADA system this may create differences between future and historic values.

During the SCADA checks, SKM identified that an outage on No 5 transformer at Sydney West substation had not been entered into the TOS database. As a result, this outage had not been



included in the service standards figures. Due to the missing outage, SKM requested that a second audit of the TOS and SCADA data be undertaken to ensure that the missing information was an isolated incident. The results of the second audit are shown in Table 2.

■ **Table 2 Comparison of SCADA and TOS data**

Check No	Date and Time	SCADA Output	TOS database	Check Status	Comments
1	04/05/2006 16:35 to 16:39	Outage at Tomago 330kV No 3 Transformer	Outage at Tomago 330kV No 3 Transformer	✓	No Comment
2	30/05/2006 10:27 to 14:59	Outage at Bayswater on Circuit Breaker 322	Outage at Bayswater on Circuit Breaker 322	✓	Due to substation design no line outage occurred, not reported in the Service Standards submission
3	04/05/2006 06:32 to 15:20	Outage at Smithfield on Line 11	Outage at Smithfield on Line 11	✓	No Comment
4	04/05/2006 08:53 to 11:56	Outage at Sydney North on Circuit Breaker 5442	Outage at Sydney North on Circuit Breaker 5442	✓	Due to substation design no line outage occurred, not reported in the Service Standards submission
5	05/05/2006 06:16 to 17:54	Outage at Newcastle on Line 81	Outage at Newcastle on Line 81	✓	No Comment
6	08/05/2006 08:59 to 11:55	Outage at Canberra on Transformer No1	Outage at Canberra on Transformer No1	✓	No Comment
7	22/05/2006 05:55 to 17:54	Outage at Newcastle on Line 81	Outage at Newcastle on Line 81	✓	No Comment
8	22/05/2006 06:46 to 13:09	Outage at Dapto on Transformer No 1	Outage at Dapto on Transformer No 1	✓	No Comment
9	15/05/2006 17:27 to 16/05/2006 00:06	Outage at Upper Tumut on Line 46	Outage at Upper Tumut on Line 46	✓	No Comment
10	23/05/2006 07:32 to 16:16	No entry in SCADA	Outage at Sydney West On Bus A1	✓	Note SCADA data not available for the Busbar, however SCADA data for circuit breakers on this bus show outage
11	04/02/2006 08:00 to 15:54	Outage at Lower Tumut on Line 66	Outage at Lower Tumut on Line 66	✓	No Comment
12	06/02/2006 11:28 to 02/03/2006 06:59	Outage at upper Tumut on Line 64	Outage at upper Tumut on Line 64	✓	No Comment
13	08/02/2006 07:14 to 10:36	Outage at Tomago 330 on Circuit breaker 942B	Outage at Tomago 330 on Circuit breaker 942B	✓	No Comment
14	14/02/2006 06:33 to 12:02	No SCADA data	Outage at Tamworth 132 on Line 873	✓	The existing TransGrid SCADA system does not cover Tamworth 132
15	14/02/2006 07:40 to 15:24	Outage at Tamworth 330 on Transformer No2	Outage at Tamworth 330 on Transformer No2	✓	No Comment



Check No	Date and Time	SCADA Output	TOS database	Check Status	Comments
16	14/02/2006 08:23 to 14:58	Outage at Mt Piper 330 on Circuit Beaker 732	Outage at Mt Piper 330 on Circuit Beaker 732	✓	No Comment
17	22/02/2006 06:25 to 16:17	Outage at Eraring 500 on Circuit Beaker 6422M	Outage at Eraring 500 on Circuit Beaker 6422M	✓	No Comment
18	08/09/2006 08:47 to 10:58	Outage at Mt Piper 330 on Circuit Breaker 732	Outage at Mt Piper 330 on Circuit Breaker 732	✓	No Comment
19	11/09/2006 06:35 to 15:00	Outage at Yass on Line 39	Outage at Yass on Line 39	✓	No Comment
20	21/09/2006 12:02 to 14:26	Outage at Murray on Line 65	Outage at Murray on Line 65	✓	No Comment

Following the second audit SKM is satisfied that the omission of the Sydney West outage was an isolated incident and that the PI reporting system is free from material error. However, the audit has highlight that the present reporting system is open to human error. To reduce the risk of these errors and to allow for more transparency in the process SKM recommends the follow modifications to the existing system:

- Automatically link the spreadsheets involved in the process to reduce the potential for human error; and
- Include all TOS outages throughout the PI Reporting system and indicate which have been “included” or “excluded”. SKM note that TransGrid had added an additional spreadsheet that identifies which outages have been “included” or “excluded”, however this has not been integrated with the PI reporting system and is of limited assistance in its present guise.
- Undertake a sample check the SCADA historian with the data stored in TOS to ensure all outage events are captured
- Update recording procedures to state which of the PRI times are to be recorded in the TOS data base

SKM has discussed these improvements with TransGrid and note that TransGrid will consider the modifications listed above.



