APA Group

Energy Infrastructure Investments

Asset Management Plan

2014-2018

(Excerpt of material related to Directlink)

Table of Contents

List of Appendices

List of Tables

Executive Summary

Background

The Asset Management Plan (AMP) covers the planning period from 1 January 2014 to 31 December 2018 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 CY2014 to CY2018.

Id	Description	Forecast 2013 $000s	2014 $000s	2015 $000s	2016 $000s	2017 $000s	2018 $000s
Non-pass through assets (including applicable margin)							
4	Directlink	1817	4126	2561	3953	3102	102

Table 1 – Executive summary of SIB for CY2014-2018

4 **Directlink Interconnector**

4.1 Asset Information

Directlink is a 59 km high voltage DC transmission system in New South Wales between Bungalora and Mullumbimby. Directlink transfers up to 180MW of power, between the Queensland (QLD) and New South Wales (NSW) transmission networks.

Directlink consists of three independent DC transmission lines each consisting of a pair of high voltage DC cables, buried in some areas and in others installed in steel troughs. Each cable pair is connected to a single converter station at both Bungalora and Mullumbimby. The converter stations interface to the existing high voltage, AC transmission systems via relatively short lengths of underground, high voltage AC cable at Bungalora (110kV) and overhead high voltage AC cable at Mullumbimby (132kV).

The power transferred by Directlink is determined by AEMO as a part of their central dispatch process.

4.2 Damage to Convertor Station for Pole 3 at Mullumbimby

The convertor station for Pole 3 at Mullumbimby was rendered unsalvageable by a fire in mid-August 2012.

As the result of tracking found, changes are required for phase reactor cooling on all systems. The scope of the changes is yet to be fully determined.

Work to replace the system 1 Mullumbimby converter has commenced with an expected completion date of June 2015. Until then, the capacity of Directlink is reduced from 180MW to 120MW. The CAPEX request and plan for rectifying/replacing the damaged convertor station has not been included in this Asset Management Plan.

The Direct Link fire may require additional expenditure this year to minimise the risk of a future fire. Immediate priority would be for Directlink then Murraylink the following year. Specific improvements might include:

a) Improved Ventilation to reduce moisture;

b) Updated procedures / monitoring

c) Overhaul / repair of insulation associated with reactor coils.

d) Upgrade to the fire detection and fire suppression systems

4.3 Compliance

4.3.1 Applicable Regulations

4.3.1.1 Legislation

The significant national legislation:

i. Electricity Supply Act 1995;
ii. Electricity Supply (General) Regulation 2001
iii. Electricity Supply (Safety and Network Management) Regulation 2008;
iv. National Electricity (New South Wales) Act 1997;
v. National Electricity Rules;
vi. New South Wales - Occupational Health and Safety Act 2000, and
vii. New South Wales - Occupational Health and Safety Regulation 2001.

4.3.1.2 Standards

4.3.1.2.1 Supply quality standards

Directlink has been designed and is operated to meet the standards required by the National Electricity Rules. In addition, a connection agreement exists between APA and Essential Energy, specifying power quality obligations.

Performance quality is monitored against supply quality standards 24 hours a day, 7 days a week, at the Directlink control centre, APA Dandenong.

4.3.1.2.2 Supply reliability standards

Supply reliability standards are service standards set by Essential Energy and the AER in their decision on the Directlink Application for Conversion and Revenue Cap, they are detailed in Appendix C (3) of the decision.

4.3.1.3 Licences

No licence is required to operate Directlink. As a transmission line in NSW Directlink must comply with the Network Management Plan developed in accordance with the requirements of the NSW Electricity Supply (Safety and Network Management) Regulation 2008.

4.3.1.4 Economic Regulation

Regulatory reset is due in July 2015; application for renewal will begin in May 2014. At this time the submission will include a revenue proposal, pricing methodology and proposed negotiating framework in line with National Electricity Rules.

Regulatory Periods	Details
Reference Period for OPEX Costs	July 2012 to June 2013
Actual Cost available for regulatory submission	October 2013
OPEX	Budget Cost for 2013 / 2014 Forecast 2014 / 2015
CAPEX (for period of AA)	Forecast 2013 / 2019
Submission date	May 2014
Final decision will be received by	July 2015

Table 2 – Directlink regulatory schedule

4.3.1.5 Reporting

Directlink reports internally each month on its performance against the requirements set by Essential Energy and the targets set by the AER. Annual reports are submitted to the AER on performance targets set by the AER Decision on the Directlink Application for Conversion and Revenue Cap. These results are publically available from the AER web site.

