Australian Competition and Consumer Commission (ACCC)

Audit of ElectraNet SA Service Standards Performance Reporting

PERFORMANCE RESULTS FOR 2004

- Final Report
- 23 March 2005

Australian Competition
and Consumer Commission

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1. Executive Summary

Sinclair Knight Merz (SKM) was engaged by the Australian Competition and Consumer Commission (ACCC) to conduct an audit of the performance report of ElectraNet SA for 2004 under the ACCC Performance Incentive (PI) Scheme.

The audit reviewed the performance results submitted by ElectraNet SA, in particular:

- the adequacy and accuracy of the recording system used to measure performance;
- the accuracy of the calculations of the final performance; and
- the force majeure and other exclusions to accord with the service standards guidelines.

SKM met with ElectraNet SA staff in Adelaide on Wednesday 16 February 2005, to review their data systems and procedures for gathering and processing outage information. The integrity of the system established by ElectraNet SA for retrieving data from the Events Database for reporting under both internally and the ACCC PI Scheme was audited. As a result of audit activities undertaken, Sinclair Knight Merz has formed an opinion that:

- the performance reporting by ElectraNet SA was free from material errors and was in accordance with the requirements of the ACCC service standards guidelines;
- ElectraNet SA correctly applied the PI Scheme formulas and coefficients to calculate the performance incentive amount using the equations contained in the revenue cap decision[1];
- the recording system used by ElectraNet SA to capture outage data is accurate and reliable;
- the categorisation of assets was consistent with the historical categorisation; and
- the application of exclusions was in accordance with historical calculation of performance.

SKM recommends that:

- ElectraNet SA's calculation of its S factor and performance incentive be accepted as free from material errors;
- the exclusion of parts of the Vic – SA Separation of 8 March 2004 is reasonable in light of the NEMMCO investigation findings;
- the exclusion of the transmission line rebuild event is consistent with historical calculation of performance; and

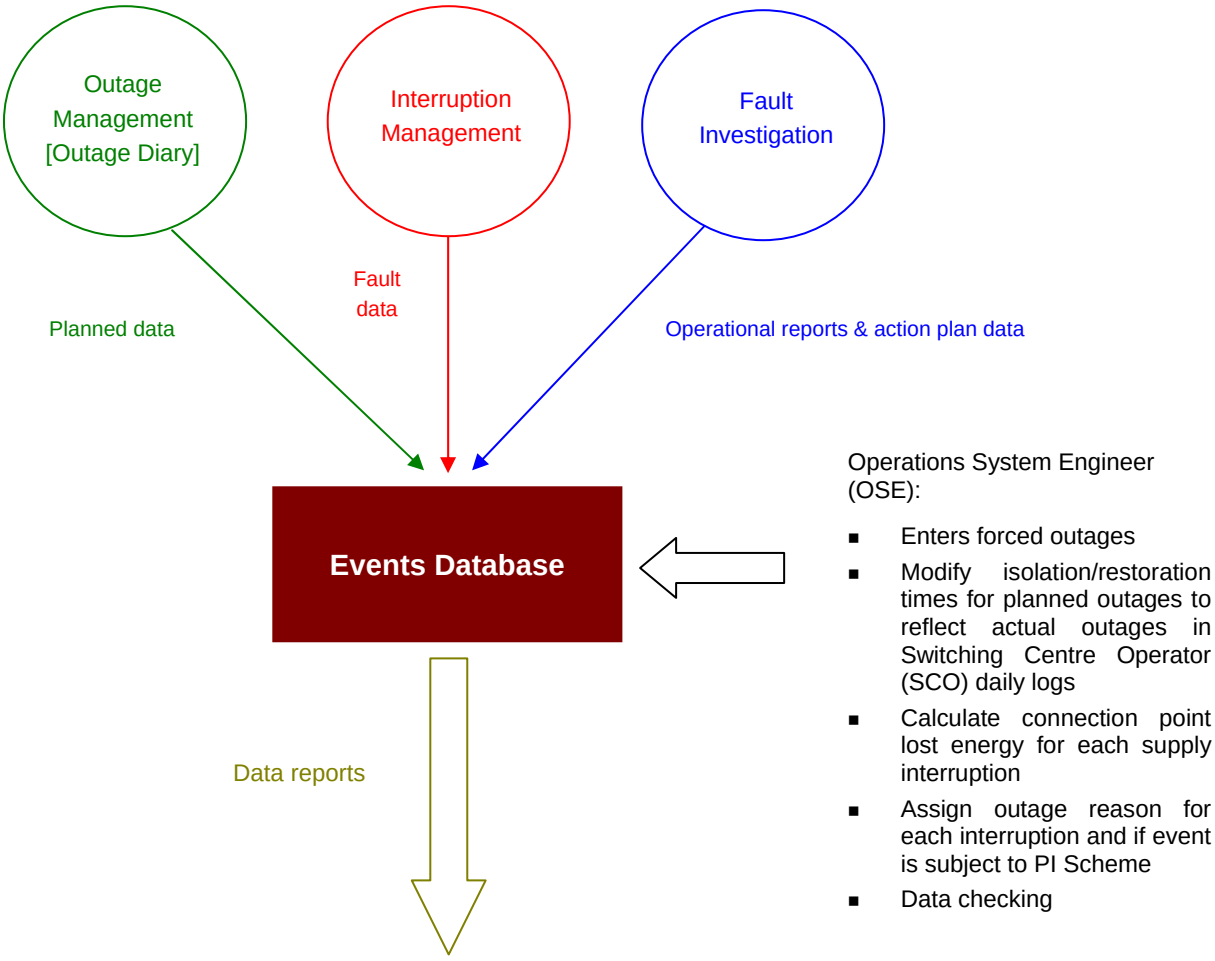
[1] The original revenue cap decision contained errors in the table in Appendix 6. The formulas contained in Appendix 7 are the correct figures, and the ACCC has written to ElectraNet SA with a corrected Appendix 6 table. The correct figures have been used by ElectraNet SA to calculate its performance incentive.

