Energy Infrastructure Investments

Asset Management Plan

(Murraylink)

2012-2016

Table of Contents

Executive Summary

Background

The Asset Management Plan (AMP) covers the planning period from 1 January 2012 to 31 December 2016 and is updated and reissued on an annual basis.

The AMP identifies the necessary actions required to optimally manage the Energy Infrastructure Investment (EII) assets. A long-term consideration of the integrity of assets is necessary to ensure that they remain fit-for-purpose.

The AMP is written on the basis of the best known information at the time of writing.

Purpose

The purpose of the AMP is:

i. To provide a comprehensive understanding of the current management approach relating to the assets, their condition and their utilisation;

ii. To identify strategic recommendations for future utilisation;

iii. To provide a platform for approval of work programs by providing discussion of the options available and recommendations; and,

iv. To identify specific issues affecting the assets and the proposed remediation for budget consideration.

Reviews

The AMP is reviewed each year to ensure that the content is current.

Changes to the assets will inevitably occur during the life of the AMP. Unless there are issues identified that significantly impact the validity of the Plan it is only intended to amend the AMP at each annual review.

The AMP will identify any material changes to budget items for the previous period.

Summary of estimated SIB expenditure

The following table shows the estimated expenditure on each asset group for the period CY2012 to CY2016.

Id	Description	Forecast 2011 '000	2012 '000	2013 '000	2014 '000	2015 '000	2016 '000
Non-pass through assets (including applicable margin)							
3	Murraylink	0	333	1,326	1,479	901	2,233

Table 1 – Executive summary of SIB for CY2012-2016

3 Murraylink Interconnector

3.1 Asset Information

Murraylink is a 180 km high voltage direct current (DC) transmission line between Red Cliffs in Victoria and Berri in South Australia. Murraylink carries up to 220MW of power between the Victorian and South Australian transmission networks, although its capability to deliver this flow is limited at times by the capacity of the regional transmission networks to which it is connected.

The Murraylink transmission line consists of a pair of high voltage DC cables buried side by side underground from Berri to Red Cliffs. The cable pair is connected to a single converter station at each end. The converter stations interface the DC cables, to the high voltage; alternating current (AC) transmission systems in South Australia (132kV) and Victoria (220kV) via short lengths of underground high voltage interconnect AC cable.

The Australian Energy Market Operator (AEMO) determines the power transmission as a part of their central dispatch process.

3.2 Commercial Summary

Customer	Australian Electricity Market Operator
Term	Ten year revenue determination starting 1 October 2003.
Key obligations	• Compliance with the economic and technical regulations in the National Electricity Rules. • Use best endeavours to provide power transfer capability between the Red Cliffs terminal station in Victoria and the Monash substation in South Australia.
DTA Fee structure	Maximum allowed revenue recovered from coordinating Transmission Network Service Providers in Victoria and South Australia.
Tenure of Sites	Sites owned by Murraylink Transmission Company Pty. Ltd. and leased to the Murraylink Transmission Partnership for 99 years.
Ownership at end of Term	EII retains ownership at the end of the term and can apply to receive a new revenue determination for a subsequent period of time.
Obligations at end of Term	Useful life of the plant will extend beyond the period of the revenue determination.

Note: The second regulatory control period is proposed to be for the ten year period from 1 July 2013 to 30 June 2023.

3.3 Compliance

3.3.1 Applicable Regulations

3.3.1.1 Legislation

The significant national legislation:

i. National Electricity (South Australia) Act 1996;
ii. National Electricity (South Australia) Regulations;
iii. National Electricity (Victoria) Act 2005;
iv. National Electricity Rules;
v. Electricity Act 1996 (South Australian Legislation);
vi. Electricity (General) Regulations 1997 under the Electricity Act 1996;
vii. South Australian Electricity Transmission Code Issue No. 4 1 July 2003;
viii. South Australian Switching Manual Revision 2 June 2004; and,
ix. Victorian Electricity Industry Act 2000;
x. Victorian Electricity Safety Act 1998;
xi. Electricity Safety (Installations) Regulations 2009;
xii. Electricity Safety (Management) Regulations 2009.