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

4.3.1.6 Management of Regulatory Changes

There were no material changes to the acts, legislation and licence during the prior year.

4.3.2 Risk management

The effective management of risk is central to the continued safe and reliable operation of Directlink. 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.

4.3.3 Environmental plan

Directlink manages environmental considerations through the Directlink Operational Environmental Management Plan. This plan is managed by the National APA Heritage,

Environment and Lands Department and is reviewed annually. The general structure includes:

i. A description of the main components of Directlink including an outline of the route and location of each component. This section also has a brief description of the environmental resources found along Directlink;
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.

4.3.4 Integrity threats

The following are considered threats to Directlink;

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 Directlink 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. Increasing public awareness; and,
iv. Identify external threats and assess external risks that can result in loss of integrity.

4.3.5 Emergency plan

The Directlink Emergency Response Plan is reviewed annually. The plan was reviewed in 2012 and is current.

4.4 Demand and Supply Integrity

4.4.1 Demand management methodologies

Directlink transfers power between two Essential Energy transmission substations, an inter-regional transmission service, interconnecting the NSW and QLD electricity networks. Directlink does not contract its transmission capacity and no loads directly connect to Directlink.

Directlink power transfer is controlled by AEMO and the service standards defined by AER and Essential Energy. Consequently the demand management methodologies are not applicable to the Directlink network.

4.4.2 System reliability planning standards

APA operates and maintains the Directlink transmission system to meet the reliability requirements set by Essential Energy and targets set in the AER Decision for Conversion and Revenue Cap.

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

4.4.3 Maintenance constraints

Due to load availability major planned maintenance is conducted to coincide with low load which generally results in maintenance taking place in July and August.

4.4.4 Supply integrity risks and solutions

Maintenance is planned in advance where possible. However, unplanned maintenance is dealt with on a case by case scenario and depending on the nature of the maintenance planned or acted on urgently.

4.4.5 Fire Damage of Pole 3 Convertor at Mullumbimby

Fire damage has rendered Pole 3 unavailable and it is likely to remain so for at least the next two years during which time the capacity of Directlink is reduced from 180MW to 120MW. The fire has been determined as an insurable event and work is proceeding to obtain a firm cost of replacement. Once the cost of replacement is confirmed, the recommended action will be presented as paper for board approval.

Key performance measures

4.4.6 Supply performance criteria

The Directlink annual performance measures and targets as set by the Australian Energy Market Operator for the last AEMO reporting period (Calendar Year 2011) and for YTD 2012 are as follows:

Calendar Year Performance Measure and Results	Target 2012	Actual 2012	Target 2013	YTD 2013
Scheduled circuit availability	99.45%	98.56%	99.45%	99.91%
Forced outage circuit availability in peak periods	99.23%	86.87%	99.23%	96.64%
Forced outage circuit availability in off–peak periods	99.23%	93.43%	99.23%	95.83%

Table 3 – Directlink performance measures

Commentary

A reduced rate of cable failure resulted in an improved availability in 2012. Laboratory analysis of cable fault samples was undertaken early in 2012. The further laboratory analysis is planned for late 2013 to determine whether silicone fluid injection will be a successful remediation method.

4.4.7 SIB project measurement

4.4.7.1 Capital works (CAPEX)

A reflection on the capital projects for CY2013.

Year	Budget $000's	Forecast $000's	% Var	Total Projects
CY2013	1635.2	1817	+11	30

Table 4 – Directlink capital projects review

Commentary

A reduced rate of cable failure allowed the purchase of new cable joints to be deferred. A significant number of IGBTs are likely to be recovered from the fire damaged system 1 converter at Mullumbimby, deferring the need to purchase replacement IGBTs. Capital budgeted for the Phase reactor temperature control is being allocated to modify the arrangement of the air handling. Cable fluid injection will be trialled in the second half of the year. ABB have not responded to date on our request for a quote to modify the valve control logic for IGBT reduced light testing.

4.4.7.2 Major Planned Operational expenditure (OPEX)

Year	Id	Description	Budget Month	Actual Month
2013	1	Annual Maintenance Shutdown	July 2013	July 2013
2013	2	Annual Valve and Reactor cooling maintenance	Aug 2013	Aug 2013

Table 5 – Directlink major operational works preview

4.5 Lifecycle and technical operating

4.5.1 Operation

Directlink has a nominal bi-directional rated capacity of 180MW, transferring power cables between QLD and New South Wales (NSW).

