Directlink Joint Venture

Directlink
Revenue Proposal

Effective
July 2015 to June 2020

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Glossary

Abbreviation	Meaning
AARR	Aggregate Annual Revenue Requirement
ABS	Australian Bureau of Statistics
AC	Alternating Current
ACCC	Australian Competition and Consumer Commission
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AMP	Asset Management Plan
AWOTE	Average Weekly Ordinary Time Earnings
CGS	Commonwealth Government Securities
DC	Direct Current
DNSP	Distribution Network Provider
DRP	Debt Risk Premium
EBSS	Efficiency Benefit Sharing Scheme
EGWWS	Electricity, Gas, Water and Waste Services
EII	Energy Infrastructure Investments
GST	Galvanised Steel Troughing
HVDC	High Voltage Direct Current
IGBT	Insulated-Gate Bipolar Transistors
km	Kilometre
kV	Kilovolt
LPI	Labour Price Index
MAR	Maximum Allowed Revenue
NEM	National Electricity Market
NER	National Electricity Rules
NPV	Net Present Value
OEM	Original Equipment Manufacturer
OHS	Occupational Health and Safety
Proposal	Directlink Revenue Proposal
PTRM	AER Post Tax Revenue Model
RAB	Regulatory Asset Base
RBA	Reserve Bank of Australia

RIT	Regulatory Investment Test
RFM	(Asset Base) Roll Forward Model
Rules	National Electricity Rules
STPIS	Service Target Performance Incentive Scheme
TNSP	Transmission Network Service Provider
WACC	Weighted Average Cost of Capital

Executive Summary

This Revenue Proposal for the Directlink transmission interconnector (Directlink) is submitted by Energy Infrastructure Investments Pty Limited on behalf of the Directlink Joint Venture.

Directlink is a privately funded electricity transmission asset operated by the Directlink Joint Venture. It connects the NSW and Queensland regions of the National Electricity Market (NEM), transferring power between Mullumbimby and Terranora, both in NSW. Directlink's current rated capacity is 180 Megawatts (MW).

Directlink comprises six AC/DC converter stations (three at each end) and the six cables (three pairs) that link them, making up three circuits of 60 MW each. It is made up of both primary equipment (the major components operating at high voltage) and secondary equipment (necessary for the operation of the primary equipment).

Originally constructed as an unregulated *Market Network Service Provider*, Directlink became a regulated Transmission Network Service Provider in 2006. The AER's decision established the Regulated Asset Base (RAB), and the revenue cap for the ten-year regulatory control period ending on 30 June 2015.

This revenue proposal commences the review process for the AER to establish a new Maximum Allowed Revenue for the next regulatory period commencing 01 July 2015 and ending 30 June 2020.

The revenue proposal outlines the capital expenditure undertaken in the previous ten-year period and established the Regulatory Asset Base as at 30 June 2015:

Table ES.1 – Opening RAB as at 1 July 2015

F/Y ending June ($m)	2006	2007	2008	2009	2010	2011	2012	2013	2014E	2015F
Opening RAB	116.68	119.16	119.72	121.52	121.11	121.13	123.78	123.73	123.78	127.39
Capex	2.11	0.85	0	0.01	0.02	2.21	1.71	0.74	3.86	3.17
Depreciation	-3.11	-3.20	-3.28	-3.42	-3.50	-3.60	-3.72	-3.78	-3.87	-3.99
Indexation	3.48	2.90	5.08	3.00	3.50	4.04	1.96	3.10	3.63	3.18
Closing RAB	119.16	119.72	121.52	121.11	121.13	123.78	123.73	123.78	127.39	129.76

Directlink forecasts a number of capital expenditure projects over the upcoming regulatory period, focused primarily on maintaining the operation of the link and improving its reliability.

Table ES.2 – Forecast capital expenditure 2015-20

F/Y ending June ($000)	2016	2017	2018	2019	2020	Total
Refurbishment	2,548	2,354	1,520	2,632	1,492	10,545
Compliance	473	437	036	0	0	945
Other	2,836	2,619	2,472	2,472	13,304	23,703
Total	5,856	5,409	4,028	5,104	14,796	35,193

No augmentation capital expenditure is proposed, and no contingent projects are proposed.

This proposal then adopts the AER's December 2013 Rate of return Guideline as it relates to cost of capital matters to develop the proposed Weighted Average Cost of Capital to apply to the 2015-20 forecast regulatory period. Adopting the same parameters for the risk free rate and debt risk premium as the AER found in the recent transitional decisions for TransGrid and Transfield, Directlink proposes a WACC of 8.06%.

Directlink proposes to align the remaining useful life of the cable and converter stations, and depreciate them over their remaining life of 26 years. Combined with indexation of the capital base at a forecast CPI of 2.5% yields the following regulatory depreciation allowance:

Table ES.3 – Forecast depreciation 2015-20

F/Y ending June ($000)	2016	2017	2018	2019	2020
Forecast straight line depreciation	-4,947	-5,311	-5,672	-5,988	-6,364
Forecast indexation	3,244	3,355	3,452	3,508	3,591
Forecast regulatory depreciation	-1,703	-1,956	-2,220	-2,480	-2,774

Together, the capital expenditure and regulatory depreciation allow us to forecast the value of the Regulatory Asset Base to the end of the proposed regulatory period.

Table ES.4 – Opening RAB as at 1 July 2015

F/Y ending June ($m)	2006	2007	2008	2009	2010	2011	2012	2013	2014E	2015F
Opening RAB	116.68	119.16	119.72	121.52	121.11	121.13	123.78	123.73	123.78	127.39
Capex	2.11	0.85	0	0.01	0.02	2.21	1.71	0.74	3.86	3.17
Depreciation	-3.11	-3.20	-3.28	-3.42	-3.50	-3.60	-3.72	-3.78	-3.87	-3.99
Indexation	3.48	2.90	5.08	3.00	3.50	4.04	1.96	3.10	3.63	3.18
Closing RAB	119.16	119.72	121.52	121.11	121.13	123.78	123.73	123.78	127.39	129.76

In light of a 2012 converter station fire, Directlink has undertaken a comprehensive review of its operations and an extensive bottom-up review of its efficient operating costs. These studies support forecast operating expenditures as follows:

Table ES.5 – Forecast operating expenditure 2015-20

F/Y ending June (000 real)	2016	2017	2018	2019	2020	Total
Operating and maintenance costs	3,720	3,092	3,169	3,114	3,142	**16,236**
Management fees and expenses	561	561	561	561	561	**2,805**
Insurance	1,402	1,370	1,390	1,422	1,394	**6,979**
Tax on property and capital	9	9	9	9	9	**46**
Accounting/audit fees	10	10	10	10	10	**52**
Other	1	1	1	1	1	**5**
Debt raising costs	82	83	83	82	82	**413**
Total Forecast opex	5,786	5,127	5,224	5,200	5,200	**26,536**

An allowance for tax has been calculated using the AER's post-tax revenue model. The outputs from that model derive the Maximum Allowed Revenue as shown below:

Table ES.6 – Summary of unsmoothed revenue requirement

FY ending	2016	2017	2018	2019	2020	Total
Return on capital	10,458	10,818	11,130	11,310	11,577	55,294
Return of capital	1,703	1,956	2,220	2,480	2,774	11,133
Total operating expenditure	5,930	5,387	5,625	5,740	5,883	28,565
Tax allowance	764	817	871	922	979	4,353
Unsmoothed revenue requirement	18,856	18,978	19,847	20,452	21,212	99,345

Directlink proposes to smooth this price path over the regulatory period as follows:

Table ES.7 – Smoothed revenue requirement and X factor

FY ending	2016	2017	2018	2019	2020	Total
Unsmoothed revenue requirement	18,856	18,978	19,847	20,452	21,212	99,345
Smoothed revenue requirement	18,137	18,962	19,825	20,727	21,670	99,322
X factor (CPI-X)		-2.00%	-2.00%	-2.00%	-2.00%	

Directlink submits that acceptance of this proposal will promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to—

(a) price, quality, safety, reliability and security of supply of electricity; and

(b) the reliability, safety and security of the national electricity system.

Directlink looks forward to working with the AER over the upcoming months to finalise this process.

1 Introduction

1.1 About Directlink

Directlink is a privately funded electricity transmission asset operated by the Directlink Joint Venture. It connects the NSW and Queensland regions of the National Electricity Market (NEM), transferring power between Mullumbimby and Terranora, both in NSW. Directlink's current rated capacity is 180 Megawatts (MW).

Directlink comprises six AC/DC converter stations (three at each end) and the six cables (three pairs) that link them, making up three circuits of 60 MW each. It is made up of both primary equipment (the major components operating at high voltage) and secondary equipment (necessary for the operation of the primary equipment).

Directlink has a number of unique features that distinguishes it from the more conventional static transmission assets operated by other Transmission Network Service Providers (TNSPs):

- The cables are exposed to direct voltages, which imposes different stresses and potential insulation breakdown mechanisms, than alternating voltage cables.
- The cables have unusual installation approaches - Directlink cables are laid primarily underground, and partly in above-ground galvanised steel troughing (GST).

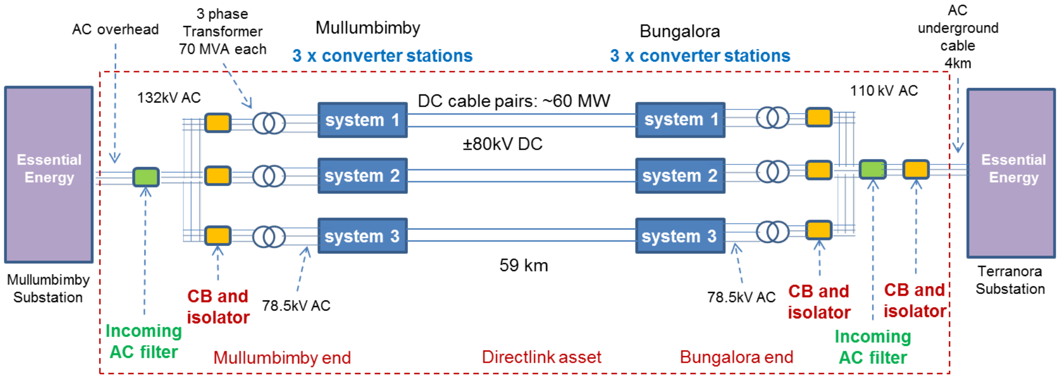
The converter stations use what was, at the time of their installation, cutting edge High Voltage Direct Current (HVDC) Light technology.

The primary equipment at the converter stations comprise:

- 132 kV power transformers;
- AC/DC converter valve banks;
- harmonic filtering and power factor correction equipment; and
- busbars and switches.

Diagrammatically, the Directlink interconnector can be shown as below:

Figure 1.1 – Directlink schematic



Directlink has been in service for approximately 14 years. The expected service life of the primary converter station equipment is 40 years. While the DC cables have a potential service life in excess of 40 years, their useful life will be limited to that of the converter stations.

This primary equipment is supported by a number of ancillary systems, all of which are essential for the secure operation of the link:

- power system protection equipment;
- computerised control systems and communications;
- air conditioning systems (necessary for the control system equipment to function);
- power transformer oil circulation pumps and cooling fans;
- converter valve water purification and cooling equipment;
- converter hall air filtering and ventilation; and
- fire protection systems.

It is important to note that the service life of these ancillary systems is much shorter than that of the primary equipment. Various components of the ancillary systems (eg. motor contactors and bearings, fluid control valves) require major maintenance or replacement at intervals ranging from 5 to 10 years.

1.1.1 Regulatory history

Directlink first came into operation on 25 July 2000 as an unregulated *Market Network Service Provider* (MNSP) under clause 2.5.2(d) of the then *National Electricity Code*, earning revenue from the National Electricity Market by providing a market network service between the NSW and Queensland power grids. By decision dated 03 March 2006, the Australian Energy Regulator (AER) decided under section 2.5.2(c) of the *Code* to reclassify Directlink's services from market network services to prescribed network services, thus converting the Directlink Joint Venture from a Market Network Service Provider to a Prescribed Network Service Provider.

The AER's decision established the Regulated Asset Base (RAB), and the revenue cap for the ten-year regulatory control period ending on 30 June 2015. Directlink collects its revenues from TransGrid, acting in the role of Coordinating TNSP in NSW under the National Electricity Rules.

1.1.2 Directlink's role in the National Electricity Market

As a result of the conversion to a regulated interconnector, Directlink is registered with the Australian Energy Market Operator (AEMO) as a Transmission Network Service Provider.

The link is dispatched by AEMO, in a similar manner to a generator, to control flows between the NSW and Queensland regions of the National Electricity Market (NEM) and thereby minimise the costs of generation in the NEM.

The implications of this arrangement, for forecasting methodology purposes, is that Directlink provides the asset to be available to AEMO for dispatch as required. Directlink is not required to derive its allowed revenue over load or demand served and therefore does not establish tariffs for the provisions of its service. Accordingly, there is no need for Directlink to forecast load or peak demand as would be the case for other regulated TNSPs.

As shown in the map below, Directlink is a small asset relative to the high voltage transmission system making up the NEM, and its total revenue requirement is small relative to the transmission networks on either end of the interconnector.

In terms of the interconnected NSW and Queensland system, Directlink makes up less than 1% of the total cost of the transmission network:

Table 1.1 – Directlink relative revenue

2014/15 Revenue Requirements	$million	%
TransGrid (NSW)[1]	845.4	46.8%
PowerLink (Queensland)[2]	949.2	52.5%
Directlink (Interconnector)[3]	13.6	0.8%
Total	1,808.2	100.0%

1 AER, *TransGrid, Transend - Transitional transmission determinations 2014–15*, March 2014. Table 1.1. http://www.aer.gov.au/sites/default/files/AER%20transitional%20decision%20-%20TransGrid%20and%20Transend%202014-15%20-%2028%20March%202014_0.pdf

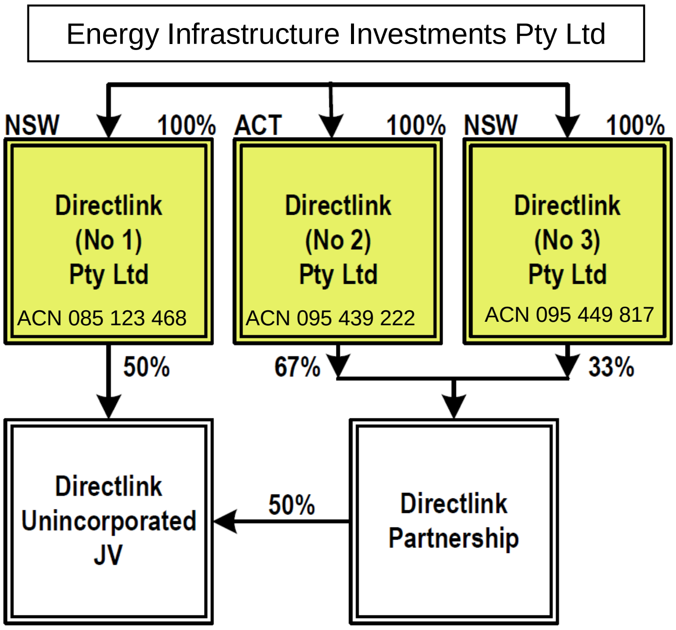
2 AER, *Powerlink Transmission determination 2012–13 to 2016–17*, April 2012. Table 1.1. This amount will be adjusted for outturn inflation. http://www.aer.gov.au/sites/default/files/Powerlink%20-%20Transmission%20determination%20-%20April%202012.pdf

3 AER, *Directlink Joint Venturers' Application for Conversion and Revenue Cap, Decision* 3 March 2006. Table 4.4. This amount will be adjusted for outturn inflation. http://www.aer.gov.au/sites/default/files/Decision%20%283%20March%202006%29.pdf

1.1.3 Corporate Structure

The Directlink Joint Venture is an unincorporated joint venture between three businesses:

Figure 1.2 – Directlink Corporate Structure



Each of these businesses is 100% owned by Energy Infrastructure Investments Pty Ltd, which in turn is owned by a consortium of investors, as shown below.

Table 1.2 – Energy Infrastructure Investments Pty Ltd ownership structure

Shareholder	Ownership percentage
Dalmeny Gas & Power Holdings BV	24.95
Midstream Investment First BV	24.95
Osaka Gas Energy Europe BV	30.20
Australian Pipeline Limited	19.90
Total	**100.0**

1.2 Purpose of this document

This Revenue Proposal provides details of Directlink's revenue requirements for prescribed transmission services for its second regulatory control period. This period is proposed to span 5 years, from 1 July 2015 to 30 June 2020.

This Revenue Proposal has been developed in accordance with Chapter 6A of the *National Electricity Rules* (Rules).[4]

This Revenue Proposal is submitted on behalf of the Directlink Joint Venture by:

- Directlink (No 1) Pty Ltd (ACN 085 123 468);
- Directlink (No 2) Pty Ltd (ACN 095 439 222); and
- Directlink (No 3) Pty Ltd (ACN 095 449 817);

all of Level 19, 580 George Street, Sydney NSW 2000.

1.3 Length of regulatory control period

S6A.1.3(9) requires Directlink to propose the commencement and length of the regulatory control period.

Directlink's current (first) regulatory control period was for the nominal 10-year period from the date of its conversion to a prescribed network service provider to 30 June 2015.

Directlink proposes that the length of the new regulatory control period be 5 years, from 1 July 2015 to 30 June 2020.

1.4 Services provided by Directlink

Directlink enhances the transfer of active power between the Queensland and NSW regions of the NEM.

Directlink is joined through the Terranora substation connection with Essential Energy to the Queensland region of the NEM. In the NSW region of the NEM, the converter station near Mullumbimby is joined through Dunoon to the Lismore 132kV substation by overhead 132kV lines owned by Essential Energy.

As an element of the transmission network, Directlink provides prescribed transmission services to customers throughout the NEM.

Directlink provides no negotiated services, and there are no negotiated services associated with these two connections to Directlink.

