Energy Infrastructure Investments

Murraylink Transmission Company Pty Ltd

Murraylink Revenue Proposal

(Public)

Effective

July 2018 to June 2023

January 2017

20170113 Murraylink Revenue Proposal

Contents

Tables

Figures

Attachments

Attachment 1.1	RIN template
Attachment 1.2	RIN sign off
Attachment 1.3	Compliance checklist
Attachment 1.4	Director's responsibility statement
Attachment 1.5	Plain English Overview
Attachment 3.1	Cost allocation methodology
Attachment 4.1	Capital expenditure model
Attachment 5.1	Regulatory asset base roll forward model
Attachment 6.1	Frontier Economics report – An equity beta estimate for Australian energy network businesses
Attachment 6.2	Averaging period
Attachment 7.1	Murraylink Asset Management Plan
Attachment 7.2	Business Cases
Attachment 8.1	Forecast operating expenditure model
Attachment 8.2	Outsourcing arrangements
Attachment 10.1	Post tax revenue model
Attachment 12.1	Negotiating framework
Attachment 12.2	Pricing methodology

Glossary

Term	Definition
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
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
HVDC	High Voltage Direct Current
LPI	Labour Price Index
MAR	Maximum Allowed Revenue
NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules
NPV	Net Present Value
Proposal	Murraylink Revenue Proposal
PTRM	AER Post Tax Revenue Model
RAB	Regulatory Asset Base
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 Murraylink transmission interconnector is submitted by Murraylink Transmission Company Pty Limited, on behalf of Energy Infrastructure Investments Pty Limited.

Murraylink is a 180 km, HVDC 220 MW transmission link between Red Cliffs in Victoria and Berri in South Australia. It can control power transfers to the limit of its capacity, in either direction, between the Victorian and South Australian transmission networks. The link is dispatched by AEMO, in similar manner to a generator, to control flows between the Victorian and South Australian regions of the National Electricity Market (NEM) and thereby minimise the costs of generation in the NEM.

The demand for Murraylink's services arises from the need for energy to be dispatched between the NSW and South Australian regions, in accordance with AEMO's requirements. The need for interconnection capacity is increasing, to match the forecast expansion in renewable generation in South Australia and reduction in thermal generation. This will require Murraylink's maximum available capacity to be maintained with a high level of availability.

At the time of its commissioning, Murraylink represented cutting-edge 'HVDC Light' technology. The Direct Current (DC) convertor stations were connected by the longest underground cable in the world. Whilst there have been a number of more recent DC transmission developments throughout the world, this type of equipment remains highly specialised.

Murraylink is very reliable with high levels of circuit availability. Murraylink's historic service performance is discussed in section 4.5 and is shown in Table 1.1

Table 1.1 – Historic service performance

	2013/14	2014/15	2015/16
Planned circuit availability (%)	99.77	98.45	98.61
Forced peak circuit availability (%)	99.47	99.42	99.96
Forced off–peak circuit availability (%)	100.00	99.68	100.00

Murraylink is now in its second decade of operation. The major elements of equipment that comprise the link (the main transformers, conversion equipment and filters) have a standard life of 40 years. However, most items of the ancillary equipment necessary for the operation of the link (notably equipment such as air conditioners, ventilation fans, water pumps and treatment apparatus, control and protection systems) have much shorter useful lives than these major assets. Some of this equipment will require refurbishment or replacement during the 2018-23 regulatory control period. These refurbishment projects have been factored into the capital expenditure program. While, as would be expected for an asset getting older, this component is increasing over time however it remains modest. The major item of capital expenditure is not the replacement of an existing asset, it is the installation of a fire suppression system. Following the fire experienced at another EII asset (Directlink) and the advice of insurers Murraylink will be installing a fire suppression system to prevent fire damage to operating equipment that could result in a catastrophic long term loss of service. More detailed information on Murraylink's capital expenditure is set out in section 4.2.

Murraylink's capital expenditure in the current regulatory control period is shown in Table 1.2.

Table 1.2 – Historic capital expenditure ($m nominal)

	2013/14	2014/15	2015/16	2016/17(e)	2017/18(e)	Total
AER forecast	1.7	1.4	1.8	0.5	0.6	5.9
Capital expenditure	0.3	0.7	0.9	7.4	7.2	16.6
Actual compared to forecast	-1.4	-0.6	-0.9	7.0	6.6	10.7

The historic Murraylink operating expenditure is set out in Table 1.3. A major component of the operating costs has been competitively outsourced and the actual expenditure is closely comparable to the AER's forecast in 2013. More detail on the historic operating expenditure is set out in section 4.3

Table 1.3 – Historic operating expenditure ($m nominal)

	2013/14	2014/15	2015/16	2016/17(e)	2017/18(e)	Total
AER Forecast	3.7	3.8	3.9	4.0	4.3	19.5
Actuals	3.7	4.5	4.0	4.7	4.2	21.1
Actual compared to forecast	0.0	0.7	0.2	0.8	-0.0	1.6

The basis for the proposed capital expenditure forecast for Murraylink for the 2018-23 regulatory control period is set out section 7 and summarised in Table 1.4. The majority of this expenditure is associated with the replacement of an obsolete control system. Given the central role of the control system in the operation of Murraylink, the capital expenditure is unavoidable in order to be confident of Murraylink's ongoing availability from 2021 onwards.

Table 1.4 – Forecast capital expenditure ($m real 2018)

	2018/19	2019/20	2020/21	2021/22(e)	2022/23(e)	Total
Forecast Capital Expenditure	5.8	13.9	10.8	2.4	1.0	33.8

Murraylink's proposed operating expenditure is set out section 8 and summarised in Table 1.5. This forecast is a projection of the existing competitively sourced maintenance costs adjusted for non-recurrent costs and a service level agreement that will deliver benefits in terms of network reliability.

Table 1.5 – Forecast operating expenditure ($m real 2018)[1]

	2018/19	2019/20	2020/21	2021/22(e)	2022/23(e)	Total
Routine	2.1	2.1	2.1	2.1	2.1	10.6
Fault and Condition	0.5	0.5	0.5	0.5	0.5	2.6
Non-Recurring	0.0	-	0.0	-	0.2	0.2
Non System	0.7	0.7	0.7	0.7	0.7	3.7
Connection Charges	1.0	1.0	1.0	1.0	1.0	4.9
Total	4.4	4.4	4.4	4.4	4.5	22.0

The proposed Murraylink revenue and price path builds upon these forecast costs and has been calculated in accordance with the National Electricity Rules and the AER's guidelines. The proposed revenue requirement, smoothed revenue and X-factors are set out in Table 1.6.

Table 1.6 – Revenue Requirement and price path ($m nominal)

	2018/19	2019/20	2020/21	2021/22 (e)	2022/23 (e)	Total
Return on capital	7.5	7.6	8.2	8.7	8.5	40.4
Return of capital	4.4	4.8	4.9	5.2	7.4	26.7
plus operating expenditure	4.5	4.5	4.7	4.7	5.0	23.4
plus EBSS	-0.2	-0.2	0.6	-	0.6	0.8
plus net tax allowance	0.9	0.9	1.0	1.1	1.1	5.0
Total	17.1	17.6	19.4	19.6	22.7	96.4
Smoothed revenue path	17.1	18.1	19.2	20.3	21.6	96.3
X factors tariff revenue (%)		-3.95%	-3.95%	-3.95%	-3.95%	

[1] Excludes EBSS and debt raising costs.

The principal challenge associated with Murraylink relates to maintaining the electrical installation, with its many sub-components, to meet high standards of availability for service. These component assets are now approaching their mid-life. Whilst they have so far proven reliable, they must be maintained to rigorous standards and their condition closely monitored, to avert unplanned premature failure.

In addition, the remote rural setting and environment of the link imposes logistics issues and costs for Murraylink's maintenance operations.

This Revenue Proposal demonstrates how Murraylink will address these challenges. It also provides comprehensive evidence of the revenue needs for the 2018-23 regulatory control period.

In recent years the generation mix in South Australia has continued to change, with the development of renewable (wind and solar PV) generation and the closure and proposed closure of thermal generation of more than 1,500 MW by 2017[2]. This is leading to greater reliance on the existing interconnections, Heywood and Murraylink, to export power from and import power to South Australia.

The 28 September 2016 "system black" South Australia incident has further emphasised the dependence of that state on its interconnections with adjacent states.

Murraylink has identified a sequence of projects with the potential to increase the capability of interconnection to South Australia and provide support to the Victorian, NSW and South Australian regional transmission networks. This sequence of projects involves the reinforcement of both the transmission networks and the duplication of Murraylink. As the matter of South Australian interconnection capacity is currently under consideration by AEMO and the TNSPs, the transmission elements constituting this upgrade have been included in this proposal as a contingent project.

---

[2] AEMO, The Heywood Interconnector: Overview of the Upgrade and Current Status - South Australian Advisory Functions, August 2015, p. 3.

1 Introduction

1.1 Purpose of this document

This Revenue Proposal provides details of Murraylink's revenue requirements for prescribed transmission services during its third regulatory control period. This period is proposed to span 5 years, from 1 July 2018 to 30 June 2023.

This revenue proposal has been developed in accordance with Chapter 6A of the National Electricity Rules (Rules)[3].

During the 2018-23 regulatory control period, Murraylink will require the investment program outlined in this proposal, to continue to reliably perform its role as an interconnection between the Victorian and South Australian Regions of the National Electricity Market (NEM).

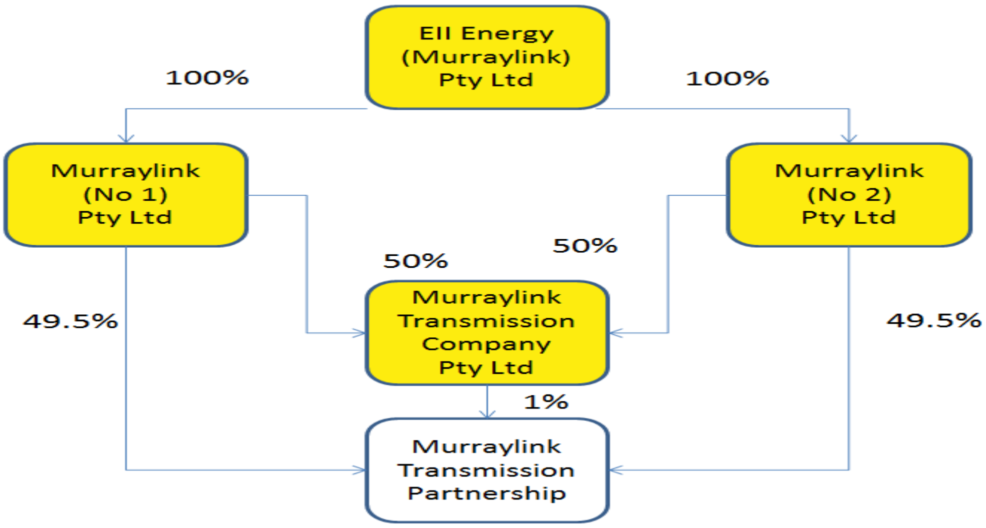
Murraylink transmission interconnector is one of a suite of gas and electricity infrastructure assets owned by Energy Infrastructure Investments Pty Limited (ABN 95 104 348 852). Those infrastructure assets are managed by an APA Group wholly owned subsidiary, APA Operations (EII) Pty Ltd.

This Revenue Proposal for Murraylink is submitted by Murraylink Transmission Company Pty Limited (ACN 089 875 080 Level 19, 580 George Street, Sydney) on behalf of Energy Infrastructure Investments.

The current Energy Infrastructure Investments organisational chart is set out in Figure 1.1.

[3] Australian Energy Market Commission, National Electricity Rules Version 45, as at 14 July 2011.

Figure 1.1 – Energy Infrastructure Investments corporate structure



1.2 Length of regulatory control period

Murraylink's current (second) regulatory control period was for the nominal 5-year period from 1 July 2013 to 30 June 2018. Murraylink therefore proposes that the length of the new regulatory control period be 5 years, from 1 July 2018 to 30 June 2023.

1.3 Services provided by Murraylink

Murraylink is notionally located within the South Australian region of the NEM. The link is connected to the transmission systems of:

- Electranet, in South Australia, at Monash 132 kV substation; and
- Ausnet Services, in Victoria, at Red Cliffs 220 kV terminal station. The location of this connection is also in close proximity to the Victorian – NSW interconnection between Red Cliffs and Buronga.

As an element of the transmission network, Murraylink provides prescribed transmission services to customers throughout the NEM. There are no negotiated services associated with these two connections to Murraylink. The quality of the prescribed services provided by Murraylink is in conformity with the standards set out in the NEM. The reliability and security of supply provided by Murraylink is subject to the AER reporting arrangements and the STPIS described in chapter 11.

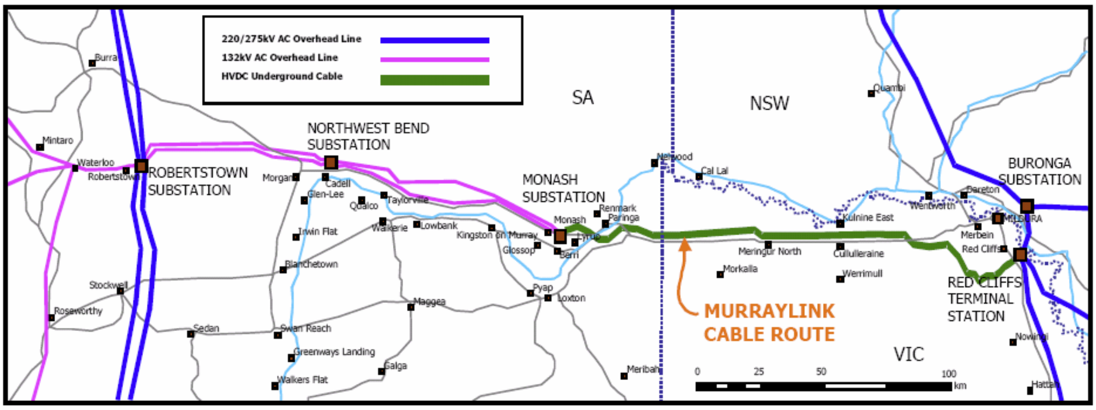
The safety of provision of Murraylink's prescribed transmission services is subject to the requirements of the NER and other national and jurisdictional requirements in relation to public and personnel safety.

Murraylink does not provide any services, regulated or non regulated, other than those outlined above.

1.4 Map of the transmission network

Figure 1.2 is a schematic transmission network map. This map identifies the Murraylink transmission line and the location of major network assets in the adjacent Electranet and SPI Powernet transmission networks.

Figure 1.2 – Murraylink transmission connection



The flow in Murraylink may be adjusted continuously up to its rating of 220 MW in either direction.

1.5 Structure of this document

The remaining elements of this Revenue Proposal are structured as follows:

- Chapter 2 describes the environment in which Murraylink operates and the main challenges anticipated in the next regulatory control period.
- Chapter 3 describes how compliance with the requirements of the Rules and the AER's Guidelines 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 control period, using the AER's Roll Forward Model (RFM).
- Chapter 6 explains Murraylink's capital financing costs and taxation.
- Chapter 7 describes the capital expenditure forecast.

- Chapter 8 describes the operating expenditure forecast.
- Chapter 9 describes the depreciation allowance.
- Chapter 10 presents the revenue needs for the 2018-23 regulatory control period, calculated using the AER's Post-Tax Revenue Model.
- Chapter 11 presents the proposed Service Target Performance Incentive Scheme (STPIS).
- Chapter 12 explains why a Pricing Methodology and a Negotiating Framework are not required for Murraylink.
- Chapter 13 outlines Murraylink's EBSS targets for the next regulatory control period.