3. Performance Measures

As set out in table 9.8.1 of the NSW and ACT Transmission Network Revenue Cap TransGrid 2004/05 to 2008/09, TransGrid have reported on the follow measures:

- Transmission circuit availability;
- Transformer availability;
- Reactive plant availability;
- Reliability (Events > 0.05 system minutes);
- Reliability (Events > 0.04 system minutes); and
- Average outage restoration time.

3.1 Inclusions

Sinclair Knight Merz has considered the inclusions discussed in TransGrid's submission and can confirm that the inclusions are in line with those stated in the Service Standards guidelines.

3.2 Exclusions

The Service Standards guidelines contain provisions for certain defined events to be excluded from the calculated outage figures, on the basis that they are beyond the control of Transmission Network Service Providers (TNSPs) or consistent with historical reporting of outages. In addition to this list of exclusions TransGrid with the agreement of the AER have included a number of specific exclusions not explicitly identified in the Service Standards guidelines these are as follows:

- Transient interruptions less than one (1) minute;
- Pumping station supply interruptions; and
- Where a customer's own control/protection system trips their plant during a transient voltage fluctuation or other quality of supply events, whether caused by TransGrid or otherwise.

As targets are based on historic data that included the same exclusions, SKM considers this acceptable until such time that a common set of criteria have been adopted.



4. TransGrid Specific Exclusions and Caps

Using the Service Standard guidelines and last year reporting outcome, TransGrid has highlighted the following events as exclusions or capped events. Details of these exclusions are set out in the following section.

4.1 Transmission Line Availability Measure

4.1.1 FEOR 3-2006-F0010 Bushfire

TransGrid claimed an exclusion for an outage caused by a bushfire that damaged 8 poles on a 132kV wood pole line. The explanation given by TransGrid for the exclusion is as follows:

Circuit breakers at both ends of the line tripped, auto-reclosed, tripped then locked out and weather conditions were hot with strong winds and a bushfire in the area of the line. A ground patrol on 2nd January 2006 identified 8 wood poles on structures 424, 451, 465, 482, 497, 500 & 506 in the Junee to Bethungra area that were damaged and destroyed by the bushfire. All eight poles were replaced and the line was returned to service on 16:40hrs on 2nd January 2006. The outage duration was 34.93 hours. It is proposed to exclude this outage under 1.3 “force majeure”.

The AER has defined a four step process for an event to be categorising as “force majeure”.

- was the event unforeseeable and its impact extraordinary, uncontrollable or unmanageable?
- does the type of event occur frequently? If so how did the impact of the particular event differ?
- could the TNSP, in practice, have prevented the impact of the event though not necessarily the event itself?
- could the TNSP have effectively reduced the impact of the event by adopting better practices?

A bushfire does not necessarily constitute a “force majeure” event as it is an event that occurs relatively frequently. However, both SKM and the AER have researched this event and consider it an extraordinary event and therefore acceptable as an exclusion. It should be noted that SKM is of the view that it should not be the responsibility of either SKM as auditors or the AER as regulator to supply sufficient supporting information for events proposed by TNSPs for exclusion.

It should also be noted that in TransGrid’s “TransGrid- 2006 Service Standards Compliance Reporting.xls” spreadsheet that the outage duration for this exclusion has been entered as 16.23 hours opposed to 34.93 hours.



4.1.2 FEOR 0-2006-F0006 Inter-trip from Victoria

TransGrid claimed a 3rd party exclusion for an outage caused when performing in service inter-trip checks with a Victorian TNSP. In their submission, TransGrid claimed that “... *an inter-trip signal was sent which tripped the circuit breaker for this line at Wodonga. Victorian TNSP staff had not isolated inter-trip links for this circuit.*”

SKM has investigated this event with TransGrid, who have provided sufficient additional information to support the proposed exclusion as a third party inter-trip. However, following a review of the SP AusNet outages for 2006, it was not apparent that this event was included in the SP AusNet performance calculations as SKM could not identify a corresponding event recorded.

4.1.3 FEOR 1-2006-F0214 EA Pilot Cable Damage

TransGrid claimed a 3rd party exclusion for an outage caused on a line when a 3rd party contractor damaged a pilot cable between a TransGrid and EnergyAustralia substation. TransGrid owns the first 7 structures of the line from the TransGrid substation with the remainder (and majority) of the line being owned by EnergyAustralia.

SKM considers that in this case, TransGrid was providing protection to the line and the cause of the event was from damage to an EnergyAustralia cable.

SKM is satisfied that this exclusion is reasonable. However, SKM recommends that the AER consider how to address events that effect lines partially owned by two TNSPs.

4.1.4 FEOR 3-2006-F0176 Snowy Hydro Ltd Auto-Synchronising Circuits

TransGrid claimed a 3rd party exclusion for an outage caused when Snowy Hydro Ltd (SHL) staff caused an unplanned opening of circuit breakers controlling the line at TransGrid's Upper Tumut substation when working on the auto-synchronising circuits within SHL premises.

SKM considers that in this case, TransGrid is entitled to the exclusion as it was caused by SHL staff incorrectly operating their auto-synchronising circuits. The transmission line is tail ended onto the generator and the only breaker available for synchronising is the TransGrid breaker at Upper Tumut. SHL has control of this breaker for synchronising purposes and the event causing the trip was generated in a third party system.

