Directlink Joint Venture

Directlink
Revenue Proposal

Attachment 8.1

Capital expenditure
business cases

Effective
July 2015 to June 2020

May 2014

This attachment contains capital expenditure business cases for the following projects:

Project	Total value ($real)
Converter Stations	
Control system upgrade	13,070,355
Fire suppression	7,186,051
Phase reactor cooling revisions (Gotland solution)	2,277,793
Sourcing program - IGBTs	1,872,002
Zero sequence reactor repair	1,498,086
Optic fibre cables and connectors	801,166
Cooling tower sound enclosure remediation	512,500
Security fence upgrade	394,870
Emergency lighting	338,515
Roof repair of converter buildings	263,224
Building safety upgrade	179,030
Converter buildings ventilation sound dampers corrosion repair	52,869
Safety hand rails - Bungalora	20,295
Cables	
Cable repairs	2,841,300
Sourcing program - Cable joints	1,941,284
Cable relocation	367,211

Business Case

Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Control System Upgrade Project		
Project Type:	*Capex:*	*$13.1 million ($2014/15)*	
	Opex:	*$0.147 million pa ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

PURPOSE

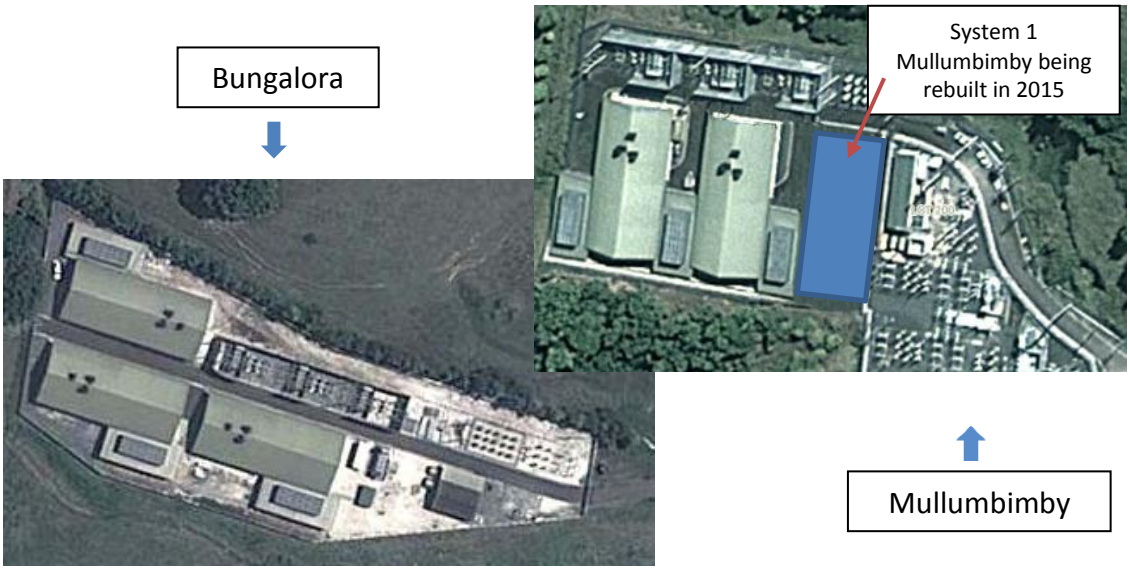
To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal covering the 2015-20 regulatory control period.

BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable and converter stations located between Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales it is connected to a 132 kV transmission grid and in Queensland to a 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated asset on 10 March 2006. APA acquired this asset in December 2006 (finalised in February 2007).

IDENTIFICATION OF NEED

The Directlink control system has not kept pace with technology since its commissioning. Central to the control system is an industrial computer based on embedded Microsoft Windows NT 4.0 operating system. Although some work has been undertaken to secure replacement hardware this has been limited as the operating system has not been supported by Microsoft since December 2004 and hardware vendors have followed suit.



ABB, the original equipment manufacturer, have recommended the system be upgraded to solve the technical obsolescence problem. In consideration that it may not be economically viable to undertake the full upgrade in the immediate future, APA also sought a support agreement from ABB in response to the anticipated higher failure rate towards the control system end of life.

Faults with the hardware are becoming more frequent, increasing the likelihood of lengthy outages due to the scarcity of replacement componentry that is still compatible with the embedded NT 4.0 operating system.

This project plans to:

- Continue supporting the current control system until financial year 2020 with the expected cost of support reflected in the annual operation and maintenance costs;
- Upgrade the Directlink control system to the ABB standard of the day in 2020, as a capital project.

EVALUATION OF ALTERNATIVES

The hardware and software components of the Directlink control system are tightly integrated. Changing the specification of one component in the control system requires substantial re-engineering to ensure consistent functionality. The control system was specifically developed by the OEM ABB for the operation of their HVDC facilities.

Experimenting with alternative third party products would increase technical risk as well as jeopardise the original design performance and ongoing OEM support of the equipment. Through investigations of potential alternative system options, no feasible alternatives were identified with guaranteed compatibility with the existing equipment provided by ABB. With the critical nature and scale of the facility it is prudent and good industry practice to follow the manufacturer's recommended control system to maintain the overall integrity of its system.

ESTIMATED COST / SCOPE

An initial scoping exercise has identified the following program of works.

On a per building basis – (x5)

Pole Control and Protection Panel

- remove existing superseded communication frameworks, communication boards and control and protection computer;
- exchange the communication and power supply boards in the remaining frameworks;
- install new MACH™ computer, DSP board and status indication panel;
- install new communication boards for the valve control communication;
- install new 24 VDC power supplies for feeding the computer and frameworks.

Valve Control Panel

- exchange the communication and power supply boards for the communication framework;
- install new 24 VDC power supplies to feed the frameworks.

Valve Cooling Panel

- exchange the communication and power supply boards in the frameworks;
- install new 24 VDC power supplies to feed the frameworks;
- move the CCP logic to pole control & protection computer.

Station Control and Monitoring

- install Operator Workstation per station and system;
- install Remote Operator Workstation;
- install SCM Server - database server for the event recorder and alarm system. File server for TFR records, archived events and analogue data (trends), digital documentation etc.;
- install ENS Server environment for compiling Hidraw code and file server for TFR records, archived events and analogue data (trends), digital documentation etc.;
- install master clock for time synchronization.

The OEM has supplied an offer to provide on-call support services for the existing control system. This support will provide a 24x7 helpdesk, to the site technicians, for control system the faults that are expected to arise in the time until the control system is upgraded. In the annual support agreement costs presented below, allowance has been made for:

- the fixed component of the support agreement cost;
- 20 hours of remote support per annum; and
- 2 x 8 hour site visits per annum.

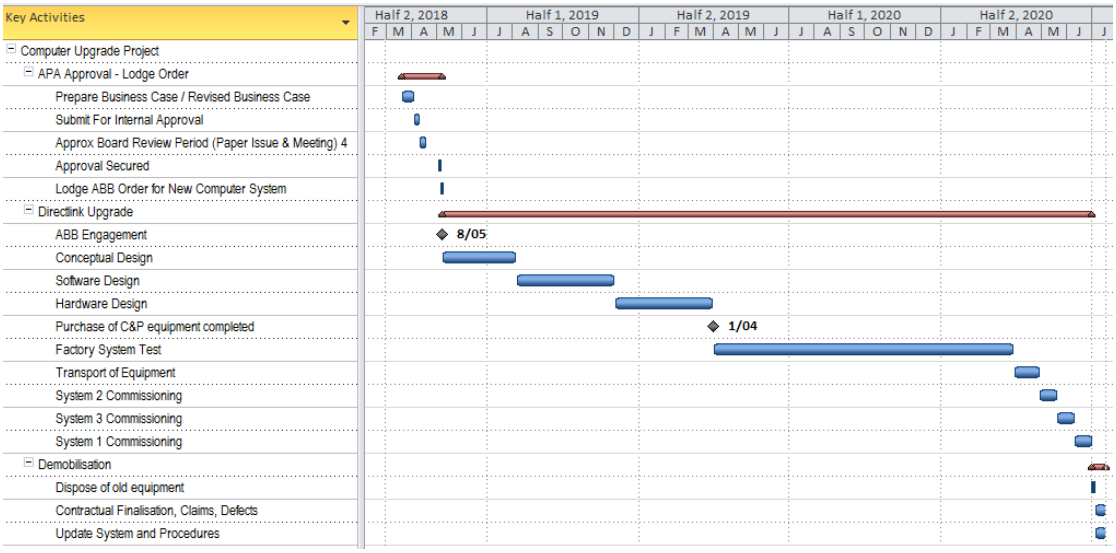
Cost for the support agreement and upgrade project over the regulatory control period are shown in the following table (assumed CPI escalation is 2.5%):

	FY 16	FY 17	FY 18	FY 19	FY 20
Support agreement opex costs ($Nominal)	$150,887	$154,659	$158,525	$162,488	$166,551
Control system capex costs (Nominal)					$14,075,343
Support agreement opex costs ($2014/15)	$147,206	$147,206	$147,206	$147,206	$147,206
Control system capex costs ($2014/15)					$13,070,355

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital and operating expenditure specified in 6A.6.7(c) and 6A.6.6(c) of the National Electricity Rules is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The following schedule represents the key activities for ABB to undertake the Computer System Upgrade Project during the 2015-20 regulatory control period.



JUSTIFICATION

This Computer System Upgrade project for Directlink is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) and 6A.6.6(a) of the National Electricity Rules (the Rules):

(3)(iii) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The project is justified under clauses (3) and (4) being required to maintain the reliable operabion of the link. The existing control equipment is obsolete and prone to extended failures due to the scarcity of replacement components. This project will ensure the computer management system (hardware and software) is a currently supported platform which can be maintained and serviced by resources and technology available in the market.

RECOMMENDATION

That the Control System Upgrade Project is implemented, to:

- Ensure the continued reliable operation of Directlink as the control system approaches end of life.
- Bring the system into line with good industry practice by maintaining a fully supported control system for the operation of the link.

The estimated costs have been included in the operating and capital expenditure forecasts for the Directlink Regulatory Proposal.

Business Case

Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Fire Suppression Project		
Project Type:	*Capex:*	*$7.186 million ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Throley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

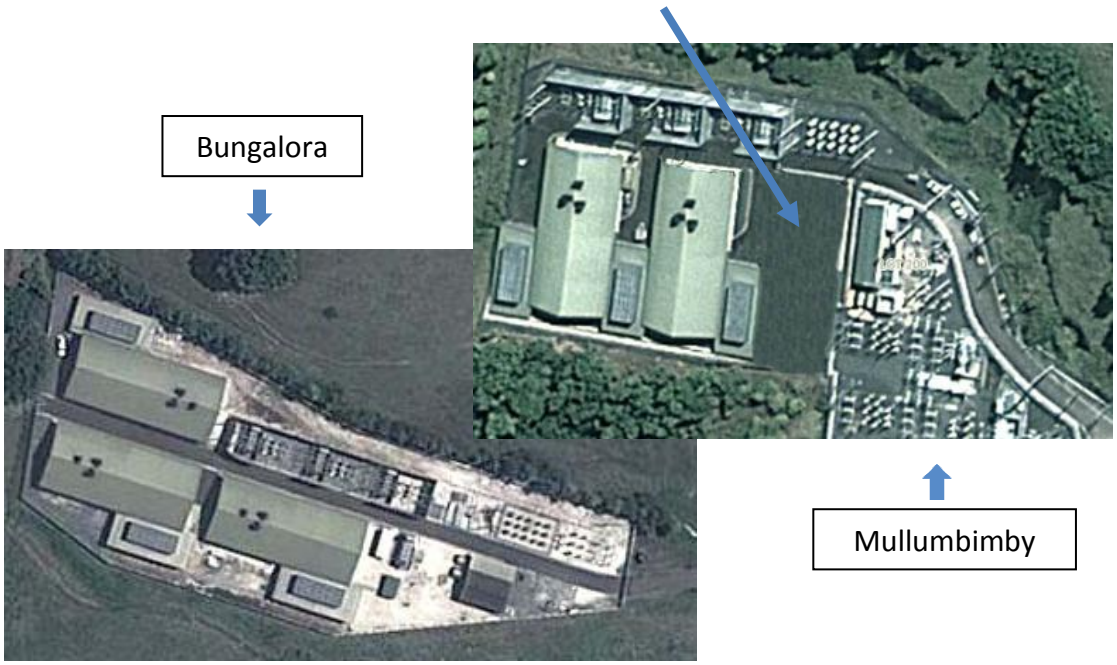
PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal covering the 2015-20 regulatory control period.

BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable between converter stations located at Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales Directlink is connected to a 132 kV transmission grid and in Queensland to a 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated transmission asset on 10 March 2006.

The Mullumbimby system 1 converter and building was destroyed by a fire in August 2012.



Directlink does not currently have a fire suppression system in place. The original converter building design and construction incorporated fire detection systems, which initiated the shutdown of systems if a fire was detected.

The failure of a Mullumbimby reactor and the ensuing intense fire that destroyed the convertor station in August 2012 has demonstrated that a fire suppression system would have been beneficial. A fire drenching system would have serve to limit equipment damage to near the source of ignition of a fire and avoid the total loss of a convertor station. Such a system would also obviate any risk of damage to adjacent equipment and property or injury to personnel. Fire drenching systems are standard industry practice within substations, used on large electrical equipment such as transformers.

The replacement convertor unit to be installed at Mullumbimby during 2015 will incorporate a fire suppression system, but the existing five convertor buildings are not so equipped. This project is in line with current industry practice and develops the primary infrastructure to install an integrated fire suppression systems in each convertor building, with systems at both Mullumbimby and Terranora.

IDENTIFICATION OF NEED

This project plans to construct Fire Suppression Systems for each of the convertor buildings at Mullumbimby and Bungalora and arises from prudent management of the risks associated with operating such a facility.

Whilst the existing fire detection system would shut down the system in the event of an incident, an unchecked fire has the potential to cause much greater damage to the convertor equipment, to adjacent equipment and properties and risks to personnel.

The risk is exacerbated by the site conditions. The facility has potentially live electrical equipment and is equipped with security fences and security doors on the buildings. This prevents immediate access by emergency services to respond to an alarm and contain a fire.

Hence a fire suppression system is required to instantly manage the fire and limit / restrict its spread to other equipment and buildings. This project is in line with current industry practice within modern electrical installations..

EVALUATION OF ALTERNATIVES

Advice has been sought from a number of expert consultancies to recommend solutions. All have provided similar recommendations for a Fire Suppression System to provide the expected level of protection to the Directlink assets.

APA's insurer (FM Global) has also issued recommendations to implement a fire suppression system to provide for better risk mitigation in light of the recent fire which destroyed Mullumbimby System 1.

Alternative technologies in the method of fire suppression system are still being considered however this will be further refined in the procurement exercise which will seek a complaint bid and alternative non-compliant bids to ensure the most effective cost / technology solution is chosen.

ESTIMATED COST

An initial scoping exercise has identified a program of works as outlined in the following tables. The costs have been derived from a desktop assessment of the issues and design constraints of the sites. Limited field analysis or testing has been incorporated into this stage of the costs.

Components	Additional Yearly Cost
Maintenance & Annual Servicing	$48,000
Sundry Power and Water Charges	$3,000

Detailed Break Down is provide on the following table

1	**Fire Suppression & Detection for both sites ($2013/14)**	
ID	**Components**	**Capital Works**
1.1	Development Approvals & Conditions	$37,950
1.2	Design, Documentation, Technical Support	$287,471
1.3	Water Storage & Works	$1,241,218
1.4	Pumps & Distribution Systems	$1,008,433
1.5	Fire Detection Systems	$1,248,251
1.6	Fire Suppression System	$2,649,517
1.7	Supervision, QA, Contract Admin, HSE	$537,941
	Total ($2014/14)	$7,010,782
	Total ($2014/15)	**$7,186,051**

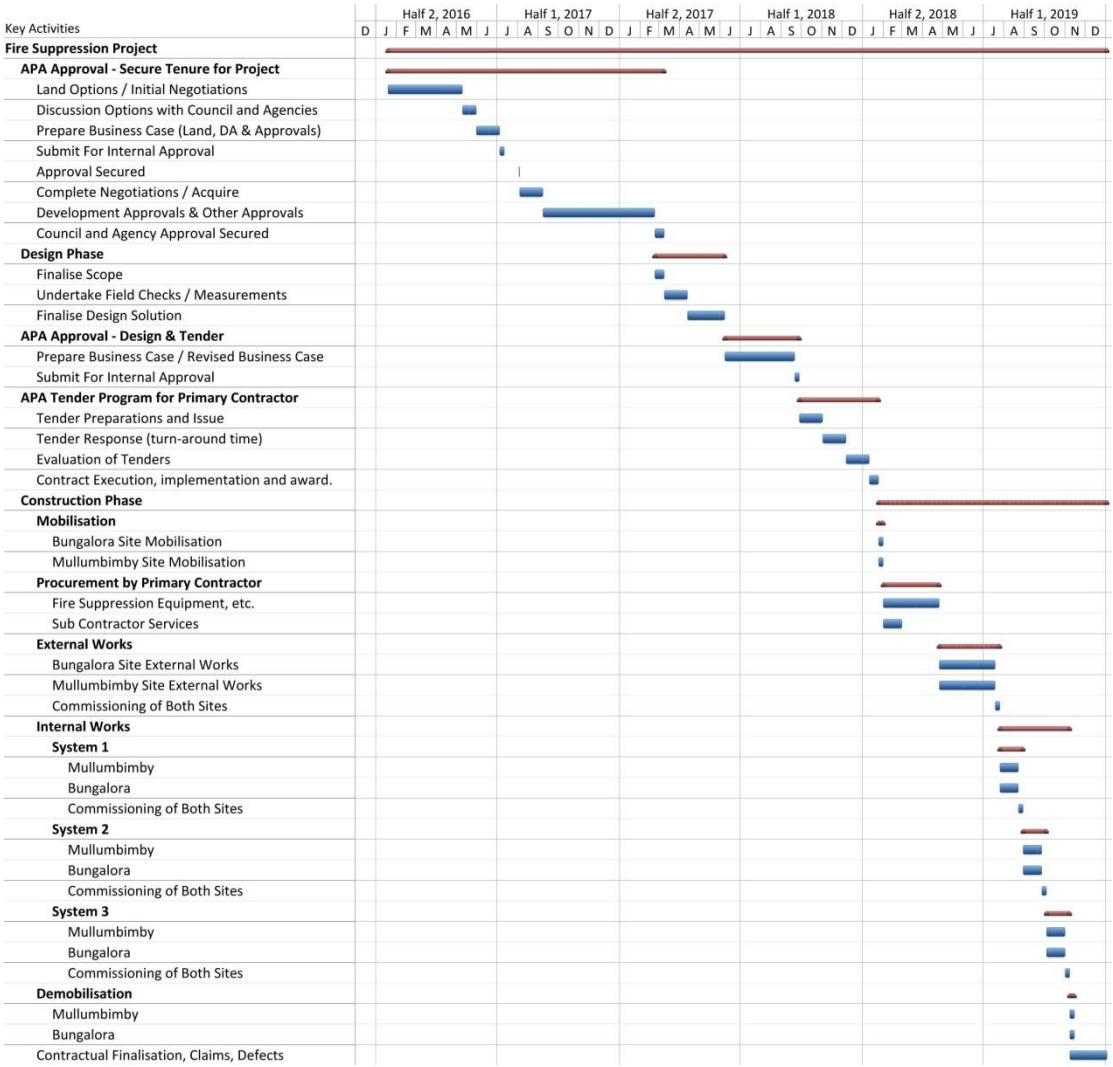
PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital and operating expenditure specified in 6A.6.7(c) and 6A.6.6(c) of the National Electricity Rules is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The following schedule represents the key activities in going to market to finalise design and secure construction of the Fire Suppression Project during the 2015-20 regulatory control period.