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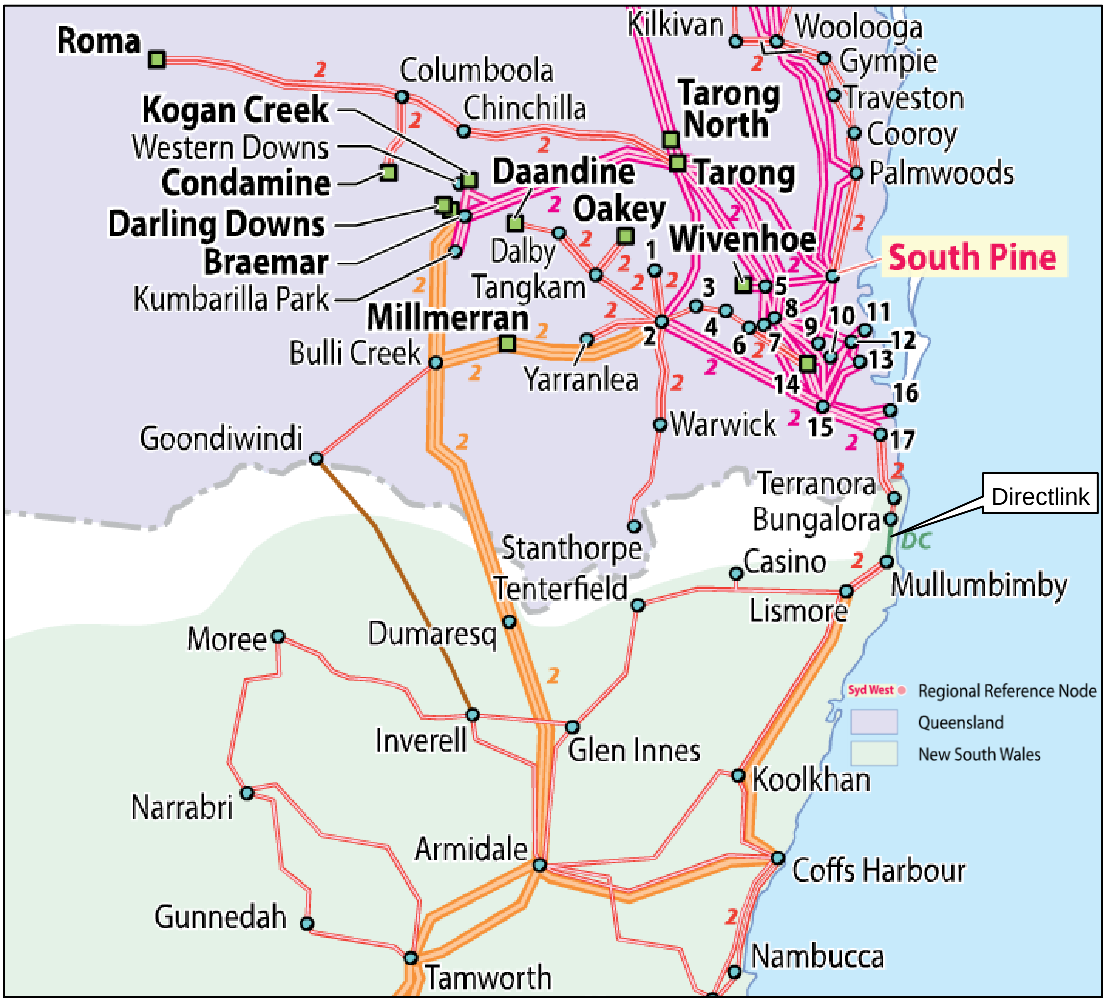
4 Australian Energy Market Commission, *National Electricity Rules* Version 60.

1.5 Map of the transmission network

The Directlink interconnector consists of a 59 km, 180 MW High Voltage Direct Current (HVDC) interconnect running between Mullumbimby and Bungalora in NSW, and a 4km 100kV line from Bungalora to Terranora, NSW.

Figure 1.3 – Map of the Directlink interconnector



Source: AEMO

1.6 Events in the current regulatory period

A number of events occurred late in the 2006-15 regulatory period that have implications for this regulatory proposal, as discussed below.

1.6.1 Mullumbimby converter station fire

In August 2012, pole 1 of the Mullumbimby converter station experienced a catastrophic failure and fire, destroying that pole of the converter station and taking that circuit completely out of service. The cause of the fire was indeterminate. While reconstruction processes are in train, the converter station and circuit are not expected to return to fully operational status until mid-2015.

As a result of the converter station being off line since August 2012, the FY2012/13 through FY2014/15 actual operating costs will not reflect the normal operations and maintenance associated with one of the three circuits.

1.6.2 Circuits 2 and 3 disconnection

Following a routine inspection of converter stations 2 and 3 in August 2013, similar partial discharge tracking conditions were found as had been discovered and addressed in prior years. As the cause of the Mullumbimby converter station fire remains indeterminate, Directlink, as a precautionary measure, took the remaining two circuits offline while repair options were investigated.

1.6.3 Implications for this regulatory proposal

As discussed in the Directlink Forecasting Methodology document lodged in November 2013, these events have made it impossible to establish a reliable base year on which to apply the revealed cost methodology for assessing a reasonable level of ongoing operating costs. Accordingly, Directlink has applied a bottom-up opex cost build process, as discussed more fully in Section 9.

As the destroyed converter station was fully covered by insurance, and is to be replaced using the proceeds of that insurance, there are no implications on the regulatory asset base.

However, this experience has had significant implications for the development of the operating and capital expenditure forecasts. As discussed more fully in section 9, Directlink has re-assessed the risks associated with operating this asset, reviewed its operating practices for compliance with Good Electricity Industry Practice, and conducted a bottom-up cost build to assess the sustainable costs associated with the ongoing operation and maintenance of the Directlink interconnector.

1.7 Consultation with consumers

Rule 6A.10.1(g)(2) requires Directlink, as part of the process of submitting a regulatory proposal to the AER, to describe how it has engaged with electricity consumers and sought to address any relevant concerns identified as a result of that engagement.

Directlink contacted, via email, all consumer groups that lodged submissions to the AER's consultation on *Consumer Engagement Guideline for Network Service Providers* or AER *Stakeholder Engagement Framework*. This included:

Table 1.3 – Consumer consultation

New South Wales Irrigators' Council	Australian Council of Social Services (ACOSS)
Conservation Council of South Australia	South Australian Council of Social Service (SACOSS)
Consumer Action Law Centre	Tasmanian Council of Social Service (TasCOSS)
Consumer Utilities Advocacy Centre	Queensland Council of Social Service Inc
Council of Small Business Australia	Energy & Water Ombudsman NSW
Qld Consumers Association	Energy and Water Ombudsman of Victoria
Northern Alliance for Greenhouse Action	Ethnic Communities' Council of NSW Inc
Total Environment Centre	Public Interest Advocacy Centre
Handle My Complaint	UnitingCare Australia
Major Energy Users Inc	

Directlink included a short informational document describing the Directlink Interconnector, and invited the consumer representatives to attend a workshop at which Directlink would engage with the consumer representative organisations to understand any relevant concerns, and to ensure Directlink can address those concerns in this regulatory proposal. In the alternative, Directlink invited interested parties to engage in individual discussions at their convenience.

Directlink appreciates the resource constraints that consumer groups face, and understands that consumer groups must use their limited resources to maximum effect. So few were able to attend the consumer engagement workshop that Directlink elected to cancel the workshop.

However, Directlink provided contact details and an invitation for each of the groups to discuss the Directlink Interconnector regulatory proposal process individually. The AER was copied in on all email correspondence.

1.8 Structure of this document

The following Sections of this Revenue Proposal are structured as follows:

- Chapter 2 describes the environment in which Directlink operates and the main challenges anticipated in the next regulatory control period.
- Chapter 3 describes how compliance with the requirements of the Rules has been met.
- Chapter 4 describes the historic cost and service performance.
- Chapter 5 outlines the calculation of the regulated asset base for the forthcoming regulatory period, using the AER's Roll Forward Model (RFM).
- Chapter 6 explains Directlink's capital financing costs;
- Chapter 7 discusses the derivation of Directlink's proposed tax allowance.
- Chapter 8 describes the capital expenditure forecast.
- Chapter 9 describes the operating expenditure forecast.
- Chapter 10 describes the depreciation allowance.
- Chapter 11 presents the revenue needs for the 2015-20 regulatory control period, calculated using the AER's Post-Tax Revenue Model.
- Chapter 12 Discusses the incentive mechanisms to apply to Directlink over the 2015-20 regulatory period.
- Chapter 13 discusses the requirements for a Pricing Methodology and a Negotiating Framework for Directlink.

To assist the AER in assessing the compliance of this Revenue Proposal with the Rules and Submission Guidelines, Directlink has provided a compliance checklist as Attachment 1.1 to this Proposal. This checklist cross-references the relevant Sections of this Revenue Proposal and the attachments that address each of the Rule requirements.

1.9 Directors' Responsibility Statement

Rule S6A.1.1(5) requires that this Proposal must contain a certification of the reasonableness of the key assumptions that underlie the capital expenditure forecast by the Directors of Directlink.

The Director's Responsibility Statement is included in Attachment 1.2.

2 Business environment and key challenges

2.1 Introduction

This Revenue Proposal demonstrates how Directlink expects to provide a flexible and cost effective transmission service in the NEM, whilst maintaining high levels of service availability.

Directlink's capital and operating costs are driven by the business and natural environment in which it operates. Key elements of this environment include:

- Obligations to meet the broad range of legislative and administrative requirements that apply to the jurisdictions in which Directlink operates;
- An obligation to meet increasing standards of public safety now being adopted by other network businesses;
- The 2012 fire at Mullumbimby has required re-assessment of the risks and consequences associated with equipment failure;
- The climactic conditions in which its sophisticated terminal equipment must operate;
- The need to replace or refurbish items of ageing ancillary equipment nearing the end of their useful life, to maintain availability standards for the DC link;
- Directlink's remoteness from major centres of population and industry;
- Rising borrowing costs, due to the global financial crisis; and
- Unprecedented competition for skilled labour and materials, from both the resources and utility sectors.

This Chapter elaborates on Directlink's environment and the ensuing challenges that must be taken into account when establishing the required revenue for the 2015-20 regulatory control period.

2.2 Directlink's role and obligations

Directlink is registered as a TNSP in the NEM under clause 2.5.1 of the Rules and must comply with those Rules. These obligations under the Rules require Directlink to operate as an efficient regulated network service provider and comply with the transmission network and technical performance standards (e.g. planning, design and operating criteria).

Directlink and its maintenance service providers are also subject to numerous other environmental, cultural heritage, planning approval, Workplace Health & Safety, financial and other regulatory obligations or requirements under a range of Federal, State and local government legislation, Codes, Standards, policies and other instruments applicable to NSW.

The main legislative and statutory obligations that Directlink must meet are referenced throughout the Proposal and in the supporting documentation.

2.3 Meeting customer demand

Directlink is an integral part of the transmission system that forms the NEM. The demand that is placed on its network services arises from the requirement for energy to be transported between the NSW and Queensland regions, to minimise the overall costs of production in the NEM. Directlink also supports the regional transmission systems in the north-east of NSW. The link is dispatched by AEMO to meet these objectives and transports energy in either direction, as the situation requires.

The demand for interconnection capacity between NSW and Queensland is increasing, due partly to changes in the gas market and the resultant closure of gas-fired power stations in Queensland.

Directlink's transmission network services must therefore remain available at their maximum available capacity and with a high level of availability, throughout the 2015-20 regulatory control period.

2.4 A maturing asset base

There are two classes of equipment that comprise the link:

- Major elements of equipment (main transformers, conversion equipment, filters and underground DC cable). These have a standard life of 40 years or more, and are approaching the mid-period of their useful service lives;[5] and
- Ancillary equipment necessary for the operation of the link (notably air conditioners, water storage and treatment apparatus, control and protection systems). These elements have service lives of 7 - 20 years and in many cases, have met or are approaching the end of their serviceable lives, as Directlink is now well into its second decade of operation.

There are a number of elements of ancillary equipment that will require refurbishment or replacement during the 2015-20 regulatory control period. These elements have been factored into the "stay in business" capital expenditure program in Section 8.

Even with a best-practice maintenance program, with age, there is an increasing risk of failure of an element of the link as equipment ages. Directlink carries insurance to cover the cost of premature failure of a major item of equipment. However, to the extent that such a major failure was not covered by insurance, Directlink would seek the approval of the AER to pass through the associated cost. This is consistent with the current regulatory determination.

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5 See the further discussion on this issue in section 10.3.

2.5 Inflation and cost escalation

Given the competition for skilled labour presented by the mining and construction industries, Directlink expects its internal and contract labour costs to increase, in real terms, over the term of the 2015-20 regulatory period.

In other regulatory processes, the proponent has engaged a specialist macroeconomic consultant to forecast real increases in labour and material costs. However, the AER has often eschewed the advice of the consultant engaged by the business in favour of the advice of its own consultant.

Directlink is conscious that, given the size of the labour costs in its operations and maintenance forecasts, any difference in labour escalation rates between those recommended by its independent consultant and those recommended by the AER's consultant are unlikely to result in a material change to the outturn capital and operating expenditure forecasts.

Directlink has therefore elected not to engage an expert economics consultant to advise on forecast levels of inflation and real labour and materials cost escalation, deferring to the AER's final decision on the revenue requirement proposals of the NSW transmission and distribution businesses.

The forecast capital and operating costs therefore reflect inflation at 2.5% and zero real cost escalation for labour and materials costs.

3 Operating and capital expenditure compliance

3.1 Introduction

This Proposal has been prepared to comply with the requirements of the Rules and the AER's Regulatory Information Notice.

This Chapter describes Directlink's governance and compliance arrangements. Specific compliance requirements are also set out in the following Chapters of the Proposal.

3.2 Corporate governance

An excerpt from the EII Asset Management Plan (AMP) forms Attachment 3.1 to this Proposal and this underpins the associated capital and operating cost forecasts. It should however be noted that the more recent assessment of expenditure requirements following the Mullumbimby converter fire has modified some of the Asset Management Plan forecasts.

Also contained in the AMP is a description of the processes that are used to establish the risks associated with each asset and, from that, determine the required activity. Adherence to specific plans is required and these include:

- Environmental Management Plan;
- Emergency Response Plan; and
- Safety and Operating Plan

Directlink capital and operating expenditures are subject to an annual budgeting process and to close scrutiny by the shareholding entities.

It should be noted that the most recent AMP was approved by the Board in November 2013. While an AMP can be viewed as a "steady state" plan, the period following the Mullumbimby converter station fire has understandably been very tumultuous. The forecast capital expenditure program in this revenue proposal therefore reflects modifications and refinements relative to the November 2013 AMP.

3.3 Cost allocation

The Cost Allocation Methodology for Murraylink and Directlink was originally approved by the AER in July 2008. In December 2008, the Murraylink and Directlink assets were transferred from the APA Group to Energy Infrastructure Investments (EII). EII subsequently applied to the AER for the approval of minor amendments to the Methodology. In March 2010, the AER approved this revised Cost Allocation Methodology.[6]

The AER-approved Directlink cost allocation methodology requires that costs should be allocated according to the following procedure: 1) direct attribution of costs that are directly attributable to a particular asset, 2) causal allocation where a causal relationship can be ascertained, and only then 3) non-causal allocation over some reasonable basis.

In preparing the operating and capital expenditure records and forecasts accompanying this Proposal, Directlink has used the approved Cost Allocation Methodology on both a historical and prospective basis.[7] This document is submitted as Attachment 3.2 to the Proposal.

The Cost Allocation Methodology and related procedures are regularly reviewed to ensure compliance to statutory, taxation and regulatory requirements while meeting Directlink's business reporting needs.

3.4 Interaction between operating and capital expenditure

Rule S6A.1.3(1) requires that a Revenue Proposal identify and explain any significant interactions between capital and operating expenditure.

Directlink is unlike a conventional transmission business in that it comprises a single transmission line, albeit one employing advanced technology. There are a small number of capital expenditure projects proposed related to improving the reliability of the link, and a limited number of capital expenditure projects mainly associated with:

- maintaining statutory and Occupational Health and Safety (OHS) compliance; and
- the refurbishment of secondary systems such as water supplies and ventilation systems.

Where a proposed capital project has been identified which would involve a significant interaction between capital and operating expenditure, this has been addressed in the associated business case, and the forecast of operating expenditure is consistent with the suite of capital expenditure projects proposed.

An example is the reliability strategy to replace longer segments of cable in response to a cable fault. This increases the capital cost associated with the cable itself, and the operating costs associated with excavation, site remediation, etc.

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6 Australian Energy Regulator, *Final decision - Electricity Transmission Network Service Providers - Directlink & Murraylink amended Cost Allocation Methodologies*, March 2010.

7 One minor refinement applies: insurance is now allocated on a causal basis rather than using a non-causal allocator.

3.5 Capitalisation policies

Directlink's capitalisation policies are the same as those approved by the AER in the recent Murraylink review, and have not changed during the current regulatory control period. Nor, at this time, is Directlink proposing to change its capitalisation policies during the next regulatory period.

3.6 Related parties

Directlink confirms that there are no material related party transactions whose costs are attributed to prescribed transmission services. All related party transactions are made on normal commercial terms and conditions and on an arms-length basis. All transactions are also consistent with Directlink's Cost Allocation Methodology and are disclosed in the annual regulatory financial statements in accordance with the AER's Information Guidelines.[8]

8 AER, *Electricity Transmission Network Service Providers Information Guidelines*, September 2007.

4 Historic cost and service performance

4.1 *Introduction*

This Chapter presents a review of Directlink's historical capital and operating costs and service performance, during the current regulatory control period. While the previous regulatory period covered a span of 10 years, the first part of that period was subject to different ownership. As EII does not have access to the relevant historical information for this period, the information discussed in this chapter focuses on the last five years of the regulatory period.

Audit reviewed results are available and have been quoted for the three years from 2010/11 to 2012/13. A part-year estimate has been used for 2013/14 and a full year estimate for 2014/15.

This analysis includes the comparison of Directlink's capital and operating expenditure outcomes against the AER allowance. This is followed by a review of performance under the AER's Service Target Performance Incentive Scheme (STPIS).

4.2 *Historic capital expenditure*

In its March 2006 Determination, the AER made no allowance for any capital expenditure by Directlink[9]. Whilst there have not been any planned replacements of major items of plant, there have been a number of minor projects required during the current regulatory control period, to maintain the serviceability and performance of the link. The ancillary assets essential for the operation of the link (pumps, fans and other rotating machinery) have useful lives much shorter than the primary equipment.

The historic capital expenditure is outlined in Table 4.1.

Table 4.1 – Historic capital expenditure

F/Y ending June ($000 nominal)	2011	2012	2013	2014E	2015F
Regulatory Allowance	0	0	0	0	0
Actual Expenditure (as incurred)	2,061	1,561	966	1,831	3,170
Difference	2,061	1,561	966	1,831	3,170

Directlink has included this capital expenditure in the roll-forward of the RAB, as outlined in Chapter 4.4.1.

9 AER, *Directlink Joint Venturers' Application for Conversion and Revenue Cap - Decision* 3 March 2006, p30.

4.2.1 Capital expenditure variance

As the 2006-15 determination featured a zero forecast for capital expenditure, any incurred capital expenditure will represent an overspend.

The more significant expenditure in the final years in part reflects the activity undertaken in response to the August 2012 converter station fire. This includes replacement of the reactor "igloos" to address partial discharge tracking, as discussed below. Other key drivers of the variance between forecast and actual capital expenditure are discussed in this section.

Easements

In 2005/6 and 2006/7 Directlink (prior to APA acquisition) finalised acquisition of the easements for the Mullumbimby and Bungalora converter station sites, at a cost of $0.86m.

Ongoing IGBT and cable joint replacement

Over the 2006-15 period, Directlink incurred costs associated with replacement of failed IGBTs ($1.35m) and repair of cable faults and the requisite cable joints used in the repair ($3.56m). These are capitalised in accordance with the Directlink capitalisation policy.

2013/14 Igloo replacement

Following a routine inspection of converter stations 2 and 3 in August 2013, evidence of partial discharge "tracking" in the domed fibreglass converter station reactor covers (known as "igloos") was found.

Historically, this "tracking" had been removed from the fibreglass surface and the igloo returned to service. The tracking was removed through a process of abrading the fibreglass dome ("igloo") to remove any evidence of tracking, and rehabilitating the fibreglass structure. This process was developed in consultation with the manufacturer and had been completed a number of times as part of routine annual maintenance over a number of years. It is acknowledged that this process was addressing the impact of an underlying design flaw in the equipment.

As discussed above, the cause of the 2012 converter station fire is indeterminate. Therefore, as a precautionary measure, Directlink took the remaining two circuits offline while repair options were investigated. Directlink concluded that the normal rehabilitation process may not be sufficient to ensure the ongoing safe and reliable operation of the asset.

A permanent solution (the "Gotland solution") is being proposed (see section 8.7). However, this solution requires engineering analysis and redesign, followed by construction, all of which require to implement. In the meantime, the Directlink interconnector would otherwise have to remain offline. This presented a problem in that the national electricity grid requires Directlink's capacity to manage the peak loads and provide system security.