3.3.1.2 Standards

3.3.1.2.1 Supply quality standards

Murraylink has been designed and is operated to meet the standards required by the National Electricity Rules. In addition, connection agreements exist with both ElectraNet and SP AusNet specifying power quality obligations.

Performance quality is monitored against supply quality standards 24 hours a day, 7 days a week at the Murraylink Control Centre, Adelaide.

3.3.1.2.2 Supply reliability standards

Supply reliability standards are service standards set by ElectraNet, SP AusNet and the Australian Energy Regulator (AER) in their decision on the Murraylink Application for Conversion and Revenue Cap. They are detailed in Appendix B (3) of the decision.

3.3.1.3 Licences

The Murraylink Transmission Company (MTC) Transmission Licence was issued as at 20 December 1999 and last varied by the Essential Services Commission of South Australia (ESCOSA) on 22 July 2008.

Murraylink has an exemption from holding a Transmission Licence in Victoria.

3.3.1.4 Economic Regulation

Regulatory reset is due in July 2013; the application for renewal will be lodged in May 2012. At this time, the submission will include a revenue proposal in conformity with the National Electricity Rules.

Regulatory Periods	Details
Reference Period for OPEX Costs	July 2010 to June 2011
Actual Cost available for regulatory submission	October 2011
OPEX	Budget Cost for 2011 / 2012 Forecast 2012/ 2013
CAPEX (for period of AA)	Forecast 2011 / 2017
Submission date	May 2012
Final decision will be received by	July 2013

Table 2 – Murraylink regulatory schedule

3.3.1.5 Reporting

Murraylink reports internally each month on its performance against the requirements set by ElectraNet and SP AusNet, and also the targets set by the AER. Annual reports are submitted to the AER on performance targets, set by the AER Decision on the Murraylink application for Conversion and Revenue Cap. These results are publically available from the AER web site.

An EII Monthly operations report is prepared at operating business unit level and compiled at National Operations level and submitted to EII.

3.3.1.6 Management of Regulatory Changes

There were no material changes to the Acts, legislation or licence during the prior year.

3.3.2 Risk management

The effective management of risk is central to the continued safe and reliable operation of Murraylink. The APA Group Risk Management Policy ensures that:

i. Appropriate systems are in place to identify all material risks that the Company faces in conducting its business;
ii. The impact of identified risk is understood, and appropriate limits set to control exposures to those risks; and,
iii. Appropriate responsibilities are delegated to control the identified risk effectively.

3.3.3 Environmental plan

Murraylink manages environmental considerations through an Environmental Management Plan. This plan is managed by APA and is reviewed annually. The general structure includes:

i. A description of the main components of Murraylink including an outline of the route and location of each component. This section also has a brief description of the environmental resources found along Murraylink;
ii. A description of APA's environmental emergency response procedures;
iii. The environmental management strategies that are employed to minimise and mitigate against environmental impacts; and,
iv. A description of monitoring, measurement and evaluation processes including incident reporting and notification.

3.3.4 Integrity threats

The following are considered threats to Murraylink;

i. First party interference;

ii. Third party interference, including site intrusion;

iii. Environmental, such as brush fires, flood, cyclones, heat, dust storms, animals; and,

iv. Lightning and uncontrolled electrical current.

Integrity of Murraylink is managed by the following:

i. Review existing condition of equipment and facilities and compliance to relevant standards and regulations;

ii. Identify threats that can result in loss of integrity;

iii. Earthing protection;

iv. Increasing public awareness; and,

v. Identify external threats and assess external risks that can result in loss of integrity.

3.3.5 Emergency plan

The Murraylink Emergency Response Plan is reviewed annually. The plan was last reviewed in 2010 and is current.

3.4 Demand and Supply Integrity

3.4.1 Demand management methodologies

Murraylink transfers power between ElectraNet's Monash Substation and SP AusNet's Red Cliffs Terminal Station, providing an inter-regional transmission service interconnecting the Victorian and South Australian electricity networks. Murraylink does not and cannot contract its transmission capacity. No loads directly connect to Murraylink.