Following this schedule, funds are expected to be expended as follows:

Year ended June	2016	2017	2018	2019	2020	Total
Amount ($2014/15)	324,075	2,385,545	2,238,216	2,238,216		7,186,051



It should be noted that there will be an additional operating and maintenance cost associated with the fire suppression system as its operation will need to be periodically checked and the pressure vessels used for water drenching inspected and maintained.

JUSTIFICATION

This Fire Suppression project for Directlink is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) and 6A.6.6(a) of the National Electricity Rules (the Rules), which states:

(3)(iii) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The project is justified under clauses (3) and (4), being required to minimise the risk of fire damage causing the extended unavailability of the link.

The estimate of capital and operating costs is considered to be a realistic estimate of the efficient costs that would be incurred by a prudent operator in meeting the expenditure objectives.

RECOMMENDATION

That this Fire Suppression Project is implemented to manage risks associated with the operation of the Directlink facility by:

- protecting and limiting the potential for extensive fire damage to Directlink assets;
- avoiding the risk of an extended shutdown to the link as a result of fire damage;
- limiting the potential for damage to adjacent properties;
- limiting the risk of injury to employees, emergency response personnel and the general public; and
- complying with the recommendations of both energy and insurance industry advisors.

The estimated costs have been included in the operating and capital expenditure forecasts of the Directlink Regulatory Proposal.

Business Case

Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Phase Reactor Cooling Revision Project		
Project Type:	*Capex:*	*$2.278 million ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

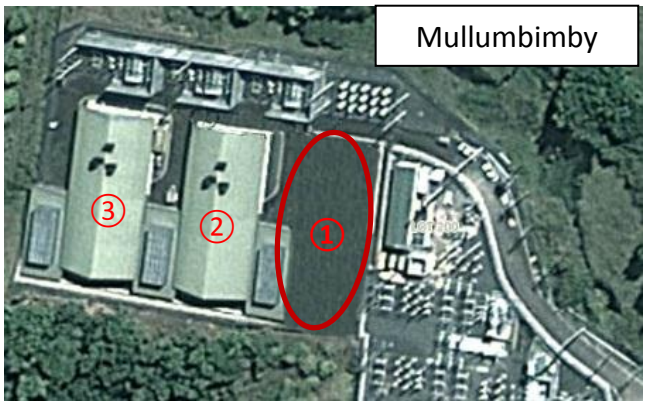
PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal covering the 2015-20 regulatory control period.

BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable between converter stations located at Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales it is connected to a 132 kV transmission grid and in Queensland to a 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated transmission asset on 10 March 2006. APA acquired this asset in December 2006 (finalised in February 2007).

The phase reactor cooling design requires changes to address on-going damage caused by partial discharge. The current design uses a fibreglass dome and fibreglass ducting to direct air into the reactors. This design, known as the “Igloo Solution”, has demonstrated on-going partial discharge across the fibreglass surfaces due to the electrical stress under which they operate. The proposed design change increases the air gap around the phase reactor coils by removing the fibre glass dome and ducting and therefore removing this partial discharge path. This design change was made by ABB to a similar plant in Gotland Sweden. This design, known as the “Gotland Solution”, has been proven to eliminate partial discharges in the Gotland plant.

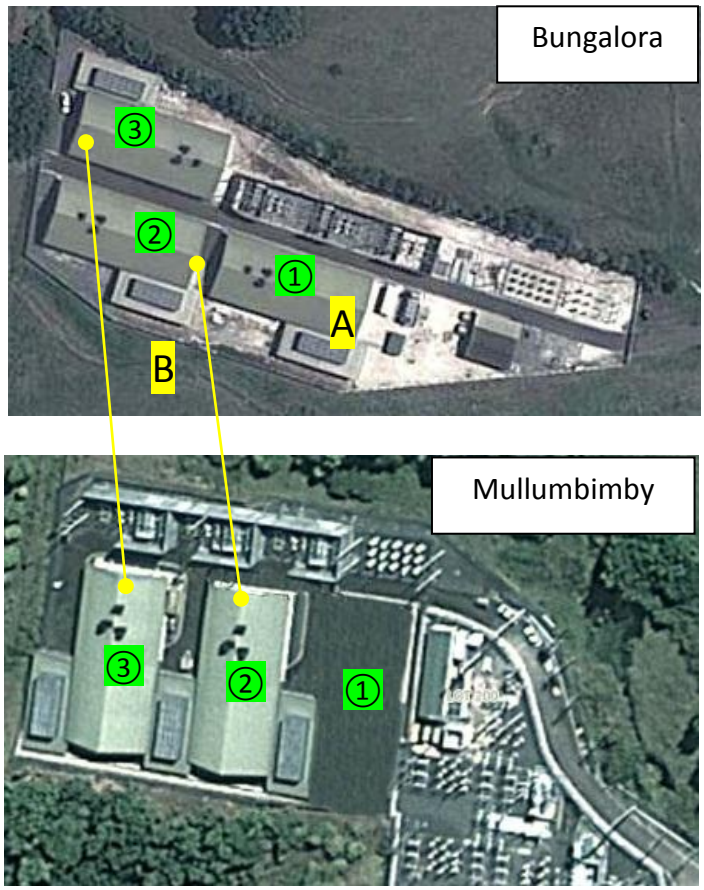


A fire destroyed the Directlink Mullumbimby System 1 converter building in August 2012. Fire investigation experts have identified the on-going damage caused by partial discharge as one possible cause of the fire. The replacement converter building is currently under construction and is planned to be completed over the 2015 financial year. This unit will use a new phase reactor design with a different cooling configuration.

The key development phases relating to the proposed project are summarised as follows:

A. Convert the system 1 Bungalora phase reactor cooling to the Gotland Solution prior to the start of commissioning the rebuilt system 1 Mullumbimby converter station. This will allow physical confirmation of the modelled air flow and cooling characteristics.

B. Review the operating effectiveness of the Pilot Project including any revision to the proposed solution and cost updates. Scheduling for the conversion of the remaining system pairs, 2 and 3, to the Gotland Solution is planned for 2017.



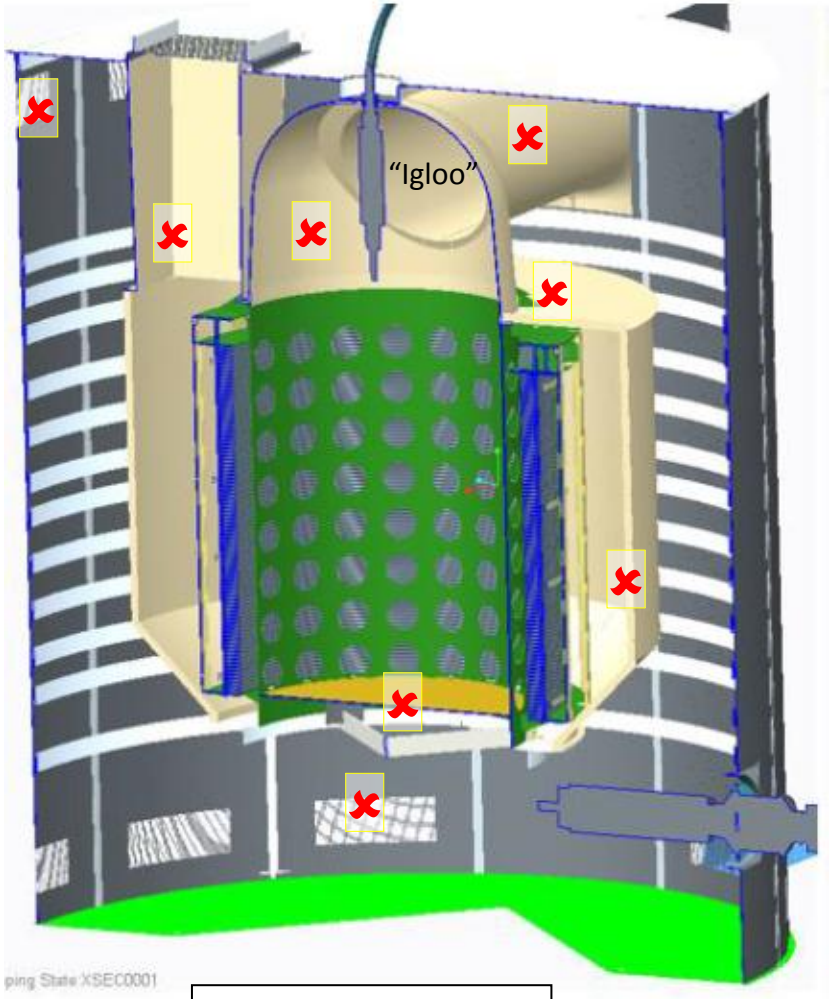
The Gotland Solution requires the following activities and applies to buildings 1, 2 and 3 at Bungalora, and buildings 2 and 3 at Mullumbimby:

- Removal of redundant fibreglass domes and ducting and the installation of new fibreglass caps;
- Installation of an air barriers at the base of each reactor;
- Installation of a “T/Guard” temperature monitoring system to control the operation of the cooling fans based on the measured temperature of the reactor;
- Modification of the exhaust air ducting from the side of the phase reactor EMC shielding enclosure;
- Sealing of the EMC shielding enclosure.

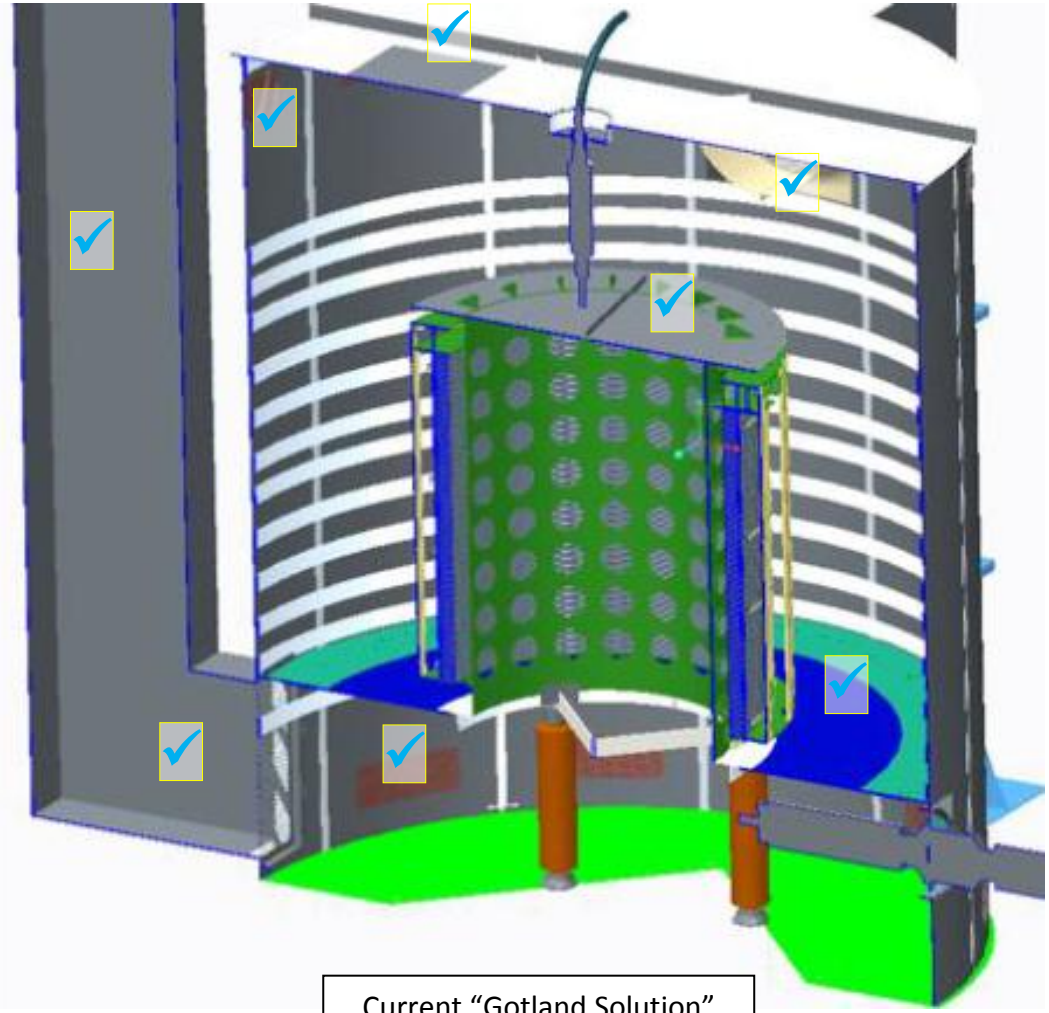
The following diagrams summarise the modifications

Items to be removed or modified ✘

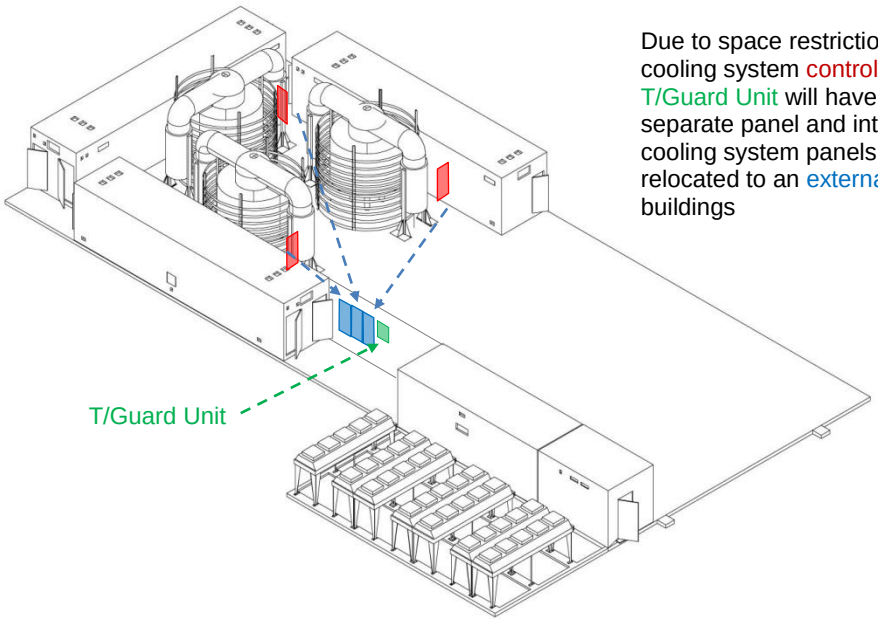
Items to be included or modified ✓



Current "Igloo Solution"

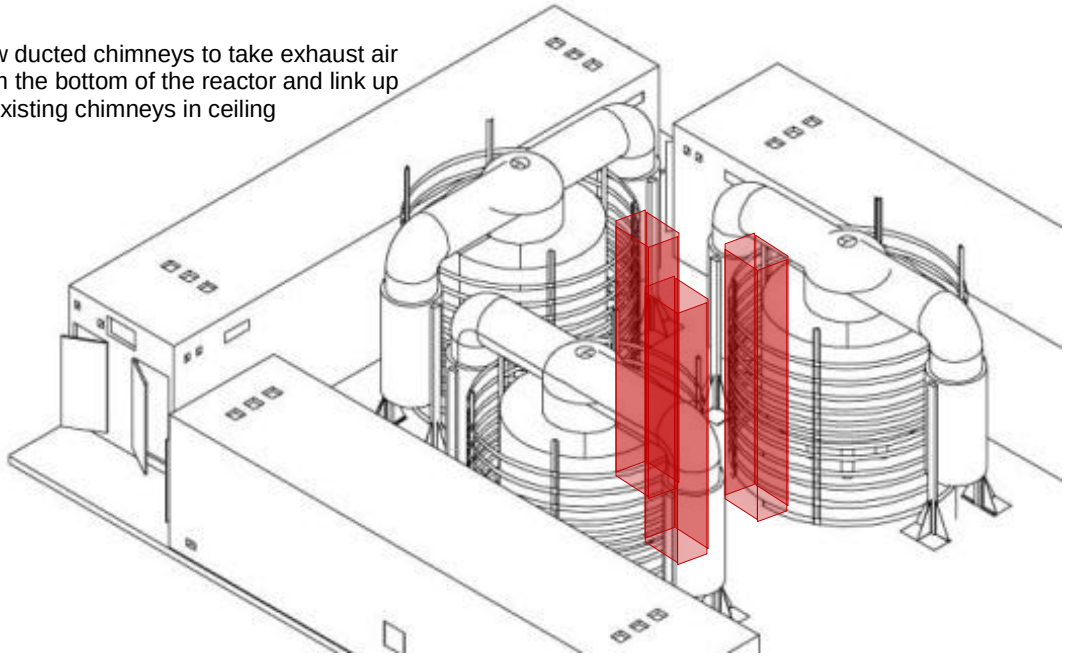


Current "Gotland Solution"



Due to space restrictions with the current cooling system control panels the T/Guard Unit will have to be installed in separate panel and interfaced to the three cooling system panels which will be relocated to an external face of the buildings

New ducted chimneys to take exhaust air from the bottom of the reactor and link up to existing chimneys in ceiling



IDENTIFICATION OF NEED

This project plans to modify the cooling systems for each of the three reactors in 5 buildings (3 at Bungalora, 2 at Mullumbimby) and arises from:

- An underlying design flaw that exists with the arrangement of fibreglass ducting used to cool the Directlink phase reactors. The design has a central fibreglass dome, called an igloo because of its shape. The design of the fibreglass ducting results in damage caused by the high voltage operating environment. The damage is in the form of partial discharge tracking across the fibreglass, burning the resin and creating fire risk. Historically the greatest damage is found on the fibreglass igloo, however all elements of the ducting system experience some form of partial discharge tracking.

- Recommendations by external industry experts and ABB, have tabled the deficiencies in the reactor cooling design. ABB has advised that the old igloos are unserviceable.

- An interim solution, to renew the old damaged igloos in Systems 2 and 3 only, was initiated over the period from November 2013 to late January 2014. The old igloos were replaced with new igloos of the same design. This work was completed to provide a window of time for engineering and modelling of the Gotland Solution for Directlink. Renewing the igloo design expedited returning Directlink to service, with no design changes, after risk assessment confirmed a dramatic increase in operating risk with the old igloos in service.

- System 1 Bungalora still has the old igloos installed but is not in service, pending the rebuild of Mullumbimby system 1. This converter station is proposed to be the "Pilot Project" for the Gotland solution. Initial design studies to validate the Gotland solution have supported its adaption to Directlink. The rebuild of System 1 Mullumbimby is forecast for completion by mid-2015 and it is proposed to complete the installation of the Gotland Solution in Bungalora system 1 in early 2015.

- Once the Gotland solution is installed in system 1 Bungalora, further assessment of the performance will be undertaken and where required the design refined. The design and performance conclusions from the Pilot Project will then be incorporated in the Gotland solution for systems 2 & 3 at Directlink.

- The current Igloo design cannot be sustained as advised by ABB. The only effective solution is to proceed with a Gotland style upgrade.

EVALUATION OF ALTERNATIVES

The modifications to the existing igloo system were specifically nominated by the OEM ABB to overcome known problems. The Gotland solution is the OEM recommended configuration.

An alternative solution would see total replacement of the all reactors similar to that currently proposed for Mullumbimby System 1 rebuild. The cost differential is in the order of ten times more expensive than the Gotland proposal.