A decision was made to implement a short term solution to replace the "igloos" on the four operating converter stations with new fibreglass domes as a strategy to have two circuits of the interconnector returned to service for the 2013/14 summer. This short term strategy avoided the up-front time required for engineering analysis and redesign.

This work was completed in the 2013/14 year at a cost of $1.72m. The efficacy of this solution is being monitored.

Gotland solution pilot project

As discussed above, the igloo replacement is considered a relatively short term solution to return 2 circuits to service while engineering assessment and design is completed on a permanent solution. The igloo replacement project was undertaken on four converter stations; following the Mullumbimby fire, converter 1 at Bungalora is not in service, and igloos were not replaced on that converter.

As discussed above, the Gotland Solution requires considerable engineering assessment and design work to be undertaken before it would be prudent to implement. As the Bungalora System 1 converter station is currently out of service, Directlink has the opportunity to undertake a trial of the Gotland solution without taking any of the other circuits off line. The effectiveness of the solution can then be assessed through testing on converter 1 at Bungalora. Once the Mullumbimby 1 converter 1 reconstruction is complete and System 1 comes back on line, the solution can be finally confirmed.

This pilot project will give Directlink the opportunity to evaluate the performance of the Gotland solution under operating conditions (in preference to the second computer model based study) and give it the flexibility to modify the cooling system operating regime to overcome any observed temperature anomalies under actual operating conditions.

The works on Bungalora converter 1 are being undertaken in parallel with the Mullumbimby Station 1 reconstruction, in the 2014/15 regulatory year, at a cost of $1,352,000.

Asset management system

In the Murraylink determination, the AER agreed to the funding of 50% of an asset management system, FRACAS.[10] This system has been deployed as the primary asset management system for both Murraylink and DirectLink. DirectLink has

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[10] AER, *Final decision - Murraylink Transmission determination 2013-14 to 2017-18*, April 2013, p. 20.

therefore included the remaining 50% of the cost of this asset management software in the historic capital expenditure of this Proposal.

4.3 Historic operating expenditure

The regulatory allowance for operating expenditure during the current regulatory control period is compared with the actual and forecast expenditures in Table 4.2. The regulatory allowance provided in the Determination has been adjusted for out-turn and current forecast inflation.

The actual operating expenditures in Table 4.2 have been subdivided into the same categories as the forecast operating expenditures in Chapter 9, reflecting the principal cost drivers.

Table 4.2 – Historic operating expenditure

F/Y ending June ($000 nominal)	2011	2012	2013	2014E	2015F
Regulatory Allowance (indexed)	**2,261**	**2,208**	**2,027**	**2,027**	**2,025**
Operating and maintenance costs	2,391	2,327	2,379	2,431	2,824
Management fees and expenses	416	367	398	373	416
Insurance	353	355	489	658	1,267
Tax on property and capital	3	8	9	9	9
Accounting/audit fees	9	0	9	11	10
Other	4	-99	79	1	1
Total Actual opex	**3,176**	**2,958**	**3,363**	**3,483**	**4,527**
Difference	(915)	(750)	(1,336)	(1,456)	(2,502)

In December 2008, a Commercial Service Agreement was entered into between the APA Group and EII. As part of this Agreement, APA provides accounting and other business services for a fee, which is shown under "Management Fees and Expenses". The efficiency of this arrangement is discussed in more detail in section 9.6 and in Attachment 9.4.

4.3.1 Operating expenditure variance

As the historical capital expenditure forecast was prepared by another entity prior to APA acquisition of the Directlink asset, detailed information is not available to identify the drivers of the 2006-15 forecast. However, based on the operating experience with the asset, Directlink operational management is able to surmise the following key differences between the basis on which the 2006-15 operating expenditure was prepared, and the ensuing actual experience.

The Directlink HVDC Light interconnector was originally characterised as a very low maintenance, unmanned asset. Directlink presumes that this characterisation is reflected in the 2006 operating expenditure forecast.

As discussed in the PSC risk assessment report (Attachment 9.2) and the Phacelift bottom-up cost study (Attachment 9.3), the actual experience over the ten-year period has been quite different.

Phase reactor partial discharge tracking

Directlink understands that Country Energy (the previous owner), following the advice of the manufacturer, did not conduct inspections of the phase reactors. Only when APA acquired the asset was the partial discharge tracking found in the converter station igloos (discussed above). This discovery resulted in a new maintenance process being developed which could not have been envisioned in the original operating expenditure forecast.

Cable faults

As discussed in the Phacelift bottom-up cost study (Attachment 9.3), location and repair of cable faults in an intensive and consuming process. Since the Directlink system was commissioned in 2000 there have been 138 cable faults.

Cable faults were a recognised feature of the Directlink asset in the AER's 2006 determination, so it is reasonable to expect that some allowance for cable repair would be included in the 2006 operating expenditure forecast.

Directlink understands that the Country Energy cable fault strategy focused on transitions (from above- to under-ground and vice versa) and joint failures, based on the knowledge and experience available at that time. Importantly, faults of these types are relatively easy to locate. However, the ongoing experience has found cable faults occurring in clusters near previous repairs and aged joints, and also in straight sections of underground cable. Fault location and repair costs in underground cable are much higher.

Particularly in recent years, Directlink has been replacing much longer sections of cable as part of its cable reliability improvement strategy, and this is part of the reliability improvement strategy going forward.

Failures of IGBTs and control system optic fibre

Each converter station valve includes 148 IGBTs (there are 5,328 IGBTs in total). Should any five of those 148 fail, the converter trips off and the circuit disconnects.

As discussed in the PSC risk assessment report (Attachment 9.2), the Directlink converter stations were originally promoted as being unmanned and virtually maintenance free. It would be reasonable to expect then, that the allowance made in the 2006 operating expenditure allowance for IGBT replacements was not adequate for the level of IGBT replacement experienced during the 2006-15 regulatory period. There have been 207 IGBTs replaced in the years from 2009-2014 alone.

As discussed in the Phacelift bottom-up cost study (Attachment 9.3), IGBT replacement is a complex and time-consuming process. It should be noted that the cost of the replacement IGBT is capitalised as discussed above, but the cost of locating the failed IGBT and replacing it is an operating expenditure.

Two fibre optic cables connect each IGBT to the control system. If the control system cannot communicate with the IGBT through the fibre optic cable, it reports a failed IGBT. Currently, approximately 50% of reported IGBT failures are caused by degraded optic fibres. On many occasions, the fibre optic cable must be replaced along with the IGBT. It would be reasonable to assume that the costs associated with widespread fibre optic cable failures and replacing failed fibres was not included in the 2006 operating expenditure forecast.

Insurance

As discussed more fully in section 9.8.3, the risk associated with insuring the Directlink interconnector was re-assessed by Directlink's insurance carriers following the 2012 converter station fire. This caused a significant increase in insurance costs.

Good Electricity Industry Practice Review

As discussed more fully in section 9.3, Directlink undertook a comprehensive review of its operations following the 2012 Mullumbimby converter station fire to ensure that it was operating the asset in accordance with Good Electricity Industry Practice. The review recommended a number of procedural and documentation changes, the impacts of which are reflected in the 2014/15 forecast costs in particular.

4.4 Historic Service Target Performance Incentive Scheme

In 2007, the AER imposed its Service Target Performance Incentive Scheme (STPIS) on Directlink.[11] Although the scheme has subsequently been modified on two occasions, the Transmission Circuit Availability parameter has applied

11 Australian Energy Regulator, *First Proposed Electricity Transmission Network Service Providers Service Target Performance Incentive Scheme* - Version No: 01, January 2007.

consistently to Directlink since 2008. No Market Impact Component applied during the 2006-15 regulatory period.

The historic availability performance against the STPIS target is set out in Table 4.3, along with the financial impact of the scheme. The STPIS operates on a calendar year basis.

Table 4.3 – Historic Service Target Performance Incentive

Calendar year	2009	2010	2011	2012	2013[12]
Scheduled Circuit Availability	99.45%	99.45%	99.45%	99.45%	99.45%
Actual Circuit Availability	98.94%	97.74%	99.14%	98.56%	99.84%
S Factor component	-0.28%	-0.30%	-0.17%	-0.30%	0.23%
Target Forced Peak Circuit Availability	99.23%	99.23%	99.23%	99.23%	99.23%
Actual Forced Peak Circuit Availability	91.47%	78.64%	82.62%	77.76%	70.54%
S Factor component	-0.35%	-0.35%	-0.35%	-0.35%	-0.35%
Target Forced Off-peak Circuit Availability	99.23%	99.23%	99.23%	99.23%	99.23%
Actual Forced Off-peak Circuit Availability	94.99%	87.97%	90.83%	89.51%	61.91%
S Factor component	-0.35%	-0.35%	-0.35%	-0.35%	-0.35%
Composite S-Factor	-0.98	-1.0	-0.87	-1.0	-0.47
S-Factor Bonus/Penalty ($)	-122,128	-126,561	-112,005	-130,218	-61,792

As discussed in section 1.6, the poor performance shown in calendar 2012 and 2013 is a direct result of one circuit being offline since the converter station fire in August 2012, and the remaining circuits being offline from August to December 2013 while the converter station igloos were being replaced.

12 Subject to AER confirmation.

4.4.1 Reliability and strategies for improvement

The above STPIS results evidence a level of historical reliability below that which is reported by other TNSPs. There are two different types of faults causing reductions in reliability and availability: the first is a cable fault, which can cause a single circuit to be offline for a number of days; the second is a more serious fault at a converter station, which could result in a catastrophic failure and result in that circuit (and potentially other circuits) being off line for an extended period.

These faults have different causes and consequences, and Directlink has developed fit-for-purpose strategies to target these causes, as discussed below.

Cable faults

The 59 km cable route consists of 6 cables connecting Mullumbimby and Bungalora (a pair of cables for each of the three converters). The cables are installed partly above ground in Galvanised Steel Trough (GST) and partly underground where they are buried directly in the soil.

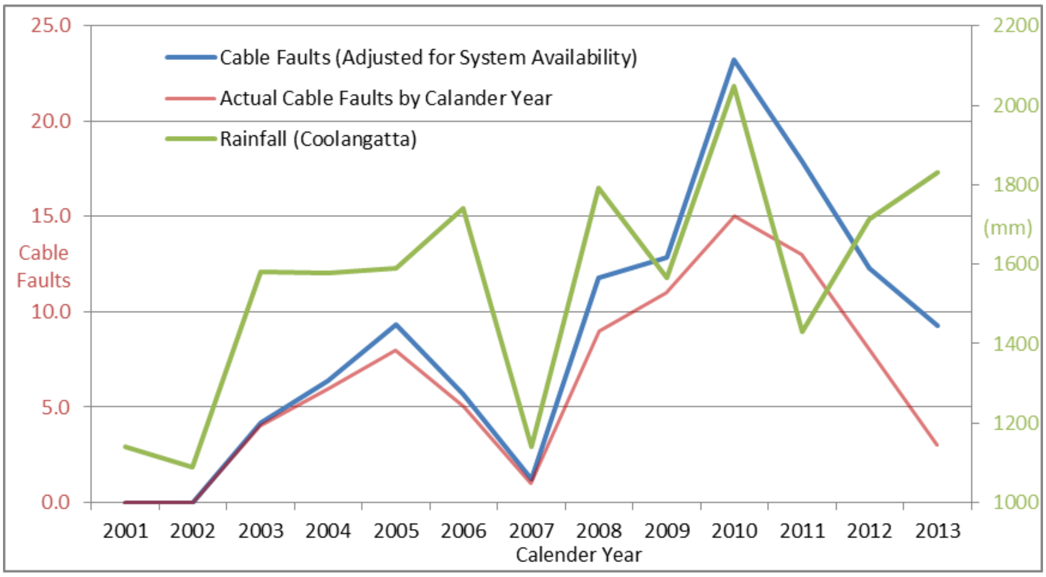
Each cable consists of a central conductor (tightly bundled strands of aluminium) surrounded by an insulating layer of cross linked polyethylene. On the outside of the insulating layer is a conducting cable screen which is connected to ground. An outer hard plastic sheath provides protection for the cable screen.

A cable fault occurs when a short circuit appears between the central conductor and the cable screen. An immediate consequence of the fault is that a large current flows through the short circuit until the control system at the converter station detects the fault and shuts down ("trips").

While the root cause of the cable faults is unknown, some possibilities include:

- Water ingress into the cable weakening the insulation. There appears to be a correlation between cable faults and rainfall, as shown in the chart below:

Figure 4.1 – Rainfall and cable faults



The originally installed cable joints were designed for AC cables, and experienced a high rate of failure allowing moisture to enter the cable. Subsequently special cable joints for use on DC cables have been released. All cable repairs use the new DC joints.

- Continuous cable flexing caused by the natural expansion and contraction of the clay soil during wet and dry periods respectively;
- Mechanical cable stresses caused by variations in temperature exposure between the above- and below-ground sections of the cable, particularly in transitional areas;
- Cable stresses caused by heating/expansion and cooling/contraction occurring at different loads.

Since the Directlink system was commissioned in 2000 there have been 138 cable faults. Over that time, Directlink has developed effective strategies and procedures for locating the fault and mobilising crews and contractors to repair the cable. As cable faults are stochastic in nature, a fast and effective reactive strategy is fit for purpose.

Historically, cable repairs focused on a short section of the cable surrounding a fault. Particularly where water ingress was observed, experience has shown that another fault often occurs nearby. Directlink has now developed a strategy to replace longer segments of cable during cable repair operations, particularly where a longer replacement segment can also replace an aged cable joint. As shown in the chart above (indicating rising rainfall and falling cable faults) this strategy appears to be delivering positive outcomes.

This strategy presents additional costs, which are reflected in the operating and capital expenditure forecasts.

Converter station faults

In contrast to cable faults, converter station faults have the potential to result in catastrophic failure, as experienced in the August 2012 Mullumbimby converter station fire. In this particular case the affected circuit will be off line for up to three years as specialist replacement equipment is manufactured overseas. The cost of recovering from a fault such as this is significant. Faults of this nature also have the potential to affect adjacent equipment, and potentially affect more than one circuit. Faults of this nature are infrequent.

Given the significant impact and low frequency of faults of this nature, a reactive strategy (such as applied to cable faults) is inappropriate. A more risk-focused strategy is required that focuses on preventive action in the first instance, and ensuring the converter station can return to service quickly should an incident occur.

The infrequency of faults and the specialised nature of the equipment conspire to restrict the global knowledge base of fault causes and preventive or corrective action. In this regard, heavy reliance is placed on the original equipment manufacturer to provide specialist technical engineering diagnosis and advice related to this equipment.

Directlink's experience has been that the OEM (ABB) has been difficult to engage to assist with fault diagnosis and correction, and this has led to extended periods in which parts of the asset have been offline, or where reliance has been placed on emergency spare equipment for inappropriately long periods. Directlink therefore proposes to engage in a firm service contract with ABB to ensure prompt response to requests for technical advice and diagnostic assistance to ensure that outages to the converter station equipment can be minimised. The costs associated with this engagement are reflected in the operating cost forecast.

In light of the 2012 converter station fire, Directlink has undertaken a comprehensive review of the risks associated with the operation and maintenance of the converter stations,[13] and has implemented a series of new procedures to address this heightened assessment of risks.[14]

There are some capital and operating costs associated with these new operating and maintenance procedures, which have been reflected in the operating and capital expenditure forecasts in this submission.

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13 See PSC report, *Directlink Operating Cost Risk and Cost-Benefit Assessment*, Attachment 9.2.

14 See PSC report, *Directlink HVDC Facility Good Electricity Industry Practice (GEIP) Review of Operations and Maintenance*, Attachment 9.1.

5 Regulatory asset base

5.1 Introduction

This Chapter explains how Directlink has determined the proposed opening Regulatory Asset Base (RAB) for the new regulatory control period.

S6A.1.3(5) requires Directlink to provide a completed asset Roll Forward Model (RFM) to accompany its Proposal. The RFM forms Attachment 5.1 to this Proposal.

5.2 Roll forward methodology

The opening RAB as at 1 July 2005 was established by the AER in its Directlink 2006-15 revenue cap Decision, at $116.68 million.[15] This amount is also codified in Rule S6A.2.1(c)(1).

From that starting point, Directlink has calculated the value of its opening RAB as at 1 July 2015. The annual adjustments to the RAB included:

- Increase by the amount of capital expenditure incurred during the current regulatory control period, to 2012/13;
- Increase by the estimated amount of capital expenditure for 2013/14 and 2014/15;
- Reduction by the amount of depreciation of the RAB, using the rates and methodologies allowed for in the AER's 2006 Directlink conversion and revenue cap Decision in accordance with Rule S6A.2.1(f)(5);[16]
- Reduction by the value of assets disposed during the current regulatory period; and
- Indexation by CPI.

These adjustments have been calculated using the AER's RFM included as Attachment 5.1.

15 AER, *Directlink Joint Venturers' Application for Conversion and Revenue Cap Decision* 3 March 2006, p. 30.

16 The previous value of the regulatory asset base must be reduced by the amount of depreciation of the regulatory asset base during the previous control period, calculated in accordance with the rates and methodologies allowed in the *transmission determination* (if any) for that period.

5.3 Regulatory Asset Base as at 1 July 2015

The outcome of applying the AER's roll forward methodology and RFM is an opening RAB for Directlink of $129.76 million, for the 2015-20 regulatory control period. This calculation is set out in Table 5.1.

Table 5.1 – Opening RAB as at 1 July 2015

F/Y ending June ($m)	2006	2007	2008	2009	2010	2011	2012	2013	2014E	2015F
Opening RAB	116.68	119.16	119.72	121.52	121.11	121.13	123.78	123.73	123.78	127.39
Capex	2.11	0.85	0	0.01	0.02	2.21	1.71	0.74	3.86	3.17
Depreciation	-3.11	-3.20	-3.28	-3.42	-3.50	-3.60	-3.72	-3.78	-3.87	-3.99
Indexation	3.48	2.90	5.08	3.00	3.50	4.04	1.96	3.10	3.63	3.18
Closing RAB	119.16	119.72	121.52	121.11	121.13	123.78	123.73	123.78	127.39	129.76

6 Cost of capital

This chapter outlines Directlink's calculation of the proposed return on equity, return on debt and allowed rate of return, for each regulatory year of the regulatory control period, in accordance with clause 6A.6.2.

6.1 Introduction

The Return on Capital section of the National Electricity Rules was significantly modified as a result of an extensive Rule change process spanning 2012 and 2013. Today, the key feature of the Rules is the allowed rate of return is to be determined such that it achieves the Allowed Rate of Return Objective in Rule 6A.6.2(c):

> (c) The *allowed rate of return objective* is that the rate of return for a *Transmission Network Service Provider* is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the *Transmission Network Service Provider* in respect of the provision of *prescribed transmission services* (the *allowed rate of return objective*).

New Rule 6A.6.2(m) also requires the AER to produce a *Rate of Return Guideline*, the scope of which is set out in Rule 6A.6.2(n). The AER published its first *Rate of Return Guideline* in December 2013.

The AER's *Guideline* is not mandatory.[17] However, if the AER makes a transmission determination that is not in accordance with the guideline, the AER must state, in its reasons for the transmission determination, the reasons for departing from the guideline. Similarly, where the TNSP proposes to depart from the Guideline, Rule S6A.6.1.3(4A) requires it to identify any departure from the Guideline and the reasons for that departure.

For the proposed return on equity, return on debt and allowed rate of return, Directlink does not propose to depart from the AER's *Rate of Return Guideline*.

However, Directlink does propose to depart from the AER's *Rate of Return Guideline* in the calculation of the tax allowance, as discussed more fully in chapter 7.

