Audit of Murraylink Service Standards Performance Reporting

PERFORMANCE RESULTS FOR 2006

- Final Report
- 2 April 2007

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1. Executive Summary

Sinclair Knight Merz (SKM) was engaged by the Australian Energy Regulator (AER) to conduct an audit of the performance report of Murraylink for 2006 under the AER Performance Incentive (PI) Scheme.

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

- any refinements or additions to 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 standard definitions in the AER service standards guidelines[1] for the measures that apply to Murraylink.

SKM met with Murraylink staff in Brisbane on Monday 19 February 2007, to discuss the details of the exclusions proposed for the 2006 reporting year. As a result of audit activities undertaken, Sinclair Knight Merz has formed an opinion that:

- the performance reporting by Murraylink was free from material errors and was in accordance with the requirements of the AER service standards guidelines;
- Murraylink have correctly calculated the performance results for the three separate availability measures, based on the maintenance and other isolation outage provisions[2] allowed in the 2003 Determination; and
- Murraylink correctly determined coefficients to calculate the performance incentive amount using the equations contained in the revenue cap decision for all measures in the performance calculation spreadsheet provided by the AER.

SKM recommends:

- the proposed exclusions for the scheduled outages due to the actions/requests from neighbouring transmission companies are in accordance with the defined exclusions in the standard definitions for circuit availability that apply to Murraylink and should be accepted;
- the proposed exclusions for the forced outages related to lightning strikes on neighbouring transmission networks are considered to be third party inter-trips and should be accepted as satisfying the exclusions defined for circuit availability;

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[1] AER, *Statement of principles for the regulation of transmission revenue – Service standards guidelines*, 12 November 2003, Schedule 1

[2] AER, *Murraylink Transmission Company Application for Conversion and Maximum Allowed Revenue: Decision*, 1 October 2003, pp 176

- the exclusions relating to runback scheme operation resulting from the actions or events on the neighbouring transmission networks (with the exception of the event on 28 November 2006) be accepted;
- the recording and reporting arrangements currently in place for Murraylink, ElectraNet, SP AusNet and TransGrid be reviewed so that the causes and responsibilities for runback scheme triggers are more completely reported; and
- the bonus for Murraylink under the AER PI Scheme for 2006 is **0.211510% of the Annual Revenue for 2006**.

2. Recording System

Murraylink is a regulated electricity transmission asset operated by the Murraylink Transmission Company (MTC). It includes the 180km underground power cable and connects the Victorian and South Australian regions of the National Electricity Market (NEM), transferring power between the Red Cliffs substation in Victoria and the Monash substation in South Australia. Murraylink's current rated capacity is 220MW.

The main control centre for Murraylink is located in the Brisbane CBD[3], with some control facilities and historical data logging available on site.

The recording of outages is done via manual entry into an Outage Register. Planned outages are taken following discussions within the Brisbane office. For unplanned outages, operators detail the reason at the time of the outage, and these comments are reviewed on a monthly basis.

The primary cause for outages on Murraylink is failures in the Insulated Gate Bipolar Transistor[4] (IGBT) devices. Murraylink can operate with up to 6 faulty IGBTs before the line trips, although planning for replacement begins when 4 IGBTs have failed. There is an annual outage for shutdown maintenance for 2 days in October.

2.1 Categorisation and Exclusions

All outages are categorised as planned/scheduled or unplanned/forced. For unplanned outages, duration is recorded for peak period (0700 to 2200 hours) and off peak (2200 to 0700 hours). In 2005, weekends and public holidays in South Australia were considered off peak in the categorisation of outages.

2.2 Processing of Outage Data

Murraylink compile the Outage Register into Excel spreadsheets which record the basic details of both included and excluded events, and totals the peak and off-peak components. The cause for each outage is categorised as occurring at either MLRC (Red Cliffs) and MLBI (Berri) converter stations, or both where the entire interconnector is affected.

[3] It is understood that the Control Centre may be relocated to the ElectraNet Control Room, Adelaide in the near future.

[4] A solid-state device capable of high speed switching and high current carrying capability.

2.3 Calculation of Performance Measure Results

The performance measures are calculated using the S-factor equations defined in Tables 9.4, 9.5 and 9.6[5] of the AER Decision on the MTC Application for Conversion and Maximum Allowed Revenue of 1 October 2003.

2.4 System Audit Findings

During a previous audit, SKM conducted a sample testing of a number of randomly chosen outage records from the operator log to ensure that these were correctly recorded in the Excel file for processing. In each instance, the events, reasons and switching times were found to have been correctly transferred to the Excel file, and correctly processed for peak / off-peak hours. No such audit was conducted in this audit as there had been no change in the recording process.

SKM reviewed the categorisation of each outage event and accepted that it was in accordance with the accepted definitions of planned and unplanned.

SKM is satisfied that the recording and data processing systems that have been put in place by MTC appear to accurately log and calculate performance.

[5] pp 179

3. Performance Measures

As part of the AER decision[6] on the application for Murraylink to become a regulated asset, PB Associates was commissioned to develop a performance incentive framework. PB adopted a similar approach to that used by SKM in establishing performance measures and targets.

Due to the unavailability of historical performance data, the measures and targets were developed from a review of technical documents released by the manufacturer (ABB) of much of Murraylink's assets and a CIGRE survey.

3.1 Agreed Measures

Measure 1 Circuit Availability was recommended, subdivided into three sub-measures:

- planned availability;
- forced availability during peak periods; and
- forced availability during off-peak periods.

and associated performance targets be set for each category rather than a single overall target.