ESTIMATED COST

An initial scoping exercise has identified the forecast expenditure for the program of works in system 1 Bungalora is as outlined below:

ABB Supplied Services	**($2013/14)**
Design & Supply of Gotland Solution	$636,984
Supply & Manufacture of T/Guard	$30,196
New Ducting	$22,000
Site Engineer & HSE	$46,354
Site Labour	$222,895
Sweden Technical Support	$148,964
Sundry Materials (Parts, Equipment Hire, etc.)	$11,000
Customs & Delivery	$30,000
	$1,148,393

APA Works	**($2013/14)**
Chimney Bracing	$15,840
Fan Control Panel Reposition	$7,700
Preparatory Works (Barricading and Scaffolding)	$35,200
Project Management, HSE, QA, Financial Controls	$127,690
Mobilisation / Demobilisation Activities	$16,500
	$202,930
Total	**$1,351,873**

As previously tabled program of works is planned to be implemented during FY15.

The forecast costs for the program of works in systems 2 & 3 are as outlined below:

ABB Supplied Services	**($2013/14)**
Addition Costs for Design & Supply of Gotland Solution System 2 & 3	**$370,787**
Additional Costs for Design of T/Guard	
Transportation Costs	
Supply & Manufacture of T/Guard	**$120,786**
HSE & Local Project Management	**$64,935**
Site Management & Site Installation	**$822,654**
Site Supervision (Sweden) *Estimation	**$316,272**
Site Facilities (Toilets, Office, Mess Room)	**$55,000**
New Exhaust Ducting	**$55,000**
	$1,805,433
APA Works	**($2013/14)**
Fan Control Panel Reposition	**$4,125**
Preparatory Works (Barricading and Scaffolding)	**$140,800**
Project Management, HSE, QA, Financial Controls	**$255,379**
Mobilisation / Demobilisation Activities	**$16,500**
	$416,804
Total ($2013/14)	$2,222,237
Total ($2014/15)	$2,277,793

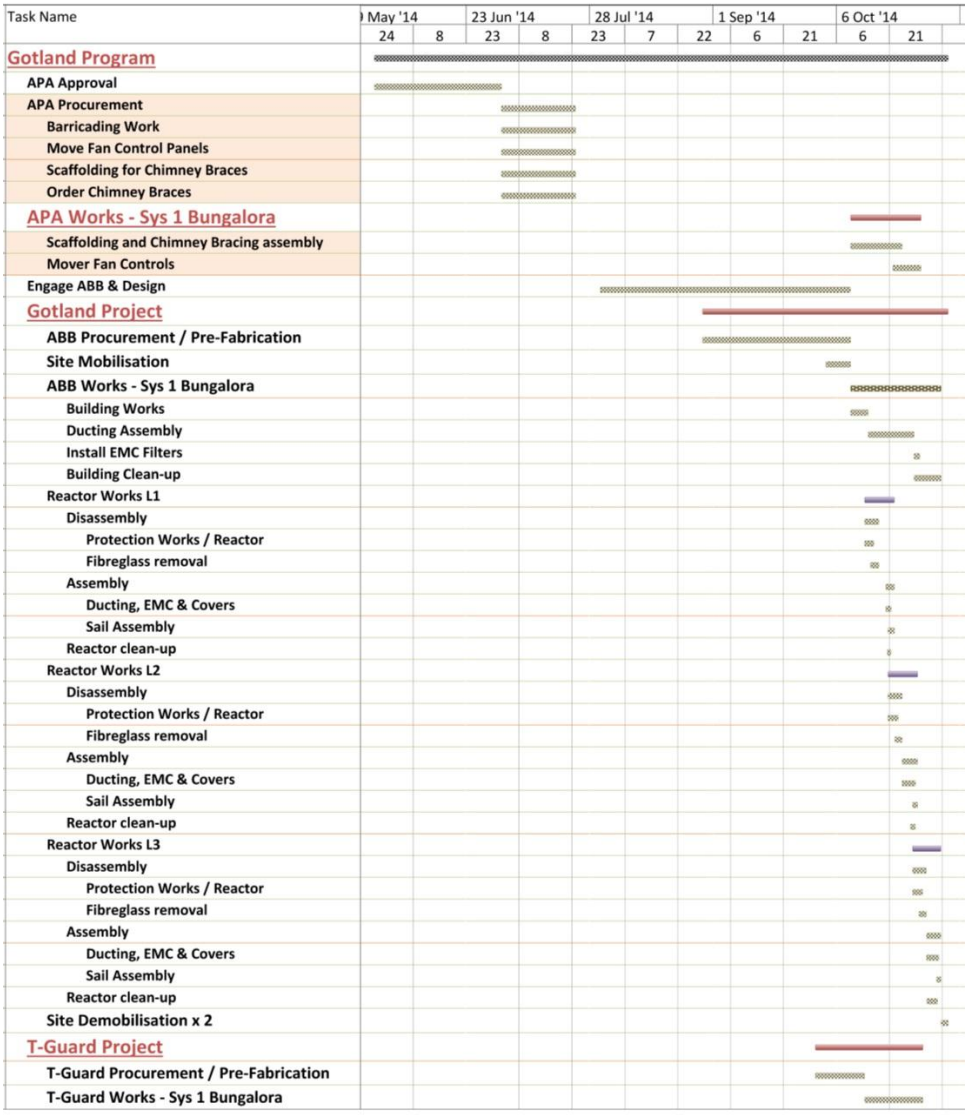
The timing of the expenditure for the program of works in systems 2 & 3 is as outlined below ($2013/14):

	FY16	FY17	FY18	FY19	FY20
Phase Reactor Cooling Program of Works for Systems 2&3	$2,277,793	$ –	$ –	$ –	$ –

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules (the Rules) is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The following schedule represents the key activities for ABB to undertake the Gotland Project during the 2015-20 regulatory control period.



JUSTIFICATION

This Gotland project for "Directlink" is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) and 6A.6.6(a) of the National Electricity Rules (the Rules), which states:

(3)(iii) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The project is justified under clauses (3) and (4) to ensure the reliable operation of Directlink by removing the current fibreglass cooling system, which is experiencing partial discharge damage, and replacing it with a newer design which has been proven in operation to eliminate the problem in the similar phase reactors.

RECOMMENDATION

That upgrading of the current phase reactor cooling design to a Gotland Solution, in two stages, be implemented. This will:

- avoid electrical tracking taking place on insulating duct surfaces, which is resulting in extended maintenance outages to repair the damage and the potential of unplanned equipment failure;
- overcome the inherent design flaws found in the reactor cooling systems by upgrading to a new design which eliminates the issues and allows continued and efficient operation of Directlink
- remove the current interim solution applied to systems 2 and 3 and establish a long term solution.

The estimated costs have been included in the capital expenditure forecast for the Directlink Regulatory Proposal.

Business Case

Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Sourcing Program for IGBT Inventory		
Project Type:	*Capex:*	*$1.87 million ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

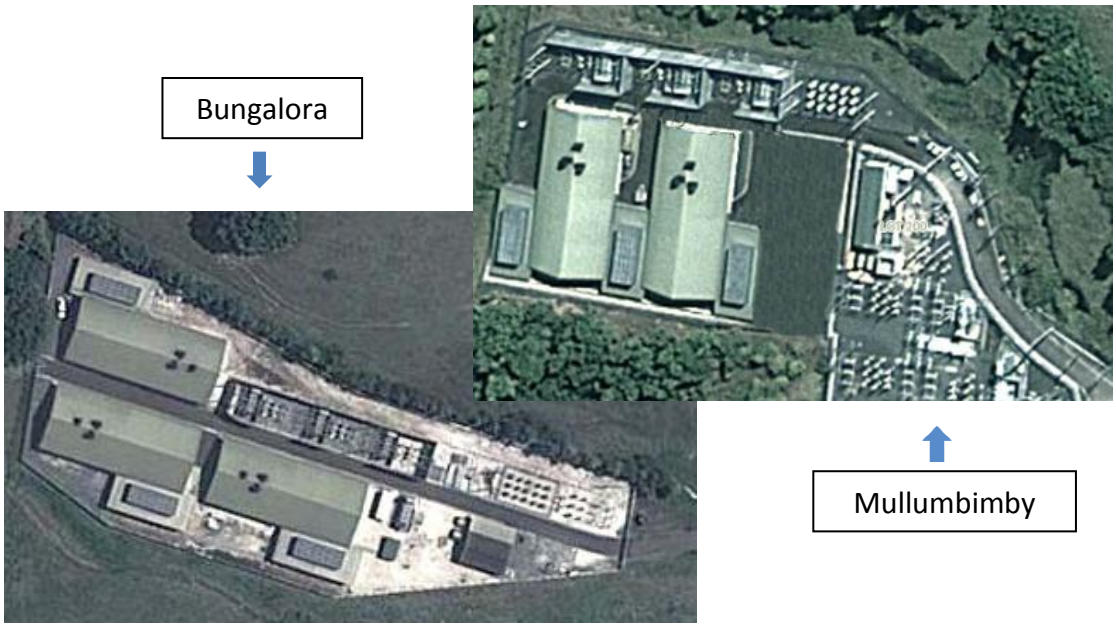
PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal for the financial years 2016 to 2020.

BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable and converter stations located between Bungalora and Mullumbimby, New South Wales. There are 3 systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales it is connected with a 132 kV transmission grid and from Queensland with 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated asset on 10 March 2006.

The operational performance of this asset has driven the need for a strategic sourcing program to secure critical inventory to minimise the system outage time.



IDENTIFICATION OF NEED

This project to secure adequate stores of Insulated Gate Bipolar Transistor (IGBT) arises from a mixture of:

- good procurement practices which drives purchasing along commercially economic quantities to minimise costs.
- balancing the need to having prudent store of critical inventory to meet operational requirements and minimise down-time of the asset.
- management of supply risk by regularly securing critical stock (past endeavours has shown marked variability in delivery of these long lead-time items into Australia, leaving the business potentially underequipped for maintenance activities).

Historic IGBT failure records indicate an average IGBT failure rate of 56 IGBTs per annum, out of a total of 5328 IGBTs in service. The failure rate is expected to diminish in response to recent and forecast IGBT optic fibre replacement works, however there will continue to be an on-going need to rebuild stocks of spare IGBTs. Currently there are no spare IGBTs at Directlink. A delivery of 40 IGBTs is expected in June 2014, however over half of this delivery is committed to existing faulty IGBT positions.

EVALUATION OF ALTERNATIVES

The IGBTs were specifically nominated by the original equipment manufacturer ABB. Experimenting with alternative third party products would increase technical risk as well as jeopardise the original design performance and ongoing OEM support of the system. With equipment of this scale and complexity it is good industry practice to follow the manufacturer's recommended consumables to maintain the overall integrity of its system.

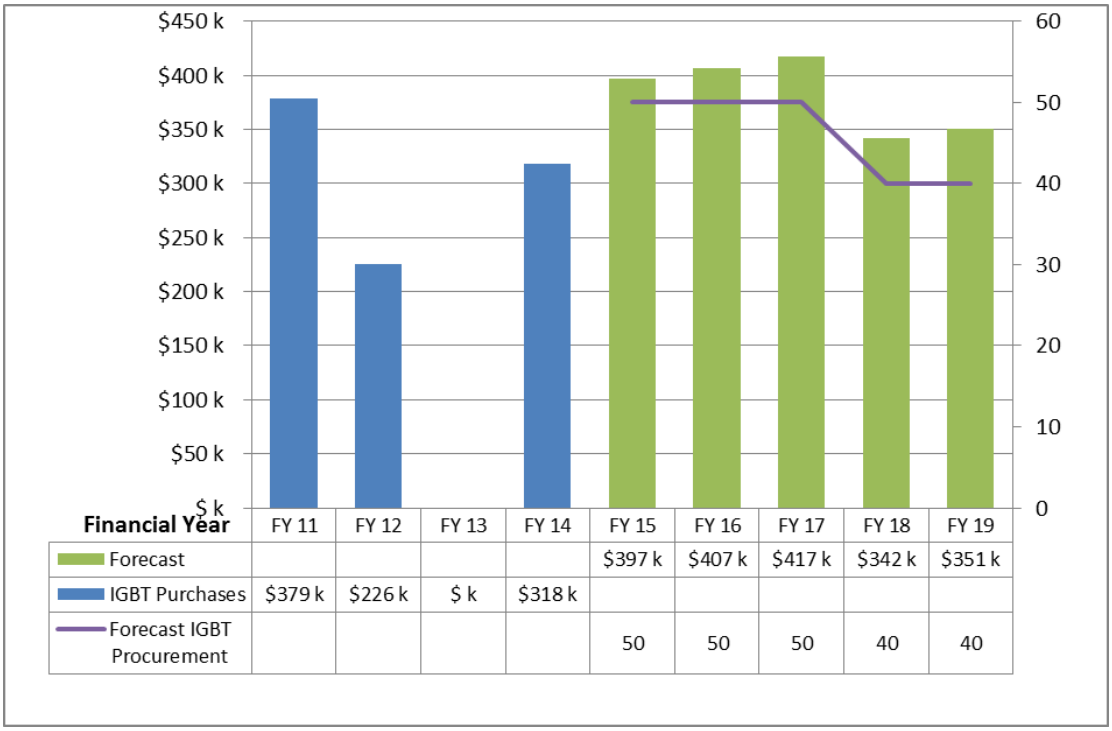
ESTIMATED COST

Historic failure rates and operational experience has demonstrated that adequate stores of IGBTs need to be maintained to minimise the down time of the system. The graph below was established from historic data and consideration of the current operating life of this asset.

Funds are expected to be expended as follows:

Year ended June	2016	2017	2018	2019	2020	Total
Amount ($2014/15)	406,957	406,957	406,957	325,566	325,566	1,872,002

This is shown below graphically ($Nominal)

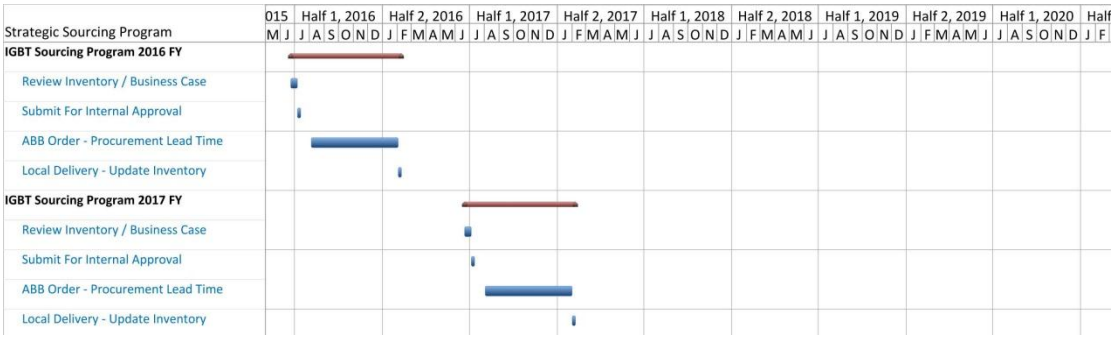


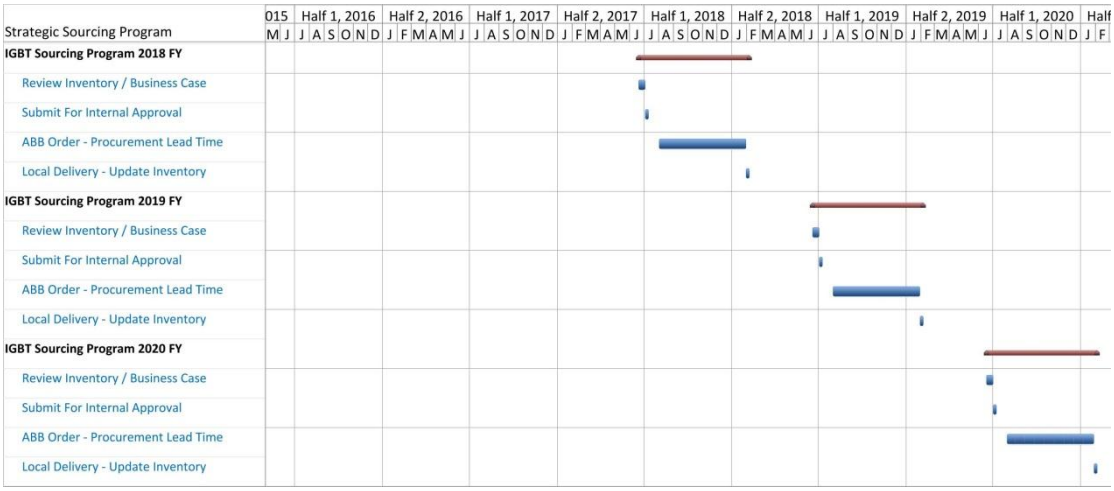
Financial Year	FY 11	FY 12	FY 13	FY 14	FY 15	FY 16	FY 17	FY 18	FY 19
Forecast					$397 k	$407 k	$417 k	$342 k	$351 k
IGBT Purchases	$379 k	$226 k	$ k	$318 k					
Forecast IGBT Procurement					50	50	50	40	40

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital and operating expenditure specified in 6A.6.7(c) and 6A.6.6(c) of the National Electricity Rules is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The purchase costs to secure the relevant inventory are those quoted by the original equipment manufacturer ABB who is the sole provider of this product consistent with their original design specification for this system. The proposed period for undertaking this strategic sourcing program will be implemented in a staged sequence of procurement initiatives to efficiently manage the inventory levels for the business over the FY 2016-2020 regulatory period.





JUSTIFICATION

This strategic sourcing project for "IGBTs" is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) and 6A.6.6(a) of the National Electricity Rules (the Rules):

(1) meet the expected demand for prescribed transmission services over that period;

(2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

(3) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The expenditure for the sourcing program is justified under clauses (1), (3) and (4), being required to maintain the efficient operability (minimise turnaround times on outages) and the security of supply in the provision of prescribed transmission services.

RECOMMENDATION

It is recommended to implement this strategic procurement initiative to source critical inventory of IGBTs to:

- Ensure effective procurement of commercially economic quantities that minimise overall costs
- Maintain critical inventory for the efficient maintenance of the system
- Minimise supply risk (delivery times) by establishing a staged regular supply-chain so critical inventory can be effectively maintained.

The estimated costs have been included in the operating and capital expenditure forecasts for the Directlink Regulatory submissions.

Business Case

Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Zero Sequence Reactor Repair		
Project Type:	*Capex:*	*$1.5 million ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal covering the 2015-20 regulatory control period.

BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable linking converter stations located at Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales Directlink is connected with the 132 kV transmission grid and in Queensland to the 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated transmission asset on 10 March 2006. APA acquired this asset in December 2006 (finalised in February 2007).

IDENTIFICATION OF NEED

During a site visit 2013 by ABB Power Transformer's Group (Ludvika, Sweden) it was identified that there was corrosion to the core of APA's spare Zero Sequence Reactor, which is a critical spare maintained for repairs to the Directlink systems.

Extract from ABB report:

ABB AB
Power Transformers
Författare - Author
Sebastian Jutäng

Rapport
Report
Från – From
PPTR/DKS

R SETFO 2013-195
Datum - Date 2013-09-26
Rev. ind
Sida - 1 (10)

Godkännare – Approved by
Martin PerOls PPTR/DK
Uppdragsgivare – Requested by
Hashim Malik PPTR/AM
Titel - Title
Site Inspection Direct Link

Ordernr – Ref.No:
Direct Link
PkI/AkI
Antal textsidor – No. of text pages
10

7. ZSSR inspection

At inspection of the spare ZSSR that was stored in the warehouse close to the airport in Brisbane (The Eagle farm) the following was noticed:

- Corrosion found in the corner window at the over-lap joints at bottom yoke.
  How serious is this? Probably it will increase the losses but could it even cause a core melt?
  This must be investigated by core specialists at ABB Power Transformers in Ludvika.
- The windings need to be megged to verify the insulation between windings and between each winding and earth. Megging instruction has been sent to Stuart Dodds APA and he will return the result.
  The result of the Megging will be checked by the senior electrical test specialist Bengt Jönsson at ABB Power Transformers in Ludvika.