To assist the AER in assessing the compliance of this revenue proposal with the National Electricity Rules, Murraylink has provided a compliance checklist as Attachment 1.3 to this Proposal. This checklist cross-references the relevant Sections of this Revenue Proposal and the attachments that address each Rule and RIN requirements.

1.6 Directors' statement

In accordance with the National Electricity Rules, this proposal contains a certification of the reasonableness of the key assumptions that underlie the capital and operating expenditure forecast by the Directors of Murraylink.

The Directors' responsibility statement is included in Attachment 1.4.

1.7 Consumer engagement

Murraylink recognises the long term interests of consumers are at the heart of the regulatory framework and is keen to engage with consumers and their representatives in a constructive way that maximises the benefit for both the consumer and Murraylink.

Murraylink has provided a plain English overview of this proposal in attachment 1.5

As stated in section 1.3, Murraylink is connected to the transmission networks in Victoria and South Australia. Murraylink has no directly connected customers.

Murraylink currently engages with AEMO, ElectraNet and Ausnet Services who all have stakes in the way Murraylink manages its network.

Murraylink views the AER's revenue determination consultation as an element in identifying and engaging consumer cohorts of relevance to its stakeholder engagement.

Murraylink welcomes constructive feedback in relation to an appropriate way to constructively engage with consumers.

2 Business environment and key challenges

2.1 Introduction

This revenue proposal demonstrates how Murraylink expects to continue providing a flexible and cost effective transmission service in the NEM, whilst maintaining high levels of service availability.

Murraylink'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 Murraylink operates;
- An obligation to meet increasing standards of public safety;
- The harsh 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;
- The remoteness of Murraylink from major centres of population and industry; and
- Continuing competition for skilled labour and materials, from both the resources and utility sectors.

This chapter elaborates on Murraylink's environment and the ensuing challenges that must be taken into account when establishing the required revenue for the 2018-23 regulatory control period.

2.2 Murraylink's role and obligations

Murraylink is registered as a TNSP in the NEM under National Electricity Rule 2.5.1 and must comply with all obligations imposed on it by the Rules. These obligations under the Rules require Murraylink 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).

Murraylink 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 in the jurisdictions in which it operates – South Australia and Victoria.

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

2.3 Meeting customer demand

Murraylink 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 Victorian/NSW and South Australian regions, to minimise the overall costs of production in the NEM.

Murraylink also supports the regional transmission systems in the north-west of Victoria and South Australia's Riverland area. 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 South Australia is increasing, due largely to the development of renewable energy resources in this jurisdiction and in western Victoria. This is the subject of current investigations by AEMO and the TNSPs.

Murraylink's transmission network services must therefore remain available at their maximum available capacity and with a high level of availability, throughout the 2018-23 regulatory control period.

The maximum useable capacity from the Murraylink interconnection is limited from time to time by the capability of the conventional transmission networks to which the link is connected, particularly when elements of those networks are out of service.

Murraylink has developed a sequence of augmentations to increase the interconnection capacity to South Australia, making use of the existing transmission corridor through Murraylink. These developments have been included as a contingent project in this Proposal, but are subject to further detailed analysis, the application of the RIT-T and the approval of the AER.

2.4 A maturing asset base

The equipment at Murraylink can be divided into two groups:

- Main circuit 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; and

- Ancillary equipment necessary for the operation of the link (notably uninterruptable power supplies, building ventilation, air conditioning, cooling water pumping and treatment apparatus, control and protection systems). The ancillary equipment generally has shorter service lives, between 4 and 20 years) with elements of the equipment currently at various stages in their service life.

There are a number of elements of ancillary equipment that will require refurbishment or replacement during the 2018-23 regulatory control period. These elements have been factored into the capital expenditure program in section 7.

As the nature of Murraylink's capital and operating expenditure is continue to provide network services to deliver the existing capacity there is no non-network alternatives undertaken or to be undertaken.

2.5 External factors affecting input costs

2.5.1 Murraylink logistics

The terminal stations and underground cable that comprise Murraylink are in a remote rural location, some 300 km from Adelaide and 700 km from Melbourne. As a consequence, this imposes logistics issues for:

- Obtaining skilled maintenance staff;
- The travelling and local accommodation of staff;
- The delivery of spares and equipment; and
- Local storage of spares and equipment.

Notwithstanding that a significant portion of Murraylink maintenance is carried out by a principal maintenance contractor, these cost elements are factored into the contract costs, as well as the costs incurred directly by Murraylink.

2.5.2 Cost escalation

Murraylink is proposing no cost escalation beyond forecast inflation

2.5.3 Connection costs

Murraylink pays connection charges to the adjacent TNSPs AusNet Services and Electranet. These connection costs are a significant component of the operating cost. The connection costs will change, potentially significantly, during the Murraylink regulatory control period, as a result of AER regulatory decisions for the connected TNSPs in 2018 and 2019.

As a consequence, Murraylink is proposing a cost pass through for the difference between the estimated connection costs in this proposal and the annual payments made to the TNSPs.

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 Murraylink'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 forms attachment 7.1 to this proposal and this underpins the associated capital and operating cost forecasts.

Also contained in this plan 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.

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

- corporate governance processes
- accountabilities and control systems

Murraylink's historic capital expenditure and historic operating expenditure are consistent with the requirements of the National Electricity Rules.

The corporate governance processes have ensured that Murraylink's operating expenditure had remained consistent with that forecast by the AER for the current regulatory control period.

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 sold by the APA Group to the Energy Infrastructure Investments Group (EII Group). The EII Group 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[4].

In preparing the operating and capital expenditure records and forecasts accompanying this Proposal, Murraylink has used the approved Cost Allocation Methodology on both a historical and prospective basis. This document is submitted as attachment 3.1 to the Proposal.

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

Consistent with the requirements of the Regulatory Information Notice, the Directors' Responsibility Statement that accompanies this proposal as Attachment 3.2 certifies that historic expenditure is presented fairly and in accordance with the Cost Allocation Methodology.

3.4 Interaction between operating and capital expenditure

The Rules[5] require that a revenue proposal identify and explain any significant interactions between capital and operating expenditure.

Murraylink is unlike a conventional transmission business in that it comprises a single transmission line, albeit one employing advanced technology. Murraylink is only forecasting capital expenditure associated with a limited number of capital expenditure projects mainly associated with maintaining the reliability of the interconnector.

Moreover, maintenance activities are currently carried out by a principal contractor, in accordance with a long-term agreement. It is proposed that this will remain the case.

No proposed capital project has been identified that would involve a significant interaction between capital and operating expenditure.

3.5 Capitalisation policies

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

---

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

[5] Chapter 6A, schedule S6A.1.3(1).

3.6 Related parties

Murraylink 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 Murraylink's Cost Allocation Methodology and are disclosed in the annual regulatory financial statements in accordance with the AER's Information Guidelines.

3.7 Regulatory accounts

Murraylink maintains a set of regulatory accounts which it uses to submit to the AER annually in compliance with the obligations the AER places on it. These accounts and reports are audited by an external auditor. These accounts form the basis for this submission.

4 Historic cost and service performance

4.1 Introduction

This chapter presents a review of Murraylink's historical capital and operating costs and service performance, during the current regulatory control period.

Audited results are available and have been quoted for the three years from 2013/14 to 2015/16. A part-year estimate has been used for 2016/17 and a full year estimate for 2017/18. These costs are contained within the AER's Regulatory Information Notice template, which forms Attachment 1.1 to this proposal. There is no difference from the material provided in the Regulatory Information Notice template and material previously provided to the AER.

This analysis includes the comparison of Murraylink'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

The historic capital expenditure for Murraylink is set out in Table 4.1. This table also compares it to the AER's forecast for the same period. No capital expenditure incentive scheme was applied to the current period nor is Murraylink proposing one for the forecast control period.

Table 4.1 – Capital expenditure for the current regulatory control period compared to AER forecast ($000 nominal)

	2013/14	2014/15	2015/16	2016/17(e)	2017/18(e)	Total
Actual						
Expansion	-	-	-	-	-	-
Replacement /refurbishment	322	707	916	7,409	7,231	16,585
Non-network	-	-	1	-	-	1
Total	322	707	917	7,409	7,231	16,586
AER Forecast						
Expansion	-	-	-	-	-	-
Replacement /refurbishment	1,743	1,351	1,771	455	572	5,893
Non-network	16	6	-	-	-	22

Total	1,760	1,357	1,771	455	572	5,915
Difference						
Expansion	-	-	-	-	-	-
Replacement /refurbishment	-1,421	-644	-856	6,954	6,659	10,691
Non-network	-16	-6	1	-	-	-21
Total	-1,437	-650	-855	6,954	6,659	10,670

As can be seen in Table 4.1 the actual capital expenditure, including estimates for 2016/17 and 2017/18 was higher than the AER's forecast. The main driver of this difference is the project to install a fire protection system as outlined in section 4.2.1. This project was not foreseen at the time of the previous revenue proposal. Murraylink undertook a number of projects aimed at supporting the ongoing operating of the interconnector. Material projects are outlined below. These projects account for over 80 percent of Murraylinks capital expenditure during the current regulatory control period.

4.2.1 *Fire protection system enhancement*

The original design of the fire detection and protection systems at Murraylink has been proven to be inadequate, by a catastrophic fire at the similarly equipped Directlink, in August 2012. Suitable fire suppression systems have since been installed at Directlink. Murraylink is undertaking a similar installation of fire suppression systems in the current regulatory control period. The network insurer (FM Global) has supported and advised of appropriate solutions. The cost of these works has been estimated at $12.2 M. Work for this project is currently being tendered. The tender is expected to be completed by the end of February 2017.

The damage, cost and extended outage that would result from an uncontrolled fire makes this expenditure prudent.

Table 4.2- Capital expenditure fire protection system ($'000 nominal)

	2013/14	2014/15	2015/16	2016/17(e)	2017/18(e)	Total
Fire protection system	-	-	-	6,104	6,104	12,207

4.2.2 *Site security enhancement*

A number of incidents involving the injury or death of trespassers in high voltage substations has resulted in changes to the standards for substation security. These changes were incorporated into the substation fencing requirements detailed in the National Guideline for Prevention of

Unauthorised Access to Electricity Infrastructure published by the Energy Networks Association.[6]

The AER approved capital expenditure for construction of site security in the current regulatory control period. Murraylink continues to monitor the costs of projects and adjust them for a range of factors including input costs, scope of projects and management approaches. Murraylink currently estimates the cost of upgrade to the security at the Berri and Red Cliffs sites at $0.9m

Table 4.3- Capital expenditure site security enhancement ($'000 nominal)

	2013/14	2014/15	2015/16	2016/17(e)	2017/18(e)	2018/19 (f)	Total
Actual	-	-	-	198	468	278	944
AER Forecast	990	-	-	-	-	-	990
Difference	-990	-	-	198	468	278	-46

4.2.3 *Insulated Gate Bipolar Transistors*

An insulated-gate bipolar transistor is a device primarily used as an electronic switch. Due to the number of these devices utilised on its network, Murraylink holds spares to replace those units that fail. The number of spares is based on the expected failure rate to avoid the circumstances of an insulated gate bipolar transistor failing with no replacement being available. The AER approved the inclusion of capital expenditure for insulated-gate bipolar transistors for the current regulatory control period. That approval was based on the failure rate experienced over the years prior to Murraylinks revenue submission in 2012. While it remains very low the failure rate has risen in the current regulatory control period requiring additional purchases of insulated-gate bipolar transistors.

Table 4.4- Capital expenditure Insulated Gate Bipolar Transistors ($'000 nominal)

	2013/14	2014/15	2015/16	2016/17(e)	2017/18(e)	Total
Actual	79	271	392	18	63	823
AER Forecast	73	75	76	77	78	379
Difference	6	196	316	-59	-15	444

[6] ENA, National Guidelines for Prevention of Unauthorised Access to Electricity Infrastructure, 2006

More detail of Murraylink's capital expenditure is available in the capital expenditure model (attachment 4.1)

4.2.4 *Historic capital expenditure compared to the AER's forecast*

Under rule S6A.2.2A the AER may determine to reduce the amount of historic capital expenditure for a review period that may be added to the capital based where one of the following requirements is satisfied.

- Overspending requirement
- Margin requirement
- Capitalisation requirement

Table 4.5 demonstrates that Murraylink's capital expenditure for the review period does exceed the AER's forecast.

Table 4.5 – Historic capital expenditure and AER forecast for the review period ($M nominal)

	2011/12	2012/13	2013/14	2014/15	2015/16	Total
AER Forecast	0.3	0.7	0.9	7.4	7.2	16.6
Actuals	1.8	1.4	1.8	0.5	0.6	5.9
Difference	-1.4	-0.6	-0.9	7.0	6.7	10.7

All Murraylink's capital expenditure is undertaken on an arms length basis. All capital expenditure for Murraylink is consistent with its capitalisation policy and is the same as for its financial accounts.

4.3 Historic operating expenditure

Table 4.6 below sets out the actual incurred and estimated operating expenditure against the AER's forecast from the last revenue determination.

Table 4.6 – Historic operating expenditure compared to AER forecast operating expenditure ($M nominal)

	2013/14	2014/15	2015/16	2016/17(e)	2017/18(e)	Total
AER Forecast	3.7	3.8	3.9	4.0	4.3	19.5
Actuals	3.7	4.5	4.0	4.7	4.2	21.1
Difference	0.0	0.7	0.2	0.8	-0.0	1.6

As can be seen from the table above the variation from the AER's forecast for the period is very small at $1.6 m or 8 per cent of the AER's forecast opex.

4.3.1 *Movements in provisions*

Murraylink does not have any provisions in its historic or forecast capital expenditure or operating expenditure.

4.4 Small Scale Incentive Scheme

Murraylink does not have a small scale incentive scheme and consistent with the AER's Framework and Approach paper, Murraylink is not proposing one.

4.5 Historic Service Target Performance Incentive Scheme

The table below sets out Murraylink's performance against the AER's Service Target Performance Incentive Scheme. This data is produced on the same basis as the AER's Service Target Performance Incentive Scheme.

Table 4.7 – Service Target Performance Scheme outcomes

	AER Target	2013 (half year)	2014	2015
Planned circuit availability (%)	99.17	99.77	98.45	98.61
Forced peak circuit availability (%)	99.48	99.46	99.42	99.93
Forced off–peak circuit availability (%)	99.34	100.00	99.68	100.00

Table 4.8 – Service Target Performance Scheme outcomes – Market impact

	AER Target	2013 (half year)[7]	2014	2015
Market Impact Parameter	782.3	159	179	544

4.6 Efficiency Benefit Sharing Scheme

Murraylink is subject to the AER's Efficiency Benefit Sharing Scheme (EBSS). The operating expenditure for the comparison to the AER's target is set out in Table 4.9.

Table 4.9 – EBSS operating expenditure ($000 nominal)

	2013/14	2014/15	2015/16	2016/17(e)	2017/18(e)
Total operating expenditure	3,681	4,453	4,026	4,745	4,212

[7] Target for half year was 391.

Excluded items	957	995	971	1,020	1,010
EBSS operating expenditure	2,724	3,458	3,055	3,726	3,202

This table does not make any adjustments to the proposed approach to calculating the EBSS for the current period.