With consideration of information provided by MTC, the AER adopted the three sub-measures with targets that take account of the Murraylink maintenance and inspection program. The parameters for the sub-measures are shown in Table 1.

Table 1 Performance Targets

No	Measure	Performance for Maximum Penalty	Target Performance	Performance for Maximum Bonus	Weighting Factor
1a	Planned circuit availability	99.04%	99.17%	99.38%	0.40
1b	Forced outage circuit availability in peak periods	98.90%	99.48%	100.00%	0.40
1c	Forced outage circuit availability in off-peak periods	98.84%	99.34%	99.94%	0.20

These parameters considered advice from MTC regarding its required maintenance program, which includes 3-hour outages for monthly inspections. This allowance reduced Murraylink's planned availability.

[6] AER, *Murraylink Transmission Company Application for Conversion and Maximum Allowed Revenue: Decision*, 1 October 2003

4. Exclusions

The AER 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.

4.1 Allowable Exclusions

The exclusions allowed under the standard definition for Circuit Availability[7] are:

- Exclude unregulated transmission assets;
- Exclude from 'circuit unavailability' any outages shown to be caused by a fault or other event on a '3rd party system' eg. intertrip signal, generator outage, customer installation; and
- Exclude force majeure events.

In addition, in the decision related to the MTC application for conversion, the AER defined that the replacement of a transformer will be an exclusion *"… from the incentive scheme, if:*

- *Murraylink can demonstrate that the replacement of the transformer was needed;*
- *Murraylink can demonstrate that the time taken was needed; and*
- *The AER is satisfied that the replacement was the best alternative and all reasonable preventative measures had been taken."*[8]

4.2 Audit Findings

The scheduled and forced outages for Murraylink are summarised in Table 2.

There are 10 scheduled outages and 25 forced outages that have been claimed for exclusion by Murraylink.

The proposed excluded scheduled outages have been attributed to third party requests from Victorian Network Switching Centre (VNSC) and SP AusNet maintenance, and the majority of the proposed excluded forced outages have been categorised as third party inter-trips resulting in operation of runback protection that caused Murraylink to reduce its power transfer to 0.

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[7] AER, *Statement of principles for the regulation of transmission revenue – Service standards guidelines*, 12 November 2003

[8] AER, *Murraylink Transmission Company Application for Conversion and MAR: Decision*, 1 October 2003, pp 176

SKM

Table 2 Outages in 2006

Type	No of Events	Duration mins	Peak mins	Off-Peak mins	Total mins
Scheduled maintenance					
Annual maintenance	3	2,734	-	-	2,734
Equipment repair[9]	1	1,172	-	-	1,172
VCU communications	4	650	-	-	650
NSW Runback test	2	85	-	-	85
Subtotal	*10*	*4,641*	-	-	*4,641*
Forced outages					
Runback testing or incorrect operation	3	-	1,165	-	1,165
Red Cliffs protection	1	-	-	357	357
Failure to follow dispatch	1	-	-	75	75
VCU fault	1	-	63	-	63
Red Cliffs communications	1	-	-	57	57
Subtotal	*7*	-	*1,228*	*489*	*1,717*
Excluded events claimed					
Scheduled third party	10	3,182	-	-	3,182
Forced third party	25	-	1,502	286	1,788
Subtotal	*35*	*3,182*	*1,502*	*286*	*4,970*
Total	**52**	**7,823**	**2,730**	**775**	**11,328**

4.3 Excluded Events

As an interconnector between Victoria and South Australia, Murraylink may occasionally be subject to an outage resulting from the maintenance and capital works programs of SP AusNet (Vic) and ElectraNet (SA), or by forced outages on the neighbouring Victorian, South Australian and New South Wales transmission networks.

Such outages may fall within the purview of an exclusion due to " ... *a fault or other event on a 3rd party system*" (refer section 4.1). SKM has reviewed each event claimed for exclusion where it is directly related to activity on the connecting transmission networks to ensure that SP AusNet and ElectraNet have included the same outage in their respective performance result calculations.

[9] Included six month portable fire extinguisher maintenance, replacing IGBTs, and transformer oil sampling

4.3.1 Scheduled Outages

Table 3 shows the outages requested for exclusion by Murraylink as scheduled or planned outages due to work on the Victorian and South Australian networks and, where appropriate, the related records from SP AusNet and ElectraNet.

Table 3 Requested Scheduled Outages for Interstate Work

Start Date	Duration (mins)	Murraylink record	Interstate TNSP	Interstate TNSP record	Note
01.05.06	1,067	SP AusNet required MLRC[10] CB WT.Q1 open for work on the connection assets at RCTS[11]. Powercor also doing working at RCTS and had isolated the backup 22kV supply to Murraylink but had not notified MTC ML UPS batteries ran flat	SP AusNet	66kV bus at RCTS was isolated for work on No. 3 22kV bus. SP AusNet considered work as DB (distributor) augmentation. Work to continue during month of May on W/O 10235357	a
02.05.06	94	SP AusNet required MLRC CB WT.Q1 open to close RCTS CB. SP AusNet circuit breaker was not working and Murraylink return to service was delayed until investigations were complete	SP AusNet	W/O 10240794 detailed work on bus connections on HV side for transformer 3 on No. 1 220kV bus at RCTS	b
22.06.06	544	VNSC[12] requested outage for system security	SP AusNet	SP AusNet has accepted 5 outages for maintenance activities in its performance calculations. W/O 10242328 for maintenance on BSS 220kV line bus	c
28.06.06	725	VNSC opened both ML CBs at RCTS	SP AusNet	Multiple VENCorp requested augmentation and other maintenance activities	d
10.08.06	722	VNSC opened both ML CBs at RCTS	SP AusNet	Maintenance work at RCTS	e
13.09.06	20	VNSC required ML CB open to reclose RCTS No.1 Bus CB	SP AusNet	Five separate capex/opex activities on connection transformers and capacitor banks at different locactions between 0633 and 1727	f