ABB subsequently advised that the damage to the core would not be practical to repair via dismantling, cleaning / repair and then reassembly back into the reactor. ABB advised that a new replacement core was the most cost effective treatment to restoring the reactor as a serviceable unit.

The core requires a long lead time (47 weeks) to procure, build and supply, and for this reason it is imperative to maintain at least one spare unit in stock to avoid a lengthy shutdown of one of the DC systems in the event of failure of an existing in-service reactor.

EVALUATION OF ALTERNATIVES

The Zero Sequence Reactor is a specialised item developed by the OEM ABB. Experimenting with alternative third parties for a solution to the damaged core would only increase technical risk as well as jeopardise the original design performance and ongoing OEM support of the Directlink system. Given the critical nature and scale of the facility it is considered prudent and sound industry practice to follow the manufacturer's recommended treatment to replace the core and test the reassembled reactor to ensure we have a viable spare.

ESTIMATED COST

The proposed works are outlined below:

1. Project administration of activities here and in Sweden
2. Suppling a new Core for the spare Zero Sequence Reactor
    - Involving Design calculation's and Engineering support from ABB Ludvika
3. Movement of the spare core from APA's storage facility
4. Transportation costs for the new core from Sweden to ABB Darra
5. Exchanging the core at the Brisbane offices of ABB
    - It is anticipated that the installation will take 3 weeks, utilising a installation team of 4 personnel consisting of a supervisor and technician from Ludivka and 2 transformer technicians provided by the local transformer service.
6. Testing of the unit after completion
7. Sundry costs associated with travel, accommodation, local transport of staff, plant and materials.

The repaired Zero Sequence Reactor will meet the original design specification for the Directlink system.

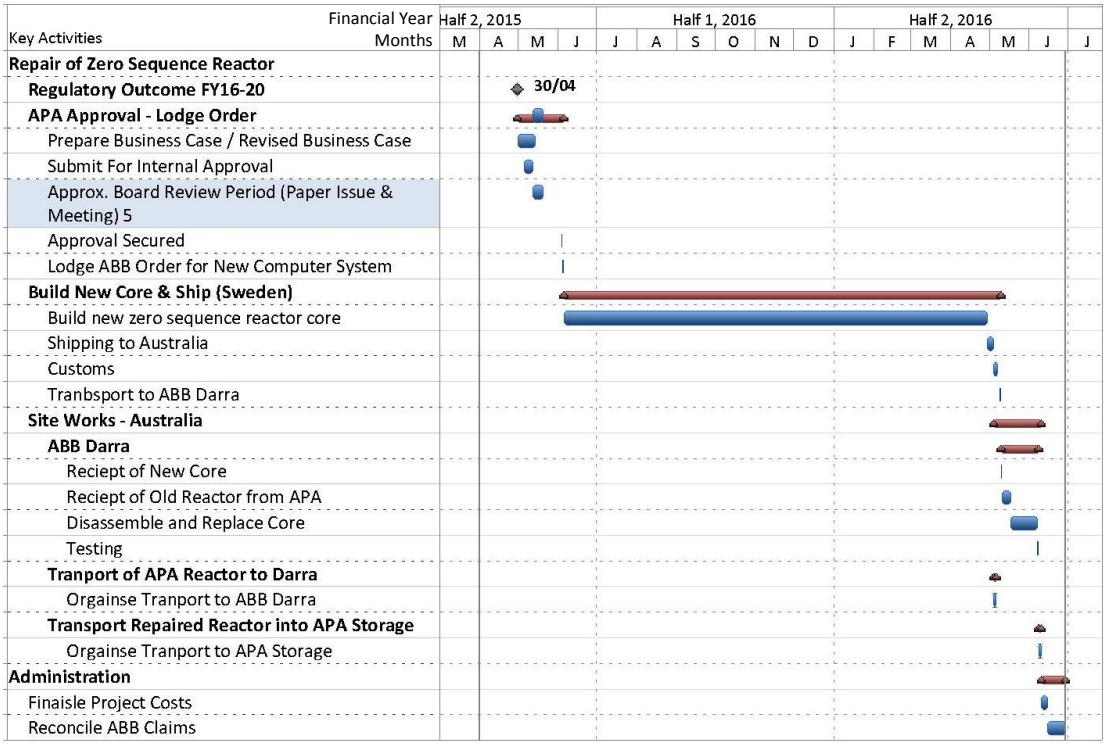
Total Cost **$1,461,547** ($2013/14)

Given the long lead time, these costs are expected to be incurred on two instalments of 50% each.

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules (the Rules) is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The following schedule represents the key activities for ABB to undertake the repair of the spare Zero Sequence Reactor during the 2015-20 regulatory control period.



JUSTIFICATION

The repair of the spare Zero Sequence Reactor for Directlink is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) of the Rules:

(3)(iii) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The project is justified under clauses 6A.6.7(a)(3) and (4), being required to ensure the continued reliable operation of Directlink. The project will ensure that stock is maintained of a critical, long lead time, spare Zero Sequence Reactor to minimise the risk of long term outages, should such a unit need to be replaced.

The Directlink Zero Sequence Reactor is a critical spare and should a problem occur in the period leading up to the repair of the spare Zero sequence reactor an extended outage would be experienced whilst an alternative unit is sourced.

RECOMMENDATION

That the repair of the spare Zero Sequence Reactor be undertaken as a matter of urgency to maintain the continued reliable operation of Directlink. Critical spares for the Directlink assets will ensure:

- timely response to any future faults with the Zero Sequence Reactors allowing effective repair and minimising the duration of outages;
- adequate stock of critical components are maintained for the longer term maintenance and availability of the system; and
- Good industry practice by maintaining stock of critical components for the long term sustainability / availability of the plant.

The estimated costs have been included in the capital expenditure forecast for the Directlink Regulatory Proposal.

Business Case

Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Replacement Program for Optic Fibre Cable and Optic Fibre Connectors		
Project Type:	*Capex:*	*$801,166 ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

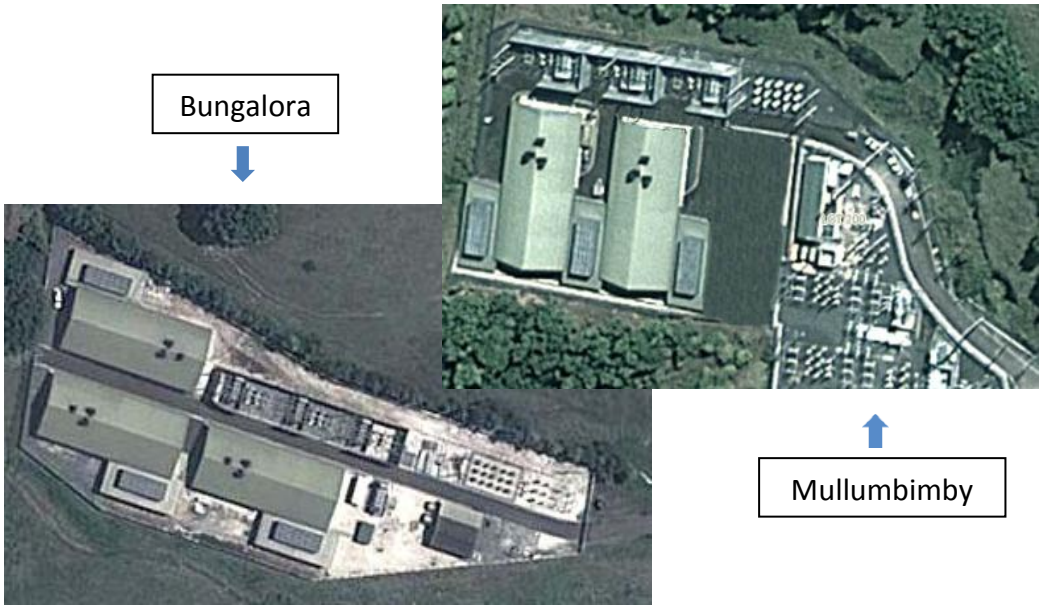
PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal for the 2015-20 regulatory control period.

BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable between converter stations located at Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales Directlink is connected to a 132 kV transmission grid and at Queensland to a 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated transmission asset on 10 March 2006.

Deterioration in the performance of the IGBT optic fibres has been identified during the maintenance of Directlink in recent years. The deterioration of the IGBT optic fibres has impacted the availability of the Directlink, necessitating a program of work to replace the fibres with known poor performance.



IDENTIFICATION OF NEED

This project will replace IGTB optic fibres in the valve rooms and arises from:

- The current degradation of the existing IGBT fibre optic systems and the depletion of all inbuilt spares with in the valve enclosures
- the potential of significant outages due the exhausting of all spare fibre optic cable normally contained in the IGBT enclosures.
- good asset management practices driving a solution that ensures there is adequate supply of IGBT optic fibres to replace degraded fibres as they are identified.

Currently 52.5% of the time that an IGBT reports as faulty, root cause is degraded optic fibres. Currently 10.5% of IGBTs are forecast to report faulty every 12 months, resulting in 5.5% of IGBT optic fibres requiring replacement per annum.

With 8880 IGBT optic fibres in service (two for each IGBT) in the five remaining converter buildings, less the 511 already replaced, a forecast replacement rate of 459 per annum is required to prevent failed IGBT optic fibres impacting the availability of Directlink.

EVALUATION OF ALTERNATIVES

To independently experiment with alternative third party products would increase technical risk as well as jeopardise the original design performance and ongoing OEM support of the system. The IGBT optic fibre cable and connectors were type tested by the original equipment manufacturer ABB. With equipment of this scale and complexity it is prudent and good industry practice to follow the manufacturer's recommended componentry to maintain the overall integrity of its system.

ESTIMATED COST

Empirical evidence of failure rates has been used to forecast the need and timing of replacement of IGBT optic fibre replacements, to minimise the impact on Directlink availability. The following represents the estimated project execution costs:

Year ($nominal)	FY 16	FY 17	FY 18	FY 19	FY 20
Cost of Fibres	$98,114	$100,566	$103,081	$105,658	$108,299
Fibres	459	459	459	459	459
Fibres replaced per outage (forecast 4 outage per annum)	115	115	115	115	115
Labour cost per outage event	$11,000	$11,275	$11,557	$11,846	$12,142
Labour per year	$44,000	$45,100	$46,228	$47,383	$48,568
APA Margin 10%	$14,211	$14,567	$14,931	$15,304	$15,687
Forecast Annual Expenditure	$156,325	$160,233	$164,239	$168,345	$172,554
$2013/14	$156,325	$156,325	$156,325	$156,325	$156,325
$2014/15	$160,233	$160,233	$160,233	$160,233	$160,233

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules (the Rules) is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The purchase costs to secure the replacement of the fibre Optic networks are those quoted by the original equipment manufacturer ABB who is the sole provider of this product, consistent with their intended design specification for this system. The proposed schedule of works will occur during the 2015-20 regulatory control period.

JUSTIFICATION

This project for new Optic Fibre Cable and Optic Fibre Connectors bundles is required to meet the following capital expenditure objectives set out in clause 6A.6.7(a) of the Rules:

(3)(iii) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The expenditure for the project is justified under clauses (3) and (4), being required to maintain the reliability of the link convertor equipment and the security of supply in the provision of prescribed transmission services.

RECOMMENDATION

It is recommended that the IGBT optic fibre replacement be carried out to:

- minimise supply outage occurrences from faulty optic fibres by replacing the deteriorating cables, to ensure improved future performance from the system.
- deliver effective cost management and repair of the Directlink assets

The estimated costs have been included in the capital expenditure forecast for the Directlink Regulatory Proposal.

Business Case

Service Provider:	APA Group	**Date:**	27 May 2014
Asset:	Directlink		
Project:	Cooling Tower Sound Enclosure Remediation		
Project Type:	*Capex:*	*$512,500 ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

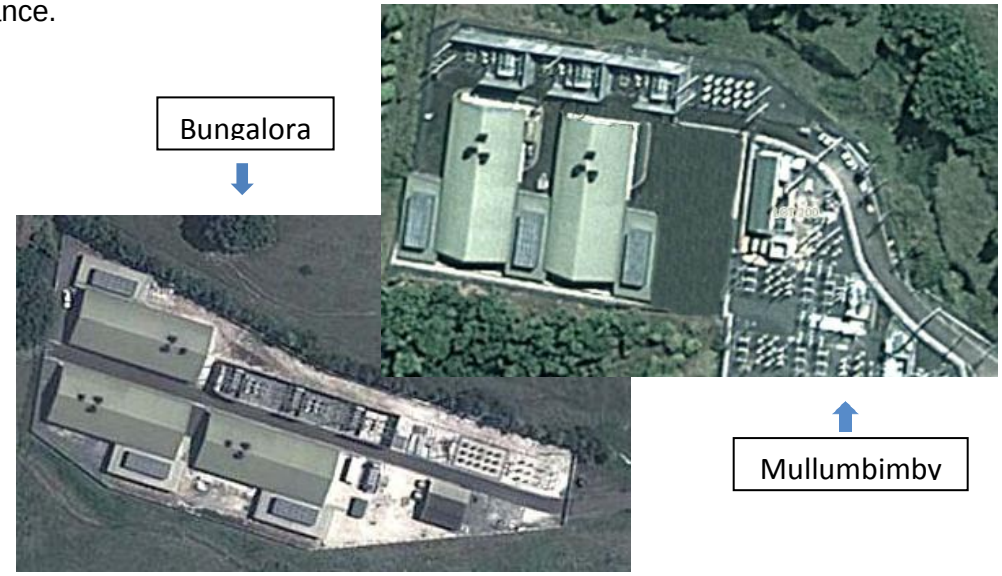
PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal for the 2015-20 regulatory control period.

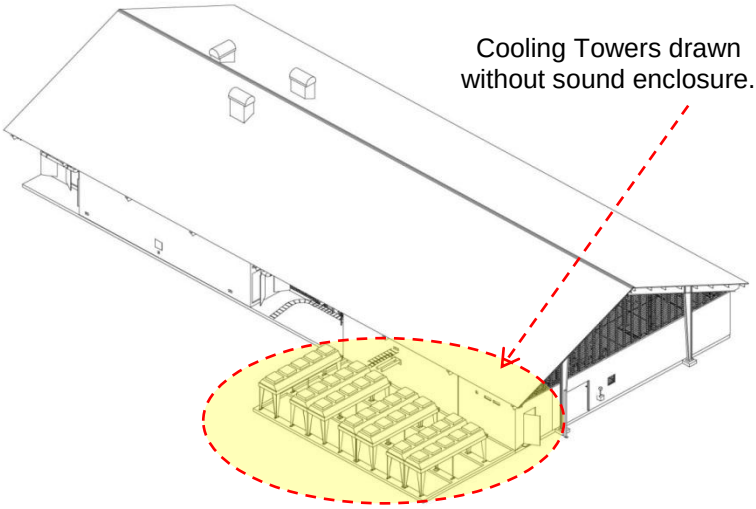
BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable and converter stations located between Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales it is connected with a 132 kV transmission grid and from Queensland with 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated asset on 10 March 2006.

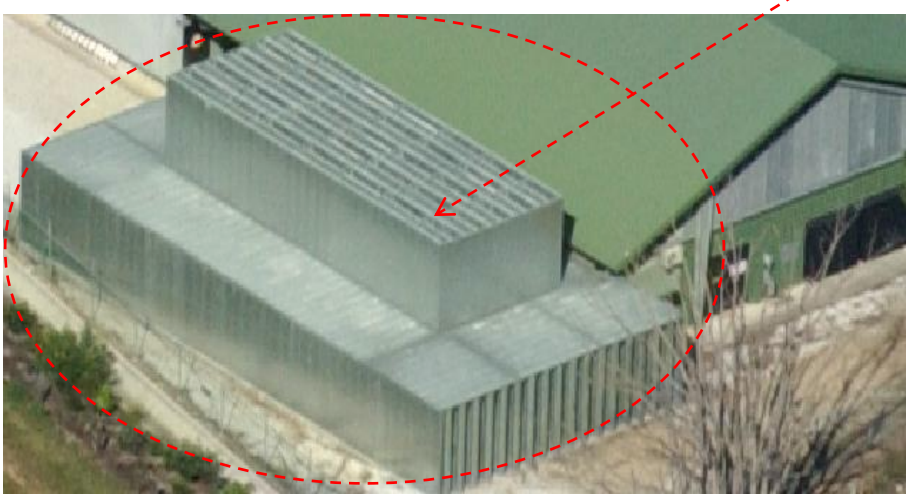
The Directlink converter building cooling towers are installed inside a sound enclosure to prevent audible noise from the fans causing a disturbance to the community. The sound enclosures were installed in the year 2001 in response to community complaints. Corrosion has developed in several of the sound enclosure panels and repair is required to prevent deterioration of the sound damping performance.



IDENTIFICATION OF NEED



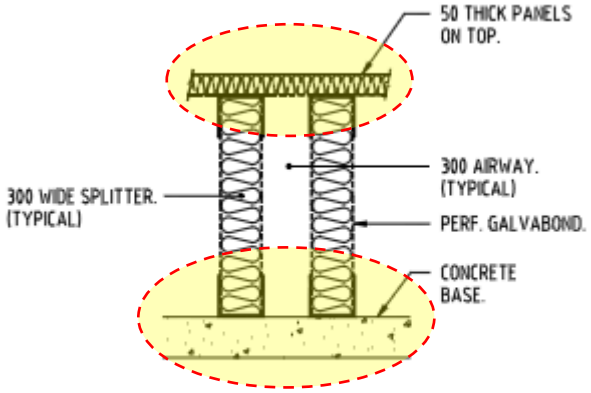
Cooling Tower enclosure corrosion is occurring on the inside horizontal panels and where the metalwork abuts the concrete floors.



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 and sound damping performance of the cooling tower sound enclosure.

Corrosion is occurring across all 5 cooling tower enclosures, requiring replacement of an estimated 50% of panels. Exact numbers will be determined once the units have been opened up for detailed inspection. Where the units are salvageable remedial actions will be undertaken to remove the corrosion and reseal the metal work. The rest will be replaced.

Areas experiencing corrosion:



TYPICAL SECTION THROUGH INLET ATTENUATOR

EVALUATION OF ALTERNATIVES

Advice has been sought from a number of engineering consultancies on the best long term solution / treatment for this corrosion problem. All have provided similar recommendations for annual inspection / corrective action program to sustain the operating functions / life of the cooling tower enclosures.

The alternative strategies explored focused on the complete replacement with revised design to mitigate the water settlement / deposition on the units and inclusion of heavier gauge / galvanised materials - however this proved a considerable capital outlay and unwarranted given the remaining serviceability of the units.

ESTIMATED COST

The first year's program will be a major exercise to address all significantly degraded areas and then using the annual inspections to further remediate / replace elements as identified. The program would be scheduled around other system outages to minimise any unnecessary down time for the plant.

$2013/14	Y1	Y2	Y3	Y4	Y5
Per System	$61,000	$15,000	$8,000	$8,000	$8,000
5 Systems	$305,000	$75,000	$40,000	$40,000	$40,000
$2014/15	**$312,625**	**$76,875**	**$41,000**	**$41,000**	**$41,000**

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules (the Rules) is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The selection of the relevant cooling system contractor and materials will follow APA Group Policy to ensure effective contestable sourcing. These proposed works will be scheduled over 5 years targeting the dryer months (August – September) and planned outages during the 2015-20 regulatory control period.