SKM notes that these assets (the line and Upper Tumut substation) were owned by SHL up until 30th June 2002. SKM recommends that TransGrid and SHL consider adopting procedures and training for the operation and testing of the auto-synchronising circuits to avoid future trips due to staff error.



4.1.5 FEOR 3-2006-F-0179 Snowy Hydro Ltd Fault on 17kV Busbar

TransGrid claimed a 3rd party exclusion for an outage caused by a fault on Snowy Hydro's 17kV busbar on No.11 generator.

This exclusion is similar to that described in section 4.1.4 and as such, TransGrid is entitled to the exclusion.

4.1.6 FEOR 3-2006-F0208 Snowy Hydro Ltd Fault on Voltage Transformer

TransGrid claimed a 3rd party exclusion for an outage caused by a fault on a Snowy Hydro voltage transformer secondary.

This exclusion is similar to that described in section 4.1.4 and as such, TransGrid is entitled to the exclusion.

4.1.7 FEOR 1-2006-F0177 Lightning Strike on QLD-NSW line

TransGrid claimed a 3rd party exclusion for an outage caused by a lightning strike on the QLD-NSW interconnector. TransGrid claimed the fault was on the Queensland portion of the line. TransGrid has not been able to verify the location of the fault and categorically determine that the lightning strike occurred on the Queensland portion.

SKM do not consider this exclusion to be valid. In addition, this outage was a trip and auto-reclose outage and as such does not need to be included as the AER is only concerned with sustained outages.

4.1.8 FEOR 2-2006-F0105 Fault in Energy Australia System caused 760MW Loss

TransGrid claimed a 3rd party exclusion for an outage caused by over voltage when 760MW of load was lost in Energy Australia's system.

SKM considers this exclusion to be valid as the originating fault was on a third party asset and outside of TransGrid's control.

4.2 Transformer Availability Measure

4.2.1 FEOR 2-2006-F0117 Liverpool Transformer Trip due to Integral Energy

TransGrid claimed a 3rd party exclusion for an outage caused when Integral Energy staff removed temporary protection from an Integral Energy transformer and trip the TransGrid transformer. The TransGrid transformer is tail-ended to Integral's transformer. TransGrid confirmed that the protection operated correctly on both No.1 and No.2 protection.

SKM considers this exclusion to be valid as the originating fault was on a third party system and outside of TransGrid's control.



5. Calculation of S-Factors

SKM has checked TransGrid's calculation of its S-Factors for 2006, and re-calculated the S-factors taking into account its recommendations regarding each of TransGrid's requested exclusions and the discrepancy discovered during the audit process. These results are shown in the tables below. SKM considers TransGrid has calculated its S-factors accurately and in accordance with the PI Scheme Guidelines, except where requested exclusions not been included by SKM referred to in section 4 of this report.

■ **Table 3 Performance Results**

No	Performance Measure	Target	TransGrid Without Exclusions	TransGrid With All Requested Exclusions	SKM Without Exclusions	SKM With Recommended Exclusions
S1	Transmission line availability	99.5%	99.563127%	99.565846%	99.563127%	99.567043%
S2	Transformer availability	99.0%	98.837670%	98.837889%	98.837084%	98.837303%
S3	Reactive Plant availability	98.6%	98.922566%	98.922566%	98.922566%	98.922566%
S4	Reliability (Events > 0.05 system minutes)	5	2	2	2	2
S5	Reliability (Events > 0.4 system minutes)	1	0	0	0	0
S6	Average Outage Restoration Time (7 day cap per event)	1500	857	824	857	812

■ **Table 4 Calculated S-factors**

No	Performance Measure	TransGrid Without Exclusions	TransGrid With Exclusions	SKM Without Exclusions	SKM With Exclusions
S1	Transmission line availability	0.06313%	0.06585%	0.06313%	0.06704%
S2	Transformer availability	-0.03044%	-0.03040%	-0.03055%	-0.03051%
S3	Reactive Plant availability	0.04608%	0.04608%	0.04608%	0.04608%
S4	Reliability (Events > 0.05 system minutes)	0.25000%	0.25000%	0.25000%	0.25000%
S5	Reliability (Events > 0.4 system minutes)	0.20000%	0.20000%	0.20000%	0.20000%
S6	Average Outage Restoration Time (7 day cap per event)	0.09524%	0.09801%	0.09524%	0.09897%
Total		0.62401%	0.62954%	0.62390%	0.63159%



The profiles for each of the applicable measures are shown in Appendix A to illustrate the performance in graphical terms.

Based on these results, SKM recommends the bonus for TransGrid should be **0.62747% of the agreed Annual Revenue for 2006.**



Appendix A 2006 Performance Measure Profiles

The Performance Measure profiles graphically illustrate the 2006 performance against the targets for availability, reliability and average outage measures.

The profiles shown are:

- Transmission line availability
- Transformer availability
- Reactive Plant availability
- Reliability (Events > 0.05 system minutes)
- Reliability (Events > 0.4 system minutes)
- Average Outage Restoration Time (7 day cap per event)