[10] Murraylink Red Cliffs converter station

[11] Red Cliffs Terminal Station

[12] Victorian Network Switching Centre

Start Date	Duration (mins)	Murraylink record	Interstate TNSP	Interstate TNSP record	Note
06.11.06	3	SP AusNet required MLRC CB WT.Q1 open to close CB at RCTS	SP AusNet	Three capex activities between 0610 and 0842 on the 220kV capacitor bank, connection transformer and 220kV bus at RCTS	
19.11.06	1	SP AusNet required MLRC CB WT.Q1 open to close CB at RCTS	SP AusNet	Transformer bank maintenance between 0702 and 0715 on W/O 10103861	
08.12.06	4	TOC required ML CB open to reclose No.2 Bus CB at RCTS. No.2 bus recalled for system security - bushfires in Victoria	SP AusNet	Several events where Country Fire Authority (CFA) requested outages due to bushfires between 1804 and 2316, and NEMMCO instructed switching on 220kV lines at Ballarat, Bendigo, Red Cliffs and Horsham	g
20.12.06	2	TOC required ML CB open to reclose Bus CB at RCTS	SP AusNet	Five capex events at RCTS during the day between 0638 and 1800 on capacitor bank and connection transformer	

Notes:

a) SP AusNet records do not specifically refer to an outage at Murraylink converter station at Red Cliffs. Outage was categorised as DB_AUG, suggesting that the outage was required by Powercor, the local distributor for the Red Cliffs area.

b) W/O extended between 1700 and 2359, with no specific reference to Murraylink interruption. Murraylink outage occurred between 1839 and 2013. During SP AusNet work, it is considered highly likely that some switching would have been required at Murraylink to allow work to continue.

c) Minor discrepancies in outage times on noted work order between Murraylink and SP AusNet.

d) Multiple works orders between 0708 and 1900. Murraylink outage between 0705 and 1910. These commissioning activities have been recorded by SP AusNet.

e) Murraylink event times 0614 to 1816, SP AusNet recorded 0616 to 1812 on W/O 10243701.

f) Not apparent from SP AusNet records that outage at Murraylink required, although reasonable to accept an isolation was needed during work on connection assets.

g) SKM considers the categorisation of this event as “Scheduled” as inappropriate, as the cause of the outage was a natural event (bushfire). In a price revision incident report, NEMMCO made the following observations - “ *… with the Ballarat to Bendigo and Red Cliffs to Horsham 220kV lines out of service due to system separation arrangements associated with bushfires, there were unresolved contingencies flagged in NEMMCOs Energy Management System (EMS) for the trip of the Shepparton to Bendigo 220kV line. VENCorp advised NEMMCO that recalling the 220kV No. 1 bus at Red Cliffs would require*

Murraylink flows to be at 0MW. "[13] A constraint equation that acts on Murraylink flow alone was used for for the dispatch of Dispatch Interval 19:50.

4.3.2 Forced Outages

Table 4 and Table 5 shows the outages requested for exclusion by Murraylink as forced outages caused by a "third party". These faults are mostly attributed to trips on the neighbouring transmission networks, with a bushfire event of 23 January 2006 included.

The events listed in Table 4 are those for which SKM has been able to identify a corresponding event record with SP AusNet and ElectraNet, supporting the proposed exclusion. In each case, the neighbouring TNSP has been recognised as including the event in their performance calculations.

Table 4 Requested Forced Outages with identifiable cause

Start Date	Duration (mins)	Peak (mins)	Off-Peak (mins)	Murraylink record	Cause	Note
19.01.06	27	27	0	MLBI[14]: Runback[15] caused by circuit breaker opening at Monash	Runback	a
20.01.06	23	23	0	MLRC[16]: Runback caused by NSW network	Runback	b
23.01.06	966	752	214	MLRC: Trip due to fire system operation. Heavy smoke caused by bush fires.	Bushfire	c
25.03.06	125	125	0	MLRC: Runback by VVFRB. TOC operator claimed they could not reset the runback. A check of the ML control system revealed that all was ok. TOC then reset the runback.	Runback	d

[13] NEMMCO, *Price Revision Incident Report - 8 December 2006*

[14] Murraylink Berri converter station, South Australia

[15] An extract from a CIGRE paper B4-103 presented to the 2004 session describing Murraylink stated that " *... in order to increase Murraylink power transfer capability without requiring major physical AC network augmentations, MTC elected to ... implement power transfer run-back controls. The run-back schemes monitor the status of remote network elements (circuit breakers, lines and transformers) and in the event of a remote trip will reduce Murraylink power transfer... run-back speeds can be designed to accommodate specific outages of critical plant and also future load growth in the surrounding AC networks.*"