JUSTIFICATION

This Cooling Tower Sound Enclosure Remediation project for Directlink is required to meet the following capital expenditure objectives set out in clause 6A.6.7(a) of the National Electricity Rules (the Rules), which states:

(2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

(3)(iii) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The project is justified under clauses (2), (3) and (4).

Directlink must comply with the noise emissions requirements established in environmental legislation and it must be noted the original sound absorbing enclosures were originally erected in response to complaints by nearby residents. A failure to maintain these enclosures in serviceable condition could affect the performance and availability of the link whilst remedial measures are taken, therefore jeopardising the reliability and security of supply in the provision of prescribed transmission services.

RECOMMENDATION

That this Cooling Tower Sound Enclosure Remediation Project, to recondition / repair the cooling system, is carried out to ensure continued compliance with noise emissions requirements. The effective life of the asset will be maintained by addressing the corrosion problems with the cooling tower components.

The estimated costs have been included in the operating and capital expenditure forecasts for the Directlink Regulatory submissions.

Business Case

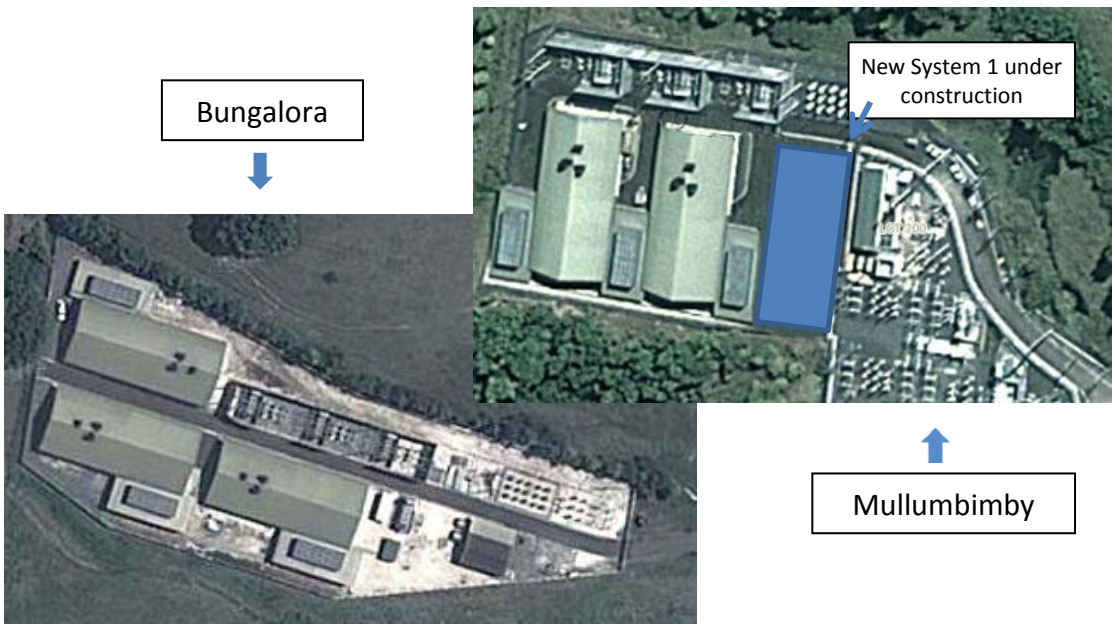
Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Security Fencing Upgrade Project		
Project Type:	*Capex:*	*$394,870 ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal covering the 2015-20 regulatory control period.

BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable linking converter stations located between Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales Directlink is connected to a 132 kV transmission grid and in Queensland to a 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated transmission asset on 10 March 2006.



IDENTIFICATION OF NEED

The Directlink Bungalora and Mullumbimby sites have experienced frequent incidents of trespassing, theft and vandalism. The original fencing for both sites was constructed from chain wire mesh, with three barbed wires along the top. This was common practice at the time and all utilities have been upgrading their security fences in recent years.

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 NSW Coroner provided a report on substation fencing after the death of a teenager at an Ausgrid substation. This report made recommendations about substation fencing. These recommendations were incorporated into the substation fencing requirements detailed in the *National Guidelines for Prevention of Unauthorised Access to Electricity Infrastructure* published by the Energy Networks Association (ENA Guidelines).

Prudent risk management and good industry practice requires that the Directlink site be secured at the current industry standard. The ENA Guideline sets the current industry standards and requires an intruder resistant fence. The current chain wire mesh fence does not meet those requirements for an intruder resistant fence.

The Bungalora security fence was upgraded in 2011, due to its higher level of trespass and other incidents. Mullumbimby is proposed for a fence upgrade in 2016. The new security fence at Bungalora has been successful at halting illegal entry and a similar solution is now required for Mullumbimby.

The issue of an emergency exit from these sites is also to be addressed by including specific “exit only” gates into the security fencing for use in emergency evacuation. Currently exit from the site can only be achieved via a keyed gate and only certain

authorised persons hold a key. All other personnel must be assisted in exit / entry via these persons.

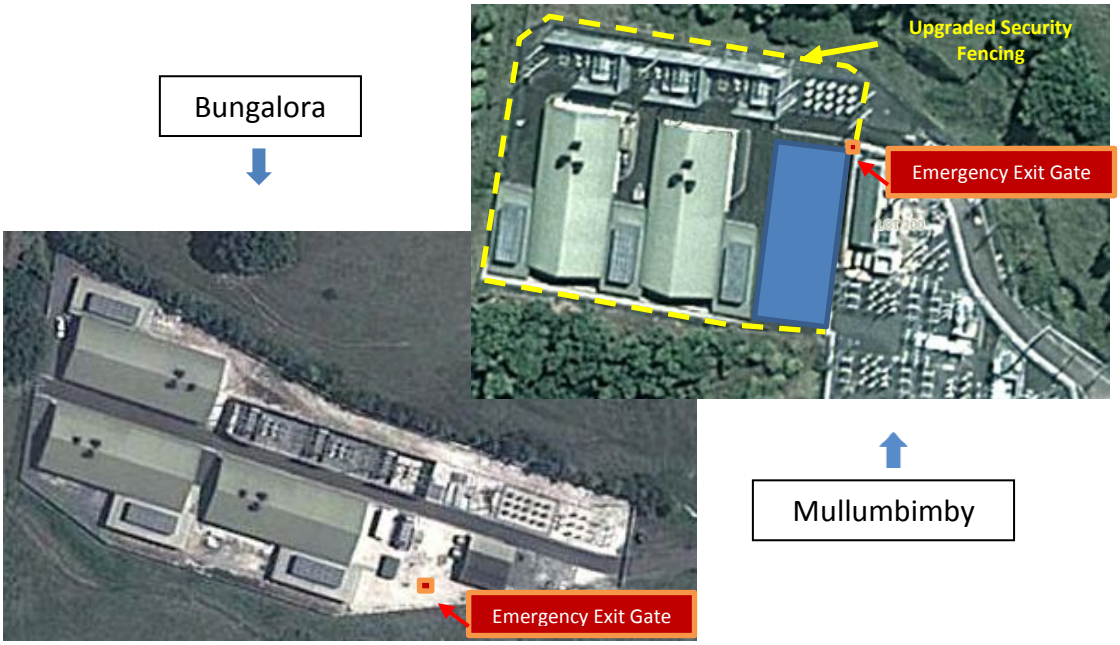
EVALUATION OF ALTERNATIVES

Advice has been sought from a number of fencing providers who provide similar solutions to other utilities to prepare the scope and budget for this project. All have recommended similar solutions using “Securemax”, to meet the specific requirements for a high voltage site. This project will be undertaken via competitive tender when rolled out and will ensure the most effective solution will be offered to deliver a compliant system.

The above photo from our Bungalora site is an example of the type of “Secure Max” installation proposed, including electrification of the top wires.

ESTIMATED COST

An initial scoping exercise has identified a program of works as outlined in the following table.



Security Fencing , Electrification, Construction		$351,278
Security Gate		$14,497
Emergency Exits		$17,263
Electrification Controls		$2,200
	Total ($2013/14)	$385,239
	Total ($2014/15)	**$394,870**

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules (the Rules) is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The following schedule represents the key activities in going to market to secure the installation of upgraded security fencing during the 2015-20 regulatory control period.

JUSTIFICATION

This upgrades to security fencing for Directlink is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) and 6A.6.6(a) of the National Electricity Rules (the Rules), which states:

(2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

(3)(iii) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The project is justified under clauses (2) (3) and (4), as follows, to:

- maintain public safety of the Directlink sites, in accordance with the NSW Coroner's recommendations;
- ensure safe working conditions for staff by providing emergency exit gates;
- ensure the security of the site against intrusion and malicious damage that could affect the reliability of the link.

RECOMMENDATION

That the security fencing is upgraded at Mullumbimby to protect the Directlink assets from uncontrolled entry and provide safe operating environments for the staff working on Directlink via emergency exits.

The estimated cost has been included in the capital expenditure forecast for the Directlink Regulatory Proposal.

Business Case

Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Emergency Lighting Project		
Project Type:	*Capex:*	*$338,515 ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

PURPOSE

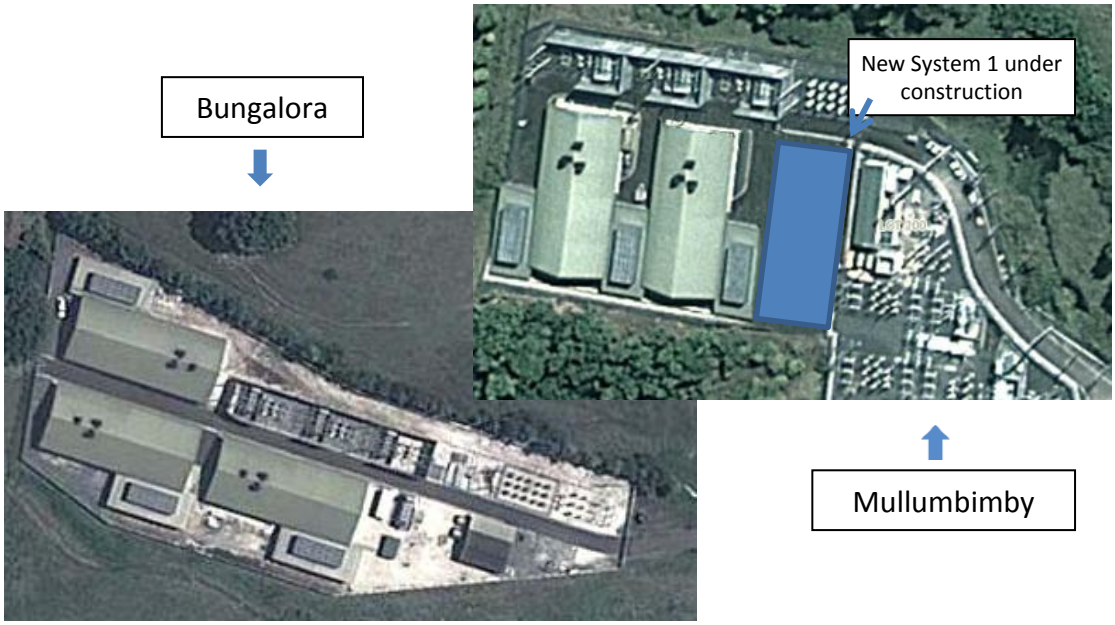
To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal covering the 2015-20 regulatory control period.

BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable between converter stations located between Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables with a total capacity of 180 MW.

The system was commissioned in December 1999 and became a regulated transmission asset on 10 March 2006.

The convertor stations are illustrated below. The DC convertor equipment is housed within buildings, with the transformers and switchgear located outdoor within the security enclosure.



The Directlink convertor stations are nearing 15 years old and have limited emergency lighting and illuminated exit signs.

The Building Code of Australia requires the installation of exit signs to be in accordance with AS 2293.1-2005[1]. The Directlink convertor stations do not comply with this standard.

Updating of the emergency lighting systems at the convertor stations is necessary to meet current standards and to ensure safety of personnel who work in the high voltage buildings and enclosed secure compounds.

IDENTIFICATION OF NEED

This project plans to meet current Building Code and Australian standards requirements for emergency lighting by constructing effective Emergency Lighting Systems for each of the 5 reactor buildings (three at Bungalora, two at Mullumbimby).

This will ensure staff that working in these environments are afforded the appropriate levels of protection in the case of an emergency.

EVALUATION OF ALTERNATIVES

Advice has been sought from a number of lighting providers to establish a scope and budget for this project. All have recommended similar solutions to meet the legislative requirements and standards followed in like facilities. This project will be undertaken via competitive tender when rolled out, which will ensure the most cost-effective solution to deliver a compliant system.

ESTIMATED COST

An initial scoping exercise has identified a program of works as outlined in the following table. ($2013/14)

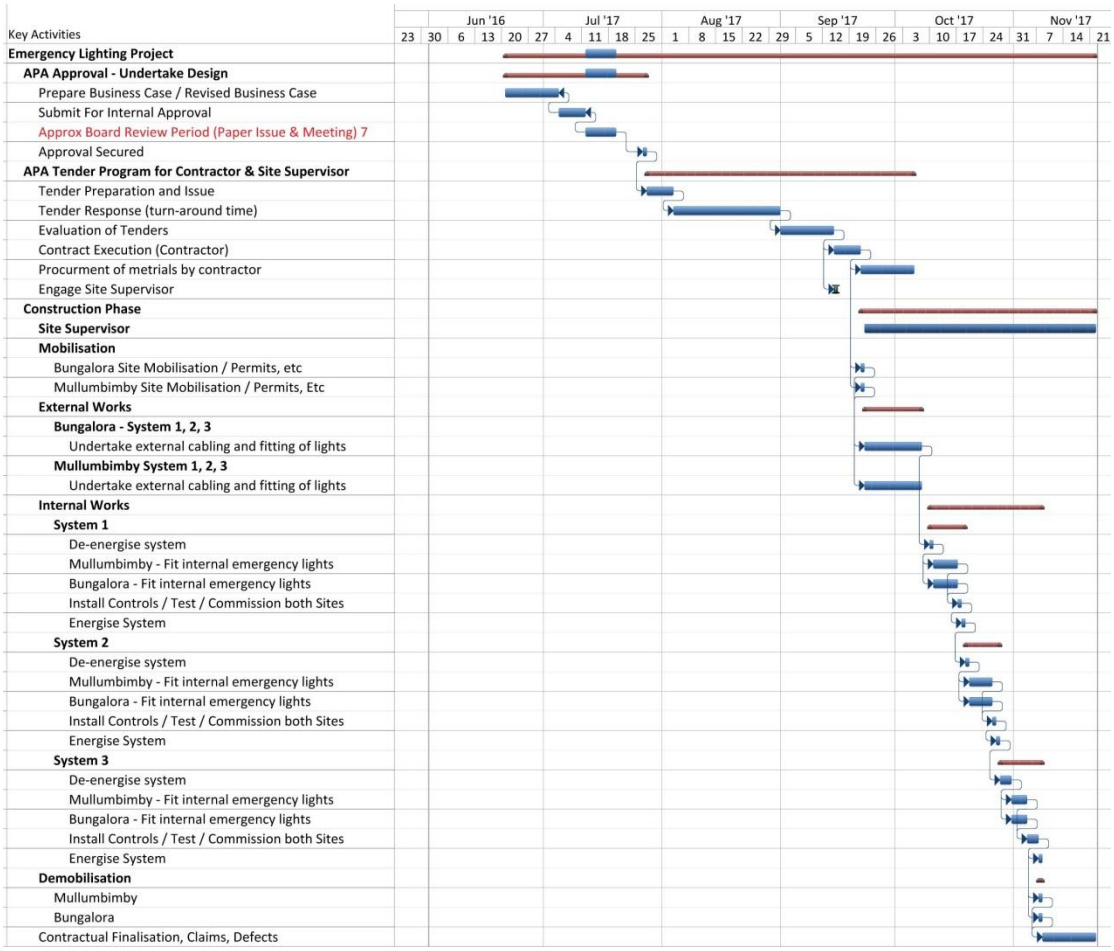
Installation Contractor & Materials	$243,369
Site Supervision and Contract Management	$86,890
Total ($2014/14)	$330,259
Total ($2104/15)	**$338,515**

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules (the Rules) is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The following schedule represents the key activities in going to market to secure installation of the Emergency Lighting Project during the 2015-20 regulatory control period.

[1] Standards Australia, *Australian Standard AS2293.1-2005 (Incorporating Amendment No. 1) – Emergency escape lighting and exit signs for buildings – Part 1: System design, installation and operation*, September 2008.



JUSTIFICATION

This Emergency Lighting Project for “Directlink” is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) and 6A.6.6(a) of the Rules, which states:

> (2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

The project is justified under clause (2) being required to comply with current Building Code and Australian Standards requirements and thereby maintain a safe working environment for staff employed on the Mullumbimby and Bungalora high voltage enclosed sites.

RECOMMENDATION

That this Emergency Lighting Project be implemented to ensure that the Directlink convertor stations comply with current Building Code and Australian Standards requirements, thereby providing a safe operating environment for the maintenance staff

The estimated costs have been included in the capital expenditure forecast of the Directlink Regulatory submission.

Business Case

Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Roof Repair of Converter Buildings		
Project Type:	*Capex:*	*$263,224 ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

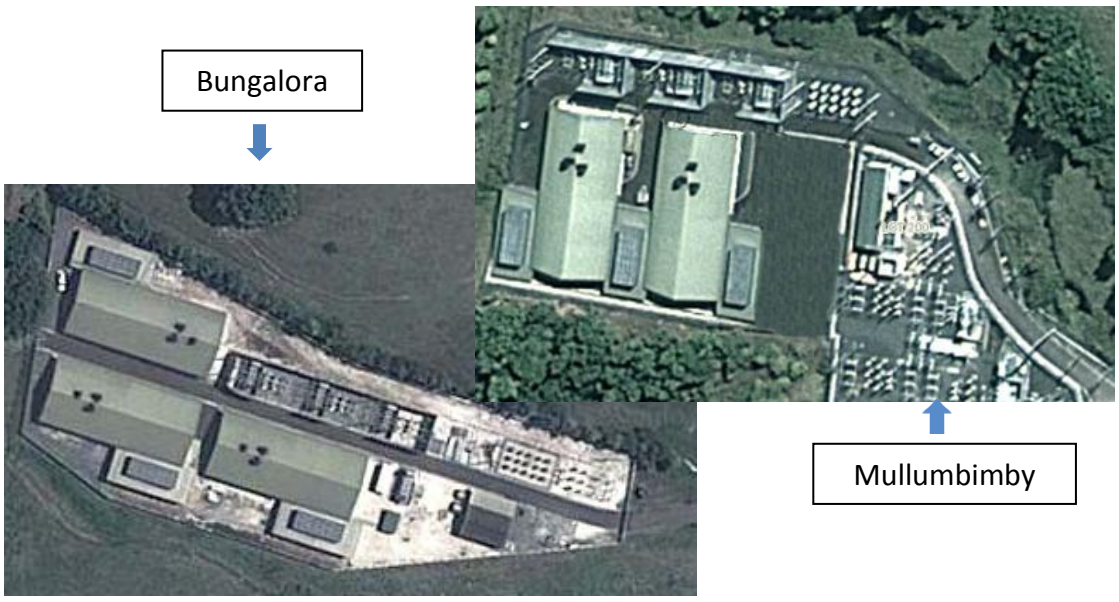
PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal for the 2015-20 regulatory control period.

BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable linking converter stations located at Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales Directlink is connected to a 132 kV transmission grid and in Queensland to a 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated transmission asset on 10 March 2006.

The efficient maintenance of this asset has driven the need for a repair or replacement program to address the roof deterioration of the converter buildings. The roof deterioration is allowing rain water collect in the roof insulation and steel substructure, risking further damadge to both and to the electrical equipment located within the buildings.