6.2 Proposed Rate of Return

The proposed rate of return applied for the purpose of this submission is calculated using a Weighted Average Cost of Capital approach, and applying the Sharpe-Lintner Capital Asset Pricing Model for the purposes of calculating the required return on equity, in accordance with the AER's *Rate of Return Guideline,* in which*:*

17 Rule 6A.2.3(c).

- Risk free rate is to be based on the annualised yield on 10-year Commonwealth Government bonds, for an agreed or specified period; [18]
- Equity beta: 0.7[19]
- Market risk premium: 6.5%[20]
- Gearing: 60%[21]
- Credit rating: BBB+[22]

Directlink has adopted these parameter values for the purposes of this Proposal.

6.2.1 Nominal risk free rate

The AER's Rate of Return Guideline provides that the AER proposes to adopt a forward looking risk free rate that is commensurate with prevailing conditions in the market for funds as close as practicably possible to the commencement of the regulatory control period.

The risk free rate is to be derived from the yield on Commonwealth Government Securities (CGS) with a 10 year term, observed over a short (specifically, 20 consecutive business days in length) averaging period as close as practicably possible to the commencement of the regulatory control period.

The AER's Final Transmission Determination will be based on observations of the yield on 10 year CGS as close as practicably possible to the commencement of the regulatory control period – that is, as close as practically possible to 01 July 2015. This submission therefore proposes a "placeholder" risk free rate for the purposes of determining Directlink's proposed return on capital and revenue requirement for the 2015-20 regulatory period.

For the purposes of this submission, Directlink proposes to use 4.3 per cent, the same risk free rate as applied in the AER's March 2014 transitional determinations for TransGrid and Transend.[23]

Directlink has nominated the period to be used by the AER to calculate the nominal risk free rate for the purposes of calculating the return on equity to apply to the 2015-20 regulatory period. This information was provided to the AER on a confidential basis, and will not be disclosed prior to the release of Directlink's Final Determination. Directlink reserves the right to nominate an alternative period within

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18 AER *Rate of Return Guideline* p15.

19 AER *Rate of Return Guideline* p15.

20 AER *Better Regulation - Explanatory Statement - Rate of Return Guideline*, December 2013, p93.

21 AER *Rate of Return Guideline* s4.3.2.

22 AER *Rate of Return Guideline* s6.3.3.

23 AER, *TransGrid, Transend - Transitional transmission determinations 2014–15,* March 2014, p39.

a reasonable timeframe, in the event that market conditions within the proposed averaging period appear abnormal.

6.2.2 Return on debt

Rule 6A.6.2(h) requires that

> (h) The return on debt for a *regulatory year* must be estimated such that it contributes to the achievement of the *allowed rate of return objective*.

The AER's *Rate of Return Guideline*[24] proposes the following estimation procedure for estimating the prevailing return on debt for each service provider during the averaging period using:

- the published yields from an independent third party data service provider;
- a credit rating of BBB+ from Standard and Poor's or the equivalent rating from other recognised rating agencies; and
- a term to maturity of debt of 10 years (or extrapolated to a 10 year equivalent)

The AER also proposes that the return on debt be updated each year of the regulatory period as outlined in section 6.3.1 of the Guideline, subject to transitional arrangements outlined in section 6.3.2.

Directlink does not propose to depart of the *Rate of Return Guideline* for the purposes of calculating the cost of debt.

For the purposes of this submission, Directlink proposes to apply a nominal Pre-tax Cost of Debt of 7.50 per cent, the same rate as applied in the AER's March 2014 transitional determinations for TransGrid and Transend.[25]

The cost of debt is the sum of the risk free rate and the debt risk premium (DRP). The purpose of the DRP is to compensate the additional cost of debt financing a benchmark regulated network asset, above the yield on Australian government debt which is deemed to be risk free.

For the purposes of this submission, the Debt Risk Premium is 3.20 per cent, consistent with the recent TransGrid transitional determination. Both the risk free rate and the debt risk premium will be updated over an averaging period closer to the date of the AER's Final Determination.

The transitional approach to estimating the cost of debt

The AER's *Rate of Return Guideline* proposes long and complex transitional arrangements to move from the current "on-the-day" approach to the envisioned

[24] AER *Rate of Return Guideline* s6.3.3.

[25] AER, *AER transitional decision - TransGrid post tax revenue model (PTRM) cell WACC!F11.*

trailing average approach.[26] Under this approach, the AER proposes to assess the allowed cost of debt initially using the “on the day” approach, gradually eroding the weight applied to that measure each year over a ten-year transition to the trailing average approach.

Directlink notes that the Reserve Bank of Australia (RBA) has now published a reliable data series of ten-year bond yields going back ten years. This was not available at the time the AER issued its Rate of Return Guideline.

As discussed more fully in Attachment 6.1, the RBA data set would allow the AER to move immediately to the trailing average approach to calculating the cost of debt.

Directlink is concerned that the long transitional approach adds additional and needless complexity to the regulatory regime, and indeed may not satisfy the Allowed Rate of Return Objective and the Revenue and Pricing Principles.

Directlink submits that, considering independent and reliable data is currently available to allow an immediate transition to the trailing average approach, it is incumbent on the AER to implement this approach immediately and dispense with the transitional process.

6.3 Forecast inflation

For the purposes of calculating the allowed rate of return for this submission, Directlink has adopted the 2.5% forecast inflation rate applied by the AER in the TransGrid and Transend transitional decision of March 2014.

[26] AER, *Better Regulation Rate of Return Guideline* December 2013 s6.3.2.

6.4 WACC calculation: summary

For the purposes of this submission, a summary of the relevant parameters for calculation of the rate of return is included in Table 6.1.

Table 6.1 – Proposed WACC parameters

Nominal Risk Free Rate	Rf	4.30%
Real Risk Free Rate	Rrf	1.73%
Inflation Rate	f	2.5%
Cost of Debt Margin	DRP	3.20%
Nominal Pre-tax Cost of Debt	Rd	7.50%
Real Pre-tax Cost of Debt	Rrd	4.85%
Market Risk Premium	MRP	6.50%
Corporate Tax Rate	T	30.00%
Proportion of Equity Funding	E/V	40.00%
Proportion of Debt Funding	D/V	60.00%
Equity Beta	βe	0.70
Post-tax Nominal Return on Equity (pre-imp)		8.90%[27]
Post-tax Real Return on Equity (pre-imp)		6.24%
Nominal Vanilla WACC		**8.06%**
Real Vanilla WACC		5.42%

Consistent with clause 4.3.3 of the AER *Rate of Return Guideline*, Directlink proposes that the overall rate of return should be updated annually in line with annual adjustments to the cost of debt. However, Directlink proposes that the expected return on equity should not be updated for the duration of the regulatory control period.

[27] Rounded to one decimal place as per the AER Guideline.

7 Tax

A separate allowance is made in the revenue cap for corporate income tax, net of the value ascribed to dividend imputation credits. The notional taxable income and tax payable, taking into account deductions for tax depreciation calculated from the tax asset base, are derived from the Post Tax Revenue Model (PTRM).

As discussed in section 10.2, Directlink proposes to align the remaining lives of the cable and converter stations as was approved in the recent Murraylink decision. The remaining tax asset lives have been similarly aligned, again consistent with the AER's views on Murraylink.

7.1 Value of imputation credits

Directlink's submission on the value of imputation credits, and a supporting expert consultant report, are included as Attachment 7.1 and Attachment 7.2 respectively.

Gamma (γ) is defined in Clause 6A.6.4 of the Rules as "*the value of imputation credits*".

Directlink considers that it is clear that what is required under the NER is an estimate of the value of imputation credits to investors in the business. This interpretation is consistent with the broader regulatory framework and the task set by the Rules to determine total revenue, as well as past regulatory practice, and previous decisions of the Australian Competition Tribunal (Tribunal).

This is also the interpretation that best achieves the National Electricity Objective (NEO), as it ensures that the adjustment for imputation credits in the taxation building block properly reflects the actual value of imputation credits to investors, not merely their notional face value or *potential* value. Accounting for gamma in this way ensures that the overall return received by investors (including the value they ascribe to imputation credits) is sufficient to promote efficient investment in, and use of, infrastructure, for the long-term interests of consumers.

Directlink proposes to calculate gamma in the orthodox manner, as the product of:

- the distribution rate (i.e. the extent to which imputation credits that are created when companies pay tax, are distributed to investors); and
- the value of distributed imputation credits to investors who receive them (referred to as theta).

Directlink proposes a distribution rate of 0.7, which is consistent with the AER's Rate of Return Guideline. Recent empirical evidence continues to support a distribution rate of 0.7.

Directlink proposes a value for theta of 0.35. The reasons why Directlink is proposing a different value for theta to that in the Rate of Return Guideline include:

- Directlink does not agree with the conceptual framework adopted by the AER for estimating theta, and in particular the focus on utilisation evidence, rather than market value evidence. The AER's approach is not consistent with the NEO. It does not measure the required return for the purposes of promoting efficient investment, and would lead to underinvestment;
- In order to provide an acceptable overall return to equity holders, theta must be estimated as the value of distributed imputation credits to equity-holders. This is the conventional and orthodox approach to estimating theta. It is also the approach which best gives effect to the NEO, as it provides for recognition of the value to equity-holders of imputation credits and provides for overall returns which promote efficient investment.
- There are compelling reasons why the benefit of imputation credits, which is the amount by which the allowable return otherwise calculated in accordance with the Rules should be reduced, is significantly less than the face value of imputation credits or the utilisation of imputation credits. However, these were not considered in the Rate of Return Guideline.
- The value for theta proposed by Directlink accords with what one would expect to be the additional benefit conferred by the system of imputation credits. The value of theta proposed in the Rate of Return Guideline does not;
- There are overwhelming problems with the taxation statistics and other forms of evidence given primary emphasis in the Rate of Return Guideline. They are, and are well recognised to be, simply unreliable. Further, a key piece of evidence used by the AER (Handley and Maheswaran (2008)) is not an empirical study at all (because the data was not available), but merely involves an assumption of full utilisation by domestic investors; any reliance upon it involves obvious error;
- The only source of evidence capable of providing a point estimate for the value of distributed imputation credits to investors is market value studies. Evidence of utilisation rates (or potential utilisation rates, as indicated by the equity ownership approach) can only indicate the upper bound for investors' valuation of imputation credits. The conceptual goalposts approach referred to by the AER provides no relevant information on the actual value of credits; and
- The best estimate of investors' valuation of imputation credits from market value studies is 0.35.

Combining a distribution rate of 0.7 with a theta estimate of 0.35 produces a value for gamma of 0.25.

Directlink's reasons for proposing a different value for theta to that in the Rate of Return Guidelines are elaborated in Attachment 7.1.

7.2 Summary

As required by the Rule 6A.6.4 the taxation allowance was calculated using the following formula:

$ETC_t = (ETI_t \times r_t)\ (1 - \gamma)$

- ETI_t is an estimate of the taxable income a prudent and efficient TNSP would earn in a particular year (t) as a result of providing the same prescribed transmission services as the TNSP under review
- r_t is the expected statutory income tax rate for that regulatory year as determined by the AER, currently 30%
- γ is the value of imputation credits, determined to be 0.25 as discussed above and in Attachment 7.1.

Directlink has used the AER's PTRM to calculate the net taxation allowance, summarised in Table 7.1.

Table 7.1 – Tax allowance 2015-20

F/Y ending June (000)	2016	2017	2018	2019	2020
Tax allowance	764	817	871	922	979

8 Forecast capital expenditure

8.1 Introduction

This Chapter contains Directlink's capital expenditure forecasts for each year of the 2015-20 regulatory control period, as well as the total for the period. The Chapter also describes the capital expenditure categories used and the methodology adopted to forecast the capital expenditure. The major inputs and assumptions underpinning the forecasts are explained.

The major projects that contribute to the capital expenditure forecast are described. The forecast capital expenditure is then demonstrated to be efficient.

No contingent projects are proposed.

The AEMO 2013 *National Transmission Network Development Plan for the National Electricity Market* (NTNDP) modelling has not identified a requirement for major investment in inter-regional augmentations following the completion of the Victoria–South Australia (Heywood interconnector) augmentation. The Directlink Revenue proposal does not propose any augmentation.

8.2 Rule requirements

The information and matters relating to capital expenditure that must be provided in Directlink's Proposal are set out in Rules 6A.6.7 and schedule S6A.1.1. The proposed capital expenditure must:

- Meet the capital expenditure objectives;
- Be allocated to prescribed transmission services in a manner consistent with the Cost Allocation Methodology;
- Include both total and year-by-year forecasts; and
- Be a reliability augmentation, or have satisfied the AER's Regulatory Investment Test (RIT), if required.

The Proposal should also include capital expenditure required in relation to contingent projects, of which there are none.

No capital expenditure corresponding to augmentations or for projects that have satisfied the RIT has been identified.

Rule S6A.1.1(7) requires the TNSP to provide "an explanation of any significant variations in the forecast capital expenditure from historical capital expenditure." Directlink considers that this is a meaningful requirement in a mature "steady state" system with recurrent capital expenditure programs. However, Directlink is a single asset with stochastic capital expenditure requirements.

By way of analogy, an airline operating a large fleet of aircraft may need to replace a set of seats on at least one of its aircraft every year. Over time, this will reveal a reasonably smooth and predictable level of ongoing capital expenditure. However, an airline with a single aircraft will face a spike in its capital expenditure levels in the year in which its single aircraft requires seat replacement. While there are some aspects of the capital expenditure program that are expected to stabilise (such as cable repairs and IGBT replacements), the majority of projects outlined below are stochastic in nature.

It should also be noted that Directlink is facing a number of “end-of-life” projects, notably the replacement of the technically obsolete control system, which would not have been included in the historical capital expenditure.

8.3 Capital expenditure objectives

The capital expenditure that Directlink has proposed is required to:

- Maintain the full capacity of the link, for the duration of the regulatory control period;
- Continue to comply with the range of applicable regulatory obligations described in Section 2.2;
- Maintain the security of supply of prescribed transmission services, in accordance with its obligations under the Rules; and
- Maintain the reliability, safety and security of the transmission system through the continued supply of prescribed transmission services.

Directlink considers that this Revenue Proposal achieves the capital expenditure objectives set out in Rule 6A.6.7. Directlink also considers that the forecast of required capital expenditure reasonably reflects the efficient costs that would be incurred by a prudent network operator in meeting the capital expenditure objectives.

8.4 Capital expenditure categories

The demand for Directlink’s service will remain equal to its maximum capability during the new regulatory control period. The capital expenditure is therefore not growth related. Expenditure is directed at maintaining the maximum capability of the link with a high degree of reliability, whilst ensuring that all regulatory, statutory and legislative requirements are met.

The projects that go to make up the proposed capital expenditure program are associated with the following investment drivers:

- Refurbishment: The refurbishment or replacement of auxiliary equipment nearing the end of its useful life, necessary for the functioning of the link;
- Compliance: Meeting legislated and industry accepted safety and environmental standards; and

- Reliability: Improving Directlink's reliability and capability to support the operation of the interconnector.

To assist the AER's understanding of the capital expenditure program, capital expenditure projects have been subdivided into these three categories, reflecting their principal driver.

8.4.1 Reliability and strategies for improvement

As discussed in section 4.4.1, there are two different types of faults causing reductions in reliability and availability: the first is a cable fault, which can cause a single circuit to be offline for a number of days; the second is a more serious fault at a converter station, which could result in a catastrophic failure and result in that circuit (and potentially other circuits) being off line for an extended period.

These faults have different causes and consequences, and Directlink has developed fit-for-purpose strategies to target these causes, as discussed below.

Cable faults

The 59 km cable route consists of 6 cables connecting Mullumbimby and Bungalora (a pair of cables for each of the three converters). The cables are installed partly above ground in Galvanised Steel Trough (GST) and partly underground where they are buried directly in the soil.

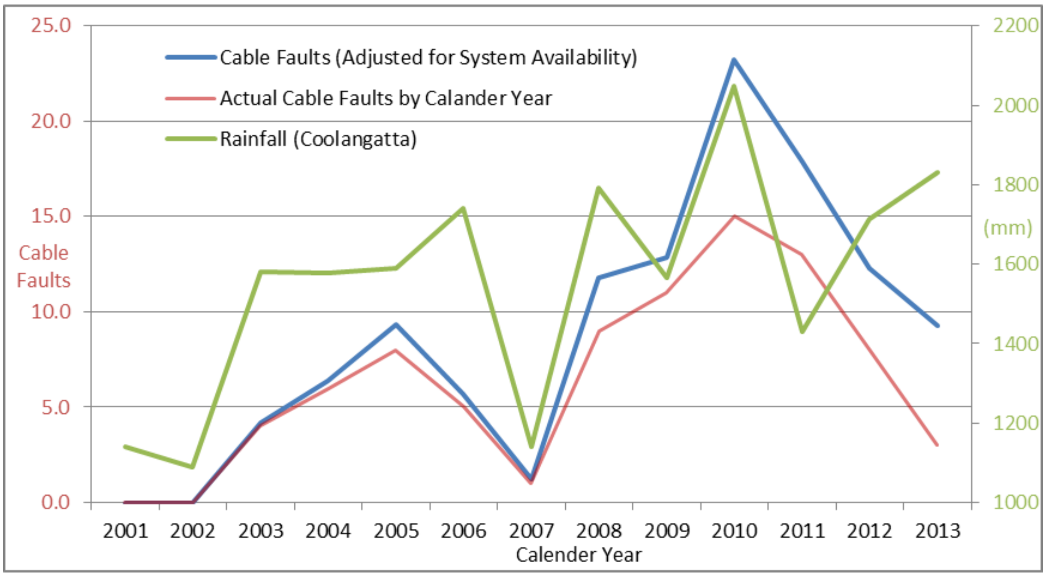
Each cable consists of a central conductor (tightly bundled strands of aluminium) surrounded by an insulating layer of cross linked polyethylene. On the outside of the insulating layer is a conducting cable screen which is connected to ground. An outer hard plastic sheath provides protection for the cable screen.

A cable fault occurs when a short circuit appears between the central conductor and the cable screen. An immediate consequence of the fault is that a large current flows through the short circuit until the control system at the converter station detects the fault and shuts down ("trips").

While the root cause of the cable faults is unknown, some possibilities include:

- Water ingress into the cable weakening the insulation. The originally installed cable joints were designed for AC cables, and experienced a high rate of failure allowing moisture to enter the cable. Subsequently special cable joints for use on DC cables have been released. All cable repairs use the new DC joints. There appears to be a correlation between cable faults and rainfall, as shown in the chart below:

Figure 8.1 – Rainfall and cable faults



- Continuous cable flexing caused by the natural expansion and contraction of the clay soil during wet and dry periods respectively;
- Mechanical cable stresses caused by variations in temperature exposure between the above- and below-ground sections of the cable, particularly in transitional areas;
- Cable stresses caused by heating/expansion and cooling/contraction occurring at different loads.

Since the Directlink system was commissioned in 2000 there have been 138 cable faults. Historically, cable repairs focused on a short section of the cable surrounding a fault. Particularly where water ingress was observed, experience has shown that another fault often occurs nearby. Directlink has now developed a strategy to replace longer segments of cable during cable repair operations, particularly where a longer replacement segment can also replace an aged cable joint. This strategy is delivering positive outcomes.

This presents additional costs associated with the cable replacement, which are reflected in the capital and operating expenditure forecasts.

Converter station faults

In contrast to cable faults, converter station faults have the potential to result in catastrophic failure, as experienced in the August 2012 Mullumbimby converter station fire. In this particular case the affected circuit will be off line for up to three years as specialist replacement equipment is manufactured overseas. The cost of recovering from a fault such as this is significant. Faults of this nature also have the potential to affect adjacent equipment, and potentially affect more than one circuit. Faults of this nature are infrequent.