Operational control is from a manned (24 hours a day, 7 days a week) remote control room, staffed by fully trained operators. Directlink receives dispatch targets from AEMO on a five-minute basis, in a manner similar to scheduled generation plant. Directlink dispatch (both direction and magnitude) is optimally determined by the Scheduling, Pricing and Dispatch (SPD) software.

4.5.2 Maintenance

Maintenance work of Directlink network assets is undertaken by a combination of APA staff and contractors under the guidance of APA asset management staff. The aim of the APA asset management and operational plans is to ensure the maintenance work is in accordance with the following objectives.:

1 Ensure that all personnel act, and plan for action, in a manner that will not put any property or any person at risk of damage or injury;
2 Diligently undertake the maintenance services so as to provide maximum availability and maintain Directlink network assets in good condition, in accordance with the requirements of Directlink procedures, good electricity industry practices and applicable laws;
3 Schedule and co-ordinate Maintenance Services in advance and re-schedule planned outages accommodating requests from AEMO or any Transmission Network Service Provider (TNSP);
4 Take suitable action to avoid collateral damages to any other asset owned or operated by Directlink and any electrical infrastructure or asset of a TNSP or any other person;
5 Ensure sufficient trained and competent personnel are available to undertake the maintenance.

4.5.3 Planned Capital Works (Stay in Business and Growth Opportunities)

Id	Description	2014 $000's	2015 $000's	2016 $000's	2017 $000's	2018 $000's
1	Revise Phase Reactor Cooling	3085				
2	Control System Spares	20	20	20	20	20
3	UPS Batteries	10	10	5	5	5
4	Upgrade Industrial computer control system		900			
5	Spare capacitors	50	22	22	22	22
6	Spare IGBTs	330	330			
7	Spare Cable	300				
8	Spare cable joints (maintain inventory)		557	557		
9	Contingency Spares	35	39	33	33	33
10	Spare valve optic fibres	100	100	100	22	22
11	Security fencing enhancement (1 site)			540		
12	Contingent relocation of cables		220	220		
13	Cable Switch Yard				2750	
14	Cable fluid injection assessment & trial (R&D / engineering) Cost benefit & risk v replacement.	55	55			
15	Fire Suppression			2200		
16	Temperature regulation of valve cooling water		120			
17	Sound Dampening Replacement for Ventilation Inlet		36			
18	Test Equipment	10				
	Cameras	10	6	6		
	Site Lighting Improvement	6	6			
	Valve Control logic changes.	110				
	Failure Analysis software.	5				
19	Cooling Tower Sound Enclosure Panel Replacement			250	250	
20	Building Roof Corrosion Repair		70			
21	Bungalora Storm Water Drainage Repair		50			
22	Bungalora Hand Rails		20			
	Totals	4126	2561	3953	3102	102

Table 6 – Directlink stay in business proposals

Commentary

The CAPEX request and plan for rectifying/replacing the damaged convertor station has not been included in this Asset Management Plan.

1. Revise Phase Reactors Cooling

The Directlink phase reactors are air cooled with the cooling fan running continuously when the converter is in operation. During periods when the converter is lightly loaded, the

reactor generates minimal heat and continuous operation of the cooling fan can cause condensation in the reactor. The condensation is considered to be the primary cause of the partial discharge in the reactor. The project will investigate the cooling requirements for the phase reactor and implement a solution that eliminates condensation.

2. Control System spares

To maintain an appropriate level of control systems spares required for operations.

3. UPS Batteries

To maintain UPS batteries required for operations.

4. Upgrade industrial computer control system

The Directlink converters have an industrial computer integrated into their control system. The motherboards used in the industrial computers are out of manufacture and all spares have been used. Should a motherboard develop a fault, second-hand motherboards will need to be sourced as replacements. The proposed solution is to replace the motherboards with a current model. It is intended to spread this change out over the next five years, therefore reducing the impact financially to the business.

5. Spare capacitors

There are several hundred capacitors in service at Directlink. Capacitors have been identified as an item that has a failure rate above that of other HV equipment. The is an on-going need to maintain a level of spare capacitors.

6. Spare IGBTs

There are several thousand IGBTs in service at Directlink. IGBTs have a failure rate above that of other HV equipment. There is an on-going need to maintain a level of spare capacitors. A large number of IGBTs have been salvaged from the fire damaged Mullumbimby System 1. These IGBTs will need to be cleaned and tested before becoming spares remaining operating systems.