IDENTIFICATION OF NEED

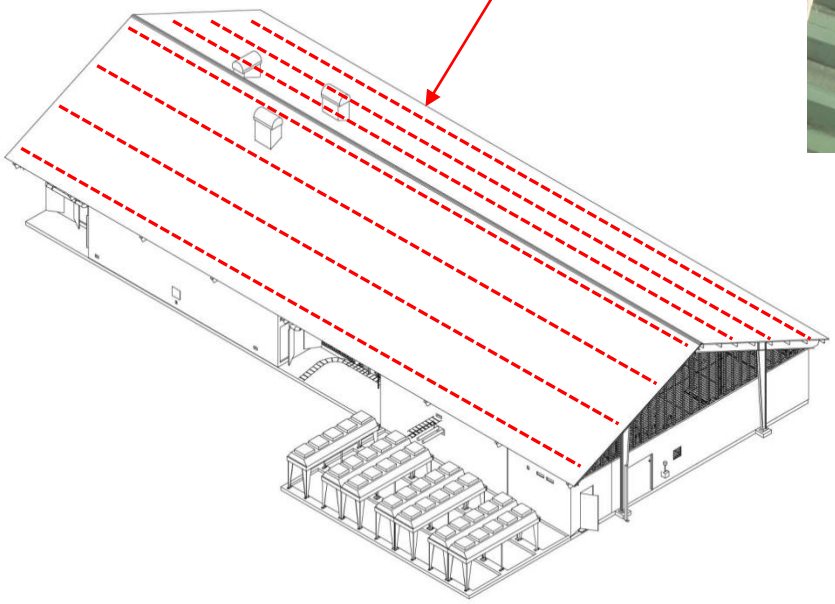
This project plans to repair or replace the deteriorating roofing. A number of alternatives were evaluated, and best solution is to use locally available roofing product, inhibitors and fibreglass to undertake spot repairs and replacement (option 2 from below).

The requirement for this project arises from a mixture of:

- prudent protection of the roof substructure, sound proofing, and electrical equipment contained within the buildings, thereby maintaining high levels of reliability for the link.
- good facility management practices are followed in sustaining assets and reducing maintenance costs by select the most effective whole-of-life net cost solution.

The information below illustrates the current state of these buildings. It should be noted that the roof profile originally adopted by the OEM can only be sourced from Europe. The cost associated with sourcing and importing replacement product would be uneconomic and the product has proven not to be suitable for Australian coastal conditions.

Rust has been forming on the peak and channels of the roofing sheets at all fixing points



EVALUATION OF ALTERNATIVES

The original roofing material was specifically nominated by the OEM ABB and has not proven durable in the Australian coastal conditions, given the degree of deterioration since construction in 1999.

Range of solutions considered ($2014):

1. Source original product to undertake spot repairs / replacement.	Not an effective long term solution as the product is demonstrably not suited to Australian conditions. Cost of works and materials would be higher than local product with no warranty under Australia conditions.
2. Use locally available roofing product, inhibitors and fibreglass to undertake spot repairs / replacement.	Spot repairs requiring tailored flashing to join between non uniform profiles. **<u>Annual</u> contract works circa $50,000 / year (scope covers 5 buildings). One year warranty on repairs.**
3. Use local product to undertake a staged replacement as and when required with the goal to fully replace roof.	Piece meal activity requiring tailored flashing to join between no uniform profiles at each stage. Additional mobilisation / demobilisation costs due to staging. Additional puncturing of new sheets to match staging joins will impact on warranty. Roofing works $115,000 / building. With one year warranty on joins, 25 year on materials
4. Use local product to undertake a staged, building by building replacement.	Roof completely replaced per building, with one building undertaken each year. Per building roof replacement $85,000 with 25 years warranty on product and defective workmanship
5. Do nothing	Continued deterioration of roof will increase water leakage into insulation compartment in ceiling (200 mm thick). Water will migrate across insulation and escape through perforated ceiling panels. High Voltage electrical equipment will be exposed to dripping and pooling water, potentially causing outages and increasing safety risks. Insulation will break down and issues of mould / spores may occur in ceiling.

ESTIMATED COST

Preliminary estimates have been obtained from local providers and are subject to a detailed inspection, sourcing of metal roof products at the time of construction. Each building is expected to take 1-2 weeks of repair work (weather permitting).

Activities	Duration	Cost $2013/14
Roof Repairs along 43m x 5 rows x 5 Buildings	5-8 weeks	$53,460
Site supervision (RIC)	8 weeks	-
Mobilisation of site (safety protocols, barricading, etc.)	1 week	$2,200
Demobilisation of site	1 week	$1,100
Totals	**7-10 Weeks**	**$56,760**

5.00% Efficiency improvement year on year

2.50% Escalation per year

	FY 16	FY 17	FY 18	FY 19	FY 20
	5 Blds	5 Blds	5 Blds	5 Blds	5 Blds
($Nominal)	$59,633	$58,068	$56,544	$55,060	$53,614
($2014/15)	$58,179	$55,270	$52,507	$49,881	$47,387

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules (the Rules) is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The selection of the relevant roofing contractor and local materials will follow APA Group Policy to ensure effective competitive sourcing. These proposed works will be repeated over 5 years targeting the dryer months (August – September) during the 2015-20 regulatory control period.

JUSTIFICATION

This capital project for roof repair is required to meet the following capital expenditure objectives set out in clause 6A.6.7(a) of the Rules:

(3)(iii) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The expenditure for the roof replacement program is justified under clauses (3) and (4), being required to maintain the reliable operation of the link and ensure security of supply in the provision of prescribed transmission services.

RECOMMENDATION

That necessary roof repairs use locally available roofing product, corrosion inhibitors and fibreglass to undertake a program of spot repairs / replacement. This program should be carried out to:

- ensure high levels of system reliability by prudent protection of the roof substructure, sound proofing, and electrical equipment contained within the buildings; and
- ensure good facility management practices are followed in sustaining assets and reducing maintenance costs by select the most effective whole-of-life net cost solution.

The estimated costs have been included in the capital expenditure forecast for the Directlink Regulatory Proposal.

Business Case

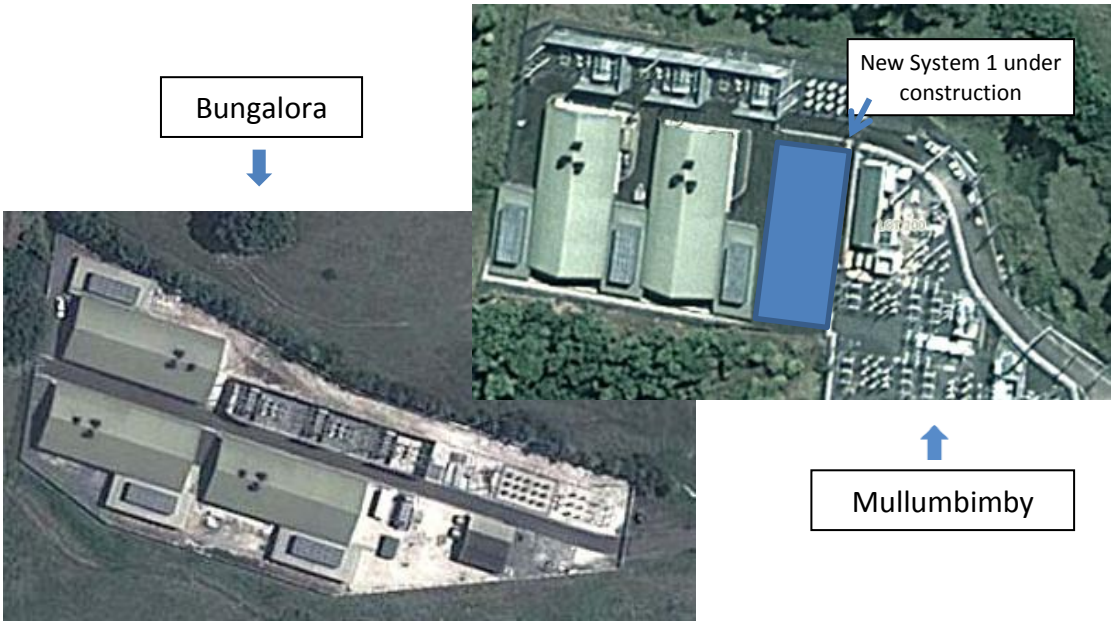
Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Building Safety Upgrade Project		
Project Type:	*Capex:*	*$179,030 ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal covering the 2015-20 regulatory control period.

BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable linking converter stations located at Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales Directlink is connected to a 132 kV transmission grid and in Queensland to a 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated transmission asset on 10 March 2006.

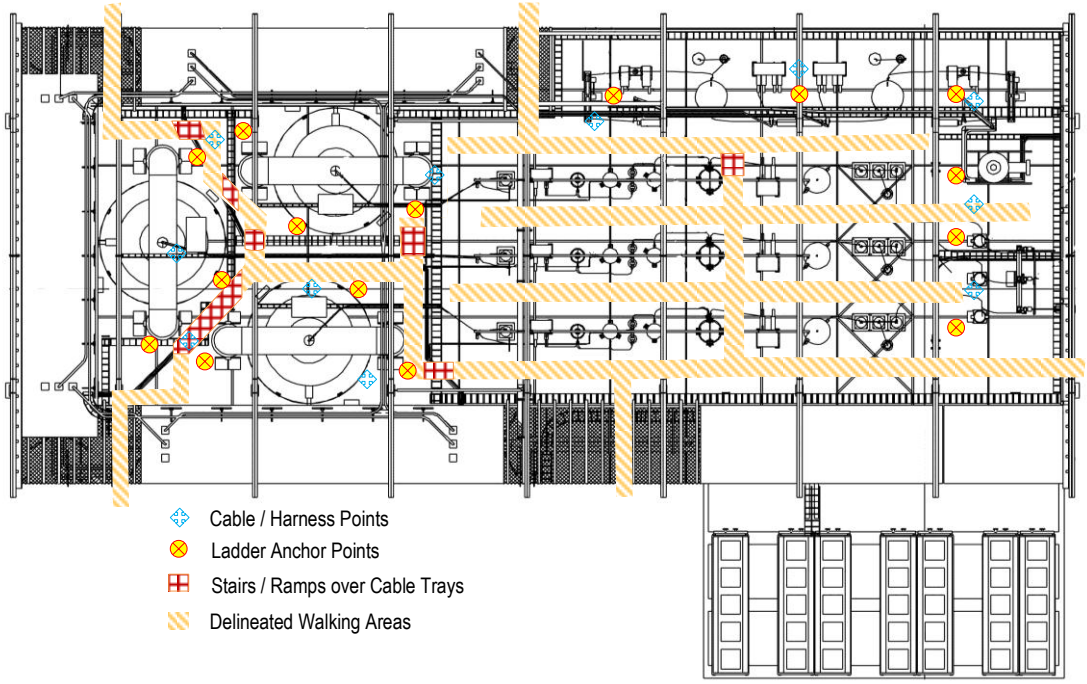


Directlink's original building and equipment design layout has left many challenges which under current safety requirements and obligations require a significant upgrade to the current safety measures deployed around these facilities.

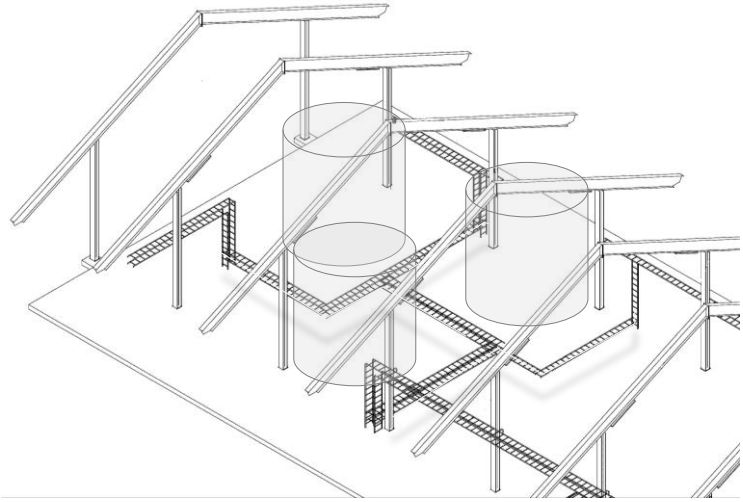
IDENTIFICATION OF NEED

This project plans to upgrade the safety aspects of common walkways, ladder points and harness points / support cables throughout the buildings. These requirements have been highlighted over the 2014 financial year when considerable construction work and continuous access to the buildings showed up the need to have better systems in place to ensure the safety of staff and contractors traversing these areas:

- Preliminary reviews by safety advisors have identified the following minimum requirements to reduce the current safety risks found in these areas. The floor plan below outlines the proposed marking of designated walkways, stairs / ramps across cable trays and other cable runs, ladder fixing points and the inclusion of cable / anchor points for when harnesses are worn by personnel working at heights.



- The structural perspective below shows the elevated cable trays (600 mm above ground level) running around the reactors where specific stairs and ramps are proposed.



- Past temporary measures to protect both personal and equipment have seen significant outlays in time and money to establish temporary timber barricades and stairs which had to be removed after each activity. The new safety

upgrades are planned to be permanent structures and fixing points which will be available to personnel whenever they access the buildings.

It is anticipated that the new reactor building to be installed at Mullumbimby will be equipped to meet current safety requirements and accordingly this project is for the five remaining buildings at Mullumbimby and Bungalora.

EVALUATION OF ALTERNATIVES

Advice has been sought from a number of safety providers to establish a scope and budget for this project – all have recommended similar solutions to meet the legislative requirements and standards followed in like facilities[1],[2]. This project will be undertaken via competitive tender when rolled out and will ensure the most effective solution will be offered to deliver a compliant system.

ESTIMATED COST

An initial scoping exercise has identified a program of works as outlined in the following table. ($2013/14)

Delineated Walkways	5,296
Ladder Anchor Points	7,865
Harness Points, Cables & Rollers	5,445
Door Restraints	508
Cable Tray Walk Overs	6,050
per Building	25,165
Supervision across sites / project management activities	48,840
5 Buildings	174,663
($2014/15)	**$179,030**

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules (the Rules) is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The selection / price to secure the relevant project management staff, safety contractor and materials will follow APA Group Policy to ensure effective sourcing. These proposed works will be implemented to coincide with planned system outages during the 2015-20 regulatory control period.

Funds are expected to be expended as follows:

Year ended June	2016	2017	2018	2019	2020	Total
Amount ($2014/15)	71,612	71,612	35,806			179,030

1 NSW, *Work Health And Safety Act 2011*, as at 1 January 2014.

2 NSW, *Work Health And Safety Regulation 2011*, as at 7 May 2014.

JUSTIFICATION

This Building Safety Upgrade Project for “Directlink” is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) and 6A.6.6(a) of the National Electricity Rules (the Rules), which states:

(2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The project is justified under clauses (2) and (4) being required to ensure safe working conditions for staff on this type of high voltage enclosed sites.

RECOMMENDATION

It is recommended that the Building Safety Upgrade Project for Directlink, be carried out to ensure compliance with NSW Work health and Safety legislation in maintaining a safe working environment, by updating the safety systems to current standards for high voltage sites.

The estimated costs have been included in the capital expenditure forecast for the Directlink Regulatory submission.

Business Case

Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Converter Buildings Ventilation Sound Dampers Corrosion		
Project Type:	*Capex:*	*$52,869 ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

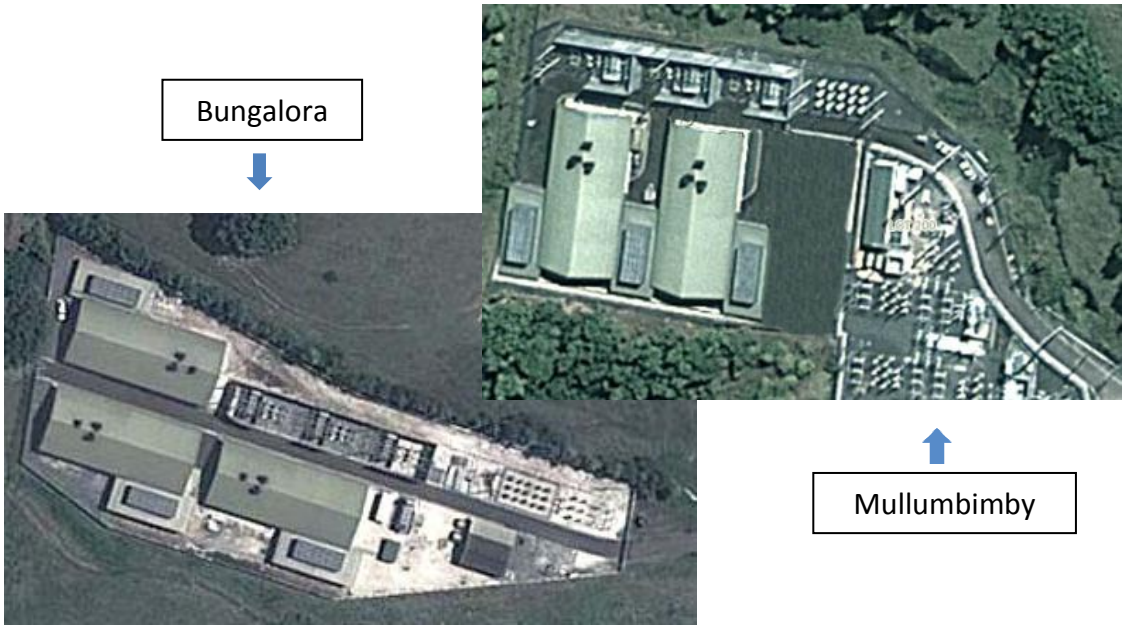
PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal for the 2015-20 regulatory control period.

BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable linking converter stations located between Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales Directlink is connected to a 132 kV transmission grid and in Queensland to a 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated transmission asset on 10 March 2006.

The need to maintain conpliance with noise emissions requirements has driven the need for a repair or replacement program to address corrosion in the building ventilation, air inlet sound dampers.



IDENTIFICATION OF NEED

This project to repair or replace the corroded air inlet sound dampers at both Mullumbimby and Bungalora arises from a mixture of:

- prudent management of the audible sound levels emitted from the converter buildings (which have been the subject of complaint by nearby residents at Mullumbimby); and
- good facility management practices in maintaining assets in a serviceable condition and reducing maintenance costs by select the most effective whole-of-life net cost solution.

The illustrations below highlight the current state of the corrosion in the sound dampers.

External View of building sound dampers

Internal View of corrosion in building

EVALUATION OF ALTERNATIVES

Advice has been sought from the original provider to establish a scope and budget for this project. This project will be undertaken via competitive tender when rolled out, which will ensure the most effective solution will be offered to deliver a compliant system.

ESTIMATED COST

Preliminary estimates have been obtained from the original provider of the building ventilation, air inlet sound dampers for their repair.

Activities	Per year $2013/14	Total Cost $2013/14	Total Cost $Nominal
Sound Damper Repair for Building Air Vent	$9,876	41,379	
Site supervision			
Mobilisation of site (safety protocols, barricading, etc.)[1]	$440	$2,200	
Totals	10,316	51,579	$56,969

2.50% Escalation per year

	FY 16	FY 17	FY 18	FY 19	FY 20
	1 Blds	1 Blds	1 Blds	1 Blds	1 Blds
$Nominal	10,838	11,109	11,387	11,671	11,963
$2014/15	10,574	10,574	10,574	10,574	10,574

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules (the Rules) is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The selection / price to secure the relevant contractor / materials will follow APA Group Policy to ensure effective sourcing. These proposed works will be targeted during system outages during the 2015-20 regulatory control period.