The impact on Murraylink's revenue for the forecast regulatory control period is set out in Table 4.10.

Table 4.10 – EBSS outcomes ($m real $2018)

	2018/19	2019/20	2020/21	2021/22	2022/23
Efficiency Benefit Sharing Scheme	-0.2	-0.2	0.5	0.0	0.5

5 Regulatory asset base

5.1 Introduction

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

Murraylink is required by the Rules 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

Murraylink has calculated the value of its opening RAB as at 1 July 2018. The annual adjustments to the RAB included:

- Increase by the amount of capital expenditure incurred during the current regulatory control period, to 2015/16;
- Increase by the estimated amount of capital expenditure for 2016/17 and 2017/18;
- Reduction by the amount of depreciation of the RAB, using the rates and methodologies allowed for in the AER's final determination for the current regulatory control period;
- Reduction by the value of assets disposed of during the current regulatory control period; and
- Indexation by CPI.

These adjustments have been calculated using the AER's RFM.

5.3 Opening RAB as at 1 July 2018

The outcome of applying the AER's roll forward methodology and RFM is an opening RAB for Murraylink of $114.2 M, for the 2018-23 regulatory control period. This calculation is set out in Table 5.1.

Table 5.1 – Opening regulatory asset base as at 1 July 2018 ($M, nominal)

	2013/14	2014/15	2015/16	2016/17(e)	2017/18(e)
Opening RAB	106.7	106.7	105.3	103.9	109.9
Capital expenditure	0.3	0.7	0.9	7.7	7.5
Depreciation	-3.4	-3.6	-3.7	-3.8	-3.9
Indexation	3.1	1.4	1.4	2.1	2.2

Adjustment	-	-	-	-	-1.4
Closing RAB	106.7	105.3	103.9	109.9	114.2

5.3.1 *Asset classes*

Murraylink is not proposing any new asset classes. In the 2013 Final Determination the AER accepted the "Test equipment" asset class but did not set a standard life for this class on the basis that Murraylink was not forecasting any expenditure in that class. Murraylink has now undertaken capital expenditure in relation to test equipment and a standard life is required in order to properly account for those assets. Murraylink has applied a standard life for "Test equipment" of 10 years consistent with Murraylinks revised proposal in 2013.

Table 5.2 – Standard asset lives by asset class

Asset class	Useful life
Switchyard	40
Transmission line	40
Easements	n/a
Ancillary 15 - control systems	15
Ancillary 30	30
Ancillary 7 - pressure vessel testing and inspection	7
Test equipment	10
Other operating assets	5
Office machines	3

These standard lives are consistent with those used in the regulatory financial statements.

5.4 Tax Asset Base

Murraylink has also used the AER's Roll forward model to calculate the Tax Asset Base. This is set out in Table 5.3.

Table 5.3 – Opening Tax Asset Base as at 1 July 2018 ($M, nominal)

	2013/14	2014/15	2015/16	2016/17(e)	2017/18(e)
Opening TAB	81.3	79.1	77.1	75.4	73.9
Capital Expenditure	0.3	0.7	0.9	1.3	13.3

Depreciation	-2.6	-2.6	-2.7	-2.8	-2.8
Closing TAB	79.1	77.1	75.4	73.9	84.5

6 Rate of Return and value of imputation credits

The return on capital included in the required revenue of a TNSP is to be determined as the product of the allowed rate of return and the value of the regulatory asset base at the beginning of each regulatory year in a regulatory control period (NER, clause 6A.6.2, paragraph (a)).

The way in which Murraylink proposes to determine the allowed rate of return, guided by the AER's Rate of Return Guideline, is set out in this chapter of this submission.[8]

The value Murraylink proposes to attach to the franking credits available to equity investors under the dividend imputation provisions of Australian taxation law is also noted and discussed.

The allowed rate of return of clause 6A.6.2 is to be the weighted average of a return on equity and a return on debt. Murraylink proposes to estimate a single return on equity for the regulatory control period (1 July 2018 to 30 June 2023), and a (potentially different) rate of return on debt for each of the regulatory years in that period. Murraylink proposes, by estimating a rate of return on debt for each regulatory year, to update that rate annually to reflect prevailing financial market conditions in each year of the regulatory control period.

The allowed rate of return used to calculate the required revenue of the Murraylink revenue proposal has been determined assuming that the rate of return on debt estimated for the first regulatory year of the regulatory control period will apply in each of the remaining years of that period.

Murraylink's proposed allowed rate of return is 6.54 per cent.

The way in which Murraylink has established the proposed allowed rate of return is set out in sections 6.1 to 6.3 below.

Four implementation issues – credit rating, data, annual updating process, and averaging periods – are discussed in section 6.4.

Section 1.5 discusses estimation of the value of imputation credits, and explains Murraylink's gamma estimate of 0.25.

6.1 Gearing

The allowed rate of return of clause 6A.6.2 of the NER is to be the weighted average of a return on equity and a return on debt determined on a

[8] AER, Rate of Return Guideline, December 2013.

nominal vanilla basis (clause 6A.6.2, paragraphs (d)(1) and (d)(2)). In this weighted average, determined on a nominal vanilla basis, the weight to be given to the return on equity should be the proportion of equity in the total capital of the benchmark efficient entity of clause 6A.6.2, paragraph (c) (which is assumed to be financed by equity and debt). The weight to be given to the return on debt – the gearing – should be the proportion of debt in the total capital of the benchmark efficient entity.

Section 4.3.2 of the Rate of Return Guideline advises that the gearing of the benchmark efficient entity for which the weighted average of the return on equity and the return on debt is to be determined is to be 0.6.

Murraylink has therefore used gearing of 0.6 to calculate the nominal vanilla weighted average of returns on equity and debt which is to be the allowed rate of return for its revenue proposal.

6.2 Estimating the return on equity

This section of the submission sets out Murraylink's approach to estimating the return on equity for the revenue proposal.

Murraylink proposes that an initial estimate of the return on equity of 8.6 per cent be used in establishing the allowed rate of return.

This initial estimate has been made using financial market data available prior to submission of the Murraylink revenue proposal. It will be updated – by updating the estimate of the risk free rate of return – using data which become available during the revenue proposal approval process so that the rate of return on equity used in determining the allowed rate of return has been estimated having regard to prevailing conditions in the market for equity funds.

The foundation model of the Rate of Return Guideline – the Sharpe-Lintner Capital Asset Pricing Model (SL CAPM) – is noted in section 6.2.1. The way in which Murraylink has applied the foundation model to estimate the return on equity is explained in sections 6.2.2 to 6.2.4. Murraylink's estimation of the return on equity is summarised in section 6.2.5. In section 6.2.6, Murraylink evaluates its estimate of the return on equity against the requirements of the NER, and in section 6.2.7 explains why a view that it has applied the "Wright approach" would be incorrect.

6.2.1 Foundation model

The Rate of Return Guideline identifies four quantitative financial models which may have a role in estimating the return on equity. These four financial models are:

- the SL CAPM;

- Black's Capital Asset Pricing Model (Black CAPM);
- the dividend growth model;[9] and
- the Fama-French Three Factor Model.

The SL CAPM is referred to as the "foundation model". It is to be the starting point for estimating the expected return on equity.

The Black CAPM is not to be used directly to estimate the return on equity. It is to be used only to inform estimation of the beta to be used in applying the SL CAPM.

Similarly, the dividend growth model is to be used to inform estimates of the market risk premium (MRP) to be used in applying the foundation model. It is not to be used for the purpose of estimating the return on equity itself.

Although the Fama-French Three Factor Model is a relevant financial model, the Rate of Return Guideline advises that it has no role in estimating the return on equity.

The SL CAPM explains the expected return, E(rj), on financial asset j, as the sum of the rate of return on a risk free asset and a premium for risk:

$E(r_j) = r_f + \beta_j \times [E(r_M) - r_f]$,

where rf is the return on the risk free asset, and βj x [E(rM) – rf] is the premium for risk. βj is the beta for financial asset j, defined as cov(rj, rM)/var(rM), and E(rM) is the expected return on the market portfolio of assets. E(rM) – rf is the MRP.

Clause 6A.6.2, paragraph (g), of the NER requires that an estimate of the return on equity be made having regard to prevailing conditions in the market for equity funds.

The SL CAPM is, as the AER notes, a forward looking model. It provides an estimate of a forward looking – expected – rate of return on equity. If the model is to produce the estimate required by clause 6A.6.2, paragraph (g), it must be used with parameters which are, as appropriate, current or forward looking. The estimates of the risk free rate and beta used in applying the SL CAPM must be current estimates; they must be made having regard to prevailing conditions in financial markets. The MRP is inherently forward looking.

[9] Murraylink uses the singular term dividend growth model to refer to the class of financial models which can be used to estimate the return on equity as the discount rate which equates the present value of future dividends with the current share price.

The AER has noted that historical data may be used in estimating the parameters of the SL CAPM where those data are good evidence of forward looking parameters. Historically based estimates that are clearly not representative of forward-looking parameters should not be used; they will result in biased estimates of the return on equity.[10] Murraylink would add that historically based estimates that are clearly not representative of current rates should, similarly, not be used.

That the SL CAPM provides a forward looking estimate of the rate of return on equity, and requires current or forward looking parameter estimates, raises significant issues for the estimation of beta and the MRP. These are discussed in sections 6.2.3 and 6.2.4 below. Estimation of the risk free rate of return is less contentious; it is discussed in section 6.2.2.

6.2.2 *Risk free rate of return*

The risk free rate is the rate of return on a financial asset which is without risk. To estimate the risk free rate, a proxy for this riskless financial asset – the risk free asset – must be found from among the traded financial assets for which returns can be observed. The Rate of Return Guideline proposes that Australian Government securities with a term to maturity of 10 years be the proxy for the risk free asset. The risk free rate of return is then to be estimated from the yields on these securities.

When estimating the return on equity, recognition will be given to conditions prevailing in the market for equity funds if, when applying the foundation model, the risk free rate is commensurate with prevailing conditions in financial markets at the commencement of the regulatory control period. The estimate of the risk free rate used in estimating the return on equity should, then, be an estimate made immediately prior to the commencement of that period.

To remove the effects of "noise" from the estimate of the risk free rate, yields on Australian Government securities with the required term to maturity should be averaged over a period of between 10 consecutive business days and one year. To provide an estimate of the risk free rate which is commensurate with prevailing conditions in financial markets, this period should be as close as practicably possible to the commencement of the revenue control period for which the allowed rate of return is being determined.

Murraylink understands the reasons for choosing the averaging period as close as practicably possible to the commencement of the revenue control

---

[10] AER, Final Decision Amadeus Gas Pipeline Access Arrangement 2016-2019, Attachment 3 – Rate of Return, May 2016, pp 3-198.

period, and anticipates that the AER will estimate the risk free rate for an averaging period which is close to the time of its making a final decision on the revenue proposal.

For the rate of return for this proposal, a much earlier averaging period must necessarily be assumed. Murraylink has estimated the risk free rate as the average of yields on Australian Government securities with terms to maturity of 10 years over the period of 20 consecutive business days ending 30 December 2016.

Murraylink's estimate of the risk free rate of return is 2.82 per cent.

6.2.3 Beta

Application of the SL CAPM, the foundation model of the Rate of Return Guideline, requires an estimate of beta for a benchmark efficient entity with degree of risk similar to Murraylink in respect of its provision of prescribed transmission services.

Murraylink's estimate of beta is 0.8.

This was the estimate of beta which the AER made for the purpose of estimating the return on equity for its April 2013 Final Decision on Murraylink's May 2012 revenue proposal.[11]

Beta estimate in the AER's April 2013 Final Decision

In its revenue proposal submitted to the AER in May 2012, Murraylink proposed an estimate of beta of 0.8.

This was the estimate of beta which the AER adopted in the course of a review of the weighted average cost of capital parameters to be used in determinations for electricity transmission and distribution network service providers. That review, which was undertaken in accordance with the requirements of earlier (pre-November 2012) versions of the NER, was completed in May 2009. The AER advised, in its Final Decision:

- the empirical evidence suggested that the beta of a benchmark efficient network service provider was in the range 0.41 to 0.68;
- consideration was given to other factors, including:
  - o the need to achieve an outcome that was consistent with the National Electricity Objective (in particular the need for the efficient

[11] AER, Final Decision Murraylink transmission determination 2013-14 to 2017-18, April 2013, Table 5.1, p. 34.

investment in electricity services for the long term interests of consumers of electricity);

- o the revenue and pricing principles (in particular providing service providers with a reasonable opportunity to recover at least efficient costs, providing service providers with efficient incentives for efficient investment, and having regard to the economic costs and risks of the potential for under and over investment); and
- o the importance of regulatory stability;[12]

- having taken a broad view, the regulator considered a value of 0.8 to be appropriate.[13]

When assessed from the perspective of the requirements of the NER, an estimate of beta of 0.8:

- was supported by the most recent available and reliable empirical evidence;
- was likely to promote efficient investment in providing prescribed transmission services in current market conditions; and
- was an appropriate estimate of a forward looking rate commensurate with prevailing conditions in the market for funds for a benchmark efficient network service provider.

On this basis, the AER considered an estimate of 0.8 to be consistent with the NEO.[14]

The AER therefore accepted an estimate of beta of 0.8 in its March 2013 Final Decision on Murraylink's revenue proposal, having earlier accepted an estimate of 0.8 in its November 2012 Draft Decision.[15]

---

[12] In other decisions made at this time, the AER added the level of imprecision around beta estimation to the list of factors to which it gave consideration when deciding to adopt an estimate above the range of the empirical estimates. See, for example, AER, Access Arrangement Final Decision: APA GasNet Australia (Operations) Pty Ltd 2013-17, Part 2: Attachments, March 2013, p. 93.

[13] AER, Final Decision Electricity Transmission and distribution network service providers Review of the weighted average cost of capital (WACC) parameters, May 2009, pp xvi – xvii.

[14] AER, Final Decision Electricity Transmission and distribution network service providers Review of the weighted average cost of capital (WACC) parameters, May 2009, p 244.

[15] AER, Final Decision Murraylink Transmission determination 2013-14 to 2017-18, April 2013, p 34

Rate of Return Guideline

In its Rate of Return Guideline, the AER proposed estimation of a range for beta, and selection of a point estimate from within that range.

The AER advised that it would obtain a range of estimates of beta from empirical analysis using data from a set of Australian energy network businesses. These network businesses for which data were available were, the AER contended, reasonably comparable to the benchmark efficient entity referred to in clause 6A.6.2, paragraph (c), of the NER.

The AER then proposed to use other information sources to inform the selection of a point estimate from within the empirical range of beta estimates. This additional information included:

- empirical estimates of betas for overseas energy networks; and
- the theoretical principles underpinning the Black CAPM.

The AER's range for beta estimates was subsequently established by reference to econometric analysis by Professor Olan T. Henry in April 2014. Professor Henry advised that, from his consideration of a number of estimation methods, and ranges of data for individual firms and portfolios of those firms, a point estimate for beta could be expected to lie in the range 0.3 to 0.8. The average of the ordinary least squares estimates of beta which he had obtained was 0.5223, and the median estimate was 0.3285.[16]

Professor Henry's April 2014 econometric analysis used samples for varying periods between 29 May 1992 and 28 June 2013.