- based on the exclusion of the transmission line rebuild event as being consistent with historical performance calculation, the bonus recommended under the ACCC PI Scheme for 2004 is **0.66% of the agreed Annual Revenue for 2004**, whilst the bonus recommended for an alternate view that includes the event with the effect capped to 14 days, would be **0.631% of the agreed Annual Revenue**.

2. Recording System

An overview of the ElectraNet SA transmission performance data management process is shown in Figure 2-1.

- **Figure 2-1 Transmission Performance Data Management Process**



- Reporting and Data Acquisition Management
- Fault Management
- PI Scheme Management
- Network Performance Management

2.1 Events Database

The Events Database was developed in-house using Oracle. Data entry is currently based on a series of manual inputs, although the system is being developed and more direct data input methods would be employed in the future.

Operators in the Switching Operation Centre maintain an electronic log[2] using a database system, which the Operations System Engineer (OSE) subsequently uses to review events and cross check the start and finish times for outages with the SCADA records.

Certain defined events, such as forced outages, automatically generate an email from the operator in the Switching Operation Centre to a defined list of staff, advising of the details of the incident.

Planned work is recorded in the Outage Diary, which is entered into the Events Database. The OSE reviews each planned outage against the daily logs and SCADA records to modify the isolation and/or restoration times to reflect actual times. Each planned outage is part of the System Switching Program and carries a SSP number for easy identification.

All relevant events from the logs, interruption reports, and the outage diary are entered into the Events Database. Fault investigation reports are used in some cases to establish the cause of outages, and to assign the appropriate classification (eg included/excluded).

For each outage, the Operation System Engineer calculates the unserved energy using actual load data from revenue metering, reviews the cause for the outage and codes the event for calculation of performance under the PI Scheme. This coding is checked by others as part of the operational report for each event, and modified if the original categorisation is deemed inappropriate. It was noted that the original coding is not overwritten, but updated, so that there is a history maintained for this coding phase.

2.2 Categorisation and Exclusions

The reasons for each event are considered at the time events are entered into the Events Database, and excluded events are “tagged” in the database. Separate database fields for each of the defined performance measures allow events excluded from one measure to be included in another, as appropriate (eg outage duration, energy not served, outage > 0.2 minutes).

[2] During 2004, ElectraNet SA replaced the previous system of operators maintaining hand written logs that were subsequently transferred to an electronic log with this practice. There have been some problems with the implementation of the new scheme, which are currently being attended to. However, SKM is satisfied that the correct and complete logging of events has not been compromised during this phase.

2.3 Processing of Outage Data

ElectraNet SA have developed database queries and reports that extract relevant data from the Events Database for further analysis in a spreadsheet for PI Scheme analysis and reporting.

The Events Database acts as a single information source for PI Scheme reporting, with all relevant events exported to spreadsheets for summation and analysis. There is a separate sheet for each performance indicator, listing total events for that indicator, and a separate total after force majeure exclusions. A cover sheet summarises the results for each performance indicator, and calculates the S factors and revenue bonus/penalty.