JUSTIFICATION

This capital project for sound damper corrosion repair is required to meet the following capital expenditure objectives set out in clause 6A.6.7(a) of the National Electricity Rules:

(2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

[1] This must be undertaken every year of the project. Allocated evenly over the 5 years.

(3)(iii) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The expenditure for the sound damper corrosion repair program is justified under clauses (2) to avoid the potential infringement of environmental protection guidelines on noise emissions (the convertors at Mullumbimby have already been the subject of complaints from nearby residential properties)[2]. The timely restoration of the sound dampers would avoid unplanned shutdown of the links affecting the reliability of the link under (3) and (4), thereby maintaining the efficient operation of the link and security of supply in the provision of prescribed transmission services.

RECOMMENDATION

It is recommended to undertake a program of repairs / replacement of the building ventilation, air inlet sound dampers. This program should be carried out to:

- avoid the potential infringement of environmental protection guidelines on noise emissions by prudent management of the audible sound levels emitted from the converter buildings;
- avoid the risk of shutdown of the link affecting its reliability, to carry out unplanned repairs on unserviceable equipment; and
- ensure good facility management practices are followed in sustaining assets and reducing maintenance costs by select the most effective whole-of-life net cost solution.

The estimated costs have been included in the operating and capital expenditure forecasts for the Directlink Regulatory submissions.

[2] Environmental Protection Authority NSW, *NSW Industrial Noise Policy*, 16 December 1999.

Business Case

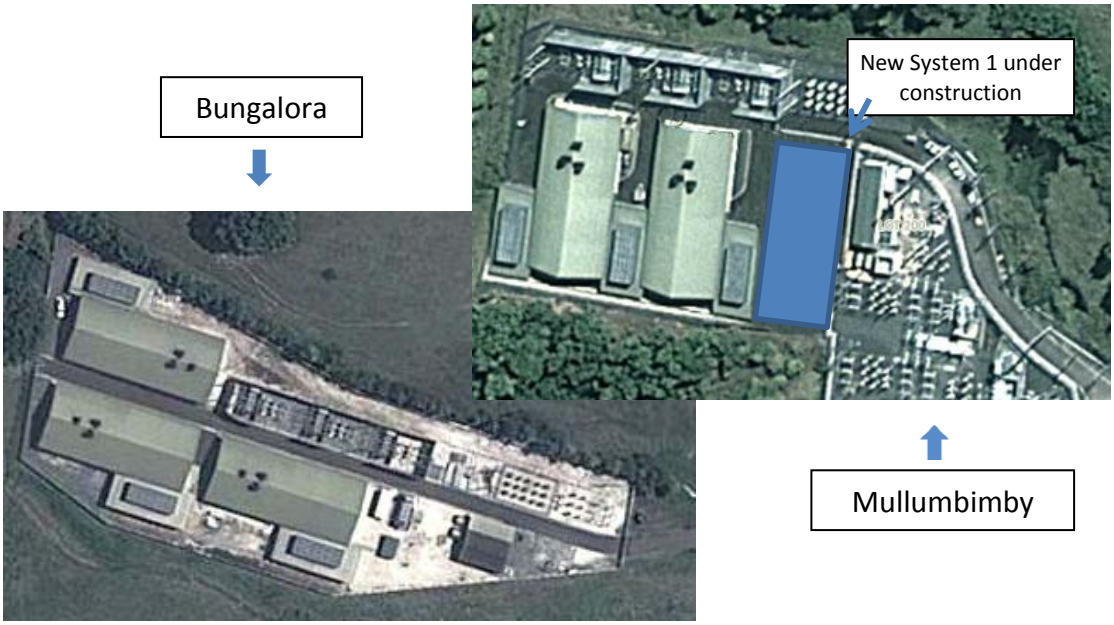
Service Provider:	APA Group	**Date:**	27 May 2014
Asset:	Directlink		
Project:	Safety Hand Rails Project - Bungalora		
Project Type:	*Capex:*	*$20,295 ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal covering the 2015-20 regulatory control period.

BACKGROUND

Directlink is a 59 kilometre bipolar HVDC cable between converter stations located t Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales Directlink is connected to a 132 kV transmission grid and at Queensland to a 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated transmission asset on 10 March 2006.



Directlink's original building and equipment design layout has left many challenges which under current safety requirements and obligations require a upgrading to the current safety measures deployed around these facilities.

IDENTIFICATION OF NEED

This project plans to upgrade the safety of the common walkways that surround the buildings. These requirements have been highlighted over the 2014 financial year when considerable construction work and continuous access around the buildings showed up the need to have better railings in place to ensure the safety of staff and contractors traversing these areas.

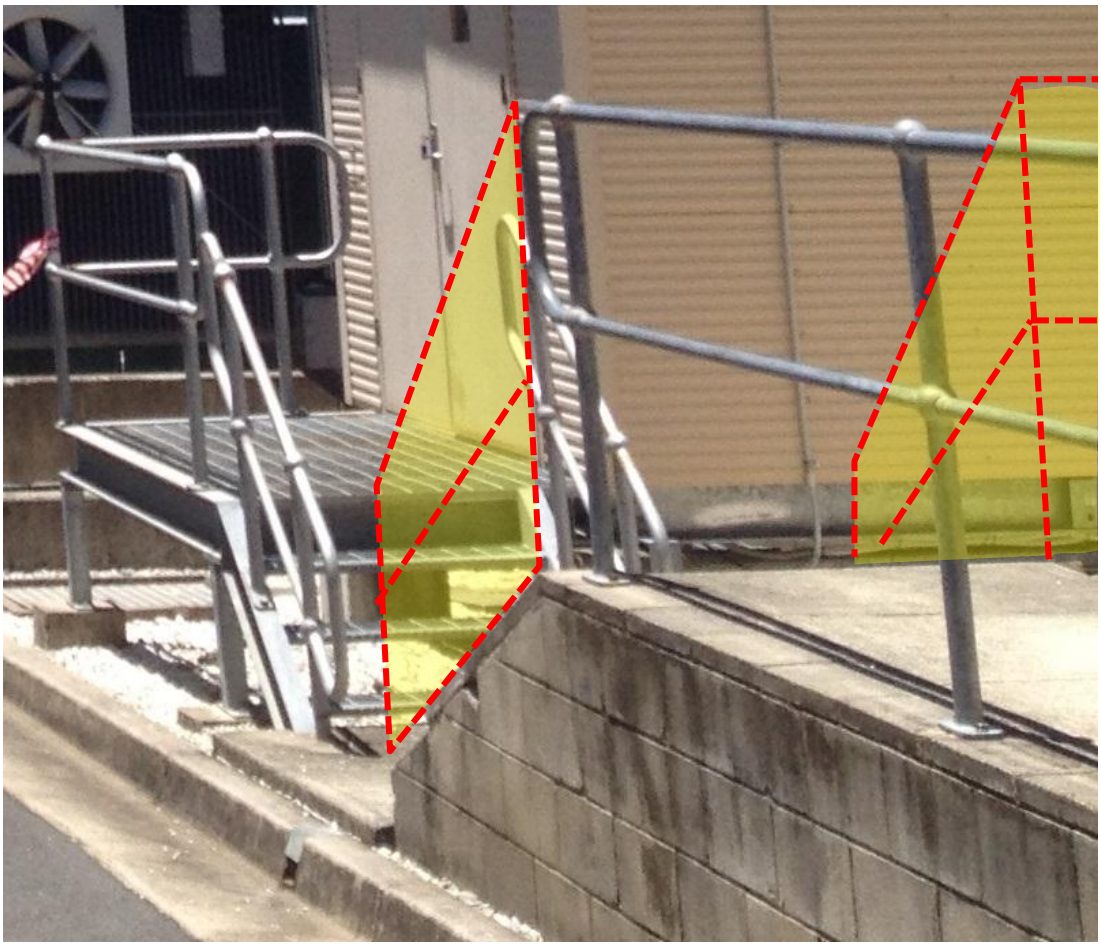
Preliminary reviews by safety advisors have identified the minimum requirements to reduce risks and comply with current safety obligations. Approximately 72 m of walkways requiring hand rails were identified. These are depicted in the diagrams below.

Red dashed lines represent approximate locations for new railings

Proposed railings at buildings 2 & 3, Bungalora

Proposed Railing at builing 1, Bungalora

Proposed railings for stairs and terrace, off building 1, Bungalora



Proposed railings off building 1, Bungalora

EVALUATION OF ALTERNATIVES

Advice has been sought, from a number of providers, to establish a scope and budget for this project – all have recommended similar solutions to meet the legislative requirements and standards followed in like facilities. This project will be undertaken via competitive tender when rolled out and will ensure the most effective solution will be offered to deliver a compliant system.

ESTIMATED COST

An initial scoping exercise has identified a program of works as outlined in the following table.

72m of hot dip galvanized railings – Dyna-bolted to existing concrete walk ways / stairs	$20,295 ($2014/15)

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules (the Rules) is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

This project will be undertaken via competitive tender when rolled out which will ensure the most effective solution will be offered to deliver a compliant system.

JUSTIFICATION

This Safety Hand Rails Upgrade Project for Directlink is required to meet the following capital and operating expenditure objective set out in clause 6A.6.7(a) of the Rules, which states:

> (2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

The project is justified under clause (2) being required to maintain the safe working environment for staff on this type of high voltage enclosed site.

RECOMMENDATION

It is recommended that the Safety Hand Rails Upgrade Project for Directlink, be carried out to ensure a safe working environments for staff, by installing additional safety hand rails to current standards.

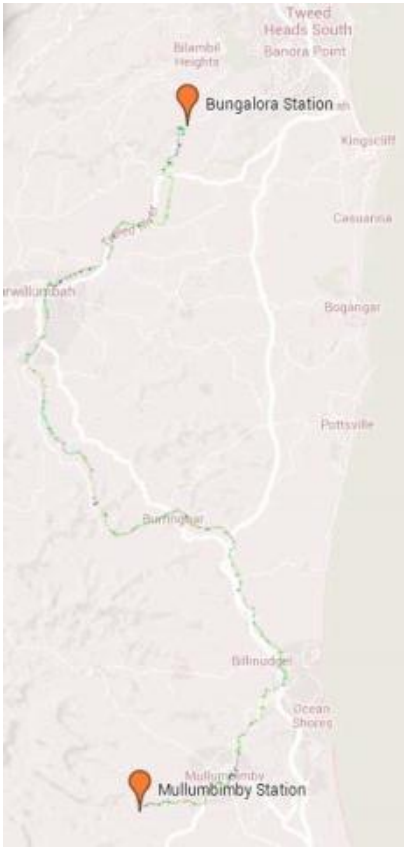
The estimated costs have been included in the capital expenditure forecasts for the Directlink Regulatory Proposal.

Business Case

Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Cable Repair Program		
Project Type:	*Capex :*	*$2.841 million ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal for the 2015-20 regulatory control period.



BACKGROUND

Directlink is a 59 kilometre bipolar HVDC link and converter stations located between Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales the link is connected to the 132 kV transmission grid and in Queensland to the 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated asset on 10 March 2006.

The operational performance of this asset has driven the need for an expanded cable maintenance program to address recurring faults (caused by deterioration of the cable leading to moisture ingress) along the HVDC cable.

This project is complementary to the cable joint kit procurement project described in a separate business case.

IDENTIFICATION OF NEED

This project arises as a result of an expanded cable and repair regime designed to reduce the number of cable faults and consequent impact on the reliability of Directlink. This strategy is:

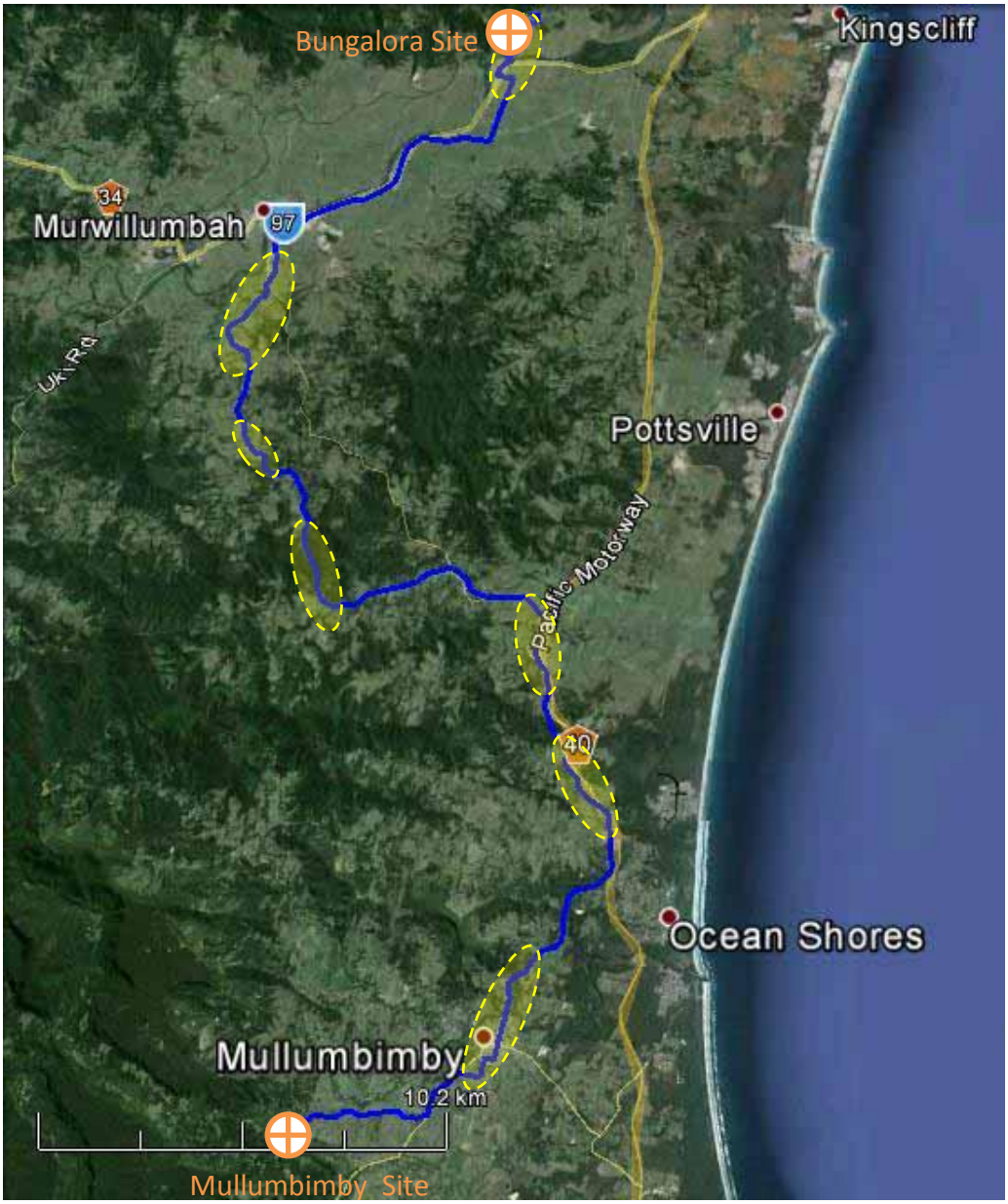
- Cable fault repair is now targeting an expanded repair program where a significant section of cable on each side of a fault (~125m) is replaced, to

remove potentially moisture affected cable (capillary action migrates moisture along the cable). The ingress of moisture to the cable is causing multiple faults in close proximity.

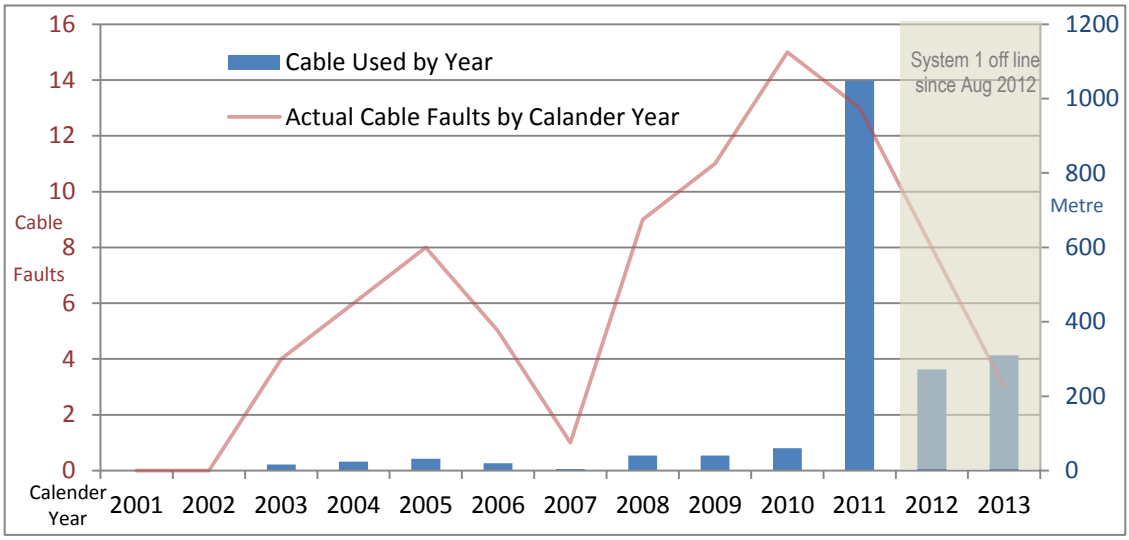
- It is envisaged that an average of 12 faults (empirical evidence, see chart below) per year will require ~250 m cable per event (3 km per annum). This program will therefore see less than 1% of Directlink's cable being replaced per year.

- Recent use of this above repair strategy has seen a distinct improvement in the reoccurrence of faults in close proximity (refer to the chart below for supporting historical data).

The following map presents the concentration of faults over the cable route. It is proposed that these areas will receive specific focus to replace any future faults or past fault repairs in close proximity, with an expanded cable repair program.



The graph below demonstrates historic usage (replacement) of cable in maintaining the Directlink assets. Since 2011, longer sections of cable have been replaced due to the high number of faults which were occurring in close proximity. The expanded repair strategy has delivered positive results and has thus formed the basis of the program to manage this asset during the next regulatory period.



EVALUATION OF ALTERNATIVES

The cable used is specifically nominated by the original equipment manufacturer ABB. Experimenting with alternative third party products would increase technical risk as well as jeopardise the original design performance and ongoing OEM support of the cable system. With equipment of this scale and complexity it is prudent and good industry practice to use the manufacturer's recommended products to maintain the overall integrity of its system.

Cable remediation options (silicone injection into cables) was investigated with the aim of reducing the forecast consumption of cable and cable joints, however the recent testing of Directlink's cable in laboratories has not demonstrated success. A watching brief will be maintained on this and similar techniques to restore deteriorated cable.

ESTIMATED COST

The following table represent the proposed expenditure for purchase of cable. Note that the cable installation cost is an opex cost:

FY ($ nominal)	**2016**	**2017**	**2018**	**2019**	**2020**
Faults p.a.	12	12	12	12	12
Cable per Fault (m)	250	250	250	250	250
Cable purchase p.a. (m)	3000	3000	3000	3000	3000
Cable purchase p.a.	$ 582,467	$ 597,028	$ 611,954	$ 627,253	$ 642,934
$2014/15	**$ 568,260**	**$ 568,260**	**$ 568,260**	**$ 568,260**	**$ 568,260**

Note: Cable Joint costs are covered by a separate business case

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules (the Rules) is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The cable purchase costs to secure the required inventory are those quoted by the original equipment manufacturer ABB who is the sole provider of this product consistent with their original design specification for this system.