Murraylink power transfer is controlled by AEMO and the service standards defined by AER, ElectraNet and SP AusNet. Consequently, demand management methodologies and incentives are not applicable to the Murraylink network.

3.4.2 System reliability planning standards

The APA operates and maintains the Murraylink transmission system to meet the reliability requirements set by ElectraNet; SP AusNet; and the availability targets set in the AER Decision on the Murraylink Application for Conversion and Revenue Cap.

The adequacy of the transmission system and its need for development is assessed against these requirements and targets.

3.4.3 Maintenance constraints

Due to the requirement for high levels of Murraylink availability, major planned maintenance is scheduled to coincide with low loads, generally resulting in major planned maintenance taking place in the autumn and spring periods.

3.4.4 Supply integrity risks and solutions

Maintenance is planned in advance to ensure that the integrity of supply is secured and that the asset has high availability. However, equipment failure or unplanned maintenance is dealt with on a case by case scenario and depending on the nature of the repair or maintenance, planned or acted on urgently.

3.5 Key performance measures

3.5.1 Supply performance criteria

The Murraylink annual performance measures and targets as set by the Australian Energy Market Operator for the last AEMO reporting period (Calendar Year 2010) and for YTD 2011 are as follows:

Performance Measure	Target 2010	2010	Target 2011	YTD 2011
Scheduled circuit availability	99.17%	99.58%	99.17%	99.28%
Forced outage circuit availability in peak periods	99.48%	100%	99.48%	99.89%
Forced outage circuit availability in off–peak periods	99.34%	100%	99.34%	99.98%

Table 3 – Murraylink performance measures

Commentary

Murraylink met all performance targets.

3.5.2 SIB project measurement

3.5.2.1 Capital works (CAPEX)

A reflection on the capital projects for CY2011.

Year	$ Budget '000's	$ Actual '000's	% Var	Total Projects
CY2011	30	0	NA%	Nil

Table 4 – Murraylink capital projects review

Commentary

No material capital expenditure in CY2011.

3.5.2.2 Major Planned Operational expenditure (OPEX)

Yr	Id	Description	Budget Month	Actual Month
2011	1	Annual Valve and Reactor cooling Maintenance	Sept 2011	
	2	Annual Maintenance Shutdown	Oct 2011	

Table 5 – Murraylink major operational works preview

3.6 Lifecycle and technical operating

3.6.1 Operation

Murraylink has a nominal bi-directional rated capacity of 220MW, transferring power between Berri in South Australia and Red Cliffs in Victoria.

Operational control is manned 24 hours a day, 7 days a week from a remote control room staffed by fully trained operators located in Adelaide, South Australia. Murraylink receives dispatch targets from AEMO on a five-minute basis, in a manner similar to scheduled generation plant. Murraylink dispatch (both direction and magnitude) is optimally determined by the Scheduling, Pricing and Dispatch (SPD) software to optimise the cost of energy in the National Energy Market.

3.6.2 Maintenance

Maintenance work of Murraylink network assets has been contracted to Transfield Services (Australia) Pty Limited. The responsibilities and obligations of the maintenance contractor are:

i. In undertaking the maintenance services, to ensure that all personnel under its control act, and plan for action, in a manner that will not put any property or any person at risk of damage or injury;
ii. To diligently undertake the maintenance services, as required, and in a manner and applying appropriate resources, so as to provide maximum availability and maintain Murraylink network assets in good condition, subject to fair wear and tear, in accordance with the requirements of Murraylink procedures, good electricity industry practices and applicable laws;
iii. Acknowledging that Murraylink as a network service provider, to use its reasonable endeavours to schedule and co-ordinate Maintenance Services in advance and re-schedule planned outages accommodating requests from AEMO or any Transmission Network Service Provider (TNSP);
iv. In undertaking the maintenance services, to take suitable action to avoid collateral damages to any other asset owned or operated by Murraylink and any electrical infrastructure or asset of a TNSP or any other person;
v. To provide 24/7 attention for maintenance activities and deploy human and physical resources accordingly;
vi. To supply all reimbursable materials complying with the Murraylink standards;
vii. To undertake appropriate training, induction and workshop for the contractor's personnel;
viii. To comply with the requirements of Murraylink procedures whilst engaged in maintenance activities which require access to the Murraylink sites and facilities;
ix. To report to the APA O&M Engineer or Murraylink Operator any breach, incident or injury incurred whilst attending the Murraylink sites and facilities, or any other business on behalf of Murraylink; and,
x. To record and report all maintenance activities and technical modifications to any Murraylink plant or equipment in accordance with Murraylink maintenance and reporting procedures.