2.4 Calculation of Performance Measure Results

The performance measure results are calculated using the S-factor equations defined in the South Australian Transmission Network Revenue Cap decision (2002). The Commission has written to ElectraNet SA clarifying the discrepancies between Appendices 6 and 7 of the original decision document, and confirming that the equations in Appendix 7 prevail over the figures in Appendix 6. ElectraNet SA have applied the equations and coefficients from Appendix 7.

2.5 System Audit Findings

Following the extensive testing of the recording system in the 2003 audit which found no errors in the processing of event data, SKM conducted sample testing of the Events Database to ensure correlation with spreadsheet reports. The tests confirmed that each of the events had been correctly transferred, with the date, time and other details intact. SKM was satisfied the reasons and classification for each event was reasonable and in accordance with historical reporting protocols.

3. Exclusions

The ACCC service standard guidelines noted that the PI Scheme adopted standard definitions for performance measures to ensure that TNSPs have similar incentives, whilst recognising that these definitions needed to be flexible. It was highlighted that the definitions should align with appropriate information that the TNSP has been collecting historically to ensure that performance is measured consistently over time to preserve the incentive to improve. The audit identified the events that have been excluded in the past.

3.1 Excluded Events

For each of the performance measures applicable to ElectraNet SA, there are different exclusions specified for each. These exclusions are shown in Table 3-1 for each of the performance indicators.

Shaded areas represent exclusions applied by ElectraNet in line with historical practice that are not explicitly listed in the ACCC PI Scheme (as per the South Australian Transmission Network Revenue Cap decision (2002)).

Table 3-1 Exclusions for ElectraNet SA performance indicators

Circuit Availability	Loss of Supply Event Frequency Index	Average Outage Duration
Unregulated transmission assets;	Unregulated transmission assets	Unregulated transmission assets
3rd party initiated events (TNSPs, generators, customers, NEMMCO)	3rd party initiated events (TNSPs, generators, customers, NEMMCO)	3rd party initiated events (TNSPs, generators, customers, NEMMCO, faults causing correct operation of ElectraNet protection)
Extended outages for major line rebuilding involving substantial multi structure replacements, restringing and reinsulation	Planned outages	Planned outages
	Successful reclose within one (1) minute	Momentary interruptions (<1 minute)
Force majeure	Force majeure	Force majeure
Voltage control [3] where circuit is available for immediate restoration	Outages resulting from an interconnector outage are capped to thirty (30) minutes	Outages resulting from an interconnector outage are capped to thirty (30) minutes
Opening of only one end of a transmission line ie. where the transmission line remains energised and available	SA Water pumping station supply outages (refer section 3.2)	

[3] Circuit switched out to provide actual or contingency voltage control.

3.2 SA Water

Interruptions involving SA Water pumping stations are included in Average Outage Duration performance calculations but excluded from the Loss of Supply Event Frequency Index. This is due to two main considerations:

- These interruptions were excluded from historical data used in setting performance targets under the ACCC PI Scheme, as pumping station loads are highly irregular, which makes any accurate estimation of load profiles and therefore projected energy lost very unreliable; and
- SA Water pumping stations are classified as Category 1 loads under the South Australia Transmission Code, and were historically interruptible by ElectraNet and therefore excluded from any calculations of lost system minutes.

The Transmission Code defines a Category 1 load as

> *"A transmission entity shall not contract for an amount of agreed maximum demand greater than 100% of installed line capacity. A transmission entity shall have no obligation to provide N-1 line capacity [4] beyond that necessary to maintain power system performance and quality of supply standards under the National Electricity Code. A transmission entity shall use its best endeavours to restore the contracted line capacity within 2 days of an interruption."*[5]

4 N-1 means the ability of the transmission system to continue to supply loads connected to the system in the event of a "worst case" outage of any single element (line, transformer, busbar, circuit breaker…)

5 Section 2.2.2, Electricity Transmission Code, Essential Services Commission of South Australia, 2003.

3.3 Audit Findings

During 2004, there were 308 events recorded for transmission line circuit outages, and 150 customer interruption events[6]. The number of exclusions, and primary cause for exclusion, are shown in Table 3-2 and Table 3-3.