7. Spare cable

It is proposed to purchase additional cable. This elevated rate of failure decreases the plant reliability and increases the risk of prolonged plant outages. Currently there are limited supplies of spare cable at Directlink and purchases in 2013 will not significantly improve the inventory. These cables have a long time period between order and delivery, therefore the spare cable will reduce the risk of prolonged plant outages.

8. Spare cable joint kits Replenish critical spares

It is proposed to purchase and maintain an inventory of cable joint kits in preparedness for cable faults. Currently there are limited supplies of spare cable joint kits at Directlink. These kits have long lead times between order and delivery which increases the risk of prolonged plant outages. The spare cable joint kits will ensure that repairs can be carried out swiftly reducing the risk of prolonged plant outages.

Cable injection trials (see 16) may ultimately lead to a reduction in the level of inventory being held and purchasing would reflect the replenishment of the desired inventory level rather than a particular budgetary value.

9. Contingency spares

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

10. Spare valve optic fibres

An elevated failure rate has led to depletion of spare optic fibres. Spare optic fibre cable and optic fibre connectors were purchased in 2012. Future optic fibres are being assembled from the purchased components as required throughout 2013.

11. Security fence

The Directlink Bungalora and Mullumbimby sites have experienced frequent incidents of trespassing, theft and vandalism. An improved security fence is required to mitigate the risk of liability in the event of a trespasser being killed or injured, and the risk of major equipment failure as a consequence of theft or other malicious damage. The Bungalora security fence was upgraded in 2011, due to the highest level of trespass and incident. Mullumbimby is proposed for a fencing upgrade in 2016. The result of increased security at these sites will reduce the likelihood of trespass and incident.

12. Contingent relocation of cables

The Directlink cable may require relocation to make way for potential developments along the cable route in the future. The Directlink cables have non-exclusive rights to occupy road reserves under section 45 of the Electricity Supply Act in New South Wales, however sections of the route pass along a disused rail corridor which has the potential to be re-established. In the event that some future development is planned for an area where the cables are installed along the rail corridor Directlink may be required to relocate the cables which would involve significant difficulty due to the poor access. The budget allocated is a provisional allowance to deal with such development. The scope and likelihood of the relocation works will not be known until such development is proposed.

13. New Switchyard /Busbar arrangement

Currently each Directlink system is dedicated to a pair of cables. It is proposed to install a gas insulated switch gear and busbar arrangement to allow the converter stations to be switched between different cables, thereby maximising availability and reliability of plant. This proposal will require review of the cost/benefit prior to any development.

14. Cable fluid injection assessment & trial

Discussions are underway with a North American based company supplying HV cable remediation by fluid injection. In order to select an appropriate fluid, further assessment of the cable faults is required. It is proposed to engage the fluid injection company to review the results of the investigations undertaken to date and to examine samples of failed cables. Should the consultant determine a remediation technique that appears viable it would be recommended to the Board before implementation.

15. Fire Suppression

A fire suppression system will remove the risk of a total loss of a converter building in the event of a fire. The costs of a fire suppression system were put in 2016 to allow possible recovery under the next revenue period. Earlier installation of a fire suppression system may be required if the ongoing fire risk is determined to be high.

16. Valve Cooling Control Logic Changes.

The incidence of IGBT failure shortly after start up can be reduced by maintaining the IGBTs at operating temperature during plant shutdown. Currently the valve cooling control system regulates cooling water temperature to 20ºC. It is proposed to have ABB undertake an engineering review and control logic changes to add a second cooling water temperature regulation set point. The second temperature seta point will maintain the operating temperature of the IGBTs when the converter station is shutdown. The cost estimate includes an engineering review and implementation by ABB as a separate project.

17. Sound Dampening Replacement for Ventilation Inlet

Considerable rusting has occurred to the sound damping at the inlet of the barn ventilation at both Mullumbimby and Bungalora. This is starting to collapse and will result in the blocking of the ventilation shaft. As system 1 is not operating we with require 4 dampers to be replaced at $5000 per damper.

18. Test Equipment

It has been identified that there is a need to have test gear on site to enable adequate maintenance to be conducted. The test equipment includes the following items:

a. micro-ohm meter – this is necessary to measure the resistance of high current connections that have been disturbed during maintenance. It can also be used to test the grounding network. Current model being looked at is the 6250 at $4190.00 + GST.

b. Thermal imaging camera - this is necessary to allow routine monitoring of high current connection during operation.. Current model being looked at is the 6250 at $4190.00 + GST.