The existing contract with Transfield expires on 30 June 2012. Tenders are being sought from interested parties, for the provision of maintenance services on an ongoing basis. It is anticipated that the new maintenance contractual arrangements will be put in place during the third quarter of 2012.

3.6.3 Planned Capital Works (Stay in Business)

Id	Description	2012 '000	2013 '000	2014 '000	2015 '000	2016 '000
1.	Install fixed earthing switches	0	0	0	310	625
2.	Reprogram runback control logic	61	0	0	0	0
3.	IGBT replacement	0	181	0	0	0
4.	Capacitor can spares replacement	0	32	0	0	0
5.	Perimeter fence security	0	0	875	0	0
6.	SF6 Pressure Gauge	3	0	0	0	0
7.	Optic Fibre test equipment	4	0	0	0	0
8.	Switchyard Barrier Fences	9	0	0	0	0
9.	Critical spares	35	44	29	33	33
10.	Replace fire alarm Vesda chassis	0	32	0	0	0
11.	Fire system pressure vessel testing	0	131	0	0	0
12.	Chilled water piping lagging	0	20	0	0	0
13.	Refurbish rotating ancillary equipment	40	477	437	0	0
14.	Air conditioner compressor and head unit	0	0	0	25	25
15.	Install additional air conditioning chillers	0	0	0	517	0
16.	Berri water tank and plumbing	0	0	7	0	0
17.	Control system end of life replacement	0	0	0	0	2,387
18.	Contingent relocation of cables	0	0	0	220	0
19.	Building ventilation changes	0	0	0	222	0
Totals		**152**	**918**	**1,348**	**1,327**	**3,071**

Table 6 – Murraylink stay in business proposals includes margin

Commentary

1. Install fixed earthing switches

The cable terminations for the transformer primary and secondary connections at both Berri and Red Cliffs are 7m above the ground. Applying portable earths to these cable terminations requires significant manual effort to clamp the earth cable onto the conductor. On the execution of this task (annually) there is a significant risk of injury to the switching operator as he tightens the earth clamp at the end of the 5m long operating stick with 7m of heavy earth cable hanging from the clamp. It is proposed to install fixed earthing switches to enable efficient and safe application of earth leads.

Note - This project has been deferred to CY12 due to phase reactor in CY11.

2. Reprogram runback control logic

The control logic for the fully automated Murraylink runback schemes does not have operator override capability. The proposed solution is to engage a contractor to re-program and test the runback control logic to enable operator override during runback events.

3. Insulated Gate Bipolar Transistor (IGBT) replacement

The annual failure rate of IGBT's over the period 2007-2010 was 4, 3, 3 and 4 per annum, respectively. In stock we have 14 IGBT's with 6 IGBT's positions reporting faulty across the facility. It is proposed to purchase additional IGBT's in CY12 to mitigate the risk of a prolonged outage.

4. Capacitor can replacement

There are a total of 300 capacitor cans that make up the harmonic filters at the conversion stations at Berri and Red Cliffs. As a consequence, it is necessary to

maintain a sufficient number of spare capacitor cans to cater for several failures per year.

5. Perimeter fence security

To maintain a high level of security, protecting the public and trespassers, the perimeter fences at Berri and Red Cliffs will require an upgrade in CY15. Upgrading the fence maintains a high level of facility security and will significantly reduce the incidence of theft, injury, and malicious damage by trespassers. Similar action to upgrade security fencing has, or is being undertaken by other network businesses. The proposed solution is to upgrade to weld mesh. This has been scheduled to CY15, minimising costs.