Table 3-2 Transmission line circuit availability outages

Outage type	No. of events	Hours	Notes
Included events	290	5,751.09	
Excluded events	11	1,373.18	Rebuilding of Para – Waterloo 132kV line
	3	5.79	Work initiated by Northern Power Station (2) and Hallett Power Station (1)
	2	1.28	Vic – SA separation event[7]
	1	8.83	Contingency switching
	1	2.26	Work initiated by Amcor
Subtotal	*18*	*1,391.36*	
Total	**308**	**7,142.45**	

Table 3-3 Customer interruption events

Outage type	No. of events	Minutes	System minutes[8]	Notes
Included events	48	1,761	3.181	
Excluded events	55	0	0.000	Failure of third party equipment in unspecified locations
	17	23	0.094	Vic – SA separation event
	11	135	0.290	Outage caused by third party
	9	0	0.000	Trips caused by generators
	7	412	0.308	Trips caused by ETSA Utilities protection
	3	501	0.000	Under frequency caused by generation loss in NSW
Subtotal	*102*	*1,071*	*0.692*	
Total	**150**	**2,832**	**3.898**	

[6] A single customer interruption event may affect a number of separate connection points.

[7] Vic-SA Separation Event 8 March 2004, NEMMCO investigation

[8] System Minutes are calculated for each individual connection point affected by an event. It is calculated as *System Minutes = Average Load Lost (MW) * Outage Duration (minutes) / System Maximum Demand*

Table 3-4 summarises the overall results by included and excluded events.

Table 3-4 Summary of inclusions and exclusions

Category	Total no. of events		Total Duration	
	Included	Excluded	Included	Excluded
Transmission line circuit outages	290 (94%)	18 (6%)	5,751 (81%)	1,391 (19%)
Customer interruption events	48 (32%)	102 (68%)	1,761 (62%)	1,071 (38%)

3.4 Significant Events

Of the events excluded by ElectraNet SA from the performance calculations, there were two significant events:

- The rebuilding of the 132kV transmission line between Para and Waterloo substations; and
- An event that resulted in the separation of the South Australian and Victorian networks on Monday 8 March 2004.

3.4.1 Para – Waterloo 132kV Transmission Line Rebuild

The 132kV transmission line between Para and Waterloo substations forms a major segment of the former Northfield (Adelaide) – Waterloo – Bungama line built in 1953 as part of the network connecting Playford Power Station at Port Augusta to Adelaide. ElectraNet SA advises that it is one of the oldest lines in their network, is of an early steel/concrete composite construction, and designed for 49^{O}C conductor temperature.

ElectraNet SA decided to defer the substantial cost of line replacement by rebuilding the 90km section between Para and Waterloo to an 80^{O}C conductor temperature design. This project represented a major rebuild, with replacement of all crossarms and insulators, replacement of 20% of structures, upgrading of earthing and retensioning of conductors.

The outages related to this capital work were excluded from the ElectraNet SA performance calculation in accordance with their historical definition applied to Circuit Availability. This definition excludes "… *Transmission lines decommissioned for an extended period of time for major line rebuilding activities such as restringing, reinsulation or multiple structure replacements.*"

ElectraNet SA provided a paper as an attachment to both its 2003 and 2004 performance reporting submissions detailing the definitions for the measures adopted under the PI Scheme. This paper highlighted that, in accordance with the principle established in the ACCC Service Standards Guidelines, the standard definitions for the performance measures included in the revenue cap

decision will be modified to align with those used to collect data in the past, so as to preserve the incentive for the TNSP to improve.[9]

However, the ACCC also stated that it "… *would be reluctant to make substantial changes to the standard definitions as this may adversely affect performance incentives.*"[10] In the revenue cap decision, in response to concerns raised regarding potential penalties being incurred in performing work to improve network reliability, the Commission reinforced this position by suggesting that it was for the electricity transmission company to decide how to operate its network when undertaking capital works, and that the financial incentives for minimised outages and maximised availability should influence the decision making process.[11]

The ElectraNet SA view is that it "… *does not exclude the effects of capital works. On the contrary, as a general rule, the effects of capital works are included. Consistent with the historical treatment used for target setting, major line rebuilding activities have been excluded where these effectively result in the commissioning of a new transmission line. If ElectraNet did not seek this cost effective and least disruptive solution for customers and had instead decided to build a new replacement transmission line then there would similarly have been no extended outages to include in the performance measure.*" Transmission lines that have been decommissioned for extensive rebuilding work are no longer part of the network, and therefore no performance should be reported. The works program undertaken for this particular work was designed to improve the overall reliability for customers.

An alternate view could be that the rebuilding work associated with this transmission line is included in the capital expenditure forecasts included in the determination, and would therefore be considered part of the capital works program. Capping the impact of this capital work to an aggregate duration of 14 days[12] would result in a transmission circuit availability of 99.351% (compared with reported 99.38%), and reduce the S-factor for Measure 1 from 0.0013 to 0.00101.