[16] Murraylink Red Cliffs converter station, Victoria

Start Date	Duration (mins)	Peak (mins)	Off-Peak (mins)	Murraylink record	Cause	Note
21.07.06	192	140	52	MLRC: SP AusNet work on the VFRB caused a runback at 16:11:00. The runback was not reset by TOC. At 17:40:00 power flow changed to Vic to SA and ML was not following dispatch until TOC reset the runback at 22:52:00.	Runback	e
10.10.06	25	25	0	MLRC: Runback caused by failure of battery charger at RCTS.	Runback	f
01.11.06	52	52	0	MLRC: Runback by VVFRB. Contractor disturbed connections in control box at RCTS	Runback	g
01.12.06	85	85	0	MLBI: tripped due to under frequency[17]. Circuit breakers opening at Monash substation due to triggered by lightning.	Lightning	h
04.12.06	3	3	0	MLRC: Runback from Victorian fast Runback. SP AusNet contractor caused the operation of the runback scheme.	Runback	i

Notes:

a) No similar incident recorded by ElectraNet, but there was evidence of lightning storms in the vicinity of the Monash region during the day. ElectraNet recorded trip and successful reclosing of 132kV Robertstown - North West Bend line.

b) Whilst there was no information available from TransGrid relating to event, SP AusNet recorded faults at Red Cliffs terminal station on the 66kV capacitor banks and reactors. SP AusNet included these outages in their availability calculations.

c) No specific SP AusNet record for this event. There was ongoing maintenance work at Red Cliffs terminal station by SP AusNet for Powercor during May. No bushfire outage was recorded by SP AusNet. Further information about this event is included in section 5.2.

d) SP AusNet outage records have no specific listing for this event. Capital work was in progress at Ballarat terminal station during 25 and 26 March.

e) Whilst there is no specific record relating to this event included in the SP AusNet outage list, there was maintenance and capital work that may have contributed to this outage.

f) On 10 October between 0714 and 2002, SP AusNet was undertaking capital work on transformers and capacitors at Red Cliffs that required an outage on the 22kV bus. This work was included in the SP AusNet performance calculation. Whilst there is no specific reference to a battery charger failure in the SP

AusNet outage list, it is conceivable that the capital work may have contributed to an initiation of this outage for Murraylink.

g) Maintenance work at Red Cliffs on No. 1, No. 2 and 22kV capacitor bank between 0734 and 1827, categorised by SP AusNet as DNSP requested augmentation, and outage taken and work undertaken by a third party.

h) ElectraNet recorded, and included in performance calculations, an outage on 132kV Berri - North West Bend no. 2 line due to a lightning strike.

i) Capital work at Red Cliffs on No. 2 transformer by a third party between 0719 and 1743.

Table 5 shows the exclusions proposed by Murraylink for forced outages for which SKM (and Murraylink) has been unable to identify an incident record in the neighbouring TNSPs.

Table 5 Requested Forced Outages where cause unclear

Start Date	Duration (mins)	Peak (mins)	Off-Peak (mins)	Murraylink record	Cause	Note
29.01.06	20	0	20	MLBI: Runback caused by Monash substation bus zone trip.	Runback	i
03.02.06	3	3	0	MLRC: Runback scheme operation	Runback	ii
16.02.06	3	3	0	MLRC: Runback scheme operation	Runback	iii
18.02.06	60	60	0	MLRC: Runback scheme operation	Runback	iv
23.02.06	4	4	0	MLBI: Runback caused by Monash substation bus zone trip.	Runback	v
26.02.06	10	10	0	MLRC: Runback scheme operation	Runback	vi
19.03.06	24	24	0	MLRC: Runback by VVFRB[18]	Runback	vii
24.03.06	63	63	0	MLRC: Runback by NSW Runback scheme. Scheme disabled but power failure in RCTS shut down the backup trip panel triggering the runback.	Runback	viii
10.04.06	15	15	0	MLRC: Runback by VVFRB. Trip on Kerang Line.	Runback	ix
07.05.06	25	25	0	MLBI: Runback caused by trip at Monash substation.	Runback	x

[17] In order for the power grid to remain stable, the frequency must be within certain limits. An excursion in frequency above the upper threshold is an "over-frequency" event, and load is typically shed to protect against damage.

[18] Victorian Very Fast Runback scheme

Start Date	Duration (mins)	Peak (mins)	Off-Peak (mins)	Murraylink record	Cause	Note
02.08.06	2	2	0	MLRC: Runback by VVFRB	Runback	xi
16.08.06	36	36	0	MLRC: Runback by Vic Slow Runback	Runback	xii
06.09.06	1	1	0	MLRC: Runback by Vic Fast Runback. SP AusNet working on comms at RCTS	Runback	xiii
07.10.06	9	9	0	MLBI: Runback caused by trip at Monash substation breaker failure protection trip.	Runback	xiv
28.11.06	6	6	0	MLBI: Runback by SA runback scheme from 145MW to 117 MW	Runback	xv
30.11.06	9	9	0	MLBI: Runback by SA runback scheme from -114MW to 0MW	Runback	xvi

Notes:

(i) The ElectraNet outage reports list only momentary disruptions on 29 January 2006 due to lightning strikes on the 275kV Davenport - Robertstown line which is some distance from the Monash substation.

(ii) SP AusNet outage records have no specific listing for this event. An extended fault was noted on the capacitor bank at Terang terminal station during 3 February to 4 February 1104.

(iii) SP AusNet outage records have no specific listing for this event. An outage occurred at Hazelwood Power Station between 14 February and 16 February which may be related but the correlation between the events is not apparent.

(iv) There is no specific record relating to this event included in the SP AusNet outage list. SP AusNet was undertaking several capital projects at this time, with no direct reference to Murraylink or the terminal station at Red Cliffs.