Given the significant impact and low frequency of faults of this nature, a reactive strategy (such as applied to cable faults) is inappropriate. A more risk-focused strategy is required that focuses on preventive action in the first instance, and ensuring the converter station can return to service quickly should an incident occur.

The capital expenditure associate with the converter stations is focused on two strategies: first to prevent failures, and second to reduce the impact of any failures that may occur.

8.5 Forecasting methodology

Directlink's forecast of capital projects in the Refurbishment and Compliance categories was developed in the context of its asset management practices, which aim to ensure that the EII assets are designed, constructed, operated and maintained in an appropriate manner to ensure that they will continue to meet the required service levels efficiently and cost effectively.

These management practices and a description of the associated projects are included in the EII Asset Management Plan, of which an excerpt is provided in Attachment 3.1. This document has a 5-year planning horizon, and contains some information on planned projects.

As discussed in section 3.2, the most recent AMP was approved by the Board in November 2013. While an AMP can be viewed as a "steady state" plan, the period following the Mullumbimby converter station fire has understandably been very tumultuous. The forecast capital expenditure program in this revenue proposal therefore reflects modifications and refinements relative to the November 2013 AMP.

This has been supplemented with business cases for the projects that are expected to be required in the regulatory control period, in Attachment 8.1.

8.6 Key inputs and assumptions

8.6.1 Asset replacement/refurbishment framework

Directlink's asset management processes are described in the Asset Management Plan. This process calls for the:

- maintenance history;
- condition; and
- service performance;

of each component of equipment to be monitored.

Plans to replace or refurbish equipment components are formulated when:

- The service performance of the equipment deteriorates, to the point where it jeopardises the availability performance of the link; or
- Maintenance costs escalate, to the point where it becomes economic to replace or refurbish the equipment.

8.6.2 Project scope, cost and timing estimates

Directlink's approach to estimating the scope, cost and timing of the projects that comprise the capital expenditure program is set out in Table 8.1.

Table 8.1 – Project scope and cost estimates

Expenditure Category	Refurbishment	Compliance
Project Scope	All projects are relatively small in scope and readily specified.	
Project Timing	Based on equipment condition.	As soon as is reasonably practicable.
Project Cost Estimate	Based on similar minor works carried out for Directlink, or by obtaining a quotation for the work from existing service providers.	

8.6.3 Cost escalation

All forecast expenditures in this chapter are in real $2014/15 and exclude real cost escalation.

The cost escalators described in section 2.5 were used in preparing the capital cost forecasts. That is, no real cost escalation has been included pending the AER's decision.

8.7 Significant components of the capital expenditure program

The following projects form significant elements of the capital expenditure program. They are detailed in the supporting information that accompanies this Proposal. A selection of these projects are described below. These are described in more detail in the relevant business cases provided in Attachment 8.1.

Refurbishment program

The refurbishment program is termed "stay-in-business" capital expenditure. This program is required to ensure the ongoing serviceability of a range of ancillary equipment at the terminal stations of the links (such as fans, pumps, air conditioners). This equipment is essential to the continued reliable performance of the links. The program contains numerous periodic and one-off items of expenditure.

Many elements of ancillary equipment are duplicated, so that the links may be maintained in service (sometimes with reduced flow) whilst refurbishment is carried out. However the criticality of and access to some components requires the link to be shut down for maintenance.

Refurbishment of ancillary equipment is carried out on an as-needed basis, based on manufacturers' recommendations tempered by in-service experience and periodic condition assessment. The action taken for individual items of ancillary equipment can be either replacement or refurbishment, depending on the effectiveness of the refurbishment and which action is the most cost effective at the time.

The total cost of the refurbishment program is $10.1 (million, real 2014/15). This has been incorporated into the capital expenditure forecasts for the 2015-20 regulatory control period.

Directlink cooling system upgrade – "Gotland solution"

The reactor cooling systems use fans to circulate air from external to the reactor buildings through the electrical apparatus (unlike Murraylink and other designs that utilise a heat exchanger and circulate chilled water). Apart from being drawn through a filter screen, the air is not currently treated to remove small insects, moisture and dust particles.

This system has led to identified problems where impurities attracted by electrostatic fields are deposited on the insulating fibreglass cooling system parts, which leads to electrical tracking. In order to mitigate this issue, it is proposed to revise the reactor cooling system design as recommended by ABB, to a design developed for the link between the Swedish mainland and the island of Gotland.

The replacement reactor to be constructed at Mullumbimby will use updated cooling arrangements. As discussed above, one converter station at Bungalora will have been retrofitted during the 2014/15 regulatory year. The cost of cooling system revisions for four remaining reactor stations (two at each of Terranora and Mullumbimby) is forecast to be $2.3 million.

This project has been subject to considerable engineering analysis and assessment as described in the related business case.

F/Y ending June ($000)	*2015F*	2016	2017	2018	2019	2020
Directlink cooling system upgrade – "Gotland" solution	*1,352*[28]	2,278				

[28] Included in historical capital expenditure.

Fire Suppression

The original ABB design of the Directlink converter stations incorporated fire detection alarms which initiate shutdown of equipment, but did not include a fire suppression system in the reactor buildings.

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

The replacement converter unit to be installed at Mullumbimby during 2015 will incorporate a fire suppression system, but the existing 5 converter buildings are not so equipped.

The cost of installing fire suppression on the existing five converter buildings is $7.2 million (real, 2014/15) and would be scheduled for completion early in the regulatory control period.

F/Y ending June ($000)		2016	2017	2018	2019	2020
Fire Suppression		324	2,386	2,238	2,238	

Cable Replacement Program

There are three bipolar DC cable pairs that link the terminal stations at Bungalora with those at Mullumbimby. These cables operate at a nominal voltage of ±88 kV and are installed in a disused rail easement over much of their route, partly with above ground sections encased in metal troughing and with underground sections.

When a DC cable fails, the two associated converter stations must also be removed from service and the capacity of the link is reduced.

The cables have historically exhibited relatively high rates of failure. The principal mode of failure is mechanical deterioration of the cable sheathing leading to moisture ingress, electrical tracking and eventual flashover. The number of faults has led over time to an increase in the number of joints in the cable, which in turn are a source of potential weakness.

A cable remediation option (silicone injection into cables) was investigated with the aim of improving the reliability performance of cable and cable joints. The recent testing of Directlink's cable in laboratories, however, has not demonstrated success with this initiative.

In 2012, an expanded maintenance strategy was adopted for the replacement of sections of failed cable. Previously, a short section of cable on each side of the failed section or joint was replaced, which typically was 10-20 metres in length. This involved a short section of new cable and the installation of two joints. In order to ensure all water-damaged cable is replaced, the revised strategy involves the replacement of an average of 160 metres of cable in the vicinity of a failure.

It is too early to be certain that this strategy will prove effective as there is a stochastic element to these cable failures, but the early indications are encouraging. The trend in outages affecting performance (ie. as a percentage of system up time) had been increasing since 2001, but by CY2013 was about 40% of the trend.

It is therefore proposed to continue with this strategy of cable section replacement throughout the 2015-20 regulatory control period. This will require Directlink to purchase and maintain an inventory of cable and cable joint kits, in preparedness for cable faults.

Currently there are limited supplies of spare cable joint kits for Directlink. These kits have long lead times between order and delivery, which increases the potential of prolonged link outages. The spare cable joint kits will ensure that repairs can be carried out expeditiously, reducing the risk of prolonged outages.

The proposed expenditure is based on historical failure and repair rates and the current requirement to maintain an inventory of joint kits and cable to guard against the shortage of spares leading to protracted outages.

The cost of the cable spares program is $4.8 million over the 2015-20 regulatory control period.

F/Y ending June ($000)		2016	2017	2018	2019	2020
Cable Replacement Program		568	568	568	568	568
Spare cable joints		388	388	388	388	388

Upgrade industrial computer control system

The Directlink converters are equipped with industrial computers, which are central to their control system and essential for the reliable operation of the link. There are two such computers at Mullumbimby and three at Bungalora. The link was commissioned in 2000 and this equipment has now been in service for 14 years.

The motherboards used in the industrial computers are now out of manufacture and all spares have been used. Should a motherboard develop a fault, second-hand motherboards are sourced as replacements, which is increasing the risk of extended repair times. The proposed interim solution is to repair or replace these motherboards as they fail. The rate of repair in recent years has been two per annum.

The high rate of failures and unavailability of spare parts mean that the end of life for this control system cannot realistically be extended beyond its nominal life of 20 years. This replacement will be required during the regulatory control period and experience with periodic failures has been such that it will not be economic to attempt further life extension.

This expenditure item therefore includes maintaining the existing computers in service until 2017/18, followed by the replacement of the computers and associated control peripherals to current ABB designs.

The total cost of ongoing repairs to the control system is included in operating expenditure. The cost of replacement of computer and control systems at Mullumbimby and Bungalora is $13.1 million.

F/Y ending June ($000)		2016	2017	2018	2019	2020
Upgrade industrial computer control system						13,070

Spare IGBTs (maintain inventory)

Directlink uses insulated-gate bipolar transistors (IGBT) as electronic switches in the converter stations. There are 5,328 IGBTs in service at Directlink. Whilst very reliable, this number in service contributes to annual failures averaging 56 per annum. The link may generally be maintained in service with a limited number of failed IGBTs (a maximum of 4 failures per 148 unit stack) but this increases the electrical stresses on the remaining in-service units and my lead to reduced link flows.

There is thus an on-going need to maintain a level of spare IGBTs to provide for their periodic replacement. Directlink's estimate of the expenditure required to provide sufficient spare IGBTs is based on historic failure rates and allows for the time taken for their procurement overseas and shipment to site. These components are a proprietary item and recent purchase costs have been used.

The cost of the IGBT spares program is $1.9 million over the 2015-20 regulatory control period.

F/Y ending June ($000)		2016	2017	2018	2019	2020
Spare IGBTs		407	407	407	326	326

Spare valve optic fibres

The switching of the IGBTs that control the power flow in the link is controlled via fibre optic links to the associated control systems. The fibre optic cables have demonstrated an increasing rate of failure. The problem of fibre cable failure is compounded since when an optical fibre fails, it causes the control system to assume failure of the associated IGBT. Approximately half of reported IGBT failures are caused by optic fibre failures.

The progressive replacement of the optic fibre cables is planned. The cost of the optic fibre replacement is $0.8 million over the 2015-20 regulatory control period.

F/Y ending June ($000)		2016	2017	2018	2019	2020
Spare valve optic fibres		160	160	160	160	160

Security fencing enhancement

The Bungalora and Mullumbimby Directlink sites have experienced incidents of trespassing, theft and vandalism.

Australian utilities have in recent years been improving the perimeter security of their sites, to reduce the risk of entry and the concomitant risk of injury or damage to personnel and equipment. Indeed, in 2013 the AER permitted expenditure for similar works to improve the security at the more remote terminal sites on Murraylink.

An improved security fence is required to mitigate the risk of liability in the event of a trespasser being killed or injured, and the risk of major equipment failure as a consequence of theft or other malicious damage.

The Bungalora security fence was upgraded in 2011, due to the more frequent level of trespass and incident. This cost is included in the historic capital expenditure of this proposal.

An upgrade to the security fencing at Mullumbimby is proposed for 2016. The result of increased security at these sites will reduce the likelihood of trespass and incident. The cost of fencing has been estimated from recent similar quotations.

The cost of upgrading security fencing at Mullumbimby is $0.39 million (real, 2014/15).

F/Y ending June ($000)		2016	2017	2018	2019	2020
Security fencing enhancement		395				

Sound Dampening Replacement for Ventilation Inlet

Considerable rusting has occurred to the sound damping at the inlet of the building ventilation for both Mullumbimby and Bungalora sites. This is starting to collapse and will result in the blocking of the ventilation shaft. As system 1 is not operating only 5 dampers are costed to be replaced.

F/Y ending June ($000)		2016	2017	2018	2019	2020
Sound Dampening Replacement for Ventilation Inlet		11	11	11	11	11

Cooling Tower Sound Enclosure Panel Replacement

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

F/Y ending June ($000)		2016	2017	2018	2019	2020
Cooling Tower Sound Enclosure Panel Replacement		313	77	41	41	41

Building Roof Corrosion Repair

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

F/Y ending June ($000)		2016	2017	2018	2019	2020
Building Roof Corrosion Repair		58	55	53	50	48

Zero Sequence Reactor Repair

A recent audit of Directlink's critical spares identified corrosion in the core laminates of the spare zero sequence reactor. The repair requires replacement of the core. The zero sequence has a long lead time for replacement and a spare is essential to prevent prolonged outages of Directlink.

F/Y ending June ($000)		2016	2017	2018	2019	2020
Zero Sequence Reactor Repair		749	749			

Emergency Lighting

Directlink has limited emergency lighting and illuminated signs. Current building code specifications and good industry practice require the updating of emergency lighting systems for the safety of personal that work in high voltage buildings and enclosed secure compounds.

F/Y ending June ($000)		2016	2017	2018	2019	2020
Emergency Lighting			338			

Safety compliance program (working at heights and obstacles)

Recurring activities within the buildings has flagged the need for working at height safety equipment fitted to the inside of the building and cable walkover platforms.

F/Y ending June ($000)		2016	2017	2015	2019	2020
Safety compliance program (working at heights and obstacles)		72	72	36		

These are described in more detail in the relevant business cases provided in Attachment 8.1.

8.8 *Forecast capital expenditure*

The forecast capital expenditure required to maintain the prescribed transmission services by Directlink during the 2015-20 regulatory control period is set out in Table 8.2.

Table 8.2 – Forecast capital expenditure 2015-20

F/Y ending June ($000)	2016	2017	2018	2019	2020	Total
Refurbishment	2,548	2,354	1,520	2,632	1,492	10,545
Compliance	473	437	036	0	0	945
Other	2,836	2,619	2,472	2,472	13,304	23,703
Total	5,856	5,409	4,028	5,104	14,796	35,193

9 Forecast Operating Expenditure

9.1 Introduction

The AER's *Expenditure Forecast Assessment Guideline for Electricity Transmission*[29] proposes using the AER's preferred base-step-trend revealed cost methodology, using past actual costs as the starting point for determining efficient forecasts.

The AER's reasoning for adopting this methodology is that, where a TNSP has operated under an effective incentive framework,[30] actual past expenditure should be a good indicator of the efficient expenditure the TNSP requires in the future. The *ex ante* incentive regime provides an incentive to reduce expenditure because TNSPs can retain a portion of cost savings (i.e. by spending less than the AER's allowance) made during the regulatory control period.

The revealed cost methodology is then augmented by an analysis of adjustments which are required for efficient increases or decreases in expenditure (step and scope changes).

The *Guideline* notes that the AER must undertake analysis to ascertain whether it is appropriate to rely on the revealed costs as the starting point for its assessment.[31]

Directlink is concerned that the revealed cost methodology may not be appropriate to apply in its case, because:

- Directlink has recently undergone material change in its operating framework, moving from an outsource operating model to an insource model;
- Directlink has experienced a number of material events which have impacted the availability of the link and have consequential impacts on reported and forecast operating costs.

These are discussed below.

Operating framework

In the first years of operation, the Directlink interconnector was operated by Transfield under a comprehensive outsourcing arrangement. From 01 July 2012, the contractor terminated this arrangement, owing largely to the peaky nature of the workload and the remote locations for the work to be undertaken. Directlink then moved from the previous comprehensive maintenance resourcing strategy to a model comprised of outsourcing some specialised functions and insourcing the

[29] AER, *Better Regulation - Expenditure Forecast Assessment Guideline for Electricity Transmission*, November 2013.

[30] Directlink does not have an Efficiency Benefit Sharing Scheme (EBSS) in place.

[31] AER, *Better Regulation - Expenditure Forecast Assessment Guideline for Electricity Transmission*, November 2013, p8.

general maintenance functions. It should be noted that Transfield outsourced key aspects of the specialist electrical work, and Directlink has established direct relationships with those specialists.

For example, Transfield previously outsourced technically complex maintenance work. APA have formed relationships with the same specialists that Transfield employed, for example Thearle Pty Ltd have been employed to undertake the specialist electrical maintenance work. More recently SAE has been engaged to undertake similar specialist electrical maintenance work.

APA also works directly with the Original Equipment Manufacturers (OEMs) and use them to undertake highly specialised maintenance. This includes the power transformers (Wilson), dehumidifiers (Munters) and circuit breakers (ABB).

FY 2012/13 was the first year of this new in-sourced operating arrangement, and it took some time to “bed down” the processes and resource requirements associated with this new arrangement.

Mullumbimby converter station fire

In August 2012, pole 1 of the Mullumbimby converter station experienced a catastrophic failure and fire, destroying that pole of the converter station and taking that circuit completely out of service. The cause of the fire was indeterminate. While reconstruction processes are in train, the converter station and circuit are not expected to return to fully operational status until mid-2015.

As a result of the converter station being off line since August 2012, the FY2012/13 through FY2014/15 actual operating costs will not reflect the normal operations and maintenance associated with one of the three circuits.

Circuits 2 and 3 disconnection

Following a routine inspection of converter stations 2 and 3 in August 2013, similar conditions were found as those that may have contributed to the pole 1 fire. As a precautionary measure, Directlink took the remaining two circuits offline while repair options were investigated.

Corrective work has been undertaken (“igloo” replacement) and these two circuits returned to service in early 2014 to serve the summer peak. Further work is anticipated that will bring these two circuits temporarily offline again, as a permanent solution (the “Gotland Solution”) is implemented. These projects are discussed in more detail in the chapter on capital expenditure.

From August 2013 to January 2014 then, all three circuits were offline. The observed operations and maintenance costs associated with the Directlink interconnector will therefore be understated for the periods during which the circuits were offline.

Cable faults

It should be noted that the events described above pertain to the converter stations at the end of each circuit. Experience indicates that there are also cable faults which need to be addressed in the normal course of operations. However, with the converter stations offline, cable faults do not have an opportunity to manifest themselves. To the extent that cable faults have been caused by water ingress, it would be reasonable to expect that water would continue to enter the cable; however any faults caused by ongoing water ingress will not be detectable until the cable is re-energised. As discussed more fully below, cable fault location and repair is the second most significant cost item in the Directlink's operating costs. Operating costs during the periods when one or more of the converter stations are offline will therefore be understated by the costs of investigation and correction of cable faults.

Defining the base year

These events make it particularly difficult to define a base year that would be representative of normal, ongoing operation of the Directlink interconnector:

- For any base year including a period prior to June 2012, the observed costs will reflect the costs associated with the outsourced operation model rather than the in-house operating model in place today;
- For any base year including or after the second half of calendar 2012, the Mullumbimby converter station fire impacts the reported operating costs because one circuit would be completely offline during that period;
- For any base year including the second half of calendar 2013, operating expenditure will be impacted by all three circuits being offline for much of that half-year; and
- In any of these periods, operating costs will also be understated by the absence of routine cable fault expenditure, as discussed above.

In summary, a base year towards the end of the current regulatory period will not present a reasonable picture of the sustainable costs of operating the Directlink interconnector over the forecast regulatory period.

Directlink has assessed the reasonableness of a number of calendar and financial year periods towards the end of the current regulatory period, and has found them all to be unrepresentative of ongoing sustainable operating costs and therefore unsuitable for definition as a base year.

9.2 Approach

Given the unrepresentative nature of the reported costs in the available base years, it was necessary to use a different approach to estimate the sustainable costs of operating the Directlink interconnector over the forecast regulatory period.