The AER concluded that the evidence from Professor Henry's 2014 econometric analysis indicated an empirical estimate for beta of approximately 0.5.[17]

The AER examined, in addition to the results from Professor Henry's 2014 analysis, estimates of beta which Professor Henry had made for the 2009 review of WACC parameters for electricity networks businesses, estimates made by the Western Australian Economic Regulation Authority (ERA), and estimates made by consultant SFG. All of this work, the AER concluded, supported an estimate of beta in the range 0.4 to 0.7.[18]

---

[16] Olan T. Henry, Estimating β: An update, April 2014, p 63.

[17] AER, Final Decision Ausgrid distribution determination 2015-16 to 2018-19, Attachment 3 - Rate of return, April 2015, pp 3-129.

[18] AER, Explanatory Statement: Rate of Return Guideline, December 2013, section 6.2.3.

Beta estimates for overseas energy networks, the AER advised, supported a point estimate at the upper end of the range 0.4 to 0.7.[19] The difficulties of comparing entities operating in different financial market conditions and under different regulatory regimes precluded a more precise conclusion. The theoretical principles underpinning the Black CAPM similarly, and as imprecisely, pointed to an estimate at the upper end of the range.[20]

This led the AER to propose, in its Rate of Return Guideline, a point estimate of 0.7 for beta.

Current evidence supports an estimate of beta higher than 0.7

In June 2016, in the context of a final decision on proposed revisions to the access arrangement for the Dampier to Bunbury Natural Gas Pipeline, the ERA updated its estimation of beta using data for the five years to 31 May 2016. The ERA found that, using returns data for portfolios of the Australian energy network businesses used for beta estimation, a 95 per cent confidence interval for beta was 0.479 to 0.870. The ERA concluded that the mean beta (0.7), obtained as an average across the estimates for equally weighted and value weighted portfolios made using the; ordinary least squares, least absolute deviation, MM and Theil-Sen estimators, was an appropriate point estimate for use in the SL CAPM.[21]

The ERA's process of estimation indicated an increase in beta since its own earlier (2013) work, and since Professor Henry's (2014) analysis for the AER. The ERA noted:

> *Across the four firms β has increased on average from 0.368 to 0.578 from 2013 to 2016 across all estimators (OLS, LAD, MM, T-S). Hence, elasticity in the response of individual asset returns to market returns has increased within the gas infrastructure sector during a period when mean market returns have decreased, consistent with the findings of CEG.*[22]

Consultant CEG had reported, in work undertaken for Dampier to Bunbury Natural Gas Pipeline owner and operator DBP, that structural break tests

---

[19] AER, Explanatory Statement: Rate of Return Guideline, December 2013, p 86.

[20] AER, Explanatory Statement: Rate of Return Guideline, December 2013, p 86.

[21] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016-2020, Appendix 4, Rate of Return, 30 June 2016, paragraph 474.

[22] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016-2020, Appendix 4, Rate of Return, 30 June 2016, paragraph 935.

which it had carried out using betas estimated from recent data showed multiple structural breaks. CEG advised:

> *When regard is had to the rising level of beta and the structural break results described above then this suggests the best estimate of the most recent β is higher than that reported by the ERA in its draft decision and discussed in section 4.3. Indeed, the most recent mean estimates (not bias adjusted) of 3 year betas are around 0.91 (0.96 when adjusted for low beta bias).*[23]

The ERA's beta estimate of 0.7 was obtained without any consideration being given to either beta estimates for overseas energy networks, or to the theoretical principles underpinning the Black CAPM. Consideration of these factors, in the way the AER proposes, should lead to a higher estimate for beta.

Frontier Economics' beta estimates

In view of the work by the ERA and CEG which was indicating an increase in beta since the estimates made by Professor Henry, for the AER, in 2014. Frontier Economics has estimated beta using current data. Frontier Economics was asked to use data for the Australian energy network businesses which were used by Professor Henry, and to use the same statistical methods.

Frontier Economics' report is provided as Attachment 6.1 to this submission.

Frontier Economics restricted its use of statistical methods to ordinary least squares estimation, advising that the ordinary least squares estimator of the slope coefficient in the regression of stock returns on market returns (the standard method of estimating beta) had the same definition as beta in the SL CAPM. Other estimators (including the least absolute deviation estimator, which was used by Professor Henry and the ERA) did not have this equivalence between the estimator and the parameter which was to be estimated.[24]

Using weekly data for the period of five years to 1 September 2016, Frontier Economics obtained value and equally weighted portfolio estimates for beta

---

[23] CEG, Estimating beta to be used in the Sharpe-Lintner CAPM, February 2016, paragraph 120. The CEG report is Appendix F to DBP's submission 56 to the ERA dated 24 February 2016.

[24] Frontier Economics, An equity beta estimate for Australian energy network businesses: Report prepared for APA Group, December 2016, p 17.

of 0.65 and 0.72, respectively.[25] Frontier Economics advised that its current beta estimates were materially higher than the AER's empirical estimate of approximately 0.5 (which had been obtained using data no more recent than 28 June 2013).[26]

Consistent with the results obtained by the ERA and CEG, the Frontier Economics results indicated an increase in beta estimates for equally weighted and value weighted portfolios as data from 2014, 2015 and 2016 is introduced into the sample from which the estimates are made, and as older data from 2006 to 2008 are deleted. Frontier Economics made a series of rolling beta estimates for the two portfolios using data for successive periods of five years. The rolling beta estimates were sufficiently high that the AER's empirical estimate of 0.5 was not within the standard 95 per cent confidence intervals for the most recent periods. Estimates of beta had increased significantly since the time of the Rate of Return Guideline (December 2013).[27]

Frontier Economics sought to confirm its view that the estimates of beta for Australian energy network businesses obtained using recent data were significantly higher than the AER's empirical estimate (approximately 0.5) by examining beta estimates for a set of comparable infrastructure businesses operating in the transport sector. These businesses, like the energy networks:

- owned and operated tangible assets with long lives;
- were capital intensive;
- provided an access service to customers which yielded relatively stable cash flows; and
- were listed on the ASX.

The beta estimates for equally weighted and value weighted portfolios of these transport infrastructure businesses were 0.98 and 0.79, respectively.[28]

---

25 Frontier Economics, An equity beta estimate for Australian energy network businesses, December 2016, p 16.

26 Frontier Economics 2016, An equity beta estimate for Australian energy network businesses, December 2016, p 18.

27 Frontier Economics 2016, An equity beta estimate for Australian energy network businesses, December 2016, pp 19-20

28 Frontier Economics 2016, An equity beta estimate for Australian energy network businesses, December 2016, p 23

They were clearly well above 0.5, and pointed to estimated betas for energy network businesses now being well above 0.5.

Beta estimate for Murray link revenue proposal

In 2013, the empirical evidence available to the AER indicated that an estimate for beta could lie in the range 0.41 to 0.68.

In its April 2013 Final Decision on the revenue proposal which Murraylink had submitted for approval in May 2012, the AER advised that an estimate above this range was appropriate when consideration was given to:

- the need to achieve an outcome consistent with the NEO;
- the revenue and pricing principles; and
- the desirability of stability in regulatory decision making over time.

In the Final Decision, the AER adopted an estimate of beta of 0.8. This estimate was, the AER concluded, consistent with the requirements of the NEO.

By April 2014, the AER had the evidence of a number of studies in which beta had been estimated, including Professor Henry's 2014 work. These studies continued to show a range of 0.4 to 0.7 for beta.

Professor Henry's econometric analysis indicated to the AER an empirical estimate of beta of 0.5.

More recent analyses, by the ERA, by CEG, and now by Frontier Economics, provide statistical evidence of an increase in estimates of beta since 2014.

When estimates of beta are increasing, an updated estimate is essential to making an estimate of the return on equity which has been made having regard to prevailing conditions in the market for equity funds.[29] A current beta estimate is essential to estimating a rate of return on equity which contributes to the achievement of a rate of return commensurate with the

---

[29] The time variation of beta is well known, even though the model in which it is used, the SL CAPM, is a static equilibrium model in which beta is necessarily time-invariant. On the time variation of beta, see, for example, Robert D. Brooks, Robert W. Faff and Thomas Josev (1997), "Beta stability and monthly seasonal effects: evidence from the Australian capital market", Applied Economics Letters, 4, pages 563-566). Torben G. Andersen, Tim Bollerslev, Francis X. Diebold and Jin Wu (2006),"A Framework for Exploring the Macroeconomic Determinants of Systematic Risk", American Economic Association Papers and Proceedings, 95(2), pages 398-404, report economically significant variation in the betas of NSYE-listed stocks with variation in macroeconomic indicators such as industrial production growth.

efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in the provision of reference services.

There is now clear evidence that the estimated betas of energy network businesses are above the AER's empirical estimate of approximately 0.5.

The ERA has proposed an estimate of 0.7 from its own – recent – econometric analyses, and CEG has reported higher values for estimates of beta made using current data.

Econometric analyses by Frontier Economics show an increase in estimates of beta when estimation makes use of data for the period 2014 to 2016. Higher beta estimates for Australian energy network businesses are supported by estimates of beta which Frontier Economics has made for a set of comparable infrastructure businesses operating in the transport sector.

If empirical estimates of beta for Australian energy network businesses are now above 0.5, the additional information provided by beta estimates for overseas energy networks, and the theoretical principles underpinning the Black CAPM, indicate that a beta above 0.7 is now appropriate for estimating the return on equity of a gas pipeline service provider.

As Frontier Economics notes, using data for the most recent five years in beta estimation risks producing estimates with relatively low statistical precision. Longer data series are required to improve the precision of the resulting beta estimates.

Frontier Economics recommends using at least ten years of data for estimation. But simply taking data for the last ten years accords weight to a period of some 7 years in which betas appear to have been relatively low. This is clearly shown by the Frontier Economics estimates: using data for the most recent 10 years, the value and equally weighted portfolio estimates of beta were, respectively, 0.52 and 0.57.[30]

Beta has risen, but the magnitude of the increase is difficult to gauge.

For application of the SL CAPM in estimating the return on equity for its revenue proposal, Murraylink therefore proposes to retain the AER's 2013 estimate of 0.8.

In 2013, a revenue proposal incorporating a rate of return which had been calculated using a beta estimate of 0.8 achieved the broader requirements of the NEO. A revenue proposal now incorporating a rate of return calculated using a beta estimate of 0.8 should continue to achieve the

[30] Frontier Economics 2016, An equity beta estimate for Australian energy network businesses

requirements of that objective. That will be the case, irrespective of the fact that the AER has made and published the guidelines required by clause 6A.6.2, paragraph (m), of the NER. Those guidelines may now, in any case, require revision given the higher estimates of beta obtained using current data.

6.2.4 *Market risk premium*

The approach to the MRP in the Rate of Return Guideline, and the AER's preferred approach as presented in its recent regulatory decisions, is to treat the term E(rM) – rf in the SL CAPM as a single discrete parameter. In this section of this submission Murraylink examines this approach to estimating the MRP, and finds that it is inconsistent with the conceptual and theoretical foundations of the SL CAPM.

If the MRP is estimated as a single discrete parameter, as the AER proposes – if it is estimated in a way that it is inconsistent with the conceptual and theoretical foundations of the SL CAPM – then there will be no reason to expect that application of the foundation model will lead to a return on equity which contributes to the achievement of an allowed rate of return objective of clause 6A.6.2, paragraph (c), of the NER.

Estimation of the MRP in a manner consistent with the conceptual and theoretical foundations of the SL CAPM requires separate estimates for the risk free rate rf (as set out in section 6.2.2above), and for the expected return on the market E(rM). Murraylink discusses estimation of the expected return on the market in this section of the submission, and proposes an estimate of 10.0 per cent for that expected return.

When estimating the MRP and the return on equity for its revenue proposal, Murraylink has not used the so-called "Wright approach", an approach which the AER sees as having, at most, only a very limited role in the estimation of equity returns. Murraylink discusses the Wright approach in section 6.2.7 below.

MRP in the Rate of Return Guideline and recent AER decisions

In the Rate of Return Guideline, the AER proposed that the return on equity be estimated, using the SL CAPM, by adding to the risk free rate a premium for risk determined as the product of beta and the MRP. The MRP was, the AER advised, unobservable, and was to be estimated. A range for the estimate was to be established, and a point estimate selected from within that range. MRP estimation would, the AER proposed, have regard to dividend growth model estimates, survey evidence and conditioning variables, but the base for the estimate was to be historical excess return.

At the time of this submission, the AER's most recent estimations of return on equity were for its September 2016 Draft Decisions for the 2017-22 Powerlink transmission determination, and for the 2017-19 TasNetworks distribution determination. In each of these decisions, the AER selected 6.5 per cent as a point estimate for the MRP, reasoning that:

- historical excess returns provided a baseline estimate and indicated a MRP of approximately 5.5 per cent to 6.0 per cent from a range of 4.9 per cent to 6.0 per cent;
- dividend growth model estimates indicated a MRP estimate above this baseline with a range of 7.54 per cent to 8.86 per cent, but:
- although the AER's dividend growth model was theoretically sound, its implementation raised a number of practical issues which led to the view that recent increases in estimates of the MRP made using the model did not necessarily reflect an increase in the 'true' expected ten-year forward looking MRP;
- dividend growth model estimates were not reliable on their own; nevertheless they provided some support for a point estimate above the range from historical returns;
- survey evidence supported a MRP around 6.0 per cent to 6.8 per cent;
- other regulators' estimates used as a cross check indicated that a market risk premium estimate of around 6.5 per cent was reasonable;
- conditioning variables indicated that there had not been a material change in market conditions since the AER's May 2016 decisions;
- stakeholder submissions (excluding submissions by service providers) generally supported a MRP at or below 6.5 per cent; and
- a departure from the Rate of Return Guideline on the basis of the information and material before the regulator was not justified and would not contribute to the achievement of the allowed rate of return objective and the NEO.[31]

Although the AER considered forward looking estimates of the MRP obtained using the dividend growth model, its estimate of 6.5 per cent was anchored on historical excess returns. Anchoring the estimate in this way produces an

---

[31] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 3 – Rate of return, September 2016, p 3-40 and pp 3-46 to 3-49; and AER, Draft Decision TasNetworks distribution determination 2017-18 to 2018-19, Attachment 3 – Rate of return, September 2016, p 3-40 and pp 3-46 to 3-49.

MRP which varies only slowly over time as historical returns and the risk free rate vary. This would not be a problem if the MRP were relatively stable, but it is not. The AER advised, in the Explanatory Statement accompanying the Rate of Return Guideline, that the MRP varied over time:

> *Evidence suggests the MRP may vary over time. In their advice to the AER, Professor Lally and Professor Mackenzie and Associate Professor Partington have expressed the view that the MRP likely varies over time. They also suggest it would be better to use a wide range of models and information to estimate the MRP.*[32]

If the MRP varies over time, a method of estimation which anchors the estimate on the average of historical excess returns is unlikely to lead to a forward looking estimate of the premium.

Furthermore, clause 6A.6.2, paragraph (g), of the NER requires that, when estimating the return on equity, regard be had to prevailing conditions in the market for equity funds. The AER may, as it has advised, have had regard to prevailing market conditions through its use of the dividend growth model and conditioning variables to inform its estimate of the MRP.[33] However, an estimate which is anchored on an average of historical excess returns does not give much weight to prevailing conditions.

An estimate of 6.5 per cent, which is anchored on historical excess returns, and which is not forward looking, would not be an appropriate estimate for application of the SL CAPM, and could not lead to an estimate of the return on equity which contributed to a rate of return commensurate with the efficient financing costs of the benchmark efficient entity referred to in clause 6A.6.2, paragraph (c).