(v) No outages at Monash substation on 23 February recorded by ElectraNet. Relatively short interruptions recorded by Murraylink may have related to momentary outages or protection operations at Monash substation.

(vi) No similar or potentially related incident recorded by SP AusNet.

(vii) There is no specific record relating to this event included in the SP AusNet outage list. Outages were noted at Dederang terminal station around the time of this runback event.

(viii) SP AusNet recorded a fault on the Kerang terminal station line between 0829 and 0841.

(ix) Maintenance work in progress on 220kV Kerang terminal station line at Geelong terminal station between 0709 and 1630.

(x) No outages at Monash substation on 7 May recorded by ElectraNet. Relatively short interruptions recorded by Murraylink may have related to momentary outages or protection operations at Monash substation.

(xi) SP AusNet maintenance at Richmond terminal station on the outdoor bus between 0634 and 1514.

(xii) SP AusNet outage records have no specific listing for this event. Capital work was in progress at Malvern terminal station and Terang terminal station on 16 August, and continuing at Dederang terminal station.

(xiii) SP AusNet was undertaking capital work at this time, with no specific reference to Murraylink.

(xiv) No outages at Monash substation on 7 October recorded by ElectraNet. Relatively short interruptions recorded by Murraylink may have related to momentary outages or protection operations at Monash substation.

(xv) During this time, ElectraNet were undertaking contingency switching on lines in vicinity of the Monash substation. No recorded event or outage included in either SP AusNet or ElectraNet records. This event is not deemed to be an outage as Murraylink continued to transfer active power during this time.

(xvi) During this time, ElectraNet were undertaking contingency switching on lines in vicinity of the Monash substation. No recorded event or outage included in either SP AusNet or ElectraNet records.

4.4 Recommendations

4.4.1 Scheduled Outages

With reference to Table 3, SKM is satisfied that the scheduled outages claimed for exclusion are events that the neighbouring TNSP, SP AusNet, has recorded as its outage, and therefore these 10 scheduled outages should be excluded from the performance results. Whilst there was not a direct correlation in the particular case of the outages for 1 and 2 May with SP AusNet works orders records, there was sufficient circumstantial evidence to support the claim that these outages were related to maintenance work at Red Cliffs Terminal Station during the period 1 May to 31 May 2006. The discrepancies found in the recorded times between SP AusNet and Murraylink for those events that were directly related to an incident on the Victorian network were minor.

4.4.2 Forced Outages

SKM has reviewed the forced outages claimed for exclusion, and summarised those for which a related record has been found in the neighbouring TNSP outage list in Table 4, and the 16 runback events for which SKM has been unable to identify a separate record with the neighbouring TNSPs in Table 5.

Lightning Strikes

Lightning strikes are events that a TNSP can be reasonably expected to take measures to mitigate against the risk, and SKM noted that ElectraNet had included the effects of the lightning strikes on 1 December 2006 (refer listing in Table 4) in their performance reporting. SKM is of the view that the problems incurred by Murraylink were as a direct result of these lightning strikes on the neighbouring transmission network are events on a third party system. SKM considers this event should be excluded from the performance measures.

Runback Events

The runback schemes used by Murraylink are a protection against potential network overloads in the event of incidents on the neighbouring transmission networks, and are designed to control the power throughput on Murraylink from its operating level to lower preset values in a very short timeframe. This includes reducing the throughput to 0MW. The ability of these run-back schemes

to respond to an external problem and reduce the power throughput is carefully controlled as Murraylink could potentially respond faster than the connected AC networks and cause instability. Throughout all runback events, Murraylink remains on line and fully operational, and continues to support the voltage in the AC networks by the transfer of reactive power. Only the active power transfer is affected by runback events.

In response to a runback signal from a TNSP, the Murraylink control system is programmed to firstly reduce the active power transfer to the runback target value, usually 0MW, but it can be other values for the Victoria Slow runback and the South Australia runback. Secondly, the Murraylink control system is programmed to restrict the active power set points that can be entered during a runback. The active power restriction is programmed to activate when a TNSP's runback scheme sets the runback signal at the interface to Murraylink.

Murraylink has no control over the TNSP network events that trigger runbacks or when a runback event may occur. Following a runback, Murraylink contacts the owner of the runback scheme to determine the cause of the event and whether the runback can be reset. The runback is then either reset and Murraylink resumes active power dispatch, or Murraylink contacts NEMMCO to apply a constraint until the cause of the runback is resolved. During a runback, Murraylink remains fully operational and continues to provide voltage support for the neighbouring AC networks, but is unavailable for active power transfer until the runback is reset with approval from the appropriate TNSP.

In effect, the runback schemes are based on a set of equations, similar to constraint equations, which monitor the conditions in the neighbouring transmission networks in NSW, Victoria and South Australia, and will trigger a runback condition for Murraylink should the conditions of such items as load flows and circuit breakers produce a result beyond preset limits. In 2006, the Victorian Fast runback scheme was expanded to monitor 8 transmission lines, transformers at Moorabool terminal station and a bus tie at Dederang terminal station.

Previous audits[19] have accepted these outages as an inter-trip on a third party system, and recommended that these events are excluded from the performance calculations. However, SKM notes that there are many examples of runback incidents in 2006 not being directly reflected in the outage listings of ElectraNet, SP AusNet or TransGrid. As a result, the audit is relying upon an interpretation of the outages reported by the neighbouring TNSPs to determine if there appears to be sufficient cause to support the proposed exclusion. For example, there were 8 instances where the outage was attributed to either a fast or very fast runback scheme in Victoria, which may be the

[19] There were 4 runback incidents reported in 2005, with a corresponding event listed in the ElectraNet outage reports to substantiate the cause for the initiation of the runback scheme.

result of momentary interruptions on the SP AusNet network during operational, maintenance or capital works periods. Of the 23 runback events, only the 7 events shown in Table 4 appear to have a direct corresponding record included in the outage reports from ElectraNet and SP AusNet, or have TOC advice with regards to the status of the runback reset.