Directlink has conducted a comprehensive review of the interconnector operations to forecast its future operating costs, and proposes to use this information to conduct a bottom-up cost build to supplant the historical cost information.

This bottom-up cost build identifies the technical and business processes required to operate the Directlink interconnector in accordance with Good Electricity Industry Practice and the resources necessary to undertake those processes. These resources have been costed using the best available estimates of relevant materials costs and labour rates appropriate to the required skill and experience levels.

9.2.1 AER assessment of operating expenditure forecast

The AER currently prefers to apply a base year + step change "revealed cost methodology" to assess the reasonableness of forecast operating expenditure. This is reflected in the AER's *Expenditure Forecast Assessment Guideline*.

The foundation of the revealed cost methodology is that the historical actual ("revealed") costs incurred by the service provider reflect the efficient costs of operating the asset. Using this methodology, the AER's allowed forecasts for operating expenditure are derived from the historical actual costs, with allowances ("step and scope changes") for changes in statutory or regulatory obligations, or increases in costs due to increases in customer-demanded activity levels (eg customer numbers).

However this approach includes an inherent assumption that the operation of the asset has been consistent over the course of the entire period comprising both the previous period and the forecast period. This underlying assumption does not hold for Directlink, notwithstanding the difficulties in establishing a relevant base year, as described above.

In some recent determinations, the AER has also applied this argument in relation to the costs of compliance with regulatory or legal obligations: if the obligation was in effect in the base year, then the AER maintains that the cost of complying with that obligation would already be reflected in the base year costs, and no step change adjustment is necessary to derive forecast costs.

The AER has recently addressed this circumstance in its draft Guideline; the Better Regulation - Explanatory statement - Draft Expenditure Forecast Assessment Guidelines for electricity transmission and distribution (August 2013) states (p62):

> *Inefficient low historical costs and the EBSS*
>
> NSPs may claim that opex forecasts should not be based upon historical costs because base year costs are lower than their efficient costs. We are unlikely to accept these suggestions where an EBSS [Efficiency Benefit Sharing Scheme] is in place. If a NSP

> assumes an exogenous approach is used to set forecasts in the following period, and an EBSS is in place, they will have a strong incentive to reduce expenditure. This will maximise the reward they receive through the EBSS. If the revealed cost approach is not used to forecast expenditure they will not only retain all efficiency gains, they will also receive a further reward through the EBSS. Thus they will retain more than 100 per cent of the efficiency gain and consumers will be worse off as a result of the non-recurrent efficiency gain. This is not in the long term interests of consumers.
>
> In such situations, it is appropriate to retain the revealed cost forecasting approach…

The AER Explanatory Statement discusses its strong preference to apply a revealed cost methodology in the context of when there is an Efficiency Benefit Sharing Scheme (EBSS) in place, which has not historically been in place for Directlink.

9.2.2 Revealed costs and compliance with obligations

Consistent with its application of the revealed cost methodology, the AER's underlying assumption is that where an obligation existed before the regulatory filing, the costs of complying with that obligation are included in the revealed costs. This is covered in the *Explanatory Statement*:

> If the obligation is not new, we would expect the costs of meeting that obligation to be included in revealed costs. We also consider it is efficient for NSPs to take a prudent approach to managing risk against their level of compliance when they consider it appropriate (noting we will consider expected levels of compliance in determining efficient and prudent forecast expenditure). (p32)

The AER's acknowledgement that a risk management approach to compliance with obligations recognises that many obligations are unstructured in their application; it is not possible to ascertain, in a black-and-white fashion, whether a particular business is or is not in compliance with the relevant obligation.

In the case of Directlink, the relevant obligation is as broad as "Good Electricity Industry Practice". Consistent with the AER's consideration of efficient compliance with obligations, Directlink's historical costs reflect a risk-based approach to the exercise of Good Electricity Industry Practice.

While concerns over cable faults have been well known and documented, Directlink had historically operated the interconnector's converter stations in accordance with a view to risk based on representations made to it by the manufacturer.[32] This was largely in line with Directlink's experience, which indicated that while some ongoing maintenance was required, the converter stations were generally low risk assets.

However, Directlink's experience with the Mullumbimby converter station fire suggests that its previous risk assessment, which guided the extent of its application of Good Electricity Industry Practice, underestimated the risks associated with the operation of the asset. Directlink has therefore undertaken an extensive analysis of

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32 For example, the Directlink Due Diligence memorandum, referring to the manufacturer's website, identified that the HVDC Light technology "converter stations designed to be unmanned and virtually maintenance free."

its operational procedures relating to this asset in light of its recent experience in order to identify any changes required to ensure ongoing operation in line with Good Electricity Industry Practice, taking into account Directlink's revised assessment of the risks associated with this asset.

The revised risk assessment has identified additional prudent operation and maintenance activity that had not been considered necessary to be undertaken, or undertaken as extensively (including by the manufacturer), under the lower risk historical period. The costs associated with these additional activities are not reflected in the historical costs, and this has prompted Directlink to undertake the bottom-up cost study to ensure the costs associated with these activities are reflected in the operating costs to be recovered through tariffs.

The AER's *Explanatory Statement* has addressed this circumstance [emphasis added]:

> **NSPs will need to perform a cost–benefit analysis to show that meeting standards that have not been met before is efficient and prudent.** If new smart electricity meters showed extra non-compliance with voltage standards relative to current reporting and investigation procedures, for example, we will be likely to require a cost–benefit analysis to show any augmentation (materially in excess of current levels) to comply with the current standards was efficient and prudent. This is consistent with our past practice. (p34)

Given that the review of Directlink's compliance with Good Electricity Industry Practice has only recently been completed, the costs of adopting and implementing its recommendations will certainly not be included in its revealed costs. While Directlink may be able to budget the expenditure in sufficient detail to support a bottom-up cost build, the costs will not have been incurred in the base year (regardless of the base year chosen). The bottom-up cost study has not used a base year, but rather has used a 'reference year' simply as the point for assembling all costs prior to forecasting the cost for the 5 year regulatory period.

9.2.3 AER decision on Envestra Victoria

The AER addressed the question of costs associated with increased levels of compliance with existing regulatory obligations in the recent Envestra Victoria case:[33]

> The AER notes that AS/NZS 2885.3-2001 has been in place since 2001 and so does not represent a new statutory obligation. Accordingly, the AER queried the extent of vegetation management currently undertaken by Envestra and whether Envestra is currently compliant with AS/NZS 2885.3-2001. …
>
> As such, a prudent and efficient service provider would not require a step change in its opex allowance in the 2013–17 access arrangement period to enable it to become compliant with its regulatory obligations. The AER does not approve a step change for

33 AER, *Access Arrangement draft decision - Envestra Ltd*, *2013–17*; Part 2: Attachments, September 2012, s6.5.4.

> the expenditure required to clear overgrown pipelines and to bring Envestra into compliance with its regulatory obligations.

In the Final Decision, the AER concluded [emphasis added]:[34]

> Envestra further submitted that many regulatory obligations do not have an identifiable threshold between compliance and non-compliance, and therefore there are various levels of compliance that can exist. The AER generally accepts that this may be the case but is of the view that Envestra would have factored in the appropriate degree of risk when deciding what level of expenditure was necessary to ensure compliance in the base year. **If a step change is required, Envestra would need to identify why the level of risk in the base year will no longer be acceptable or identify an external driver/circumstance that will change the level of the risk.**

Directlink submits that the recent Mullumbimby converter station fire is a clear indication as to why the level of risk assessed in the historical period will no longer be acceptable.

In normal circumstances, consistent with the AER's Envestra decision, this change in risk profile would support a claim for a step change from the base year revealed costs.

However, as discussed above, Directlink cannot nominate a sufficiently robust base year on which the AER can assess the extent of a step change required to be added to the revealed costs. It is for this primary reason that Directlink has undertaken the bottom-up cost study.

9.3 This submission

Addressing the AER's stated position on this issue, Directlink has undertaken the following activities in the preparation of this submission.

9.3.1 Good Electricity Industry Practice review

Following the Mullumbimby converter station fire, Directlink engaged Power Systems Consultants (PSC) to review the operation and maintenance procedures in place for the Directlink interconnector and identify any opportunities to amend the operational activities with an aim to increasing the level of execution of Good Electricity Industry Practice (GEIP) principles.

In summary, PSC found that the asset was being operated in a manner not inconsistent with a definition of GEIP appropriate to the risks as understood prior to the fire event.

However, the expectation of what was considered GEIP in the operation and maintenance of the Directlink facility prior to the August 2012 fire is considered to

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[34] AER, *Access arrangement final decision - Envestra Ltd, 2013–17*; Part 2: Attachments, March 2013, s7.4.4.

have changed following the event due to a shift in key assumptions and a change in risk profile. This has triggered the need to re-evaluate what is now considered to be GEIP in the operations and maintenance of the Directlink facility.

PSC's review is based on what it considers to be GEIP only after the experience gained from the August 2012 fire. The recommendations developed as a result of this review and as detailed in this report are based on PSC's view that, considering that a fire has occurred, implementation of the recommendations will ensure that the asset is operated in accordance with GEIP in light of the changes in key assumptions and in the post-fire risk profile.

A total of 114 recommendations were made, and assigned a relative priority. These recommendations fit into the following broad categories:

1. Modification of an existing process or procedure;
2. Development of a new process;
3. Development of a new procedure, work instruction and/or form; and
4. Improved documentation control.

In the context of this submission, it is important to note that these additional processes and procedures were not necessary in the context of the understanding of GEIP as understood before the August 2012 converter station fire. As a result, these additional processes and procedures were not previously developed and undertaken, and as a result, the costs associated with undertaking these additional processes and procedures would not be included in the actual costs if the revealed cost methodology were applied using currently incurred costs.

PSC's report is included with this submission as Attachment 9.1.

9.3.2 Risk assessment and cost-benefit analysis

Consistent with the AER's findings on *Envestra* above, a prudent operator will take a risk-based approach to the application of broad standards such as Good Electricity Industry Practice.

Assisted by Power Systems Consultants (PSC), Directlink has undertaken a comprehensive risk assessment associated with the operation of the converter stations. This assessment has examined the risk profile of the asset based on information available to Directlink prior to the Mullumbimby converter station fire, the learnings associated with the fire experience, and any revisions to the perceptions of risk following the Mullumbimby converter station fire.

The PSC report then undertakes a cost-benefit analysis to identify which of its recommendations in the GEIP review provide the greatest operational improvements (ie reductions in risk) relative to the costs of implementing them.

PSC's risk analysis shows that the post-event residual risk levels for the selected operational risks are considerably higher than the pre-event risk levels.

Each operational risk was then considered with a view to what GEIP recommendations could be used to mitigate the post-event residual risk levels, potentially to the same levels as the pre-event residual risk profile.

Applying this suite of recommendations,[35] the result of PSC's review and analysis is that:

1. The risk levels for the selected operational risks post-event are significantly higher than the risk levels pre-event; and

2. Applying the suite of recommendations will reduce the target risk level (i.e. the risk profile after all mitigations in place) for all of the operational risks, and will reduce the risk level to pre-event levels for all but one of the operational risks.

PSC performed a cost-benefit analysis to compare the cost of implementation of the suite of recommendations against a quantification of cost exposure to a similar August 2012 Fire Event following the change in risk profile.

PSC estimated that the cost of implementing the suite of recommendations was significantly less than the quantified cost exposure. Therefore, PSC recommends the implementation of the suite of capital and GEIP recommendations.

PSC's Risk assessment and cost-benefit analysis report is included with this submission as Attachment 9.2.

The GEIP Review, the Risk Assessment and the Cost-Benefit analysis were conducted as sibling reports so that the findings of each could feed into the analysis in the others.

It should be noted that PSC's risk assessment focused primarily on the converter stations; Directlink has no evidence to suggest that the risks associated with the operation of the cables, or the location and repair of cable faults, has changed since the previous regulatory period.

9.3.3 Bottom up cost build

Directlink engaged Phacelift Consulting Services Pty Ltd (Phacelift) to examine, having regard to the PSC risk assessment and cost-benefit analysis, the sustainable activities associated with the operation of the Directlink interconnector and:

- Identify the responsibilities, tasks and practices for an end-to-end maintenance cycle when working on Directlink assets.
- Identify documents necessary to describe these responsibilities, tasks and practices.
- Identify the costs associated with undertaking the range of maintenance work.
- Identify plausible maintenance events (preventative, corrective and unforeseen).

[35] Including two capital expenditure projects.

- Model an opex forecast for Directlink maintenance from July 2015 to June 2020.

Phacelift's approach commenced with a diagnostic review of Directlink's maintenance practices using two lines of enquiry. The first line of enquiry focussed on the Directlink technology. The second line of inquiry focussed on the processes and resources deployed for operating and maintaining Directlink. By breaking down the Directlink technology into its smallest items, patterns suitable for modelling were identified. Similarly, by breaking down the key processes and resources to lower levels the effectiveness and appropriateness of these elements could be assessed.

Starting with a line diagram of the Directlink system, Phacelift analysed 60 operational and maintenance costs applicable to over 5000 individual components.

Phacelift's report is included with this submission as Attachment 9.3.

The bottom-up cost build (and its reference year) applies to those activities for which the previous periods do not represent sustainable base years. Reliance on previous periods is applied to other opex cost categories (such as corporate services) where the historical information is representative, and other methodologies are applied to derive forecasts where previous periods are not representative (eg insurance). These are discussed in more detail below.

9.4 Rule requirements

Clause 6A.6.6 and schedule S6A.1.2 of the Rules establish the information and matters relating to operating expenditure that must be provided in Directlink's Proposal. The principal requirements are that the proposed operating expenditure must:

- Meet the operating expenditure objectives;
- Be subdivided into particular programs or types of expenditure and identify the fixed and variable components;
- Include a forecast of key variables used to derive the forecast;
- Have Directors' sign off on the reasonableness of key assumptions used in the operating expenditure forecast; and
- Identify any methodology or programs to improve the performance of the transmission network, in relation to the service target performance incentive scheme.

9.4.1 Operating expenditure objectives

The operating expenditure that Directlink has proposed is required to:

- Maintain the full capacity of the link, for the duration of the regulatory control period;

- Continue to comply with the range of applicable regulatory obligations described in Section 2.2;
- Maintain the security of supply of prescribed transmission services, in accordance with its obligations under the Rules; and
- Maintain the reliability, safety and security of the transmission system through the continued supply of prescribed transmission services.

Directlink's operating expenditure forecast has been prepared in line with the operating expenditure objectives as defined in the Rules[36].

Directlink considers that this Revenue Proposal achieves the operating expenditure objectives, having regard to these factors.

9.5 Operating expenditure categories

Directlink's total operating expenditure has a number of components, as follows. These components are to a greater or lesser extent controllable, as outlined below.

Directlink's choice of operating expenditure categories was influenced by the character of the business and the commercial arrangements which have been developed to carry out operations and maintenance activities.

It must be recognised that unlike most other TNSPs in the NEM, Directlink has a single transmission interconnection asset with unique and specialised maintenance requirements. That asset comprises a number of separate items of equipment:

- ***Primary equipment:*** (operating at the transmission voltage) comprises the underground cables, the invertors (power conversion between AC and DC), their transformers and filter banks.
- ***Secondary equipment:*** includes the electrical control, protection and communications systems that control the link and are necessary for it to operate; and
- ***Auxiliary equipment:*** includes the water purification and cooling systems, air conditioning and ventilation, also necessary for the link to function.
- ***Land and buildings:*** includes the terminal buildings and depot and storage facilities adjacent to the terminal stations.

The unique features of this asset have had a major influence on the manner in which Directlink carries out its operating and maintenance activities.

Directlink's choice of operating expenditure categories is set out below.

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36 National Electricity Rules, clause 6A.6.6(a).

9.5.1 Operating and Maintenance

The majority of the routine maintenance activities for Directlink equipment were historically carried out by Transfield, as prime contractor. This contract terminated on 30 June 2012.

Directlink brought many of the routine inspection and maintenance activities in-house, and sought public tenders for specialist contractors for such functions as:

- Transformer maintenance;
- Circuit breaker maintenance; and
- Fire protection system maintenance.

Fault & condition

A proportion of operation and maintenance activity arises from equipment faults, or where the condition of equipment deteriorates to the point where its maintenance is unable to sustain an adequate level of operation.

This category of expenditure also contains the materials and spare parts associated with fault and condition related maintenance.

The largest expenditure in the category is cable fault repairs, including the locating of the cable fault, vegetation management and excavation of the cable, replacement of faulty cable and/or cable joints, and site restoration and remediation. The costs associated with replacement cable and cable joint kits are capitalised in accordance with the capitalisation policy.

Operations

Whilst the flow levels of Directlink are controlled in response to AEMO requirements, the operation of Directlink is controlled remotely. This control room is manned by shift staff and also used for the control of other assets. Accordingly, Directlink is charged an allocated cost for the control room. This amount is consistent with charges in previous periods.

9.5.2 Commercial services

The operating and maintenance activities for Directlink are carried out on behalf of the owner, Energy Infrastructure Investments Pty Limited (EII), by the Operator of the link, APA Operations (EII) Pty Limited (APA Operations). Under an agreement between these two entities, APA Operations carries out the operating and maintenance of a portfolio of gas and electricity assets owned by EII.

As discussed above, APA Operations had previously engaged a prime contractor to perform the maintenance of Directlink under an agreement that extended until 30

June 2012. On expiry of that agreement, APA Operations brought many functions in-house, and conducted a competitive tender process to engage specialist contractors to perform specialist functions.

Directlink's maintenance costs are therefore subject to competitive tender in the marketplace.

APA Operations recovers these contract costs and its direct overheads, such as rent, electricity and telecommunications from EII on the basis of a Management, Operations and Maintenance and Commercial Services Agreement (MOMCSA) entered into between the parties in 2008.

EII also provides corporate support to Directlink on the same basis as other assets in its infrastructure portfolio. These support services include IT facilities, legal, accounting and regulatory support.

9.6 Outsourcing arrangements and margins

Energy Infrastructure Investments Pty Limited (EII) understands that the AER will need to satisfy itself that the payments made under the Management, Operations and Maintenance and Commercial Services Agreement (MOMCSA) for the following services satisfy the relevant provisions in chapter 6A of the Rules:

- asset management, operating, maintenance and capital services; and
- corporate services.

To assist the AER with its assessment of this issue, EII has prepared the following information on the MOMCSA and demonstrates the consistency of the payments made under this agreement with the operating and capital expenditure criteria contained in rules 6A.6.6(c) and 6A.6.7(c).