These were problems recognised by the ERA in its recent final decisions on the proposed revisions of the access arrangements of the three Western Australian providers of regulated pipeline services.

ERA estimation of the MRP

Reliance on historical excess returns could not, the ERA reasoned, provide the forward looking estimate of the MRP required for application of the SL CAPM. In the absence of an accepted and compatible theory of expectations formation, the only model available for making such a forward looking estimate was the dividend growth model.

---

[32] AER, Rate of Return Guideline: Explanatory Statement, December 2013, p 91.

[33] AER, Final Decision Amadeus Gas Pipeline Access Arrangement 2016-2019, Attachment 3 – Rate of Return, May 2016, pp 3-83.

The present value to an equity investor, today (time 0), of the future dividends from investment in one share of the stock of a firm which is not expected to fail, is:

$$PV_0 = \frac{D_1}{(1 + r_e)} + \frac{D_2}{(1 + r_e)^2} + \ldots + \frac{D_n}{(1 + r_e)^n} + \ldots$$

where:

- D_n is the expected dividend on the share at time t = n, which is assumed to be paid at the end of year n; and
- r_e is the investor's discount rate, which is the required rate of return on equity.

If dividends are expected to grow at a constant annual rate g, the present value of the expected future dividends is:

$$PV_0 = \frac{D_1}{(1 + r_e)} + \frac{D_1(1 + g)}{(1 + r_e)^2} + \ldots + \frac{D_1(1 + g)^{n-1}}{(1 + r_e)^n} + \ldots = \frac{D_1}{r_e - g}$$

provided g < re.

The price the investor would be prepared to pay for the share today (at time 0) is, then:

$$p_0 = \frac{D_1}{r_e - g}.$$

Today's share price, p0, is set in the market for financial assets, so that, given the expected dividend in one year, D1, and expectations about the dividend growth rate, g, the investor's required rate of return – the expected rate of return on equity, re – is:

$$r_e = \frac{D_1}{p_0} + g.$$

This is the simplest form of the dividend growth model. Through its explicit use of a forecast of the dividend expected one year hence (D1), and an expected rate of growth in future dividends (g), the model clearly provides a forward looking estimate of the return on equity (re).

The average of historical excess returns is neither forward looking nor strongly reflective of prevailing financial market conditions. Nor, as the ERA advised, is the time series of excess returns stationary. However, the ERA found the market return on equity series to be stationary, with the implication that an average of a long span of data could provide a cross check on any estimate of the market return on equity made using the dividend growth model.[34]

The ERA therefore inverted the AER's approach to MRP estimation, using the estimates from a set of dividend growth models, and using the average of historical excess returns as a cross check.

The set of dividend growth models used by the ERA included its own model, and the model developed by the AER. From these models, the ERA established a range for the upper limit of possible values for the MRP. This range was 7.6 per cent to 8.8 per cent.[35]

The average of historical excess returns themselves, the ERA contended, provided, at best, a lower bound on the range of the estimate of the MRP. The value or values of this lower bound would depend on the way in which the average was calculated, either as an arithmetic mean or as a geometric mean. In its calculations, the ERA gave weight to both means, finding that a reasonable lower bound on the estimate of the MRP was 5.4 per cent.

The ERA concluded that:

- the range for the MRP implied by recent estimates made using dividend growth models was 7.6 per cent to 8.8 per cent, and
- the range for the MRP implied by historical excess returns was 5.4 per cent to 8.5 per cent.[36]

A point estimate, for use in the SL CAPM, must be established, the ERA advised, by reference to these ranges. Like the AER, the ERA examined a number of forward looking indicators – "conditioning variables" – to establish its point estimate. The indicators were:

- the dividend yield on the All Ordinaries which, the ERA found, supported an estimate for the forward looking MRP that was above the mid-point of the range implied by historical excess returns; [37]

---

[34] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline, 30 June 2016, paragraph 1011.

[35] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline, 30 June 2016, paragraph 1031.

[36] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline, 30 June 2016, paragraph 1065.

[37] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline, 30 June 2016, paragraph 1049.

- interest rate swap and bond default spreads, which were relatively high, indicating slightly elevated risk premiums; [38]
- the ASX 200 volatility index, which indicated an MRP below the mid-point of the range implied by historical excess returns;[39] and
- the (qualitative) assessment of the Reserve Bank of Australia, in its May 2016 Statement on Monetary Policy, that there was uncertainty concerning future growth in the Australian economy, which the ERA saw as driving a somewhat higher MRP at the present time.[40]

The conditioning variables indicated, to the ERA, a forward looking rate of return which was higher than the mid-point of the range for the MRP implied by historical excess returns.

The range of estimates of the MRP from dividend growth models was 7.6 per cent to 8.8 per cent but, the ERA advised, these models tended to overestimate returns.

The ERA concluded that an estimate of the MRP of 7.4 per cent would reflect market expectations at the end of May 2016.[41] It was an appropriate estimate of the MRP for estimating the rate of return on equity using the SL CAPM.[42]

---

[38] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline, 30 June 2016, paragraph 1055.

[39] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline, 30 June 2016, paragraph 1059.

[40] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline, 30 June 2016, paragraph 1062.

[41] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline, 30 June 2016, paragraph 1070.

[42] Murraylink notes that, in its estimation of rates of return, the ERA assumed the appropriate proxy for the risk free rate was the yield on Australian Government securities with a term to maturity of five years. Murraylink does not agree with the ERA's view that securities with a term to maturity of five years are an appropriate proxy for the risk free rate. As noted above, Murraylink has used Australian Government securities with a term to maturity of 10 years as the proxy for the risk free asset. This is consistent with economic theory, with financial market practice, and with the AER's Rate of Return Guideline. The ERA's use of Australian Government securities with term to maturity of five years as the proxy for the risk free asset is likely to overstate the estimate of the MRP (relative to an estimate calculated using yields on securities with a maturity of 10 years as the proxy for

The ERA's estimate of the MRP is more closely grounded in prevailing conditions in equity markets than the estimate made by the AER, and better reflects the requirement for a forward looking estimate.

Conceptual and theoretical foundations of the SL CAPM and interpretation of the MRP

In the Rate of Return Guideline and in the AER's practice, as indicated by its recent decisions, the MRP is taken to be a single discrete variable, which is to be estimated, along with the risk free rate and beta, when applying the SL CAPM. The ERA, in contrast, seems to estimate the MRP as the difference between an estimate of the expected return on the market, and an estimate of the risk free rate of return. Which is the correct approach?

A careful examination of the conceptual and theoretical foundations of the SL CAPM shows that the MRP should be estimated, not as a single discrete variable, but as a difference between estimates of the return on the market and the risk free rate. This examination of the foundations of the SL CAPM and its implications for estimation of the MRP are set out in this section of this submission.

The SL CAPM has its foundations in a single period – essentially static – general equilibrium model of exchange among a large number, m, of individuals or "investors".

At a point in time (time 0), each investor makes a decision to consume from her wealth, and to invest the remainder of that wealth in financial assets. One period later (at time 1), the investor sells those financial assets to buy goods and services.[43] That is, at time 0, the investor makes a decision to form a portfolio of financial assets for the purpose of transferring wealth to time 1 to finance future consumption.

At time 0, each investor chooses a portfolio from the N financial assets available at that time. These N financial assets are N – 1 risky financial assets, and a risk free asset:

- x_{ij} is the dollar value of risky financial asset j, j = 1, 2, . . ., N – 1 in investor i's portfolio; and

---

the risk free asset). However, this overstatement does not significantly influence the result.

[43] In a multi-period setting, the investor would also buy financial assets for the next period. The SL CAPM is not, however, a multi-period asset pricing model, and the present discussion does not need to extend beyond a single period. Most recent asset pricing research uses a multi-period or continuous time setting for the purpose of overcoming the inherent limitations of a single period model.

- x_{iN} is the dollar value of the risk free asset in investor i's portfolio.

If investor i invests the total of her remaining wealth, W_{i0}, at time 0, then:

$$W_{i0} = \sum_{j=1}^{N-1} x_{ij} + x_{iN}.$$

Each of the N – 1 risky financial assets provides investor i with a total return R_j on an investment of $1 at time 1. $R_j = 1 + r_j$, where r_j is the rate of return on risky financial asset j.

Different circumstances over which the investors have no control – different contingent states – are possible during the period of the investment (between time 0 and time 1), and lead to different possible returns on each risky financial asset. R_j is, then, a random variable. Investor i is assumed to know the probability distribution of R_j. Moreover, each investor, is assumed to have the same knowledge of this distribution.

Investment of $1 in the risk free asset provides investor i with a total return R_f during the period of the investment. $r_f = R_f – 1$ is the risk free rate of return. There is no uncertainty about the return on the risk free asset. That asset provides the investor with the same total return, R_f, in all of the contingent states between time 0 and time 1. R_f is known to all investors.

Investor i's wealth at time 1, W_{i1}, is:

$$W_{i1} = \sum_{j=1}^{N-1} x_{ij}R_j + x_{iN} R_f.$$

Investor i is assumed to have preferences for period 1 wealth which can be represented by a (von Neumann-Morgenstern) utility function $U_i(W_{i1})$. U_i is assumed to be increasing and twice differentiable.

At time 0, investors trade financial assets (choose portfolios x_{ij}, j = 1, 2, . . ., N) to maximize expected utility of wealth at time 1. Through trading, a market equilibrium is established at a set of prices for the risky financial assets at which supply and demand are equal for each of those assets.

Each investor i chooses portfolio x_{ij}, j = 1, 2, . . ., N, to maximize:

$E[U_i(W_{i1})]$

subject to

$$W_{i0} = \sum_{j=1}^{N-1} x_{ij} + x_{iN}.$$

The (first order) conditions for a maximum,

$$E[U_i^{/}R_j] = E[U_i^{/}R_f]$$

And

$$W_{i0} = \sum_{j=1}^{N-1} x_{ij} + x_{iN},$$

for all assets j, imply

$$E[U_i^{/}(R_j - R_f)] = E(U_i^{/})E(R_j - R_f) + \operatorname{cov}(U_i^{/}, R_j - R_f) = 0.$$

If investor utility functions are quadratic with

$$U_i(W_{i1}) = W_{i1} - a_i W_{i1}^2,$$

a_i a constant, for each investor i, then

$$U_i^{/}(W_{i1}) = 1 - 2a_i W_{i1},$$

and

$$E\left(U_i^{/}\right) E\left(R_j - R_f\right) + \operatorname{cov}\left(U_i^{/}, R_j - R_f\right) = E\left(U_i^{/}\right) E\left(R_j - R_f\right) - 2a_i \operatorname{cov}\left(W_{i1}, R_j\right),$$

so that

$$[E(R_j) - R_f] \frac{E\left(U_i^{/}\right)}{2a_i} = \operatorname{cov}\left(W_{i1}, R_j\right)$$

for each investor i.

Summing across all investors in the market:

$$[E(R_j) - R_f] \sum_{1=1}^{m} \frac{E\left(U_i^{/}\right)}{2a_i} = \sum_{i=1}^{m} \operatorname{cov}\left(W_{i1}, R_j\right) = \operatorname{cov}\left(\sum_{i=1}^{m} W_{i1}, R_j\right)$$

Now,

$$\sum_{i=1}^{m} W_{i1} = \sum_{i=1}^{m}\left[\sum_{j=1}^{N-1} x_{ij}R_j + x_{iN}R_f\right] = \sum_{j=1}^{N-1} x_j R_j + \sum_{i=1}^{m} x_{iN}R_f = R_M \sum_{j=1}^{N-1} x_j + R_f \sum_{i=1}^{m} x_{iN}$$

where

$$R_M = \sum_{j=1}^{N-1} x_j R_j \Big/ \sum_{j=1}^{N-1} x_j$$

is the total return on the market portfolio of risky financial assets.

Since $\sum_j^{N-1} x_j$ and $R_f \sum_{i-1}^{m} x_{iN}$ are not random,

$$\text{cov}\left(\sum_{i=1}^{m} W_{i1}, R_j\right) = \text{cov}\left(R_M \sum_{j=1}^{N-1} x_j, R_j\right) = \sum_{j=1}^{N-1} x_j \text{cov}(R_M, R_j),$$

and

$$E(R_j) = R_f - A\ \text{cov}(R_M, R_j) \qquad (1)$$

where

$$A = \sum_{j=1}^{N-1} x_j \Big/ \sum_{i=1}^{m} \frac{E(U_i^{/})}{2a_i}$$

The market portfolio is an asset for which the total return R_M is described by equation (1), and so

$$E(R_M) = R_f + A\ \text{cov}(R_M, R_M) = A\ \text{var}(R_M)$$

and

$$A = \frac{E(R_M) - R_f}{\text{var}(R_M)}.$$

Therefore:

$$E(R_j) = R_f + \frac{E(R_M) - R_f}{\text{var}(R_M)} \times \text{cov}((R_j, R_M) = R_f + \beta_j \times [E(R_M) - R_f]$$

where

$$\beta_j = \frac{\text{cov}(R_j, R_M)}{\text{var}(R_M)}.$$

In terms of rates of return,

$$E(r_j) = r_f + \beta_j \times [E(r_M) - r_f],$$

which is the SL CAPM.

Murraylink's purpose in deriving the SL CAPM is not explication of the mathematical details of the derivation, but to show the conceptual and theoretical foundations from which the model is logically derived. [44]

---

[44] The mathematics of the derivation of the SL CAPM presented in the preceding paragraphs is from Mark E Rubinstein (1973), "A Mean-Variance Synthesis of Corporate Financial Theory", Journal of Finance, 28(1): pages 167-181. A derivation, with the same

The SL CAPM is an equilibrium asset pricing model built on the foundations of the portfolio choices of individual investors choosing, at a point in time, portfolios of the N - 1 risky financial assets and the risk free asset which are available at that time. The investors know, at the time of portfolio choice, the probability distributions of the returns on each of the N – 1 risky assets, and therefore know the expected return on the market portfolio of those assets. The investors also know, with certainty, the rate of return on the risk free asset which is available at that time.

In these circumstances, there is no single discrete variable $E(r_M) - r_f$ in the SL CAPM. There are, clearly and distinctly, the expected value of the uncertain future return, $E(r_M)$, on the market portfolio of the N - 1 risky assets available to those investors, and the known return, $r_{f,}$ on the risk free asset available at the time of portfolio choice.

The term $E(r_M) - r_f$ as it appears in the SL CAPM is not a single discrete variable; it is simply the difference between the conceptually distinct r_f and $E(r_M)$ assumed for model derivation. It must be treated as such when applying the model. Estimates must be made, at the time the SL CAPM is applied, of:

- the rate of return on the risk free asset assumed to be available to investors at that time; and
- the return those investors expect, at that time, to earn on the market portfolio.

A long term average of past returns on the market portfolio may be used as an estimate of the expected return on the market, $E(r_M)$, but the use of that average involves the making of a specific assumption about the way in which expectations are formed. This assumption – indeed, any assumption which might be made about expectations formation – lies beyond the set of assumptions made for derivation of the SL CAPM itself. The absence of an explicit hypothesis about how expectations are formed about a critical element of the model (the expected return on the market portfolio) is a significant limitation of the SL CAPM.