Whilst SKM accepts all of the runback events have occurred, it is not immediately apparent where the 16 proposed exclusions listed in Table 5 (totalling 290 minutes - 270 peak, 20 off-peak) have been included, where appropriate[20], in the neighbouring TNSPs performance calculations. SKM would advocate that Murraylink seek to include any SCADA or other market data it may be able to access with regards to runback scheme operation in future submissions to the AER to support the audit process. However, for the purposes of this particular audit, SKM accepts that Murraylink has sought to identify the cause of the runback scheme triggers from the neighbouring TNSPs and through no fault of its own, the cause has neither been recorded or conveyed. Therefore, given the nature and operation of the runback protection scheme, SKM is satisfied that 15 of these events are third party inter-trips and should be accepted as exclusions.

However, SKM remains of the view that all outages and events on transmission networks that result in outages should be reported so that the appropriate TNSP accepts the accountability for the event in its performance calculations. To this end, SKM would recommend that this situation be reviewed by Murraylink, ElectraNet, SP AusNet and TransGrid to put in place a recording and reporting arrangement that adequately captures the cause and responsibility for these runback events.

Of the runback events shown in Table 5, SKM specifically does not accept the event of 28 November 2006 as an outage, as it has not resulted in a forced outage of Murraylink, but a constraint in the power being delivered at that time. For the purposes of the PI Scheme, an outage is deemed to be an event where an asset effectively becomes unavailable or not contributing to the transmission of power. The only event that was reported on a neighbouring transmission network for this day was some contingency switching by ElectraNet as part of its security obligations under the National Electricity Rules, and it is not apparent from the evidence available that this would or potentially could initiate a partial runback. Therefore, SKM would suggest that the event of 28 November 2006 should not have been categorised as a forced outage, and would recommend that it not be accepted as an exclusion. This event lasted for 6 minutes, and the recommended disallowance for exclusion has no material effect on the performance results.

[20] Momentary interruptions and instances where a successful reclose has occurred will not affect the performance calculations for ElectraNet or SP AusNet - only sustained planned or forced outages.

5. Force Majeure

In the Service Standards Guidelines published by the AER[21], 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?

5.1 Definition

The definition used by Murraylink in the determination of performance under the AER PI Scheme reflects the definition outlined in the AER service standards guidelines.

The details are outlined in Appendix B.

5.2 Bushfire

On Monday 23 January 2006 at 03:26am, Murraylink suffered a trip of the Red Cliffs converter station due to the operation of the fire protection system. The outage extended until 07:32pm, an outage of approximately 16 hours (refer Table 4).

Following a review of this incident, SKM is of the view that:

- The Bureau of Meteorology (BoM) monthly climate summary for Victoria concluded that January 2006 was the 3rd warmest January since State-wide records began in 1950. In particular, for Mildura Airport (which is in the vicinity of the Red Cliffs converter station), the maximum temperature recorded was 43.0°C and a monthly average maximum of 36.4°C;
- An extract from the BoM summary stated that " … *a significant heatwave affected Victoria between the 20th and 22nd with many locations experiencing 2 days of above 40 degrees in a row. Major bushfires developed fanned by strong Northerly winds.*";
- Media reports for 23 January 2006 described several large bushfires in Western Victoria, with many traffic diversions and very low visibility due to heavy smoke;

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

- The Red Cliffs converter station is located next to the Murray River, and is distanced from the nearby vegetation on the southern and eastern sides. The site is well protected by a levy bank and the river from scrub land to the north; and
- The converter station relies upon a normally aspirated fire protection system for the AC and DC sides of the converter station, whilst the valve housings are protected by a more sophisticated reverse cycle system.

The bushfire mitigation strategy for Murraylink appears to rely upon the physical separation of the Red Cliffs converter station from any potential bushfire area, and this would usually be sufficient for protecting the converter station from damage or interruption due to bushfire. The fire protection system in use for the AC and DC ends of the converter station is in place to control/extinguish fires that may occur in the plant inside the building, and relies upon a normal aspiration system (ie. draws air from outside of the building).

Whilst this system is fitted with a basic filtration system to remove dust and normal air-borne particles, it could not adequately cope with the heavy smoke present on 23 January 2006, resulting in an operation of the fire protection system and a shutdown of the converter station as a safety precaution. SKM considers that the outage satisfies the considerations for an extreme event within the definition of Force Majeure.

Therefore, SKM accepts that this exclusion as a Force Majeure event.

6. Assessment of S-factors

Table 7 shows the results of S-factor calculation proposed by Murraylink and recommended by SKM following its audit of Murraylink service performance report.

SKM confirmed that the Murraylink has used the S-factor equations contained in the revenue cap decision and correctly applied the formulas and coefficients to calculate the S-factors for all measures in the performance calculation spreadsheet provided by the AER. The recommended S-factor results are shown in Table 7.