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[9] pp 6, section 4.3.1 Flexible definitions

[10] pp 6

[11] pp 103, section 8.7.1, South Australian Transmission Network Revenue Cap: Decision, 11 Dec 2002

[12] Capping the effect of events to 14 days was not included in the original PI Scheme, but its application in this instance would be consistent with performance calculations for other TNSPs.

3.4.2 Vic – SA Separation of 8 March 2004

On Monday 8 March 2004, there was a fire in the vicinity of the Para substation. The NEMMCO report investigating the incident noted that "*… a single phase to ground fault caused the Para-Tailem Bend No. 2 275kV line to trip and auto-reclose*"[13]. An Essential Services Commission of South Australia (ESCOSA) annual performance report stated that the line tripped as a result of heat and smoke caused by a bushfire.[14]

The line subsequently tripped again following the reclose. Within 2 to 3 seconds, there was an unexpected reduction in generation capacity at Northern Power Station, resulting in a severe overloading of the Vic-SA (Heywood) interconnector. ElectraNet SA protection equipment operated to trip the Heywood and Tailem Bend lines out of South East substation, causing the separation between the South Australian and Victorian networks. This separation triggered automatic load shedding throughout South Australia, mostly in the Adelaide area.

In addition, the loss of the interconnector resulted in automatic under frequency load shedding at Davenport substation, and the tripping of two other 132kV lines (Kincraig-Keith and Penola Wset-Kincraig).

Customer reconnection commenced approximately 20 minutes after the original 275kV line trip, with all customers restored within 2½ hours.

The NEMMCO incident report concluded that a variety of factors involving both ElectraNet SA and NRG Flinders (operator of Northern Power Station) contributed to the separation. The fault on the Para-Tailem Bend line and the subsequent reclosure onto a persistent fault exaggerated the system power swing. The over speed protection operation at Northern Power Station temporarily reduced the generation output to 0MW, eventually resulting in the tripping of the Heywood interconnector and the separation of the 2 networks. The control of frequency was complicated by the market operation and resulted in automatic under frequency load shedding.

NEMMCO made various recommendations for a more co-ordinated effort between the 2 entities to avoid a similar future occurrence. These recommendations included the changing of auto recloser settings, recalibration of over speed protection at Northern Power Station, improved high speed data recording facilities, and a review of under frequency load shedding settings. NEMMCO did not consider there was sufficient data available to make a judgement on the extent to which either ElectraNet SA or NRG Flinders contributed to the incident. SKM noted that ElectraNet SA have

[13] pp2, section 2, Vic-SA Separation Event 8 March 2004 NEMMCO investigation, version 1.3

[14] pp 95, section 5.2.3, Performance of Regulated Electricity Businesses – 2003-04 Annual Performance Report, ESCOSA

included some of the outage related to the Para-Tailem Bend line trip in their performance calculations. Given that neither NEMMCO or ESCOSA were prepared to definitively allocation responsibility for the outage to the entities involved, SKM accepts the inclusions and exclusions claimed by ElectraNet SA for this event.

3.5 Recommendations

The audit identified that the categories used for designating exclusions are generally in accordance with the exclusions defined with the ElectraNet SA determination. The exception is system minutes[15] associated with SA Water outages and the effects of transmission lines effectively decommissioned for major rebuilding work on transmission circuit availability, which have been excluded in accordance with historical reporting protocols.

[15] System minutes are used in the calculation of the Loss of Supply Event Frequency indices.

4. Force Majeure

In the Service Standards Guidelines published by the Commission[16], there are four (4) considerations listed for determining what force majeure events should be "excluded force majeure events". These are:

- Was the event unforeseeable and its impact extraordinary, uncontrollable and not manageable;
- Does the event occur frequently – if so, how did the impact of the particular event differ;
- Could the TNSP, in practice, have prevented the impact (not necessarily the event itself); and
- Could the TNSP have effectively reduced the impact of the event by adopting better practices?

4.1 Definition

The definition used by ElectraNet SA in the determination of performance under the ACCC PI Scheme reflects the definition outlined in the ACCC service standards guidelines and which was used historically in processing performance data (see Appendix B for details).

4.2 Event

There were no events during 2004 for which ElectraNet SA sought an exclusion as force majeure events.

[16] Schedule 2, Statement of principles for the regulation of transmission revenues – Service standards guidelines, ACCC, 12 November 2003

5. Calculation of Bonus / Penalty

The results provided by ElectraNet SA were entered into the PI Scheme model provided to the ACCC. The bonus calculated varied marginally from the value calculated using the S-factors outlined by the Commission in the revenue determination[17] of 11 December 2002 due to some rounding off of coefficients.