Moreover, the use of a long term average of historical risk premiums to estimate $E(r_M) - r_f$ has the effect of replacing the risk free rate of return at the time of portfolio choice with a long term average of risk free rates of returns.

conceptual foundations, but which focuses more closely on the implications of period 1 wealth being a linear function of the random total returns R_j on the risky financial assets (and on the means and standard deviations of those risky returns), can be found in Eugene F. Fama (1968), "Risk, Return and Equilibrium: Some Clarifying Comments", Journal of Finance, 23(1): pp 29-40

But a long term average of risk free rates has no role in the derivation of the SL CAPM, and no role in the application of the model. In the derivation of the SL CAPM, there is no consideration of how expectations are formed about an uncertain future risk free rate of return. There does not need to be. The risk free rate is known with certainty at the time of portfolio choice: it is the known rate of return on the risk free asset which is available to investors at that time.

The AER supports the approach of the Rate of Return Guideline, and its current practice, in which the MRP is taken to be a single discrete variable to be estimated, along with the risk free rate and beta, when applying the SL CAPM, by reference to advice it has received from Associate Professor John Handley.

Associate Professor Handley advised the AER that:

> *The standard approach to estimation [of the SL CAPM] is to treat the MRP as a distinct random variable.*[45]

This, Associate Professor Handley contended, " . . . largely follows from the risk-return trade off paradigm". He presented the trade-off as follows:

> *In deriving the Sharpe-CAPM one arrives at the less familiar relationship between expected return and risk:*
>
> $E(r_j) = r_f + A \operatorname{cov}(r_j, r_m)$ *(4)*
>
> *where $E(r_j)$ is the expected return on asset j, r_f is the risk free rate, $\operatorname{cov}(r_j, r_m)$ is the covariance of the return on j with the return on the market, and A is a measure of the aggregate relative risk aversion in the economy in equilibrium – which in turn is a complex weighted average of the relative risk aversion of the individual investors in the economy. Equation (4) says that the appropriate risk premium on asset j is equal to $A \operatorname{cov}(r_j, r_m)$, where A represents the "price of risk" and $\operatorname{cov}(r_j, r_m)$ represents the "quantity of risk". Unfortunately A is unobservable but applying (4) to the market portfolio gives:*
>
> $$A = \frac{E(r_m) - r_f}{var(r_m)} \qquad (5)$$
>
> *where $var(r_m)$ is the variance of the return on the market. Substituting (5) into (4) gives the CAPM in its more familiar form:*
>
> $E(r_j) = r_f + \beta_j [E(r_m) - r_f]$ *(6)*

[45] Handley, John C 2014, Report prepared for the Australian Energy Regulator: Advice on the Return on Equity, 16 October, p 15

where β_j is the beta of asset j and $E(r_m) - r_f$ is the expected MRP. Equation (6) says that the appropriate risk premium on asset j is equal to βj $[E(r_m) - r_f]$ where $[E(r_m) - r_f]$ represents the "price of risk" and βj represents the "quantity of risk".

Associate Professor Handley concluded: "the standard approach is then to directly estimate the item of interest – the expected MRP". However, this does not follow from his argument. Associate Professor Handley did not consider the context within which his equation (4) was derived, and the implications of that context for his interpretation of equation (6). The MRP is not a distinct random variable; it is not a single, discrete item of interest. It is the difference between the return on the market at the rates of return on risky financial assets expected by all investors, and the rate of return on the risk free asset which is known to all investors, at the time of portfolio choice. This is the case even if one chooses to think of $E(r_M) - r_f$ as a price of risk, and β_j as a quantity of risk.

Associate Professor Handley's equation (4) is equation (1) above. Equation (1) follows, as Murraylink has already noted, from investors choosing portfolios at a point in time from the risky financial assets and the risk free asset available at that time, knowing the probability distributions of the rates of return on the risky assets available, and knowing, with certainty, the rate of return on the risk free asset.

The term $E(r_M) - r_f$, the MRP of the SL CAPM, is not a single discrete variable. It is not a single parameter for which an estimate is required separate from the estimates of the risk free rate and beta.

Since the term $E(r_M) - r_f$ as it appears in the SL CAPM is not a single discrete variable, and must be estimated using the rates of return on assets available to investors at the time the model is applied, survey and other evidence which supposedly directly informs estimates of the MRP, is largely irrelevant.

None of this means that the MRP, interpreted as a long term average of differences between the return on the market portfolio and the risk free rate, is not relevant in other contexts. Considered independently of the SL CAPM, the MRP has been, and continues to be, of great interest to investors and to financial economists. Whether the MRP is a premium for bearing non-diversifiable risk or a liquidity premium, or whether it arises from borrowing constraints or taxes and other regulatory arrangements remain open questions.[46]

---

[46] See Rajnish Mehra and Edward C. Prescott (2003), "The equity premium in retrospect", in George M. Constantinides, Milton Harris and René Stulz (eds.), *Handbook of the*

In estimating the return on equity for its revenue proposal, Murraylink has estimated the MRP, in a way consistent with the conceptual and theoretical foundations of the SL CAPM, as the difference between an estimate of the expected return on the market and an estimate of the risk free rate. Murraylink's estimate of the risk free rate was discussed in section 6.2.2 above. Estimation of the expected return on the market is discussed in the following section of this submission.

Estimating the expected return on the market

The expected return on the market in the SL CAPM is the return on the market portfolio at the rates of return on risky financial assets expected by investors at the time of portfolio choice. The expected return on the market is inherently "forward looking", and must be estimated, either directly from expectations data, or indirectly using a model of expectations formation.

Murraylink is not aware of any expectations data which might be suitable for directly estimating the expected return on the Australian market for risky financial assets. Murraylink has, therefore, relied on two simple, but widely used, models of expectations formation. These are:

- the averaging of past values of the variable for which a forward looking estimate or expected value is required; and
- the dividend growth model, the application of which is limited to determining expected rates of return in the way discussed above.

Using these two models, Murraylink obtained an estimate of 10.0 per cent for the expected return on the market to be used in applying the SL CAPM to estimate the return on equity for its revenue proposal.

Murraylink notes that the AER implicitly accepts that the averaging of past values can provide reasonable estimates of forward looking expectations when it makes estimates of the MRP which are anchored on historical excess returns. The AER has advised that, although historical data on excess returns on the market are not themselves forward looking, their use in estimating a forward looking MRP may be reasonable if investors form forward looking expectations based on past experience.[47]

The AER has also recognised that dividend growth models can be used to estimate forward looking returns on the market. The Rate of Return Guideline is explicit, advising that results from dividend growth models can inform the

Economics of Finance, Volume 1, Part B, Financial Markets and Asset Prices, New York: Elsevier, pp 889-938.

[47] AER, Rate of Return Guideline: Explanatory Statement, Appendix D, December 2013, p 78.

input parameters used in the SL CAPM and can, in particular, inform estimation of a forward looking MRP.[48]

As noted earlier, the ERA has advised that, if a time series is stationary, the series of historical data can reasonably be considered as a predictor of future values in the series.

Broadly, a series is stationary if its mean, variance and autocovariance structure are constant over time. Such a series will tend to return to its constant mean (mean reversion), and fluctuations around this mean will have a relatively constant amplitude. Because it has a finite and constant variance, a stationary series will not drift too far away from its mean value.

A nonstationary time series has a time-varying mean, or a time-varying variance, or both. In consequence, the series of historical data may not be a good predictor of future values in the series.

In preparing its Rate of Return Guidelines, the ERA examined the series of historical returns on the Australian stock market, and the corresponding series of historical excess returns. The Western Australian regulator found that the excess returns series was not stationary, but the market return series was stationary.[49]

In its June 2016 Final Decision on proposed revisions to the access arrangement for the Goldfields Gas Pipeline, the ERA concluded:

> *As the available evidence supports the hypothesis that the market return on equity is mean reverting, this historic outcome from a long span of data may be used as a cross check for the long run average of the forward looking market return on equity from each regulatory period.*[50]

In Table 3-17 of Attachment 3 to its September 2016 Draft Decision on the 2017-22 Powerlink transmission determination (reproduced below as Table 6.1), the AER listed average historical returns on the market portfolio (in nominal terms) for a number of different periods.[51] These long term averages of market return ranged from 9.9 per cent to 12.5 per cent.

---

[48] AER, Rate of Return Guideline: Explanatory Statement, Appendix D, December 2013, pp 4 and 13.

[49] ERA, Appendices to the Explanatory Statement for the Rate of Return Guidelines, December 2013, Appendix 16.

[50] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline, 30 June 2016, paragraph 1011.

[51] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 3 – Rate of return, September 2016, Table 3-17, p 3-105.

Table 6.1 – Historical returns on the market portfolio (per cent)

Sampling period	Market return (real)	Market return (nominal)
1883–2015	8.6	11.3
1937–2015	7.3	9.9
1958–2015	8.8	11.5
1980–2015	9.7	12.5
1988–2015	9.0	11.7

In the context of dividend growth model estimates of the expected return on the market, the ERA noted that estimates from these models show considerable variability because the inputs of different models incorporate new information coming from financial markets. The latest information is the most relevant to expectations of market returns and, the ERA advised that only the results from models which have been developed in the last 12 months should be relied upon.

In its June 2016 Final Decision on proposed revisions to the access arrangement for the Dampier to Bunbury Natural Gas Pipeline, the ERA reported the dividend growth model estimates of the expected return on the market shown in Table 6.2. [52] The set of models from which the ERA reported estimates was restricted to models which had been developed no more than one year prior to its Final Decision.

Table 6.2 – Recent estimates of the expected return on the market obtained using the DGM

Study	Date	Market return (nominal)
SFG	May 2015	11.37%
Frontier Economics	July 2015	11.2%
AER	September 2016	9.49% – 10.81%
ERA	May 2016	9.94%

[52] ERA, Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020, Appendix 4 Rate of Return, 30 June 2016, Table 6, p 114.

The dividend growth model estimates indicate a range of 9.5 per cent to 11.4 per cent for the expected return on the market.

Although both the AER and the ERA advise that dividend growth model estimates tend to overstate market returns, the dividend growth model estimates of expected return on the market shown in Table 6.2 have a range similar to the range of historical market returns shown in Table 6.1 (9.9 per cent to 12.5 per cent).

Murraylink has therefore looked to the lower limits of both ranges to establish an estimate of the expected return on the market of 10.0 per cent. Murraylink has used this estimate when applying the SL CAPM to estimate the return on equity for its revenue proposal.

Murraylink notes that, from an examination of the data compiled by Brailsford, Handley and Maheswaran, and taking into account (but not fully adjusting for) NERA's suggested corrections to the early part of the series for equity returns, the ERA concluded that a reasonable estimate of the nominal average return on the market was 10.3 per cent.[53] Murraylink's estimate of 10.0 per cent is consistent with the ERA's view of the Brailsford, Handley and Maheswara data.

6.2.5 *Estimating the return on equity*

Using the estimates discussed in the preceding sections of this submission (r_f = 2.82 per cent, β = 0.8, and $E(r_M)$ = 10.0 per cent), the foundation model – the SL CAPM – delivers an estimate of the return on equity of 8.56 per cent.

Murraylink has followed the AER's advice in the Rate of Return Guideline, and has rounded this estimate to 8.6 per cent (and has used 8.6 per cent as its estimate of the return on equity in the PTRM).[54]

6.2.6 *Evaluation of Murralink's estimate of the return on equity*

Murraylink considers that an estimate of the return on equity of 8.6 per cent is the best estimate in the circumstances. It is an estimate made using the AER's foundation model, and having regard to prevailing conditions in the market for equity funds. It is an estimate which can contribute to

---

[53] AER, Final Decision on Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline, 30 June 2016, paragraph 1010.

[54] AER, Rate of Return Guideline, December 2013, p. 17:

> *If the foundation model point estimate is applied, the AER proposes to round this estimate to a single decimal point. This recognises the limited precision with which the expected return on equity can be estimated.*

achievement of the allowed rate of return objective of clause 6A.6.2, paragraph (c) of the NER.

Murraylink has derived its estimate using the SL CAPM, which is a model for estimating equity returns long used by financial market practitioners and regulators. After examining the alternatives, the AER found the SL CAPM to be an appropriate model for estimating the return on equity required by clause 6A.6.2 of the NER, and adopted that model as its foundation model.

Two of the three parameters which must be estimated when applying the SL CAPM are the risk free rate of return and beta. There are well established and accepted methods of estimating these two parameters. Murralink has used the method of estimating the risk free rate of return proposed in the Rate of Return Guideline. When estimating beta, Murraylink has drawn on the estimates made for, and adopted by the AER, and has also had regard to the more recent estimates made by the ERA. These more recent estimates indicate that beta has changed since 2013. Beta estimation, by Frontier Economics, using current data confirms the change. If, as clause 6A.6.2, paragraph (g), requires, the return on equity is to be estimated having regard to prevailing conditions in equity markets, then a current estimate is required when applying the SL CAPM. Murraylink has used a current estimate, 0.8, and not the dated estimate of 0.7 associated with the Rate of Return Guideline.

Murraylink has explained above that the AER's approach to estimation of the third parameter of the SL CAPM – the MRP – is based on a view of the model which is conceptually incorrect. The MRP of the SL CAPM is the difference between the expected return on the market portfolio and the risk free rate at the time the model is applied.

Murraylink notes that this is not the Wright approach, and that it has not applied the Wright approach to the SL CAPM.

The result is a higher MRP and, in consequence, a higher return on equity, than would have been obtained by using the estimate of the MRP of the Rate of Return Guideline (6.5 per cent).

6.2.7 *The Wright approach*

The way in which Murraylink has estimated the MRP for use in its revenue proposal aligns with the way in which the MRP was estimated in APT Pipelines (NT) Pty Limited's January 2016 revised proposal in respect of proposed revisions to the access arrangement for the Amadeus Gas Pipeline, and in the APT Petroleum Pipelines Limited September 2016 Roma Brisbane Pipeline access arrangement revisions proposal. The AER has not yet issued a draft decision on the Roma Brisbane Pipeline proposal, but has made a final decision on the proposed revisions to the access arrangement for the

Amadeus Gas Pipeline. In its Final Decision, the AER described APT Pipelines (NT)'s approach to estimation of the MRP, and to estimation of the return on equity, as the "Wright approach". The Wright approach, the AER advised, may provide some insights into return on equity estimation, but these were limited. The Wright approach would not result in an unbiased estimate of the rate of return on equity, and should not be used.[55]

In its Amadeus Gas Pipeline Final Decision, the AER noted:

> *APTNT submitted that it did not use the Wright approach but rather "applies the model by making estimates of the expected return on the market, and of the risk free rate, and by estimating the market risk premium as the difference between the two". We do not consider that there is any substantive difference between APTNT's approach and the Wright approach.*[56]

However, the AER did not examine the difference between APT Pipelines (NT)'s approach and the Wright approach, and its conclusion that there was no substantive difference between the two approaches was unsubstantiated.

Table 6.3 below summarises the key aspects of the Wright approach, the SL CAPM, and the AER's foundation model.

APT Pipelines (NT) did not use the Wright approach in its access arrangement revisions proposal for the Amadeus Gas Pipeline, and Murraylink has not now adopted the Wright approach for its revenue proposal. In this section of this submission, Murraylink explains why its approach to estimation of the MRP, and to estimation of the return on equity, is not the Wright approach.

The AER's view of the Wright approach[57]

In its Amadeus Gas Pipeline Final Decision the AER stated:

> *The Wright CAPM is an alternative implementation of the Sharpe-Lintner CAPM. This is where the return on the market portfolio and the risk free*

---

[55] AER, Final Decision: Amadeus Gas Pipeline Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-46, and Table 3.5, p 3-58.

[56] AER, Final Decision: Amadeus Gas Pipeline Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, footnote 220, p 3-57.