JUSTIFICATION

This Cable Repair Program is required to meet the following capital expenditure objectives set out in clause 6A.6.7(a) of the National Electricity Rules (the Rules):

(3)(iii) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The expenditure for the sourcing program is justified under clauses (3) and (4), being required to improve the effectiveness of repairs to the cable when faults take place and thereby improve the reliability and security of supply in the provision of prescribed transmission services.

RECOMMENDATION

That this expanded cable repair program, to ensure reliable operation of Directlink's HVDC cables, be carried out to:

- address the recurring problem of water ingress found at cable faults causing subsequent adjacent faults, by undertaking an expanded cable replacement program; and
- maintain effective inventory of cable for the efficient repair of the system.

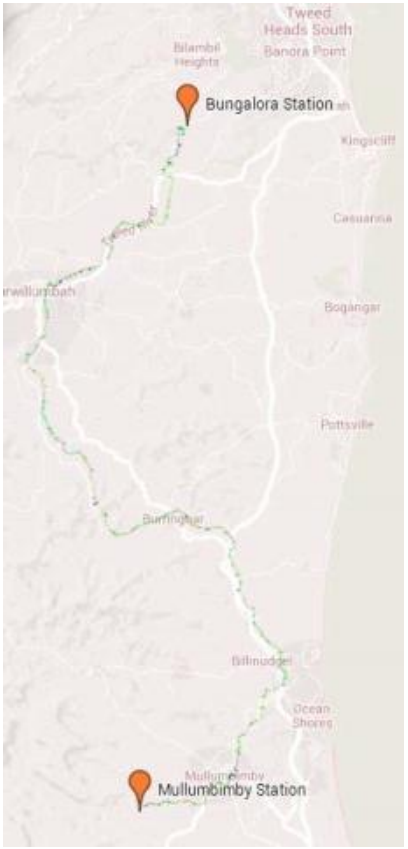
The estimated costs have been included in the capital expenditure forecast for the Directlink Regulatory Proposal.

Business Case

Service Provider:	APA Group	**Date:**	26 May 2014
Asset:	Directlink		
Project:	Sourcing Program for Cable Joint Kits		
Project Type:	*Capex:*	*$1.941 million ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal for the 2015-20 regulatory control period.



BACKGROUND

Directlink is a 59 kilometre bipolar HVDC link and converter stations located between Bungalora and Mullumbimby, New South Wales. There are three independent systems connected by pairs of bipolar transmission cables. Each pair of cables operates at +/-80 kV and transmits 60 MW. In New South Wales the link is connected to the 132 kV transmission grid and in Queensland to the 110 kV transmission grid. The system was commissioned in December 1999 and became a regulated asset on 10 March 2006.

The operational performance of this asset has driven the need for a strategic sourcing program to secure critical inventory to minimise the system outage time.

This project is complementary to the cable repair project described in a separate business case.

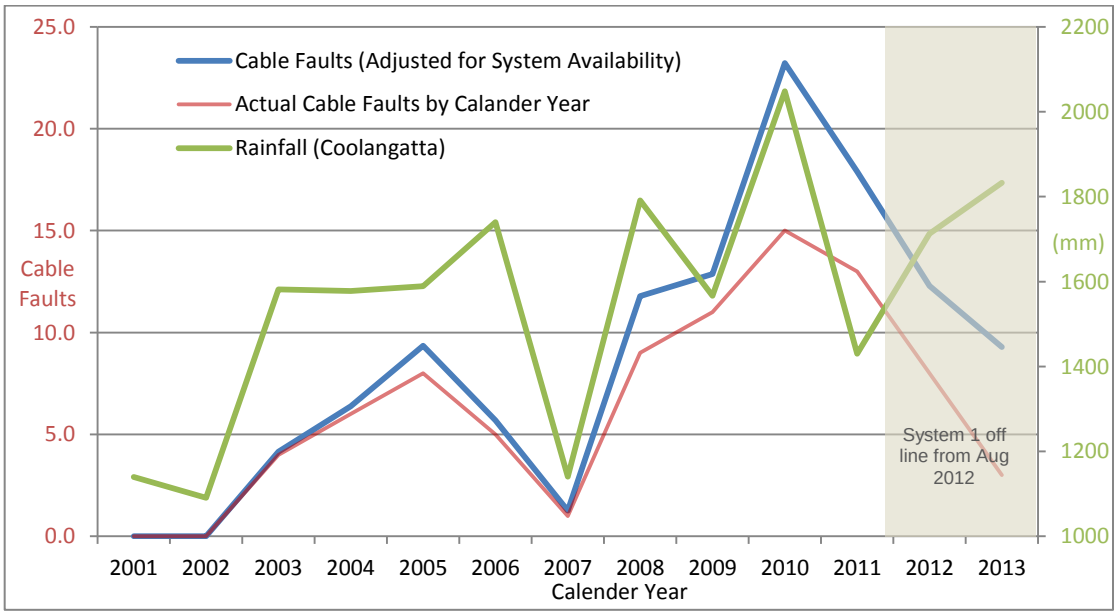
IDENTIFICATION OF NEED

This project to secure adequate stores of cable joint kits arises from the following imperatives:

- historic assessment of past cable fault occurrences and the anticipated projection of repair activity for the coming regulatory period;

- good procurement practices which drives purchasing along commercially economic quantities to minimise costs;
- balancing the need to have a prudent inventory of spares to meet operational requirements and minimise down-time of the asset; and
- management of supply risk by regularly securing critical stock (past endeavours have shown marked variability in delivery of these long lead-time items into Australia, leaving the business potentially underequipped for repair and replacement activities).

The graph below demonstrates historic cable repair activity as an increasing trend. A potential correlation to yearly rainfall levels has been identified to possibly explain the fluctuating cable fault occurrences over time:



EVALUATION OF ALTERNATIVES

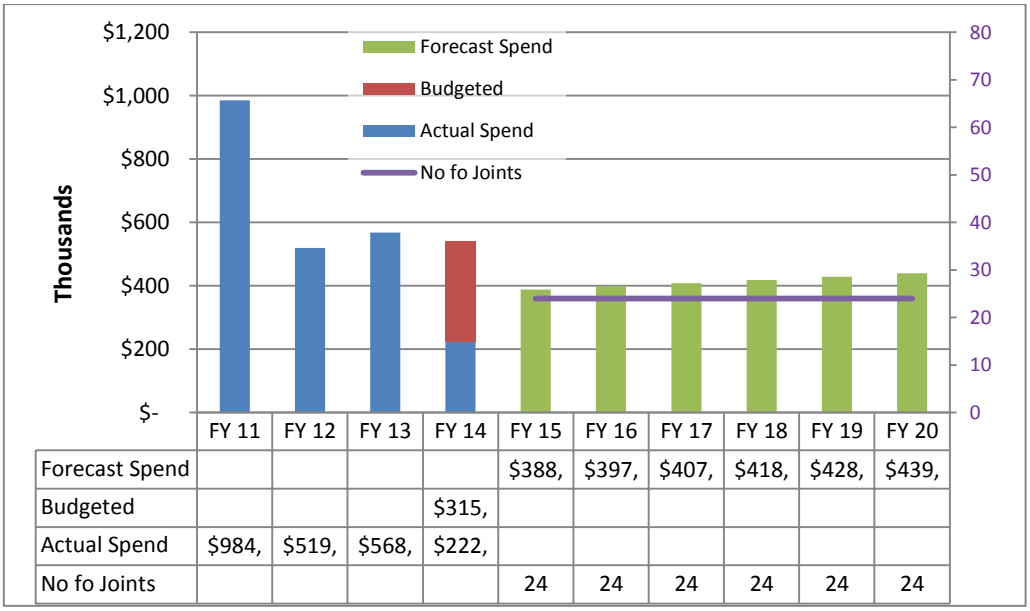
The cable joints were specifically nominated by the original equipment manufacturer ABB. Experimenting with alternative third party products would increase technical risk as well as jeopardise the original design performance and ongoing OEM support of the cable system. With such critical equipment supporting the integrity of the cabling system it would go against good industry practice to not follow the proven manufacturer's recommended consumables to maintain the overall integrity of its system.

Cable remediation options are being investigated with the aim of reducing the forecast consumption of cable joint kits, however the future success of remediation is unknown. Cable remediation may ultimately lead to a reduction in the level of inventory being held. Further studies will be required to determine whether a sound solution exists.

ESTIMATED COST

Historic expenditure and operational experience has determined that adequate stores of joint cable joint kits are maintained to minimise the down time of the system. The graph below was established from past purchasing insights, cable outage data and consideration of the current operating life of this asset.

It anticipated that the cable repair strategy planned for the next 5 years will stem the trend of increasing faults by incorporating the replacement of expanded sections (circa 125 m) of cable either side of faults to ensure any moisture ingress has been minimised / removed (recent field practices have shown a reduction in adjacent faults under this practice).



	FY 11	FY 12	FY 13	FY 14	FY 15	FY 16	FY 17	FY 18	FY 19	FY 20
Forecast Spend					$388,	$397,	$407,	$418,	$428,	$439,
Budgeted				$315,						
Actual Spend	$984,	$519,	$568,	$222,						
No fo Joints					24	24	24	24	24	24

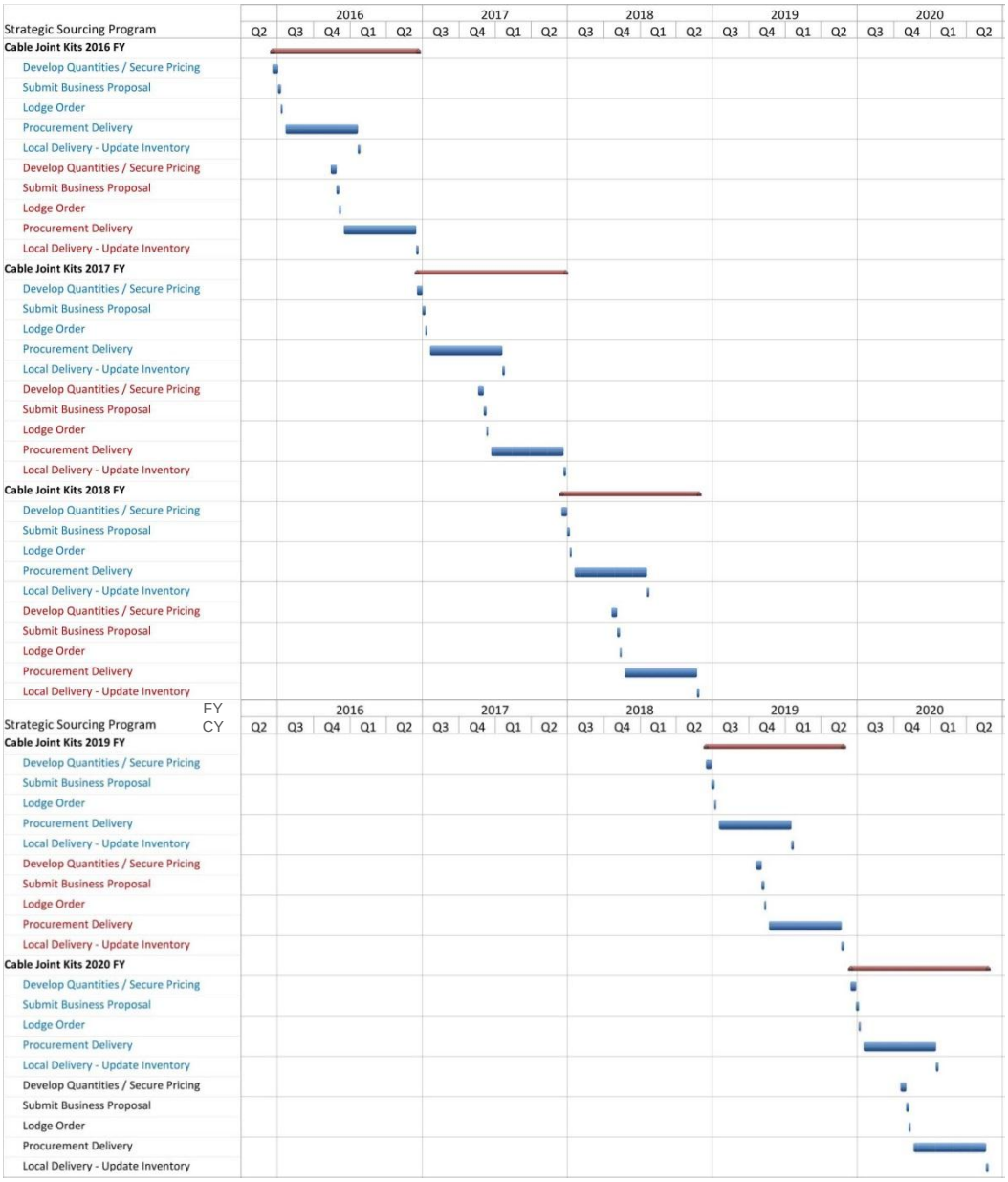
($Nominal)

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital expenditure specified in 6A.6.7(c) of the National Electricity Rules (the Rules) is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The purchase costs to secure the relevant inventory are those quoted by the original equipment manufacturer ABB who is the sole provider of this product consistent with their original design specification for this system. The proposed period for undertaking this strategic sourcing program will be implemented in a staged sequence of procurement initiatives to efficiently manage the inventory levels for the business during the 2015-20 regulatory control period.

A Gantt chart displaying the programme for the procurement of cable joint kits is sown on the next page.



JUSTIFICATION

This strategic sourcing project for cable joint kits is required to avoid extended outages of Directlink caused by the unavailability of spare parts to repair the associated DC cables. This is necessary to meet the following capital expenditure objective set out in clause 6A.6.7(a) of the Rules:

(3)(iii) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.

The expenditure for the sourcing program is justified under clauses (3) and (4), being required to maintain the reliability of the link by minimising turnaround times on outages and ensure the security of supply in the provision of prescribed transmission services.

RECOMMENDATION

Implement this strategic procurement initiative to maintain a critical inventory of spare parts to repair transmission cables to:

- ensure effective procurement of commercially economic quantities that minimise overall costs and meet expected cable joint demand;
- maintain critical inventory for the efficient repair of cable faults; and
- minimise supply risk (delivery times) by establishing a staged regular supply-chain so critical inventory can be effectively maintained.

The estimated costs have been included in the capital expenditure forecast for the Directlink Regulatory Proposal.

Business Case

Service Provider:	APA Group	**Date:**	29 May 2014
Asset:	Directlink		
Project:	Cable relocation		
Project Type:	*Capex:*	*$367,211 ($2014/15)*	
Prepared:	*Stuart Dodds*	*Operations Manager Power Transmission*	
Endorsed:	Paul Thorley	*State Manager Asset Management*	
Approved:	Kerryanne Mallitt	*General Manager Asset Management*	

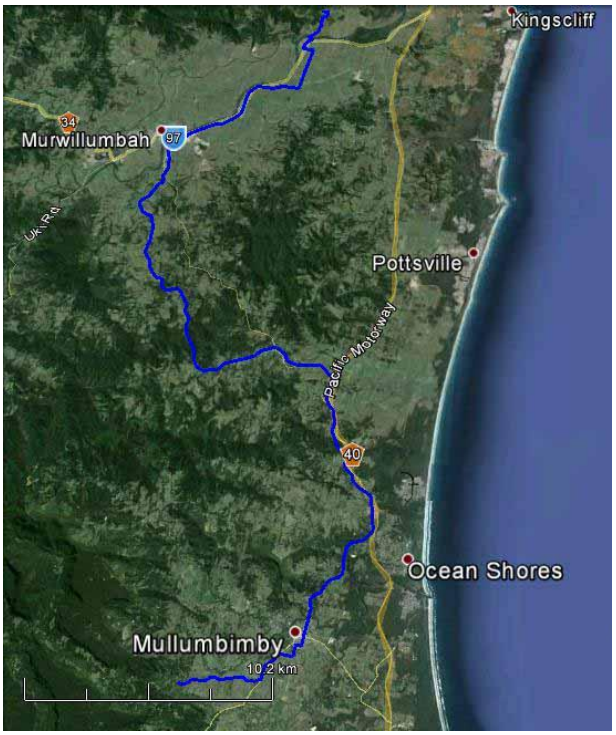
PURPOSE

To present a project recommendation and expenditure forecast for inclusion in the Directlink Regulatory Proposal for the financial years 2016 to 2020.

BACKGROUND

Directlink is comprises a 59 kilometre bipolar HVDC cable and between converter stations located between at Bungalora and Mullumbimby, in New South Wales. There are 3 systems connected by pairs of bipolar transmission cables. Each pair of DC cables operates at ±80 kV and is capable of transmitting 60 MW. The system was commissioned in December 1999 and became a regulated transmission asset on 10 March 2006.

Some half of the cable route length between Bungalora and Mullumbimby follows a currently disused rail corridor, where the cable alternates between being installed above ground in steel trough and direct buried. The remainder of the route, the cable is direct buried in road reserves.



The coastal area and associated hinterland in north-eastern NSW is subject to greater development pressures than most other areas. There is thus a strong likelihood that development adjacent to the route of the cables will impact upon their safety, reliability and integrity.

This circumstance has driven the need to plan for the relocation or protection of the Directlink cables.

IDENTIFICATION OF NEED

This project is a provision to retain the integrity of Directlink by relocating or protecting the DC cables when rail corridor works or road realignment or similar activity would otherwise damage or result in the excavation of sections of the cable.

EVALUATION OF ALTERNATIVES

The circumstances surrounding each requirement to relocate or protect the cable will differ and determine the extent of the remedial works that must be carried out. However, there will be no option but to carry out these works, to ensure the integrity and availability of Directlink's prescribed transmission services.

ESTIMATED COST

The expected cost of relocating the Directlink cables has been estimated on the basis of a requirement to relocate the cable over a distance of 100 metres. This is considered the most likely consequence of a development affecting all six cables. The costs are based on recent quotations for similar work and on current prices for the supply of cable and joints.

The cost comprises the following components ($2013/14):

The cost comprises the following components:	($2013/14)
Survey new cable alignment	$11,275
Trenching	$24,156
Jointing	$18,040
Cable Joint Supply	$189,393
Cable supply	$110,880
Total cost for one relocation	$358,255
(2014/15)	**$367,211**

It is anticipated that there will be one occasion when the cable will need to be relocated during the 2015-20 regulatory control period. As the timing of the event is unknown, the total cost of $367,211 has been factored into the Directlink capital expenditure program on the basis of 5 equal annual amounts of $73,442.

PLAN FOR EFFECTIVE EXECUTION

The requirement for AER acceptance of capital and operating expenditure specified in 6A.6.7(c) of the National Electricity Rules is that the expenditure must be such as would be incurred by a prudent service provider acting efficiently, and represent a realistic expectation of the costs to achieve the requirement.

The expected cable relocation costs above have been estimated using recent costs for the respective components and a realistic expectation of the extent, and number, of cable deviations that will be required during the regulatory control period.

JUSTIFICATION

This capital project for cable relocation is required to meet the following capital and operating expenditure objectives set out in clause 6A.6.7(a) of the National Electricity Rules (the Rules):

(3)(iii) maintain the quality, reliability and security of supply of prescribed transmission services; and

(4) maintain the reliability and security of the transmission system through the supply of prescribed transmission services.

The expenditure for the cable relocation is considered to be justified under clauses (3) and (4), being required to maintain the efficient operability and the security of supply in the provision of prescribed transmission services.

Moreover, the estimate of costs is considered to be a realistic estimate of the efficient costs that would be incurred by a prudent operator in meeting the capital expenditure objectives.

RECOMMENDATION

That provision is made for the relocation or protection of the Directlink cable, in the likely event of development taking place along the route of the DC cables that would compromise their integrity. This program of works would be carried out to ensure that the safety, reliability and integrity of this asset is maintained.

The estimated costs have been included in the capital expenditure forecasts of the Directlink Regulatory submissions.

FY
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