The differences between the two calculations are shown in Table 5-1.

Table 5-1 Calculated Bonus

No	Performance Measure	Calculated bonus / (penalty)		% variation to SKM values
		ACCC S-factors	SKM	
1	Circuit Availability (total)	$ 206,973	$ 206,973	0.00%
2a	Loss of Supply Event Frequency Index > 0.2 mins	($ 31,842)	($ 23,882)	(33.33%)
2b	Loss of Supply Event Frequency Index > 1.0 mins	$ 477,631	$ 477,631	0.00%
3	Average Outage Duration	$ 398,025	$ 398,025	0.00%
	TOTAL	**$ 1,050,787**	**$ 1,058,747**	**(0.75%)**

These calculations have been done for comparative purposes only and have been based on annual revenue (AR) of $159.21M, as the final calculation of the bonus or penalty is based on the S-factor equations defined in the ACCC determination[18]. The profile for each of the applicable measures is shown in Appendix A.

The apparently significant "error" in the calculation of the penalty for Measure 2a is due to the rounding off of coefficients in the calculation of the S-factors in the ElectraNet SA determination. The coefficient shown in the determination for 7 events is –0.0002 whilst the SKM model (which does not round off) calculates the equivalent coefficient as –0.00015. Whilst there appears to be a minor difference between the two values, the nett effect of rounding as shown in the ACCC determination is to produce the % variation shown.

Table 5-2 and Table 5-3 summarises the service standards S-factors, based on the equations contained in Appendix 7 to the ElectraNet SA revenue cap decision.[19]

[17] South Australia Transmission Network Revenue Caps 2003-08, ACCC, 11 December 2002.

[18] Appendix 7

[19] pp 123

Table 5-2 Service Standards S-factors with transmission line rebuild excluded

Measure	Performance	S-factor
Transmission circuit availability	99.38%	0.0013
Frequency of loss of supply > 0.2 mins	7 events	- 0.0002
Frequency of loss of supply > 1 mins	0 events	0.003
Average Outage Duration	48.92 min	0.0025
Total		**0.0066**

Table 5-3 Service Standards S-factors with transmission line rebuild included

Measure	Performance	S-factor
Transmission circuit availability	99.38%	0.00101
Frequency of loss of supply > 0.2 mins	7 events	- 0.0002
Frequency of loss of supply > 1 mins	0 events	0.003
Average Outage Duration	48.92 min	0.0025
Total		**0.00631**

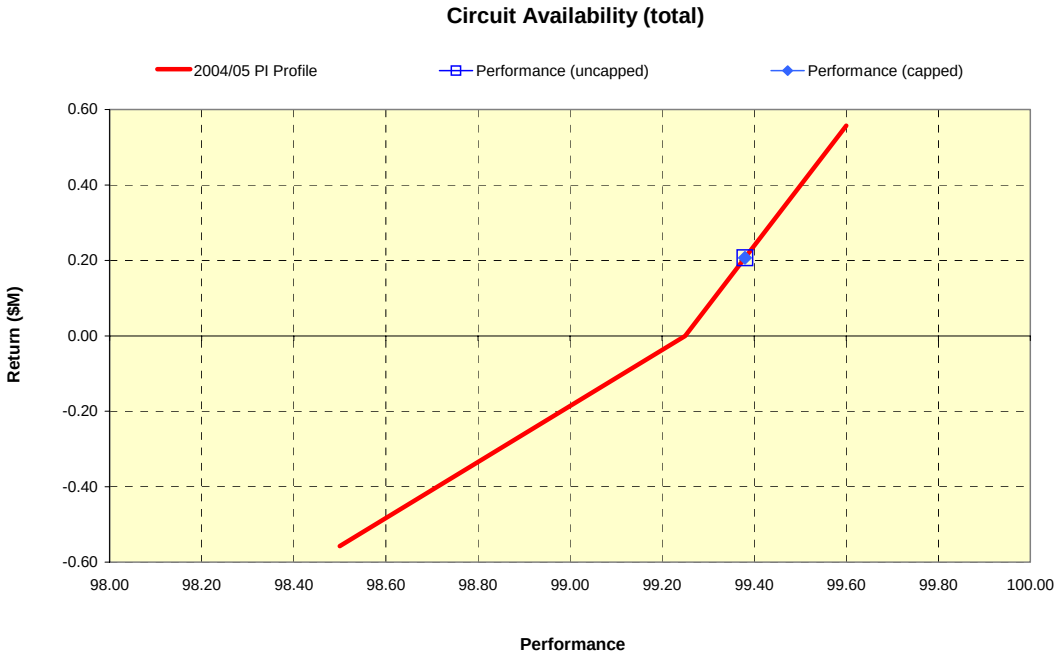
With reference to the comparative calculation results, SKM considers that ElectraNet SA's calculation of its S-factor is free of material errors. Based on the ElectraNet SA view that excludes transmission line rebuild event as being consistent with historical performance calculation, the bonus recommended for ElectraNet SA under the ACCC PI Scheme for 2004 is **0.66% of the agreed Annual Revenue for 2004**. For the alternate view that includes the event with the effect capped to 14 days, the bonus recommended would be **0.631% of the agreed Annual Revenue**.