[57] Murraylink notes that, in this discussion of the Wright approach, it makes no direct reference to the writings of Professor Stephen Wright. It is the AER's interpretation of Professor Wright's views which led the AER to its incorrect conclusion that the approach taken by APT Pipelines (NT) to estimation of the MRP, and to its estimation of the return on equity for the Amadeus Gas Pipeline, was the Wright approach.

> *rate are estimated as separate components of the market risk premium.*[58]

If this were the AER's view of the Wright approach, Murraylink would contend that:

- the Wright approach is no more than the correct approach to the SL CAPM, as explained above; and
- the AER was in error in rejecting use of the Wright approach.

However, there is more: the AER has a broader view of what constitutes the Wright approach. Moreover, the AER's reasons for rejecting the Wright approach do not derive from concern about estimation of the return on the market portfolio and the risk free rate as separate components of the market risk premium. The AER's rejection of the approach derives from its concern about other aspects of its broader view of the Wright approach. As Murraylink discusses in the paragraphs which follow, these other aspects of the AER's view of the Wright approach involve assumptions which lie outside the set of assumptions made for derivation of the SL CAPM. Whether they might be appropriate in the context of estimating the rate return on equity is irrelevant if the SL CAPM is to be used to estimate that rate of return in the way Murraylink proposes.

[58] AER, Final Decision: Amadeus Gas Pipeline Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-197.

Table 6.3 – Approaches to estimating return on equity

	Wright approach (used by UK regulators)	**SL CAPM (used by Murraylink)**	**AER foundation model**
Risk free rate	Point estimate for r_f	Point estimate for r_f	Point estimate for r_f
Expected return on market	Point estimate for $E(r_M)$	Point estimate for $E(r_M)$	-
Market risk premium ($MRP = E(r_M) – r_f$)	Point estimate for $E(r_M)$ minus point estimate for r_f	Point estimate for $E(r_M)$ minus point estimate for r_f	MRP is treated as a single parameter Estimated as a long term average of difference between return on the market and the risk free rate
Relationship between r_f and MRP	r_f and MRP are inversely related	No assumption	No inverse relationship between r_f and MRP
Real return on equity	Relatively constant over time	No assumption	-
Return on market	Stable over time	No assumption	-
MRP	Varies over time	No assumption	Constant over time
Risk free rate	Varies over time	No assumption	Varies over time

In the Rate of Return Guideline, the AER describes the Wright approach as an alternative – "non-standard" – implementation of the SL CAPM in which the market portfolio and the risk free rate are estimated as separate components of the MRP. The Explanatory Statement for the Rate of Return Guideline explains:

> *Effectively, under the Wright approach the estimation of the MRP is replaced by the estimation of the return on the market. If the return on the market portfolio is assumed to be relatively constant (and this is a strong assumption), estimates of the expected return on equity for the benchmark efficient entity, therefore, will only move marginally with variations in the risk free rate.*[59]
>
> . . .
>
> *The Wright approach, however, has a number of limitations. In particular, it assumes that the relationship between the risk free rate and the MRP is perfectly negatively correlated, and the return on equity is relatively stable over time.*[60]
>
> . . .
>
> *Consistent with our final decision for the Victorian gas service providers, we consider there is no consensus in the academic literature on the direction, magnitude or stability of the relationship between the risk free rate and the MRP. Instead, there is evidence to support both a positive and negative relationship. Given these uncertainties – in particular, that the direction of any relationship may be variable and unstable – we consider it more reasonable to assume that no consistent relationship exists between the MRP and risk free rate.*[61]

The Wright approach, the AER advises, uses the model:

$k_e = r_f + \beta_e \times (r_M - r_f)$,

where:

k_e is the expected return on equity;

r_f is the risk free rate of return;

β_e is the equity beta; and

[59] AER, Explanatory Statement: Rate of Return Guideline, December 2013, p 24.

[60] AER, Explanatory Statement: Rate of Return Guideline, December 2013, p 25.

[61] AER, Explanatory Statement: Rate of Return Guideline, December 2013, p 26.

r_M is the expected return on the market.[62]

This is the SL CAPM. However, the AER sees the Wright approach as introducing a number of auxiliary assumptions to effect implementation of that model in a particular way. These auxiliary assumptions include:

- the return on the market is relatively constant;
- the return on the market is estimated using historical data; and
- there is an inverse relationship between movements in the risk free rate and the market risk premium.[63]

None of these assumptions is made for the purpose of deriving the SL CAPM. They are, however, all part of the AER's view of the Wright approach. The AER's rejection of the Wright approach derives from its concerns about these assumptions, and not from estimation of the return on the market portfolio and the risk free rate as separate components of the MRP (which, as Murraylink has explained above, is the conceptually and theoretically correct interpretation of the SL CAPM).

The SL CAPM is, the AER explains, a forward-looking equilibrium asset pricing model and therefore requires forward looking input parameters; it is an ex ante model, which means that all of the variables represent before-the-fact, expected values. Murraylink agrees, and agrees that historical returns on the market cannot automatically replace the required – forward looking – expected return on the market.

The AER is concerned that the Wright approach does not take into account changing market conditions. Therefore, it is unlikely (at a given point in time) to provide an unbiased forward-looking estimate of the required return on equity.[64] This may well be the case. But it arises because the base on which the Wright approach is built is the SL CAPM. The SL CAPM is a static equilibrium model: it does not take into account changing market conditions. If the Wright approach does not provide unbiased forward-looking estimates of the return on equity, neither does the AER's foundation model.

---

[62] AER, Final Decision: Amadeus Gas Pipeline Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-197.

[63] AER, Final Decision: Amadeus Gas Pipeline Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-75.

[64] AER, Final Decision: Amadeus Gas Pipeline Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-198.

The AER says that it does not agree with the underlying premise of the Wright approach that there is a clear inverse relationship between movements in the risk free rate and market risk premium.[65] If this is the reason for the AER's conclusion that the Wright approach is not theoretically justified, then that conclusion may be justified.[66] But the premise in question is irrelevant to the derivation and application of the SL CAPM.

The AER contends that there is no compelling empirical evidence before it to support the use of the Wright approach.[67] Indeed, there may not be compelling empirical evidence for the proposition that return on the market is relatively constant, or for the proposition that there is an inverse relationship between movements in the risk free rate and the market risk premium. These propositions are part of the AER's view of the Wright approach, but they are not propositions required for derivation of the SL CAPM. There may be no compelling evidence for them, but these propositions are not necessary to correct application of that model.

The AER advises that market practitioners, academics and regulators do not generally accept the Wright approach. An analysis of 78 suitable independent valuation reports over the period May 2013 to January 2016, the AER notes, indicates there are no reports that appear to use the Wright CAPM.[68] This may well be the case, but it is not clear from the AER's advice why those market practitioners do not generally accept the Wright approach. If it is because they do not accept that the return on the market is relatively constant, the return on the market must be estimated using historical data, or that there is an inverse relationship between movements in the risk free rate and the market risk premium, then the observation that he Wright approach is not generally accepted is irrelevant to acceptance of the SL CAPM, and to the way in which it is applied.

Finally, the AER advises that Wright approach has been considered, and found deficient, by its consultants.

---

[65] AER, Final Decision: Amadeus Gas Pipeline Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-198.

[66] AER, Final Decision: Amadeus Gas Pipeline Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-198.

[67] AER, Final Decision: Amadeus Gas Pipeline Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-198.

[68] AER, Final Decision: Amadeus Gas Pipeline Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-198.

Associate Professor Handley considered the Wright approach and advised the AER:

> *It appears to be based on two main ideas. First, a claim that the standard approach is internally inconsistent as it purportedly uses a different estimate of the risk free rate for the purposes of estimating the MRP. But this is not correct. As discussed above, the item being estimated under the standard approach and the item being substituted into (6) is the MRP. It is a single estimate of a single item. It is not an estimate of the expected return on the market and an estimate of the risk free rate. Second, Wright draws on previous work by Wright, Mason and Miles (2003) which in turn draws on work by Siegel (1998) to conclude that:*
>
> *"regulators should work on the assumption that the real market cost of equity is constant … as a direct consequence, whatever assumption is made on the risk free rate, the implied equity premium must move point by point in the opposite direction."*
>
> *The theoretical justification for such an assumption is far from clear whilst the empirical evidence that is presented is not compelling. More importantly, this is a proposition whose widespread use and acceptance is yet to be established. Until then (if at all), there is no compelling reason to move from the standard approach to estimation.*[69]

Associate Professor Handley sees the Wright approach as being based on a view that the standard approach to the SL CAPM is inconsistent because it uses a different estimate of the risk free rate for the purpose of estimating the MRP. Handley contends that the item being estimated is the MRP, which it is a single estimate of a single item. However, as Murraylink has explained above, the MRP in the SL CAPM is not a "single item". It comprises two parameters, the expected return on the market and the risk free rate. Each of these two parameters must be estimated at the time the model is applied, and the correct estimate of the MRP is the difference the two parameter estimates.

The Wright approach, Associate Professor Handley argues, incorporates the assumption that the real cost of equity is constant. This assumption has been drawn from work by Professor Wright and others, and by Siegel. However, Handley contends, the theoretical justification for such an assumption is far from clear, and the empirical evidence advanced in support is far from compelling. This may be the case, and may justify rejection of the Wright approach. But no assumption of the constancy of the real cost of equity is

[69] John C. Handley 2014, Report prepared for the Australian Energy Regulator: Advice on the Return on Equity, 16 October, pp 17-18

required for derivation of the SL CAPM, and no such assumption is necessary for correct application of the model.

Partington and Satchell also examined the Wright approach for the AER, and advised that they were unconvinced by the approach in the context of estimating the market risk premium, and recommended that the regulator give it little weight.[70] Partington and Satchell noted that the Wright CAPM had no well accepted theoretical support, did not seem to be much used, if at all, in practice, and runs contrary to the well accepted view that asset prices are inversely related to interest rates.

Partington and Satchell were not explicit about what they saw as key assumptions underpinning the Wright approach. However, their comment that the model ran contrary to the well accepted view that asset prices are inversely related to interest rates indicates that an inverse relationship between the risk free rate and the market risk premium was one of those assumptions. Concern about this assumption, and possibly about other auxiliary assumptions, appear to be the reasons for their assessment that the model did not have well accepted theoretical support, and was not much used in practice. But the assumption of an inverse relationship between the risk free rate and the market risk premium, and the other auxiliary assumptions of the Wright approach which were noted above, are not relevant to the derivation of the SL CAPM, and are not necessary to correct application of that model.

In estimating the return on equity, Murraylink has established the MRP as the difference between:

- an estimate of the expected return on the market at the time of estimating the return on equity; and
- an estimate of the risk free rate at that time.

Murraylink has used the SL CAPM a way which is consistent with the way in which the model – essentially a static general equilibrium model of financial asset exchange – is derived.

Murraylink has explicitly recognised that what must be estimated, consistent with the structure of the model, is the expected return on the market, and has proposed an estimate of that expected return that aligns with ranges supported by the AER[71].

---

[70] Graham Partington and Stephen Satchell, Report to the AER: Cost of Equity Issues 2016 Electricity and Gas Determinations, April 2016, p 31.

[71] See "Estimating the expected return on the market" above

Murraylink has not made any assumption about whether the return on the market is relatively constant. Murraylink has not imposed a requirement that the return on the market be determined using historical data, although it acknowledges that historical data on market returns might be used to estimate the expected return required for application of the SL CAPM.

Murraylink has not assumed that there is an inverse relationship between movements in the risk free rate and the market risk premium. No such assumption is required for the proper application of the SL CAPM.

Murraylink has not used the Wright approach.

6.3 Estimating the return on debt

6.3.1 *Requirements of the National Electricity Rules*

Clause 6A.6.2, paragraph (h) of the NER provides that the return on debt for a regulatory year is to be estimated such that it contributes to the achievement of the allowed rate of return objective. Clause 6A.6.2, paragraph (h), is mandatory – it prescribes the way in which the return on debt is to be estimated for each regulatory year of the regulatory control period.

The allowed rate of return objective is that the rate of return for a TNSP 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 TNSP in respect of the provision of prescribed transmission services (NER, clause 6A.6.2, paragraph (c)). Thus, the rate of return objective requires an assessment of the efficient financing costs that would be faced in each regulatory year of the regulatory control period, by a benchmark efficient entity with a similar degree of risk as that which applies to Murraylink in respect of the provision of prescribed transmission services. This in turn requires an assessment of what an efficient financing practice would be for that benchmark efficient entity. Efficient financing costs are those costs that would be faced in each regulatory year of the regulatory control period, by a benchmark efficient entity engaged in efficient financing practices.

Clause 6A.6.2, paragraph (k), sets out a number of factors to which the AER must have regard in estimating the return on debt under paragraph (h). Of course, these factors cannot override the primary decision-making rule in paragraph (h). Rather, they are factors to be taken into account in applying that paragraph.

6.3.2 *Rate of Return Guideline*

The benchmark efficient entity of clause 6A.6.2, paragraph (c), of the NER would, the AER advised in the Explanatory Statement which accompanied the Rate of Return Guideline, issue debt with a term to maturity of 10 years. To mitigate its refinancing risk the benchmark efficient entity would hold a portfolio of debt with staggered maturities.

In the Rate of Return Guideline, the AER proposed to use a trailing average portfolio approach to estimating the return on debt, since the trailing average approach would approximate efficient financing costs for a benchmark efficient entity with a staggered portfolio of fixed rate debt. However, the AER did not propose to implement the trailing average approach immediately. Rather, the AER proposed to transition to the trailing average approach over a period of ten years.

The Rate of Return Guideline proposed that the return on debt be estimated:

- for debt with a benchmark term to maturity of 10 years;
- using an on-the-day approach (return on debt equal to the sum of a current base rate and current debt risk premium) in the first regulatory year of the regulatory control period; and
- transitioning the rate obtained using the on-the-day approach into a trailing average over 10 years by updating one tenth of the return on debt in each subsequent year to accord with prevailing financial market conditions.

The Explanatory Statement set out the rationale for a transition to trailing average estimation of the return of debt rather than its immediate implementation. Under the on-the-day approach to return on debt estimation which had been previously applied, the benchmark efficient entity would have:

- borrowed long term (10 years) and staggered its borrowings so that only a proportion (10 per cent) of the debt matured each year and needed to be refinanced;
- borrowed using floating rate debt (or using fixed rate debt converted into floating rate debt using fixed-to-floating interest rate swaps); and
- entered into floating-to-fixed interest rate swaps, during the averaging period at the commencement of each regulatory control period, for the risk free rate component of the return on debt, for the duration of the regulatory control period.

As a result, the benchmark efficient entity would have held a portfolio of floating rate debt at the time a new approach to estimation of the return on debt was to be implemented. This portfolio would need to be "unwound" as part of any change from an on-the-day to a trailing average approach to estimation of the return on debt. This, the AER proposed, would be effected by transition to the trailing average over a period of 10 years.

The hedging arrangements through which the benchmark efficient entity's portfolio of floating rate debt was created were in respect of the risk free rate components of its long term borrowings. There was no market in which the debt risk premium component could be hedged.

Transition to a trailing average approach was, in the AER's view, necessary to allow the benchmark efficient entity for which the return on debt is estimated to unwind the hedging arrangements it had entered into under the previously used on-the-day approach. Only a regulated entity would have had to contend with on-the-day estimation of the return on debt, and would have hedged in response to that on-the-day estimation of the return on debt. Thus, the AER's decision to impose a transition in the Rate of Return Guideline was premised on its view of the benchmark efficient entity as a regulated entity.