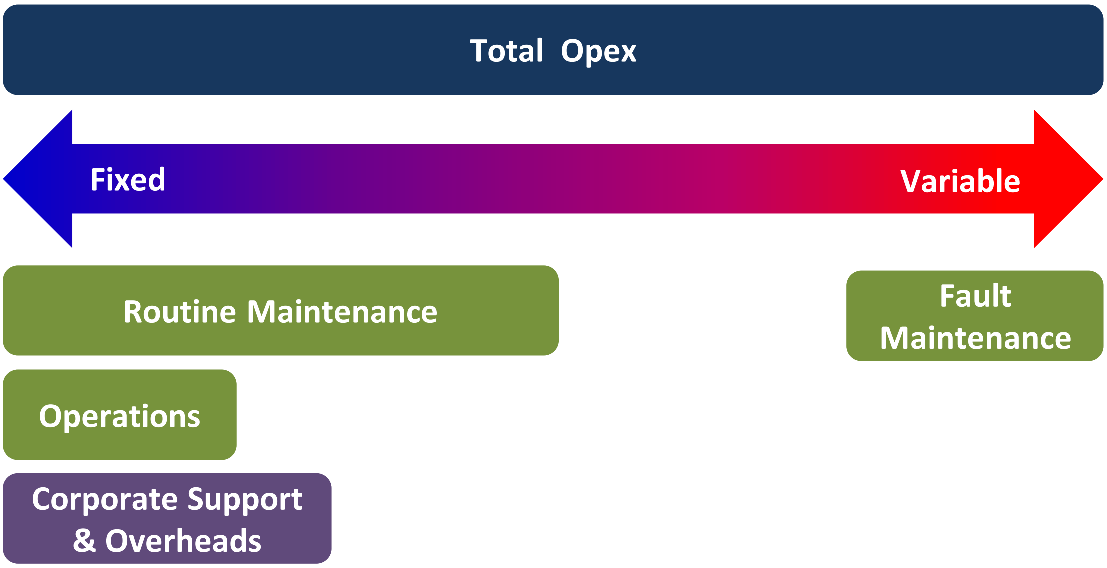
Attachment 9.4 addresses outsourcing arrangements and margins in more detail, including:

- providing an overview of the MOMCSA;
- setting out EII's understanding of the framework that the AER has developed for the purposes of assessing the consistency of outsourcing arrangements with the Rules; and
- applying the AER's framework to the MOMCSA and demonstrates the consistency of its arrangement with the operating and capital expenditure criteria.

9.7 Controllable and non-controllable operating costs

Rule S6A.1.2 requires Directlink to identify the extent to which the categories of costs above are fixed and the extent to which they are variable. This has been illustrated by the diagram in Figure 9.1.

Figure 9.1 – Fixed and variable operating costs



Consistent with the nature of Directlink's operations, in particular AEMO's control of its dispatch, none of its costs vary directly with the amount of electricity transported through the interconnector.

But this is not to say that all costs are controllable. Electricity costs, used for driving fans and cooling equipment, appear to vary to some degree with the load on the interconnector, which is driven by AEMO's dispatch procedures. While Directlink has control over the unit cost of electricity, it does not have control over the amount of electricity used.

As outlined above, most routine maintenance on the converter stations is scheduled and programmed well in advance. Maintenance in accordance with the programmed procedures and manufacturer's recommendations also involves predictable costs for spares and consumables; this category of operating cost is therefore largely fixed.

Operations costs (an allocated component of control room costs) are expected to remain fixed for the regulatory control period.

Corporate support supplied to EII is subject to a fixed commercial services agreement. Overheads are allocated among the EII assets on the basis of revenue. As Directlink's revenue is forecast to increase in the 2015-20 regulatory period relative to the 2006-15 period, its allocation of corporate services costs is expected to increase.

Fault and condition based maintenance is largely beyond Directlink's control, being associated with random asset failure or unanticipated deterioration in equipment condition. While this component of maintenance costs is variable, it does not vary with throughput.

9.8 Operating expenditure forecast

As discussed in section 9.2, it is not possible to establish a reasonable base year to apply the AER's base/step change cost forecasting approach to Directlink's opex costs. This is particularly the case for those costs impacted by the Mullumbimby converter station fire, including direct operating and maintenance costs, and insurance costs. However, there are other costs which are not so significantly impacted that can be forecast based on historical expenditure, as discussed below.

9.8.1 Key inputs and assumptions

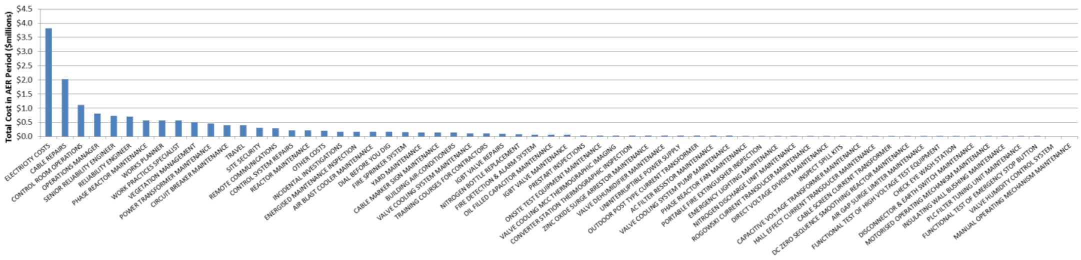
The main inputs to the operating cost forecasts are set out below for the categories of cost.

Cost escalation

As described in section 2.5 no real cost escalators were applied in preparing the operating cost forecasts. That is, Directlink will rely on the AER's findings regarding real cost escalation to apply to labour and materials.

9.8.2 Direct operating and maintenance costs

Direct operating and maintenance costs were estimated though the Phacelift comprehensive bottom-up cost study discussed in section 9.3.3. The chart below indicates the breadth and granularity of the study:



The top twenty categories account for 87% of the total direct O&M cost, as follows:

Table 9.1 – Top twenty O&M direct costs

Category	2015-20 Cost (2013/14 $000)
Electricity costs	$3,817
Cable repairs	$2,030
Control room operations	$1,111
Operations manager	$811
Senior reliability engineer	$730
Reliability engineer	$699
Phase reactor maintenance	$570
Works planner	$565
Work practices specialist	$565
Vegetation management	$502
Power transformer maintenance	$460
Circuit breaker maintenance	$399
Travel	$395
Site security	$316
Remote communications	$288
Control system repairs	$218
Reactor maintenance	$213
Other costs	$201
Incidental investigations	$180
Energised maintenance inspection	$179
Air blast cooler maintenance	$172

As developed in detail in the Phacelift report at Attachment 9.3, the total direct operating and maintenance cost forecast is as shown below.

Table 9.2 – Forecast direct operating expenditure 2016 to 2020

F/Y ending June (000)	2016	2017	2018	2019	2020F
$2013/14 real per Phacelift report	3,485	2,873	2,948	2,894	2,921
2014/15 real	3,572	2,945	3,021	2,967	2,994

Other direct operating costs

As discussed in section 1.1, the Directlink converter stations use advanced technological equipment. As there are only two of these systems in the world (the other being in Gotland, Sweden), Directlink is not able to rely on the collected industry experience as may be produced by technical bodies such as CIGRE. This forces Directlink to rely heavily on the Original Equipment Manufacturer, ABB, for expert engineering advice in managing any issues arising with the converter station components of the interconnector assets.

Directlink's experience has been that the converter stations have not performed precisely in line with the manufacturer's vision when designed and installed. As a result, for matters concerning the operation and maintenance of the converter stations, ABB is invariably required to undertake engineering analysis in order to respond to Directlink's queries.

Directlink is a small asset relative to ABB's global manufacturing and construction interests, and it has been Directlink's experience that it has been difficult to attract ABB's attention in a timely fashion. This introduces delays, which result in circuits being out of service for longer than strictly necessary. An example is the time required for ABB to conduct the engineering analysis to develop a revised converter station cooling solution.

Directlink has been working with ABB to develop a service level agreement, under which ABB undertakes to give priority consideration to Directlink queries and requests for assistance.

ABB has agreed to provide this priority service for an annual fee of $143,616 ($2013/14). As there are no other service providers that can provide this expertise, Directlink is not able to test this fee with the market.

This cost addresses Directlink's second key reliability strategy – to reduce the incidence of converter station faults in the first instance, and then to undertake actions that will return the link to service quickly in the event that a fault should occur. This has been included in the Directlink operating expenditure forecast.

Table 9.3 –Total direct operating expenditure 2016 to 2020

F/Y ending June (000) $2014/15 real	2016	2017	2018	2019	2020F
Direct operating costs	3,572	2,945	3,021	2,967	2,994
ABB Service Agreement	147	147	147	147	147
Total operating and maintenance costs	3,720	3,092	3,169	3,114	3,142

9.8.3 Insurance

The AER-approved Directlink cost allocation methodology requires that costs should be allocated according to the following procedure: 1) direct attribution of costs that are directly attributable to a particular asset, 2) causal allocation where a causal relationship can be ascertained, and only then 3) non-causal allocation over some reasonable basis.

In previous years, insurance costs were allocated among the various EII assets using a non-causal allocator – the value of the assets and revenues insured for Industrial Special Risks insurance, and the value of revenue for Public Liability insurance. In the absence of a suitable causal allocator, EII considered this allocation approach to be reasonable.

As discussed above, the Directlink Interconnector experienced a catastrophic fire event resulting in the loss of an entire converter station. This event, and the costs of reconstructing the converter station, was covered by Industrial Special Risks (property) insurance.

However this event had an understandably significant effect on the insurer's perception of the risks associated with this asset, and a correspondingly significant effect on the level of premiums applicable to that level of risk transfer. This caused insurance premiums to rise above the counterfactual (non-fire event) level.

This increase in insurance premiums now reflects the claims experience and the insurer's view of the risk of insuring the Directlink assets, and is directly attributable to the Directlink converter station fire.

In determining the amount of insurance premium attributable to the Directlink Interconnector, EII has:

- conducted an independent valuation of the Directlink assets for insurance purposes;
- sought an independent assessment of the insurance premium that would apply to the Directlink Interconnector;
- directly attributed that amount to Directlink;
- allocated its remaining insurance costs amongst the assets using risk-weighted insurance premiums as the allocation basis.

The estimate of the stand-alone insurance costs attributable to Directlink are determined by insurance experts Marsh, whose report is included as Attachment 9.5.

Now that a causal allocator is available, EII has applied the cost allocation methodology to insurance costs by directly attributing the Directlink stand-alone property insurance costs based on a causal risk-based assessment of Directlink's insurance costs.

This process underpins the 2014/15 insurance cost estimate. This approach is also partially reflected in the 2013/14 revealed costs.

The independent assessment also identified a range of risks that were not covered, for which Directlink was required to self-insure. Marsh's actuarial experts also analysed Directlink's uninsured risks and developed an actuarially-determined allowance for self insurance. Marsh's report is included as Attachment 9.5.

Table 9.4 – Forecast insurance costs 2016 to 2020

F/Y ending June ($000)	2016	2017	2018	2019	2020F
Property	774	754	774	794	754
Liability	484	472	472	484	496
Self Insurance	144	144	144	144	144
Total	**1,402**	**1,370**	**1,390**	**1,422**	**1,394**

9.8.4 Commercial services

Commercial services costs have not been significantly affected by the Mullumbimby fire, and are therefore forecast by reference to historical actual costs.

EII is an investment vehicle, and accordingly has no staff. It contracts with APA Operations (EII) Pty Limited for all administrative, accounting, and other business functions, including compliance with legal and regulatory obligations, as specified in Schedule 3 of the MOMCSA. EII then allocates the Commercial services costs among its various assets on the basis of each asset's contribution to total group revenue.

This revenue proposal results in an increase in revenues for Directlink, attributable to (among other things) return on and of capital for capital expenditure incurred in the 2006-15 period, and the increases in operating expenditure and insurance discussed in this chapter.

While the total amount of the commercial services costs under the MOMCSA are not expected to escalate by more than CPI, this increase in Directlink revenue will cause a greater proportion to be allocated to Directlink, as shown below (all other things equal):

Table 9.5 – Allocation of commercial services costs

	CY2013 Revenue	Proportion %	Allocation of Commercial Services Fee	2015/16 Revenue	Proportion %	Allocation of Commercial Services Fee
Directlink	12,460	13.6%	374	19,000[37]	19.4%	561
Murraylink	13,773	15.0%	414	13,505[38]	13.8%	398
Other assets	65,305	71.4%	1,962	65,305	66.8%	1,928
Total	91,538	100%	2,750	97,810	100%	2,889[39]

9.8.5 Other costs

The following costs have been forecast on the basis of historical costs incurred.

Tax on property and capital

This category includes property and other taxes to local governments for the Mullumbimby and Bungalora converter station sites and the NSW Office of State Revenue. It has been forecast on the basis of historical amounts.

Accounting/audit fees

Accounting and audit fees for statutory accounting and reporting purposes are captured within the commercial services agreement. This category represents the fees attributable to reviewing the Directlink regulatory accounts. It has been forecast on the basis of prior year fees.

Other

Directlink has maintained this cost category as a place holder for costs to be imposed upon Directlink by TransGrid in its capacity as Coordinating TNSP under (forthcoming) Rules 6A.29A.4 and 6A.29A.5. While TransGrid has not advised Directlink of its proposed charges under these Rules, these Rules oblige Directlink to pay those charges as so advised.

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37 Approximation.

38 Smoothed revenue per Murraylink PTRM.

39 Total assumes 2 years' CPI escalation.

To the extent the AER determines charges to be levied by TransGrid under these Rules, Directlink's opex allowance must be increased accordingly.

Debt raising costs

This amount has been calculated using the procedures in the AER's PTRM.

9.9 Forecast operating expenditure

The forecast operating expenditure required to maintain the prescribed transmission services by Directlink during the 2015-20 regulatory control period is set out in Table 9.6.

Table 9.6 – Forecast operating expenditure 2015-20

F/Y ending June (000 real)	2016	2017	2018	2019	2020	Total
Operating and maintenance costs	3,720	3,092	3,169	3,114	3,142	**16,236**
Management fees and expenses	561	561	561	561	561	**2,805**
Insurance	1,402	1,370	1,390	1,422	1,394	**6,979**
Tax on property and capital	9	9	9	9	9	**46**
Accounting/audit fees	10	10	10	10	10	**52**
Other	1	1	1	1	1	**5**
Debt raising costs	82	83	83	82	82	**413**
Total Forecast opex	5,786	5,127	5,224	5,200	5,200	**26,536**

9.10 Cost pass through

In accordance with Rules 6A.6.9 and 6A.7.3, Directlink proposes the following pass through events.

- a *regulatory change event*;
- a *service standard event*;
- a *tax change event*; and
- an *insurance event;*

where all of these terms are as defined in the National Electricity Rules.

In accordance with Rule 6A.7.3(a1)(5), Directlink also propose the following cost pass through events. With the exception of the Carbon cost event discussed below, all were recently approved by the AER in the APA GasNet Access Arrangement Determination.

In respect of the APA GasNet Access Arrangement Determination, the AER also approved a Carbon cost event, however the current uncertainty over future carbon emissions abatement policy in Australia makes the drafting of that definition potentially unsuitable for inclusion in the Directlink determination. Directlink therefore proposes a revised Carbon cost event definition, however this revised definition is intended to operate in a similar fashion to that previously approved by the AER in respect of APA GasNet.

Carbon cost event

Carbon cost event—means:

An event that occurs if, for a given Regulatory Year of the Regulatory Period, Directlink becomes liable for a carbon cost (however described) in accordance with Federal or State carbon abatement policies or requirements. The carbon cost event is taken to have occurred at the time liability for carbon costs is established.

Insurance Cap Event

Insurance Cap Event—means:

An event whereby:

(a) Directlink makes a claim on a relevant insurance policy;

(b) Directlink incurs costs beyond the relevant policy limit; and

(c) The costs beyond the relevant policy limit materially increase the costs to Directlink of providing the Prescribed Service.

For the purposes of this Insurance Cap Event;

(a) The relevant policy limit is the greater of Directlink’s actual policy limit at the time of the event that gives rise to the claim and its policy limit at the time the AER made its Final Decision on Directlink’s access arrangement proposal for the Regulatory Period, with reference to the forecast operating expenditure allowance approved in the AER’s Final Decision and the reasons for that decision; and

(b) A relevant insurance policy is an insurance policy held during the Regulatory Period or a previous period in which Directlink was regulated .

Insurer credit risk event

Insurer credit risk event—means:

An event where the insolvency of the insurers of Directlink occurs, as a result of which Directlink:

(a) incurs materially higher or materially lower costs for insurance premiums than those allowed for in the AER's Final Decision; or

(b) in respect of a claim for a risk that would have been insured by Directlink's insurers, is subject to a materially higher or lower claim limit or a materially higher or lower deductible than would have applied under that policy; or

(c) incurs additional costs associated with self funding an insurance claim, which, would have otherwise been covered by the insolvent insurer, and

in consequence, the costs to Directlink of providing the Prescribed Service are materially increased or decreased.

Natural disaster event

Natural disaster event—means:

Any major fire, flood, earthquake, or other natural disaster beyond the control of Directlink (but excluding those events for which external insurance or self insurance has been included within Directlink's forecast operating expenditure) that occurs during the Regulatory Period and materially increases the costs to Directlink of providing the Prescribed Service.

Terrorism event

Terrorism event—means:

An act (including, but not limited to, the use of force or violence or the threat of force or violence) of any person or group of persons (whether acting alone or on behalf of in connection with any organisation or government), which from its nature or context is done for, or in connection with, political, religious, ideological, ethnic or similar purposes or reasons (including the intention to influence or intimidate any government and/or put the public, or any section of the public, in fear) and which materially increases the costs to Directlink of providing a Prescribed Service.

10 Depreciation

This Chapter sets out how the proposed depreciation allowance for Directlink was determined.

10.1 Depreciation methodology

The depreciation methodology used is straight-line, over the estimated useful life of the asset concerned. This approach is the same as currently applied.

10.2 Standard asset lives

The AER has approved a change to the standard life of the cables that form a component of the Murraylink interconnector for the 2013-18 regulatory control period. The switchyard assets (the converter equipment) were assigned a life of 40 years in the 2007 determination; the cables, however, were assigned a life of 50 years.

The AER accepted that, unlike a TNSP that has a broad portfolio of assets, the Murraylink asset components work as a single entity to provide prescribed network services. It is clear that, at the time that the converter equipment reaches the end of its useful life, no investor would be prepared to renew this equipment to utilise the ageing cable for its short remaining life.

This circumstance applies equally to Directlink. The AER's 2006 decision assigned a standard life of 40 years to the substations and 50 years to the cables. Consistent with the Murraylink decision, Directlink has assigned the same remaining life to its cable as the converter equipment.

The ABB Requirement Specification document for the HVDC Light converter stations[40] indicate a life of 40 years. The standard asset lives of the converter stations and the cables have been aligned at this level.

The AER's 2006 conversion and revenue requirement decision identified only three asset classes, which comprise the entire Regulatory Asset Base. Following that delineation of asset classes the following estimated useful lives have been used for the calculation of depreciation:

40 ABB Power Systems Requirement Specification - General Requirements for HVDC Light RS-HLA-000, ABB Document number 1JNL100025-720 Rev. 01. February 1999.

Table 10.1 – Useful life by asset class

Asset class	Useful life
Substations	40 years
Transmission Lines	40 years
Easements	N/A

10.3 Remaining asset lives

Having come into service in 2001, the Directlink converter stations will have been in service for 14 years by the commencement of the 2015-20 regulatory period.

Starting from the 40 year standard life as discussed above, the major items of equipment thus have a remaining life of approximately 26 years at the commencement of the 2015-20 regulatory control period. Directlink therefore proposes that the remaining useful life of the asset should be restricted to the 26 year remaining useful life of the converter stations. Similarly, the standard life of capital expenditure projects attaching to the converter stations (for example the Gotland solution) will be restricted to this remaining life.

Other operating assets have shorter remaining lives and in the case of many ancillary items of equipment, will be renewed as part of the ongoing “stay in business” capital expenditure program during the next control period. Directlink has not elected to define new asset classes for this equipment.

10.4 Depreciation forecast

The regulatory depreciation has been calculated using the AER’s PTRM.

The forecast regulatory depreciation for Directlink during the 2015-20 regulatory control period is set out in Table 10.2.

Table 10.2 – Forecast depreciation 2015-20

F/Y ending June ($000)	2016	2017	2018	2019	2020
Forecast straight line depreciation	-4,947	-5,311	-5,672	-5,988	-6,364
Forecast indexation	3,244	3,355	3,452	3,508	3,591
Forecast regulatory depreciation	-1,703	-1,956	-2,220	-2,480	-2,774

Directlink proposes that depreciation (return of capital) for establishing the regulatory asset base as at the commencement of the 2020-2025 regulatory control period be based on forecast capital expenditure.