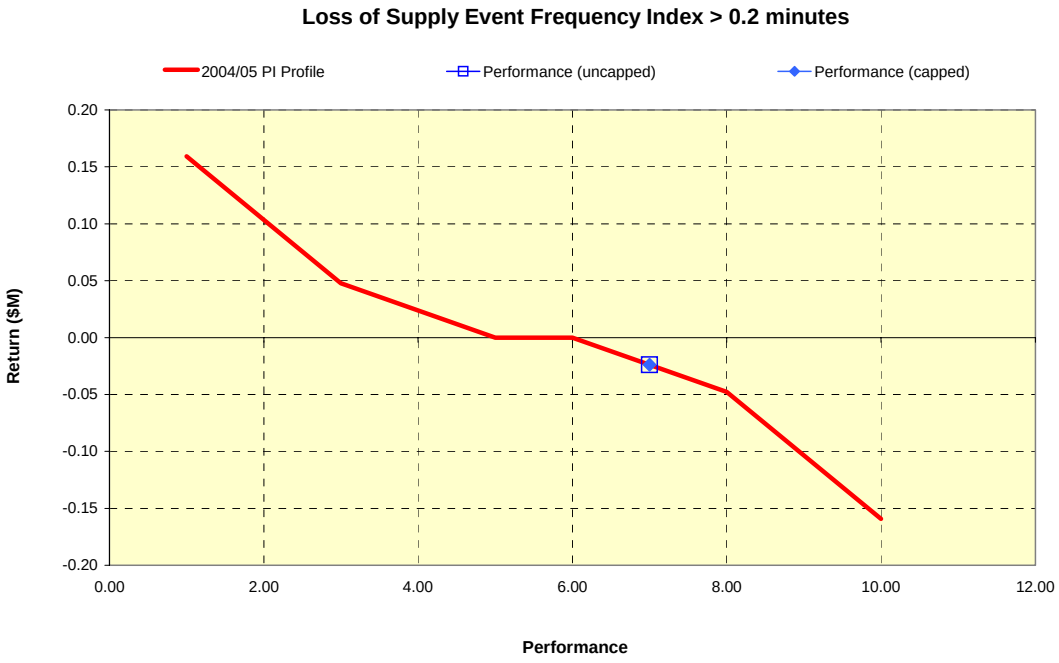
Appendix A Performance Measure Profiles

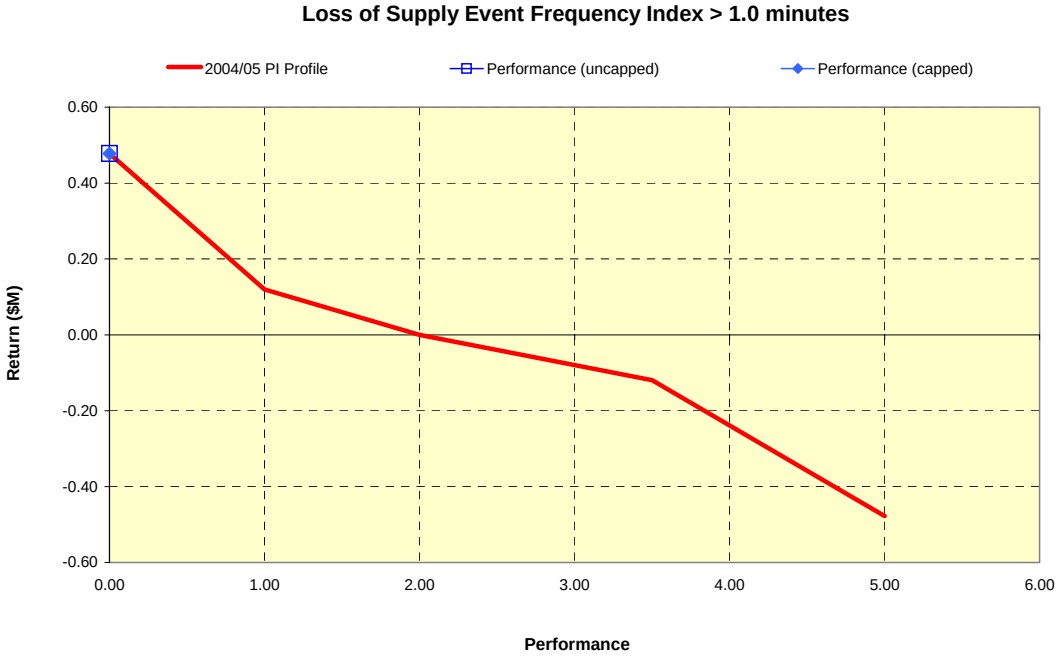
The Performance Measure profiles graphically illustrate the 2004 performance against the targets for Circuit Availability and Average Outage Duration.