6. SF6 Pressure Gauge

Required pressure gauge.

7. Optic Fibre Test equipment

Required test equipment.

8. Switchyard Barrier Fences

These fences are for safety reasons, to provide separation of the high voltage areas from common use areas, as is common practice by network businesses.

9. Contingency spares

To maintain the high level of plant integrity a contingency for critical spares has been allocated.

10. Replace fire alarm Vesda chassis

The design of the central fire alarm central unit is such that it has a history of periodic failure and needs to be replaced.

11. Fire protection system pressure vessel testing

The fire protection system has a gas suppression system. The associated pressure vessel must be inspected and tested to meet statutory requirements.

12. Chilled water piping lagging

The lagging associated with the chilled water piping deteriorates with exposure to solar radiation and the elements and requires periodic replacement.

13. Refurbish rotating ancillary equipment

The reliable performance of ancillary equipment is necessary for the security of the link. The motors and contactors associated with valve cooling systems, reactor cooling systems and cooling towers have a service life much shorter than the primary equipment. This equipment has been in service for a decade and the refurbishment of several items is planned to ensure the continued reliable operation of the link.

14. Air conditioner compressor and head unit

Routine maintenance of the existing air conditioner compressors and head units will be required.

15. Install additional air conditioning chillers

During summer, the performance of the air conditioning chillers is critical to the operation of Murraylink. The converter stations are operated by a distributed control system which malfunctions if low ambient temperatures are not maintained in the control enclosures. Control system malfunctions, due to high ambient temperatures, result in outages of Murraylink and increased control system maintenance costs. The

proposed solution is to install additional chillers and water pumps, in CY14, to secure the air conditioning system against the failure of a single chiller.

16. Control system end of life replacement

The Murraylink control system consists of a variety of computerised components and software. As the components and software age, it becomes more expensive to support and maintain the system. The proposed solution is to replace the control system components and software in CY16, to ensure the control system remains maintainable.

17. Contingent relocation of cables

The Murraylink cable may require relocation to make way for potential developments, or road realignment, along the cable route in the future. The Murraylink cables have non-exclusive rights to occupy road reserves under section 93(1)(d) of the Electricity Industry Act and a licence with VicRoads in Victoria; and under section 47 the Electricity Act in South Australia. In the event that some future development is planned for an area where the cables are installed, Murraylink is likely to be required to relocate or otherwise protect the cables from damage. This proposal is contingent on a future development that requires the relocation of the Murraylink cables.

18. Building ventilation changes

The existing converter station building ventilation system causes contamination of the high voltage equipment installed inside the building,. The converter buildings have exhaust fans installed on their roofs that extract air from the buildings. The air extraction causes a negative pressure differential between the inside and outside of the building. Debris, dust and insects are drawn into the converter buildings by the pressure difference, where they settle on the high voltage equipment, increasing the risk of an electrical flashover and increasing maintenance costs to clean inside the building annually.

The proposed solution is to change the fan impellors to pressurise the building and install filters to the air intake in CY14.

Appendix B outlines the delivery schedule for the CY2012.

Opportunities for growth capital expenditure

Subject to economic regulatory approval the following project are considered opportunities to grow the asset base:

Id	Description	2012 '000	2013 '000	2014 '000	2015 '000	2016 '000
1	Black start capability	0	0	2,293	0	0
2	Contingent reduction of converter losses	0	0	0	2,134	0
3	Contingent duplication of DC link					265,000
4	Contingent duplication of transmission lines					551,000
Totals		**0**	**0**	**2,293**	**2,134**	**816,000**

Table 7 – Murraylink growth capital opportunities

Commentary

1. Black start capability

Black start capability refers to "islanded" operating capability. Islanded operating capability is the ability to operate and supply an electricity network that is separated from any frequency controlling generators. Currently Murraylink is controlled to transfer a constant active power, varied only by changing the active power set point. Murraylink has no capability to vary the active power to control a constant frequency.