19. Cameras

The inside of the converter buildings has restricted access because of the safety risk associated with the energised high voltage equipment. It is proposed to install a camera system to allow detailed inspection of equipment inside areas of the converter building while the converter building is energised. It is expected that this will reduce the frequency and duration of outages for converter station maintenance and allow rapid internal inspection of the buildings in response to faults.

20. Improved site lighting to meet OHS requirements

Additional lighting is required at the converter station sites to allow safe movement of maintenance personnel at night.

21. VCU Control logic change

Currently each of the 5400 IGBTs has to be manually tested to determine the performance of the optic fibre triggering system. The software change will enable an automated test with no labour required.

22. Software for Collecting and analysis Failure Data

Due the age of the HVDC systems we are entering the stage of the failure trend that will see a greater increase in the rate equipment failure. Over the next 20 years of operation a the ability to handle the maintenance and replacement of equipment in a suitable timeframe will rest on the ability to trend the failures and make informed decisions. The success rests primarily on the way in which failure data is collected and accessed. Due to the limited staff operating a number of assets it is seen as essential to use software to help record, track and analysis this data.

23. Cooling Tower Sound Enclosure Panel Replacement

Corrosion is present in a large number of the panels making up the cooling tower sound enclosure. The corrosion has occurred due to moisture ingress into the sound damping material. These panels require replacing to ensure the integrity of the sooling tower sound enclosure.

24. Building Roof Corrosion Repair

The roofs of the converter buildings are developing some areas of corrosion. These areas require treating to prevent the corrosion progressing further.

25. Bungalora Storm Water Drainage Repair

The Bungalora site has high rates of storm water run-off. The stormwater run-off has eroded of the shoulder drains of the site access road. This has created a hazard for vehicles and is undermining the bitumen.

26. Bungalora Hand Rails

The Bungalora site has a number of different levels with steps and retaining walls installed to allow access around the site. The hand rails will be extended to remove the hazard created by the lack of hand rails on the stairs and some higher parts of the retaining walls.

Appendix C outlines the delivery schedule for the CY2014.

4.5.4 Opportunities for growth capital expenditure

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

Id	Description	2014 $000's	2015 $000's	2016 $000's	2017 $000's	2018 $000's
1	Phase reactor replacement				16,000	
2	Cable Fluid injection		5,000			
	Totals	0	5,000	0	16,000	0

Table 7 – Murraylink growth capital opportunities

Commentary

1. Phase reactor replacement

The current design of the phase reactors at Directlink is prone to partial discharge burning. The burning results in the higher maintenance costs and reduced availability. These issues can be eliminated by installing reactors designed to prevent partial discharge.

2. Cable Fluid Injection

Cable fluid injection is being tested on the Directlink cables in a laboratory during 2013. If found to be successful at mitigating the effects of moisture in the cable, a limited trial will be conducted on in-service cable during 2014. Following The trial section of cable know to be water effected will be injected as part of project works.

4.5.5 Planned Major Maintenance

Id	Description	Date
1	Annual Maintenance Shutdown	July
2	Annual Valve and Reactor Cooling Maintenance	August

Table 8 – Directlink major maintenance frequency plan

Commentary

Major maintenance is conducted in July where the asset has low load and minimal impact

Appendix A – Directlink Stay in Business Capital CY14

EII Budget 2014													
Directlink													
Stay in Business (SIB) Capex Budget $000's													
	Jan-14	**Feb-14**	**Mar-14**	**Apr-14**	**May-14**	**Jun-14**	**Jul-14**	**Aug-14**	**Sep-14**	**Oct-14**	**Nov-14**	**Dec-14**	**Total**
Revise Phase Reactor Cooling		925	308	309	309	1234							3085
Control System Spares		4			6			6			4		20
UPS Batteries			5			5							10
Spare capacitors			25							25			50
Spare IGBTs									330				330
Spare Cable							300						300
Contingency Spares					35								35
Spare valve optic fibres								100					100
Cable fluid injection assessment & trial				55									55
Test Equipment		10											10
Cameras				10									10
Site Lighting Improvement		1		1		1		1		1		1	6
Valve Control logic changes.	110												110
Failure Analysis software.		5											5
Directlink Total	110	945	338	375	350	1240	300	107	330	26	4	1	4126

Amounts shown include margin of 10%