- **Table 6 Performance Results**

No	Performance Measure	Target	Murraylink without exclusions	Murraylink with all proposed exclusions	SKM without exclusions	SKM assessment
1a	Circuit Availability (planned)	99.17%	98.49%	99.11%	98.49%	99.11%
1b	Circuit Availability (forced) (peak)	99.48%	99.47%	99.76%	99.47%	99.76%
1c	Circuit Availability (forced)(off-peak)	99.34%	99.85%	99.91%	99.85%	99.91%

- **Table 7 Calculated S-factors**

No	Performance Measure	Murraylink without exclusions	Murraylink with proposed exclusions	SKM without exclusions	SKM assessment
1a	Circuit Availability (planned)	(0.400000%)	(0.194676%)	(0.400000%)	(0.194676%)
1b	Circuit Availability (forced) (peak)	(0.004894%)	0.217618%	(0.004894%)	0.217618%
1c	Circuit Availability (forced)(off-peak)	0.169156%	0.188568%	0.169156%	0.188568%
	TOTAL	**(0.235738%)**	**0.211510%**	**(0.235738%)**	**0.211510%**

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

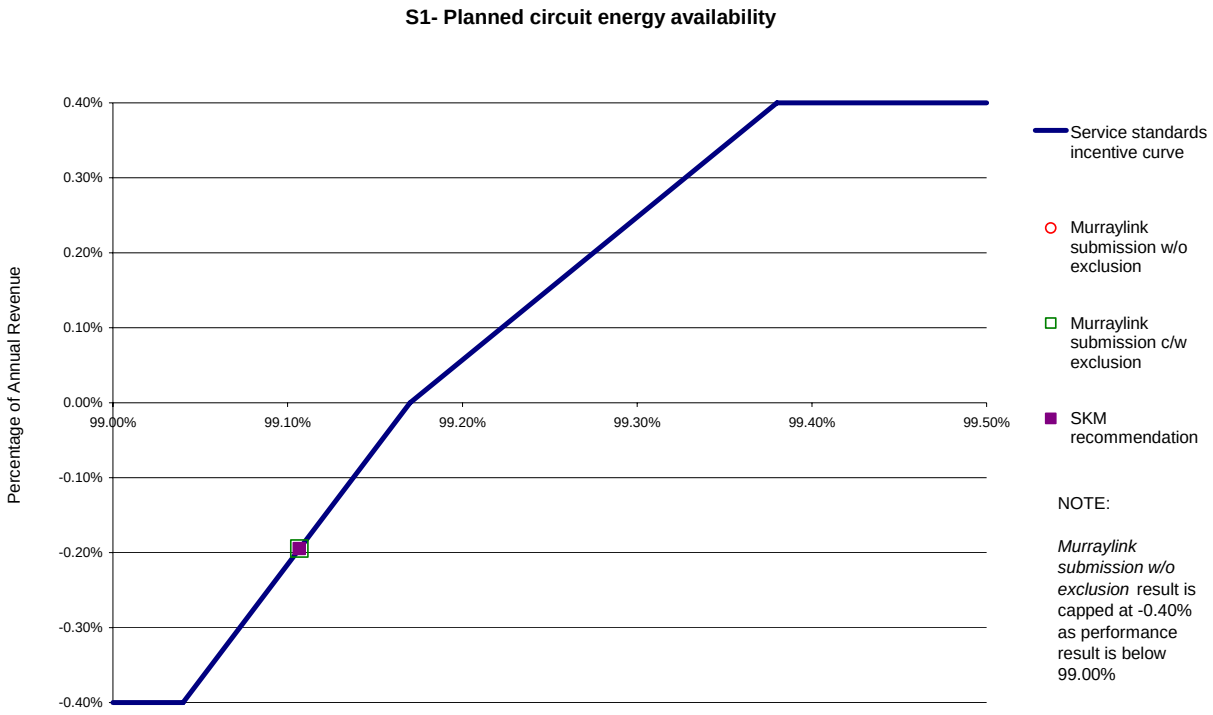
Based on these results, SKM recommends the bonus for Murraylink should be **0.211510% of the Annual Revenue for 2006**.

Appendix A 2006 Performance Measure Profiles

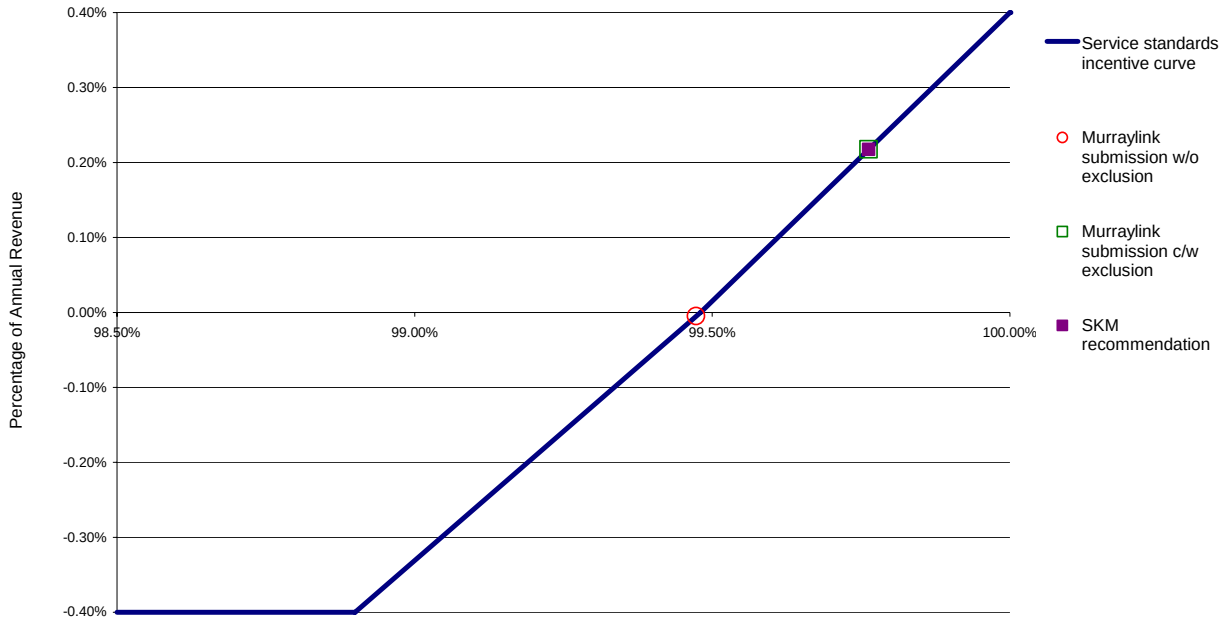
The Performance Measure profiles graphically illustrate the 2006 performance against the targets for Circuit Availability sub-measures.