11 Maximum allowed revenue

Directlink's Revenue Proposal is derived from the post-tax building block approach outlined in Part C of Chapter 6A of the Rules and the AER's PTRM.[41] The completed PTRM forms Attachment 11.1 to this regulatory proposal. This Chapter summarises the building block approach, the components of which are detailed in the preceding Chapters. The MAR and X factor for Directlink are calculated from the PTRM. Future adjustments to the revenue cap are also described.

11.1 Building block approach

The building block formula to be applied in each year of the regulatory period is:

MAR = return on capital + return of capital + opex + tax

= (WACC × RAB) + D + opex + tax

Where:

MAR	= Maximum Allowable Revenue.
WACC	= post-tax nominal weighted average cost of capital ("vanilla" WACC).
RAB	= Regulatory Asset Base.
D	= Regulatory Depreciation.
opex	= operating expenditure.
tax	= income tax allowance.

The MAR is then smoothed with an X factor, in accordance with Rule 6A.6.8.

The Rules allow for revenue increments and decrements arising from the Efficiency Benefit Sharing Scheme (EBSS). As the EBSS does not apply to Directlink in the 2006-15 regulatory period, there is no carry over amount to be included in the operating expenditure building block.

Any increment or decrement associated with the STPIS is not included in this Revenue Proposal, but as a future revenue cap adjustment.

11.2 Building Block components

The building blocks that formed a part of the revenue calculation are set out below.

[41] AER, Final decision, *Amendment - Electricity transmission network service providers Post-tax revenue model*, December 2010.

11.2.1 Regulatory asset base

Chapter 4.4.1 described the calculation of the estimated RAB of $129.755 million, as at 1 July 2015.

The capital expenditure forecast in Chapter 8 and was used to roll forward RAB, using the expected regulatory depreciation detailed in Chapter 10. The RAB for the next regulatory control period is set out in Table 11.1.

Table 11.1 – Summary of RAB

F/Y ending June ($000)	2016	2017	2018	2019	2020
Opening RAB	129,755	134,216	138,095	140,328	143,633
Capex	6,163	5,835	4,453	5,785	17,188
Depreciation	-4,947	-5,311	-5,672	-5,988	-6,364
Indexation	3,244	3,355	3,452	3,508	3,591
Closing RAB	134,216	138,095	140,328	143,633	158,047

11.2.2 Return on capital

The return on capital was calculated by applying the post-tax nominal vanilla WACC to the opening RAB in the respective year.

The post-tax nominal vanilla WACC of 8.06% was established using the methodology detailed in Chapter 6. Directlink has calculated the return on capital in using the PTRM. This calculation is summarised in Table 11.2.

Table 11.2 – Summary of return on capital forecast

FY ending	2016	2017	2018	2019	2020	Total
Return on capital	10,458	10,818	11,130	11,310	11,577	55,294

11.2.3 Return of capital

Chapter 10 describes how Directlink has calculated the return of capital provided by depreciation. The AER's PTRM combines both the straight line depreciation and an adjustment for inflation on the opening RAB. A summary of the regulatory depreciation allowance is given in Table 11.3.

Table 11.3 – Summary of regulatory depreciation

FY ending	2016	2017	2018	2019	2020	Total
Depreciation	- 4,947	- 5,311	- 5,672	- 5,988	- 6,364	- 28,284
Indexation	3,244	3,355	3,452	3,508	3,591	17,151
Regulatory depreciation	1,703	1,956	2,220	2,480	2,774	11,133

11.2.4 Operating expenditure

Chapter 9 of this revenue Proposal details Directlink's requirement for operating expenditure requirements in each year of the next regulatory period. This is summarised in Table 11.4.

Table 11.4 – Summary of forecast operating expenditure

FY ending	2016	2017	2018	2019	2020	Total
Total operating expenditure	5,930	5,387	5,625	5,740	5,883	28,565

11.2.5 Tax allowance

The tax allowance associated with the RAB is outlined in Section 7. The forecast tax allowance is summarised in Table 11.5.

Table 11.5 – Summary of tax allowance 2015-20

FY ending	2016	2017	2018	2019	2020	Total
Taxation allowance	764	817	871	922	979	4,353

11.3 Maximum Allowed Revenue

The total revenue cap and the MAR for each year of the next regulatory period is provided below. Based on the building blocks outlined in the previous Sections, the total revenue cap and maximum allowable unsmoothed revenue requirement is summarised in Table 11.6.

Table 11.6 – Summary of unsmoothed revenue requirement

FY ending	2016	2017	2018	2019	2020	Total
Return on capital	10,458	10,818	11,130	11,310	11,577	55,294
Return of capital	1,703	1,956	2,220	2,480	2,774	11,133
Total operating expenditure	5,930	5,387	5,625	5,740	5,883	28,565
Tax allowance	764	817	871	922	979	4,353
Unsmoothed revenue requirement	18,856	18,978	19,847	20,452	21,212	99,345

11.4 X-Factor smoothed revenue

Rule 6A.6.8 requires the Revenue Proposal to include the X factors nominated for each year of the regulatory period and that the X factors comply with the Rules. A net present value (NPV) neutral smoothing process is applied to the building block unsmoothed revenue requirement, while ensuring the expected MAR for the last regulatory year is as close as reasonably possible to the annual building block revenue requirement. The associated X factors are presented in Table 11.7.

Table 11.7 – Smoothed revenue requirement and X factor

FY ending	2016	2017	2018	2019	2020	Total
Unsmoothed revenue requirement	18,856	18,978	19,847	20,452	21,212	99,345
Smoothed revenue requirement	18,137	18,962	19,825	20,727	21,670	99,322
X factor (CPI-X)		-2.00%	-2.00%	-2.00%	-2.00%	

11.5 Revenue cap adjustments

In accordance with the Rules,[42] Directlink's revenue cap determination by the AER is in the CPI-X format, and may be subject to adjustment during the next regulatory period for the following reasons:

- ***Adjustment for actual CPI*** – Directlink's revenue cap will be calculated each year using the actual CPI.
- ***STPIS*** – Directlink's revenue cap will be adjusted by the impact of the STPIS as discussed in section 12;

42 AEMC, National Electricity Rules, Chapter 6A.5.3.

- ***Pass through*** – Directlink's revenue cap may be adjusted in the event that an eligible pass through amount is approved by the AER in accordance with Rule 6A.7.3.

12 Incentive mechanisms

12.1 Service Target Performance Incentive Scheme

12.1.1 Historical performance

Clause S6A.1.3(2), schedule 6A.1 of the Rules requires this Proposal to contain:

(a) The values, weightings and other elements that Directlink proposes for the performance incentive scheme parameters during the new regulatory control period; and

(b) An explanation of how those proposed values, weightings and other elements comply with any requirements set out in the scheme.

Directlink has been subject to a form of Service Target Performance Incentive Scheme (STPIS) as developed in the 2006 determination. The scheme has been used by the AER during the current regulatory control period to determine financial penalties and rewards for Directlink's service performance.

The Directlink STPIS comprised two elements:

- The service component; and
- The market impact component.

These components, their parameters, and Directlink's historical performance under the scheme are discussed in this section.

The proposed operation of the scheme during the 2015-20 regulatory control period is discussed in the following section.

Service component - transmission circuit availability

There are three parameters associated with the service component of the STPIS:

- Transmission circuit availability;
- Loss of supply event frequency; and;
- Average outage duration.

Parameters and targets

Under the previous determination, Directlink's performance was subject to the first of these parameters, with the following modifications:[43]

(a) Replace the sub-parameters in the standard definition with the following sub-parameters:

[43] Ibid, p.46.

(i) planned circuit availability

(ii) forced peak circuit availability

(iii) forced off-peak circuit availability

(b) Exclude outages needed to replace transformers where:

(i) the replacement of the transformer was needed

(ii) the time taken to replace the transformer was needed, and

(iii) the AER is satisfied that the replacement was the best alternative and all reasonable preventative measures have been taken.

The performance targets that had been agreed by the AER are set out in Table 12.1.[44]

Table 12.1 – STPIS performance targets

No	Measure	Performance for Maximum Penalty	Target Performance	Performance for Maximum Bonus	Weighting Factor
1a	Planned circuit availability	99.45%	99.45%	100%	30%
1b	Forced outage circuit availability in peak periods	98.47%	99.23%	100%	35%
1c	Forced outage circuit availability in off-peak periods	98.47%	99.23%	100%	35%

The maximum annual adjustment to revenue, to which Directlink is exposed, is ±1% of the maximum allowable revenue in any calendar year.

Directlink notes that the STPIS performance standards were based on the composite availability of all three circuits.[45] However, the Directlink asset valuation was capped at the level of market benefits attributable to 120MW (two circuits) of capacity.[46] Going forward Directlink recommends that the STPIS parameters be aligned to this 2-circuit level, for two key reasons: first the STPIS will then be aligned to the asset value, and second, this will provide a stronger incentive for increasing the reliability of all three circuits.

44 AER, *Directlink Joint Venturers' Application for Conversion and Revenue Cap Decision* 3 March 2006, Table B.2 p 38.

45 AER, *Directlink Joint Venturers' Application for Conversion and Revenue Cap Decision* 3 March 2006, Table B.3 p 39.

46 AER, *Directlink Joint Venturers' Application for Conversion and Revenue Cap Decision* 3 March 2006, p 24.

12.1.2 Performance during current regulatory control period

Calendar year 2013 is the most recently available full year of data on Directlink's performance under the STPIS. The performance against the three target parameters established by the AER and the overall bonus/penalty as a percentage of the maximum annual revenue is set out in Table 12.2.

Table 12.2 – Performance against service target levels (after exclusions)

Calendar year	2009	2010	2011	2012	2013
Scheduled Circuit Availability	99.45%	99.45%	99.45%	99.45%	99.45%
Actual Circuit Availability	98.94%	97.74%	99.14%	98.56%	99.87%
S Factor component	-0.28%	-0.30%	-0.17%	-0.30%	0.23%
Target Forced Peak Circuit Availability	99.23%	99.23%	99.23%	99.23%	99.23%
Actual Forced Peak Circuit Availability	91.47%	78.64%	82.62%	77.76%	70.54%
S Factor component	-0.35%	-0.35%	-0.35%	-0.35%	-0.35%
Target Forced Off-peak Circuit Availability	99.23%	99.23%	99.23%	99.23%	99.23%
Actual Forced Off-peak Circuit Availability	94.99%	87.97%	90.83%	89.51%	61.91%
S Factor component	-0.35%	-0.35%	-0.35%	-0.35%	-0.35%
Composite S-Factor	-0.978	-1.0	-0.87	-1.0	-0.47
S-Factor Bonus/Penalty ($)	-122,128	-$126,561	-112,005	-130,218	-61,792

As discussed in section 1.6, the poor performance shown in calendar 2012 and 2013 is a direct result of one circuit being offline since the converter station fire in August 2012, and the remaining circuits being offline from August to December 2013.

In its *Framework and Approach* Paper, the AER acknowledges that this history does not represent a normal period of operation on which to base forward looking targets.[47] Directlink undertakes to work with the AER to develop sensible targets for these incentive schemes.

12.1.3 Proposed service target levels for 2015-20

In its *Framework and Approach* Paper, the AER confirmed that it proposes to apply Version 4 of the STPIS to Directlink for the 2015-20 regulatory control period.[48] Directlink accepts that the AER will apply Version 4 of the STPIS during the 2015-20 regulatory control period.

While the *Framework and Approach* Paper notes that the AER proposes to assess whether Directlink's proposed performance targets, caps, collars and weightings comply with the version 4 STPIS requirements for:[49]

- average circuit outage rate, with two sub-parameters:
  - circuit outage rate – fault
  - circuit outage rate – forced outage
- proper operation of equipment, with three sub-parameters:
  - failure of protection system
  - material failure of supervisory control and data acquisition (SCADA) system
  - incorrect operational isolation of primary or secondary equipment.

These definitions are consistent with Appendix B of the STPIS.[50]

However section 3.4 of the STPIS applies weight to only the "Circuit outage – fault" parameter:[51]

Table 2: Weightings for each parameter/sub-parameter for Murraylink and Directlink

Parameter	Weighting (MAR %)
Average circuit outage rate:	**1.00**
Circuit outage - fault	1.00
Circuit outage – forced outage	0.00
Proper operation of equipment:	**0.00**

47 AER, *Framework and approach paper – Directlink - Regulatory control period commencing 1 July 2015*, January 2014, pp11-13.

48 AER, *Framework and approach paper – Directlink - Regulatory control period commencing 1 July 2015*, January 2014, pp11-13.

49 AER, *Framework and approach paper – Directlink - Regulatory control period commencing 1 July 2015*, January 2014, pp12-13.

50 AER, *Electricity TNSP, STPIS, version 4*, December 2012, Appendix B.

51 AER, *Electricity TNSP, STPIS, version 4*, December 2012, s3.4.

Directlink has therefore proposed the following parameters for the relevant measures. It is important to note that these parameters will be difficult to compare to those produced by other TNSPs. The main reason for this is the small number of circuits comprising the Directlink asset.

Table 12.3 – STPIS v4 Performance and parameters

	Historical actual performance					Average Actual	Proposed			Weight (% of MAR)
	2008	2009	2010	2011	2012		Collar	Target	Cap	
Average circuit outage rate (per cent):										
Circuit outage rate - fault	800	467	667	833	667	**687**	816	687	557	1.0
Circuit outage rate – forced outage	167	100	433	200	233	**227**	339	227	114	0
Proper operation of equipment (number of events):										
Failure of protection system	5	3	4	2	6	**4.0**	5.41	4.0	2.59	0
Material failure of SCADA	0	0	0	0	0	**0**	0	0	0	0
Incorrect operational isolation of primary or secondary equipment	0	0	0	0	0	**0**	0	0	0	0

Directlink appreciates that the AER may wish Directlink to commence collecting data to report against the "proper operation of equipment" parameters in the future, and Directlink is pleased to do so on the AER's request.

12.1.4 Market impact component

Version 4 of the STPIS includes a Market Impact Component (MIC). The market impact component is a positive incentive only intended to provide an incentive for TNSPs to schedule outages and maintenance at times when the market impact is low, and in coordination with other networks in order to reduce the overall frequency of planned outages.

Directlink is not currently subject to the market impact component of the STPIS, although the AER has indicated in its *Framework and Approach* Paper that it intends to apply this incentive mechanism for the 2015-20 regulatory period.[52]

[52] AER, *Framework and approach paper – Directlink - Regulatory control period commencing 1 July 2015*, January 2014, p13.

At the highest level, Directlink is concerned that rescheduling maintenance in pursuit of the MIC incentive would impose substantial additional costs, due the remoteness of the link and the high costs of travel and accommodation for staff and plant engaged in maintenance. Nevertheless, Directlink will review its maintenance arrangements in order to determine whether the incentive provided by the market impact component exceeds the marginal costs of disruption to planned work.

The AER's *Framework and Approach* Paper also acknowledges that Directlink's current operating circumstances, resulting from the 2012 converter station fire, do not provide a normal foundation on which to base the parameters applicable to the forward-looking MIC.

Directlink undertakes to work with the AER to develop sensible target and parameter levels for this incentive mechanism.

12.2 Efficiency Benefit Sharing Scheme

While Directlink has not previously been subject to an Efficiency Benefit Sharing Scheme (EBSS), it acknowledges that the AER has stated, in its Framework and Approach paper, its intention to implement an EBSS. Directlink accepts that an EBSS is to be implemented.

Directlink proposes to exclude two cost categories from the operation of the EBSS:

- Debt raising costs. These are calculated by the PTRM; and
- Fees levied by TransGrid as coordinating TNSP under (forthcoming) Rules 6A.29A.4 or 6A.29A.5. TransGrid has not advised Directlink of any such fees (the Rules providing for these fees do not come into effect until 2015), so they are not included in the operating expenditure component of the revenue proposal. Should TransGrid apply such fees over the course of the regulatory period, Directlink will deduct this amount from the actual incurred opex for the purposes of calculating the EBSS benefit or penalty.

This is appropriate as such fees are unforecast, uncontrollable and unrelated to Directlink's efficiency, as they are for the recovery of TransGrid's costs. As these fees are not currently levied, it is also impossible for Directlink (or the AER) to predict whether these fees, if levied, will be a significant proportion of future incurred operating expenditure. Given the relatively modest Directlink operating expenditure forecast, there is the potential for a significant distortion of the incentives under the scheme such that Directlink is penalised for increases in costs that are not related to its efficiency, while at the same time TransGrid achieves a corresponding gain through its EBSS, again for reasons unrelated to efficiency. For these reasons, Directlink considers that any fees levied by TransGrid under Rules 6A.29A.4 or 6A.29A.5 be excluded from the operation of the EBSS.

12.3 Capital Efficiency Sharing Scheme

The AER's Framework and Approach Paper identified that this scheme would apply, and Directlink will work with the AER to determine the parameters to apply under this scheme.

13 Negotiating Framework and Pricing Methodology

This Section describes how Directlink's revenue Proposal complies with the requirements of the Rules concerning the Negotiating Framework and Pricing Methodology.

13.1 Negotiating framework

Part D of Chapter 6A of the Rules set out the information that must be provided in a TNSP's Negotiating Framework.

Directlink is unlike a conventional transmission network, where the network may be accessed at multiple locations, and where the terms and conditions of that access are negotiated. There are, and will remain, only two terminal locations where the link is connected to the adjacent transmission networks. Access to the capacity of Directlink through these two locations is a prescribed transmission network service and is the subject of this revenue Proposal.

There are currently no negotiated transmission services associated with Directlink and no potential for such services to be developed in future; a Negotiating Framework is not required. However, the Rules do not appear to provide an exemption for Directlink, and a proposed Negotiating Framework is provided at Attachment 13.1.

13.2 Pricing methodology

Rule 6A.10.1(a) requires the TNSP to submit a *Pricing Proposal* with its Revenue proposal. Rule 6A.10.1(e) requires that *Pricing Proposal* to:

(1) give effect to and be consistent with the Pricing Principles for Prescribed Transmission Services; and

(2) comply with the requirements of, and contain or be accompanied by such information as is required by, the pricing methodology guidelines made for that purpose under rule 6A.25.

The requirements for a Pricing Methodology are set out in Part J of Chapter 6A the NER.

For the purpose of transmission pricing, Directlink is included within the New South Wales Region. TransGrid has been appointed the Co-ordinating Network Service Provider for the NSW Region in accordance with clause 6A.29.1(a) of the NER.

Directlink annually provides details of its Aggregate Annual Revenue Requirement (AARR) to TransGrid, who carries out the pricing allocation for its Region, in accordance with the NER. The transmission prices so produced recover the revenues of both TransGrid and Directlink. TransGrid passes through the Directlink component, on a monthly basis in accordance with Rules 6A.27.4 and 6A.27.5.

TransGrid's prices, of which Directlink's costs are a component, are prepared in accordance with its Pricing Methodology.

While Directlink submits that there is no need for it to prepare a separate Pricing Methodology, the Rules do not provide it an exemption from filing a Pricing Methodology with its Revenue Proposal. A Pricing Methodology is therefore included as Attachment 13.2.

In accordance with the Rules,[53] Directlink's revenue cap determination by the AER is in the CPI-X format. Directlink will adjust the AARR during the regulatory period for the following reasons:

- ***Adjustment for actual CPI*** – Directlink's revenue cap will be calculated each year using the actual CPI.
- ***STPIS*** – Directlink's revenue cap will be adjusted by the impact of the STPIS as discussed in section 12.

[53] National Electricity Rules, Rule 6A.5.3.