In the event that a remote AC network outage causes Murraylink to be separated from all frequency controlling generators, the frequency of the AC network connected to Murraylink will deviate and the Murraylink frequency protection will trip the converter station. Murraylink has received several enquiries, in recent years, about the capability to assist in restoring the AC network after a black system event. In the next AER review, consideration will be given to include a submission to implement black start capability at Murraylink. If approved by the AER, this expenditure will be added to the asset base as a recoverable prudent expenditure.

2. Contingent reduction of converter losses

Future carbon pricing may focus attention on transmission system losses and Murraylink may be required to take action to reduce transmission losses.

A significant cause of transmission losses is the switching of the valve IGBTs. The switching losses may be reduced by utilising an improved switching pattern for the IGBTs. The proposed solution is to change the switching pattern for the IGBTs and retune the AC and DC filter banks for the resultant harmonics. This proposal is contingent on a requirement to reduce transmission losses.

3. Contingent duplication and extension of Murraylink transmission line

Duplication of Murraylink will enable greater export of renewable energy from South Australia. South Australia has extensive wind energy resources; however development is currently constrained by limited transmission capacity between South Australia, Victoria and New South Wales. The proposed solution is to:

- duplicate Murraylink with a 400MW DC transmission line between Hallet in South Australia and Buronga in New South Wales; and
- extend Murraylink, between Berri and Hallet in South Australia, and between Red Cliffs and Shepparton in Victoria, to remove AC transmission network constraints that limit the South Australian export capability of Murraylink.

This proposal is contingent on AEMO acceptance, RIT-T demonstration of the cost-benefit, EII Board approval, AER regulatory approval of the contingent project and sufficient commercial arrangements from wind generators to make the investment necessary to reinforce the South Australian interconnection capacity.

3.6.4 Planned Major Maintenance

Id	Description	Date	Actual Date
1	Annual Valve and Reactor cooling Maintenance	September	September
2	Annual Maintenance Shutdown	October	October

Table 8 – Murraylink major maintenance frequency plan

Commentary

Major maintenance is conducted in the autumn and spring periods where the asset has low load and minimal impact to supply and demand.

The South Australian Department for Transport, Energy & Infrastructure is building a truck parking area and Weigh Bridge at Yamba on the Sturt Highway. There will be substantial road construction work occurring above the cables throughout construction, and longer term there will be substantial heavy vehicle traffic passing over the cables. Our options are to relocate the cables and seek compensation or require the construction contractors to protect the cables in their current situation. The second option is the preferred option. The department is expecting to ask for tenders for the construction January 2011 with work expected to start April 2011. We are seeking specialist civil engineering advice to finalise the requirements for the protection of the cables.

We will be seeking recoveries for all costs and any revenue loss in respect to this activity.

Corrective maintenance work has been undertaken on the water chillers at both the Berri and Red cliffs converter stations. The water chillers are an integral part of the air conditioning for the converter control rooms. During summer, their operation is critical to the operation of the converter. The corrective work was undertaken to ensure their reliable operation for the coming summer.

Appendix A – Murraylink Stay in Business Capital CY12

EII Budget 2012													
Murraylink													
Stay in Business (SIB) Capex Budget													
	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Total
Murraylink													-
Runback Control Logic Changes					60,500								60,500
IGBTs	181,500	-	-	-	-	-	-	-	-	-	-	-	181,500
SF6 Pressure Guage	-	3,300	-	-	-	-	-	-	-	-	-	-	3,300
Optic Fibre test equipment	4,400	-	-	-	-	-	-	-	-	-	-	-	4,400
Switchyard Barrier Fences		4,400	4,400				-	-	-	-	-	-	8,800
Contingency Spares	8,800	10,450	7,700	550	550	-	-	6,600	550	-	-	-	35,200
Murraylink Total	**194,700**	**18,150**	**12,100**	**550**	**61,050**	**-**	**-**	**6,600**	**550**	**-**	**-**	**-**	**293,700**

Amounts shown include margin