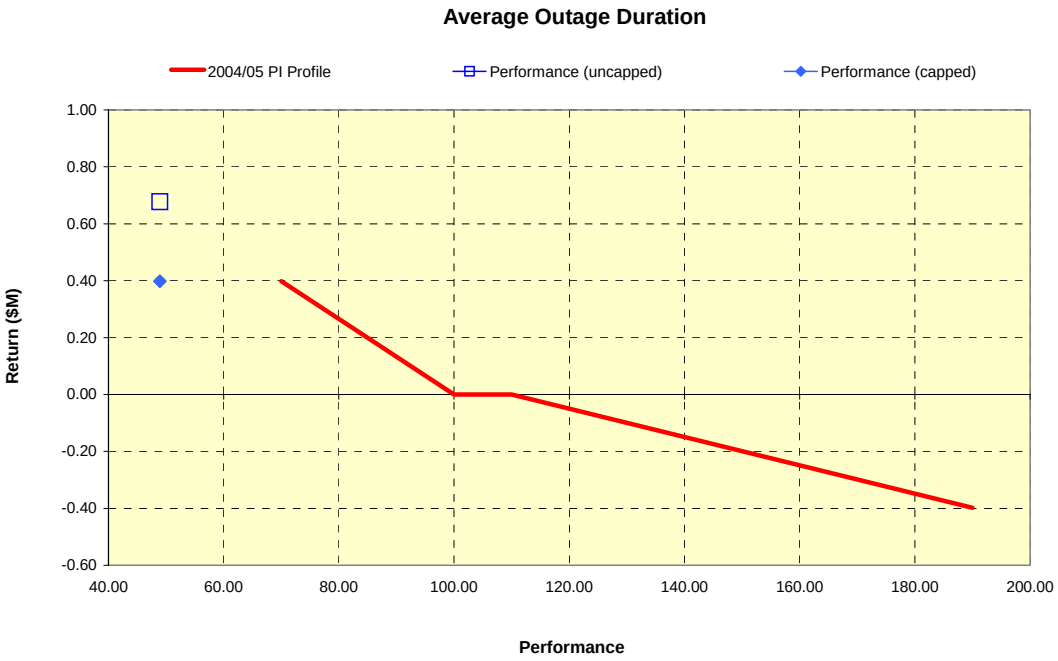
The profiles shown are:

- Measure 1 Circuit Availability (total)
- Measure 2a Loss of Supply Event Frequency Index > 0.2 mins pa
- Measure 2b Loss of Supply Event Frequency Index > 1.0 mins pa
- Measure 3 Average Outage Duration




Loss of Supply Event Frequency Index > 0.2 minutes
2004/05 PI Profile
Performance (uncapped)
Performance (capped)
Return ($M)
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
0.00
2.00
4.00
6.00
8.00
10.00
12.00
Performance


Loss of Supply Event Frequency Index > 1.0 minutes
2004/05 PI Profile
Performance (uncapped)
Performance (capped)
Return ($M)
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Performance


Average Outage Duration
2004/05 PI Profile
Performance (uncapped)
Performance (capped)
Return ($M)
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
Performance

Appendix B Definition of Force Majeure

The ACCC Revenue Cap decision does not contain a formal definition for force majeure.

On 6 February 2003 the Commission wrote to ElectraNet SA clarifying discrepancies between the coefficients in Appendix 6 and Equations in Appendix 7 of the decision. At this time the Commission included the following definition of force majeure:

"*… third party and natural events for which the TNSP can not be reasonably expected to cater for*"