The profiles shown are:

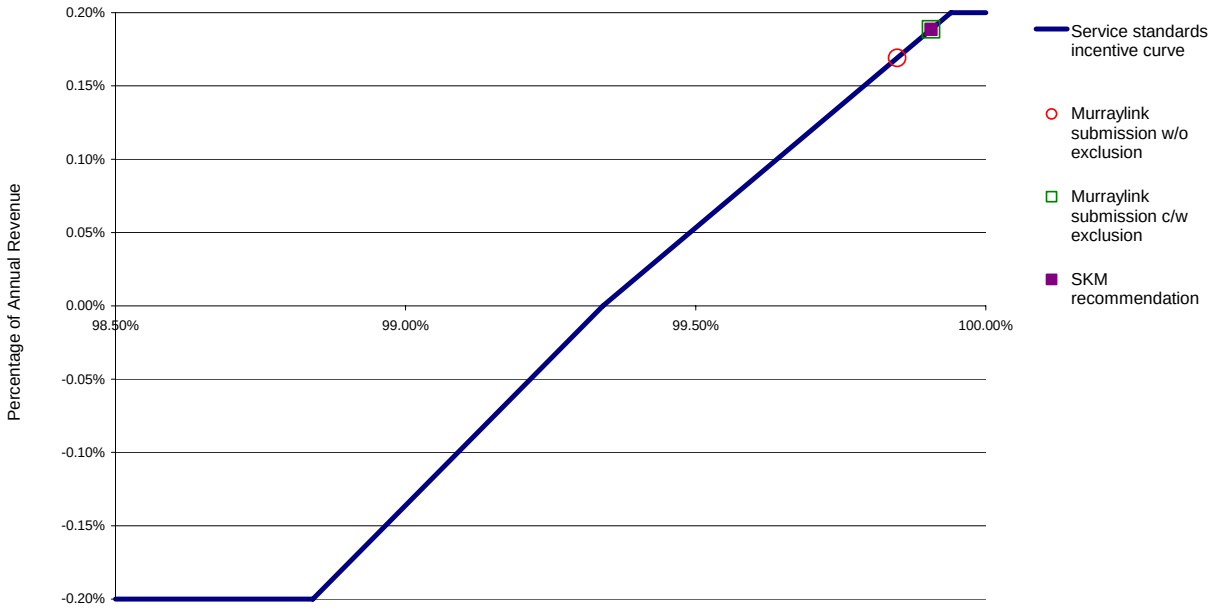
- Measure 1a Circuit Availability (planned)
- Measure 1b Circuit Availability (forced)(peak)
- Measure 1c Circuit Availability (forced)(off-peak)



S2- Peak forced outage availability



S3- Off-peak forced outage availability



Appendix B Definition of Force Majeure

The following is an extract from Appendix H to the AER decision on the MTC application for conversion and MAR[22]:

"In its past revenue cap decisions and draft service standards guidelines the AER has excluded force majeure events from the performance-incentive scheme. Below is the definition of force majeure, which Murraylink should report on to the AER on an annual basis. The AER will review, amongst other things, performance results and excluded events to ensure compliance with the revenue cap decision.

The following definition is to provide guidance of what may be considered a force majeure event, rather than specifically prescribe every event that may possibly occur.

For the purpose of applying the service standards performance-incentive scheme, 'force majeure events' are any events, acts or circumstances or combination of events, acts and circumstances which (despite the observance of good electricity industry practice) are beyond the reasonable control of the party affected by any such event, which may include, without limitation, the following:

- fire, lightning, explosion, flood, earthquake, storm, cyclone, action of the elements, riots, civil commotion, malicious damage, natural disaster, sabotage, act of a public enemy, act of God, war (declared or undeclared), blockage, revolution, radioactive contamination, toxic or dangerous chemical contamination or force of nature;
- action or inaction by a court, government agency (including denial, refusal or failure to grant any authorisation, despite timely best endeavour to obtain same) strikes, lockouts, industrial and/or labour disputes and/or difficulties, work bans, blockades or picketing; and
- acts or omissions (other than a failure to pay money) of a party other than the TNSP which party either is connected to or uses the high voltage grid or is directly connected to or uses a system for the supply of electricity which in turn is connected to the high voltage grid.

where those acts or omissions affect the ability of the TNSP to perform its obligations under the service standard by virtue of that direct or indirect connection to or use of the high voltage grid."

[22] pp 176