6.3.3 *Tribunal review of the AER's approach to estimation of the return on debt*

On 26 February 2016, the Australian Competition Tribunal (Tribunal) handed down decisions on applications for merits reviews by Networks NSW, ActewAGL and Jemena Gas Networks (NSW) Ltd (Jemena). The Tribunal decided to set aside the AER's decisions for each of the businesses, and to remit various matters to the AER for reconsideration, including in relation to the return on debt.

The Tribunal's key conclusions on the estimation of the return on debt in the AER's decisions for Networks NSW, ActewAGL and Jemena were:

- the benchmark efficient entity referred to in the allowed rate of return objective is an unregulated entity, and the AER therefore erred in treating it as regulated for the purposes of its decision on the form of transition to the trailing average method;[72]
- the AER erred in deciding that there must be a single, standard benchmark efficient entity, and that there must be a single, standard form of transition appropriate for all service providers;[73]
- in the light of the AER's errors in interpretation of the rate of return objective and in characterisation of the benchmark efficient entity, the

[72] Applications by Public Interest Advocacy Centre Ltd and Ausgrid Distribution [2016] ACompT 1, [907], [914].

[73] Applications by Public Interest Advocacy Centre Ltd and Ausgrid Distribution [2016] ACompT 1, [916].

AER's approach to transitioning to the trailing average must be reconsidered.

The Tribunal also provided some direction as to the proper implementation and application of clause 6.5.2, paragraph (k)(4) of the NER, which is equivalent to clause 6A.6.2, paragraph (k)(4).[74] The Tribunal stated that taking into account this factor involves:

- starting with the efficient financing costs of an unregulated benchmark efficient entity;
- where the AER is intending to change the method for estimating the return on debt, considering whether there would be any impact on the benchmark efficient entity as a result of the changed method; and
- taking into account any such impacts in deciding on the transition to the new method.

In relation to the first step, the Tribunal noted that as the financing costs structure of Networks NSW was readily applied to the trailing average method, the relevant inquiry would start with whether the actual financing costs were efficient as at the commencement of the new regulatory control period, and only if the actual structure was not efficient would that of the benchmark efficient entity be applied prospectively.[75]

The Tribunal did not identify what it considered to be the correct form of transition for each business. Rather, the Tribunal directed the AER to remake its decision on the transition method in accordance with the principles and guidance set out in the Tribunal's reasons.

On 24 March 2016, the AER applied to the Federal Court for judicial review of the Tribunal's decision. In particular, the AER applied for review of:

- the Tribunal's finding that the benchmark efficient was an unregulated entity;
- the Tribunal's rejection of a single benchmark efficient entity; and

[74] Applications by Public Interest Advocacy Centre Ltd and Ausgrid Distribution [2016] ACompT 1, [933].

[75] Applications by Public Interest Advocacy Centre Ltd and Ausgrid Distribution [2016] ACompT 1, [934].

- the interpretation of clause 6.5.2, paragraph (k)(4) of the NER.[76]

These matters are still before the Federal Court.

The AER is yet to remake its decisions on the transition in respect of the New South Wales distribution network service providers, and has continued to develop its approach to estimation of the return on debt in its most recent decisions.

6.3.4 *Recent AER decisions on the return on debt*

In recent decisions, the AER has adopted a justification for its preferred transition which is different from that set out in the Rate of Return Guideline.

For example, in its recent access arrangement decision for ActewAGL, the AER noted that, in response to the service provider's proposing an immediate adoption of the trailing average approach, the AER had reconsidered whether its approach to estimating the allowed return on debt would contribute to achieving the allowed rate of return objective.[77] The AER determined that it would apply the transition as set out in the Rate of Return Guideline (and as applied in distribution determinations for service providers in NSW and the ACT). However, the reasons relied upon by the AER for adopting the transition were entirely new.

There were two new aspects to the AER's reasoning in its decision for ActewAGL and its decisions for other service providers made around the same time.

First, rather than defining efficient financing costs by reference to an efficient financing practice that would be adopted by a benchmark efficient entity, the AER defined efficient financing costs as being those costs that are reflected in the prevailing market cost of capital.[78] The AER relied on a report that it had commissioned from Graham Partington and Stephen Satchell in defining efficient financing costs as current (or prevailing) market costs, rather than the costs relating to an assumed financing strategy.[79] This

---

[76] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 3 – Rate of return, September 2016, p 3-38.

[77] AER, Final Decision ActewAGL Distribution Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-95.

[78] AER, Final Decision ActewAGL Distribution Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-281.

[79] AER, Final Decision ActewAGL Distribution Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-17, footnote 57, referring to: Graham Partington and

was a departure from the approach adopted in the Rate of Return Guideline (and the earlier decisions in respect of the NSW and ACT electricity distribution network service providers) where the AER had considered efficient financing costs by reference to the financing practice of a particular type of entity (i.e. by reference to the practice of a regulated benchmark efficient entity).

Secondly, the AER considered that any transition should be "revenue neutral", relative to continuation of the on-the-day methodology.[80] The AER's position was that there should be a transition because service providers are appropriately compensated for efficient financing costs under the on-the-day approach and under the AER's transition to the trailing average approach. On the basis of this finding, the AER determined that an approach that is other than the on-the-day approach or the AER's transition (including immediate adoption of the trailing average approach or some hybrid approach) would result in over or under compensation of the benchmark efficient entity.

Murraylink considers that the approach taken by the AER in these recent decisions is incorrect. The allowed rate of return objective requires an assessment of the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of prescribed transmission services. In this context, efficient financing costs cannot simply be equated with the current (or prevailing) market cost of capital. Rather, the efficient financing costs of the relevant benchmark efficient entity must be assessed by reference to the efficient financing practice of that entity. When the efficient financing practices of the benchmark efficient entity are considered, efficient financing costs are likely to reflect a mixture of market financing rates prevailing at various points in time.

Moreover, there is no requirement under the NGR for a transition from one methodology to another to be "revenue neutral", relative to continuation of the old methodology. Indeed, if the imposition of such a condition leads to incongruence with clause 6A.6.2, paragraph (h), then it will be contrary to the NER.

Stephen Satchell, Report to the AER: Discussion of the Allowed Cost of Debt, 5 May 2016.

[80] AER, Final Decision ActewAGL Distribution Access Arrangement 2016 to 2021, Attachment 3 – Rate of return, May 2016, p 3-28.

The approach which must be taken to estimating the return on debt is, at this time, as set out by the Tribunal in its decision in the NSW and ACT matters.[81] This involves consideration of the efficient financing practice of the relevant (unregulated) benchmark efficient entity, and an assessment of the efficient financing costs associated with that practice.

6.3.5 *Murraylink's estimation of the return on debt*

For the purpose of estimating the return on debt, Murraylink has assumed that the benchmark efficient entity referred to in clause 6A.6.2, paragraph (c) of the NER, is an unregulated entity which raises debt with a term to maturity of 10 years. Debt raising is staggered so that only a part of the total debt must be refinanced each year, thereby reducing refinancing risk. The efficient financing practice of an unregulated benchmark efficient entity facing a degree of risk similar to that of Murraylink in its provision of prescribed transmission services is, then, to have a staggered portfolio of debt with 10 per cent of its debt refinanced annually.

Since the benchmark efficient entity is unregulated, it may or may not benefit from hedging interest rate risk. In the case of an unregulated entity there is, of course, no regulatory allowance for the return on debt against which the entity might hedge the risk of adverse movements in the interest rates on the debt it has, in fact, raised. Moreover, as Partington and Satchell have noted: "Hedging is a choice, but not necessarily the best choice, so not all firms will choose to fully hedge and possibly some may choose not to hedge at all".[82] In the case of an unregulated entity, whether there are benefits from hedging will depend on the specific circumstances of the entity. The benchmark efficient entity is not, therefore, assumed to hedge, and there are no hedges to be unwound.

Therefore, the efficient financing costs of the benchmark efficient entity are properly estimated using a trailing average approach. Since there are no relevant hedging arrangements to be unwound in this case, the trailing average estimation can be implemented immediately. There is no need for a transition.

Murraylink has, therefore, estimated for the benchmark efficient entity (an entity with a credit rating in the BBB range) an equally weighted average cost of debt for fixed rate debt raised in each of the last 10 years (including

---

[81] Applications by Public Interest Advocacy Centre Ltd and Ausgrid Distribution [2016] ACompT 1.

[82] Graham Partington and Stephen Satchell, *Report to the AER: Discussion of the Allowed Cost of Debt*, 5 May 2016, p 18.

the current year). For this, Murraylink has used the yields on the BBB rated debt of non-financial corporations, published by the Reserve Bank of Australia, extrapolated to maturities of 10 years. Consistent with other aspects of its determination of a proposed allowed rate of return, Murraylink has used the yield on debt in December of each year in estimating the return on debt for that year.

Murraylink's estimate of the return on debt of the benchmark efficient entity, made as a historical trailing average of yields over the last 10 years, is 7.86 per cent. This is an estimate of the return on debt which reflects the efficient financing practice of the benchmark efficient entity as required by the allowed rate of return objective of clause 6A.6.2, paragraph (c).

Now, Murraylink itself did not raise any debt under the previous on-the-day approach to estimating the regulatory allowance for the return on debt. Murraylink is, however, a company within the EII Group of companies, and all debt raising and portfolio management for Murraylink, including interest rate and foreign currency hedging, were undertaken by the Group treasury department.

Debt which the Group treasury department allocated to Murraylink was hedged over each regulatory control period. Murraylink's actual financing costs, including its hedging costs, were efficient having regard to Murraylink's particular degree of risk. In these circumstances, as the Tribunal noted, change to the trailing average method of estimating the return on debt requires a transition process like that identified by the AER during which previously efficient hedging arrangements can be "unwound".[83]

Murraylink has, therefore, estimated the return on debt for this revenue proposal as a current – on-the-day – cost of debt with term to maturity of 10 years issued by a BBB+ rated issuer. This current cost of debt is to be transitioned into a trailing average estimate of the return on debt over a period of 10 years by updating the return annually in the way discussed in section 6.4.3 below.

For this revenue proposal, Murraylink has estimated the on-the-day cost of debt using data available at 30 December 2016, recognising that the estimate may be revised as new data become available during the regulatory approval process.

The on-the-day cost of debt has been estimated as a simple average of:

[83] Applications by Public Interest Advocacy Centre Ltd and Ausgrid Distribution [2016] ACompT 1, [934].

- the yield on debt issued by nonfinancial corporations with a credit rating in the BBB range, as published by the Reserve Bank of Australia, but with the data extrapolated to the 10 year term assumed for the debt financing of the benchmark efficient entity; and
- the average of the effective annual rates calculated for the 20 trading days to 30 December 2016, in the way proposed by the AER, from the mid-prices for debt with a tenor of 10 years posted by the Bloomberg service (series BVCSAB10).

This simple average, 5.16 per cent, is Murraylink's estimate of the return on debt for this revenue proposal.

Murraylink has made its estimate of the return on debt guided by the Tribunal's February 2016 decisions in response to the applications from the New South Wales service providers. That guidance was not, in Murraylink's view, especially clear, and the AER has yet to give it effect in remaking the decisions which were appealed.

As noted above, the AER has sought judicial review of the Tribunal's decisions. Murraylink understands that the Federal Court is expected to make a decision in April 2017, prior to the AER's draft decision on this revenue proposal. Murraylink will therefore review its estimation of the return on debt in its response to the AER's draft decision.

6.4 Implementation

Four issues which arise in the implementation of the allowed rate of return are addressed in this section of the submission. They are:

- credit rating;
- data;
- annual updating process; and
- the averaging periods to be used when updating the rate of return.

6.4.1 Credit rating

Determination of a rate of return for a benchmark efficient entity with degree of risk similar to that of the service provider in its provision of prescribed transmission services, in accordance with clause 6A.6.2, paragraph (c), of the NER, requires a measure of credit risk.

Paragraph 6.3.3 of the Rate of Return Guideline proposes that this measure of credit risk be a credit rating of BBB+ from Standard and Poor's or the equivalent rating from another recognised rating agency. If financial data used to estimate the allowed rate of return do not reflect a credit rating of

BBB+, or the equivalent, they are to be those which most closely approximate data for an entity with a BBB+ credit rating.

Murraylink has therefore assumed a credit rating of BBB+ for the benchmark efficient entity. Where financial data to be used in estimating the rate of return are not available for entities with that credit rating, Murraylink has used data for BBB rated entities.

6.4.2 *Data*

Murraylink has estimated the return on debt using historical data on Australian Government securities yields and corporate bond spreads published by the Reserve Bank of Australia.[84]

Observed yields on securities with nominated maturities of 7 years and 10 years were interpolated to provide estimates of yields for maturities of exactly 7 years and exactly 10 years, respectively.

Spreads on BBB rated bonds of non-financial corporate issuers with effective tenors of 7 years and 10 years were extrapolated from the actual tenors reported by the Reserve Bank to tenors of exactly 7 years and exactly 10 years, respectively.

Murraylink has used the interpolation and extrapolation methods which are used by the AER in its estimation of the return on debt.

For the annual updating of the return on debt (see section 6.4.3 below), Murraylink will estimate the rate return on debt for the current regulatory year in the same way as it has estimated the current cost of debt for this revenue proposal (and in the same way as the AER has proposed estimating the return on debt). That is, Murraylink will estimate the current rate of return as a simple average of current yields for BBB rated bonds obtained from the Reserve Bank's corporate bond spread series, and from the series BVCSAB10 available from the Bloomberg service. These current yields will, themselves, be averages of daily yields over the 20 trading days of the averaging periods nominated by Murraylink.[85]

---

[84] Bond yields were from the Reserve Bank's series Indicative Mid Rates of Australian Government Securities – F16 (current and historical). The corporate debt spreads were from the series Aggregate Measures of Australian Corporate Bond Spreads and Yields – F3. Both series were available at http://www.rba.gov.au/statistics/tables/#interest-rates at the time of preparation of this submission.

[85] The Reserve Bank of Australia corporate debt spreads are, of course, currently a monthly series. Daily yield estimates must be obtained by interpolation of the spreads for successive months.

6.4.3 *Annual updating process*

Clause 6A.6.2, paragraph (i)(2), of the NER permits the return on debt to be estimated using a method which results in that return, and the allowed rate of return, being different for different regulatory years in regulatory control period.

Murraylink intends that the estimate of the return on debt be updated annually during the regulatory control period.

Murraylink proposes that the return on debt be estimated, immediately prior to commencement of the regulatory control period, as the current – on-the-day – cost of debt.

In the process of annual updating, one-tenth of this initial current cost of debt would be dropped from the average, and a new term, estimated using current year data, and weighted one-tenth, would be added. The new average would then become the updated return on debt to be used in the post-tax revenue model for the next and subsequent years of the regulatory control period.

If the return on debt is updated annually, then the required revenue is to be changed through the automatic application of a formula that is specified in the AER's decision on the Murraylink revenue proposal.[86]

Murraylink proposes to use the functionality which the AER has now built in to its post-tax revenue model to update the required revenue for the updated return on debt. The updated required revenue will then be used to recalculate the required revenue for the next regulatory year of the regulatory control period. This approach has been advanced, in previous AER decisions, as the automatic application of a formula required by clause 6A.6.2, paragraph (l) of the NER.

6.4.4 *Averaging period*

If the return on debt is to be updated annually, data must be collected and an estimate made of that return close to the start of each regulatory year of the regulatory control period.

Murraylink proposes an averaging period of 20 trading days for the collection of data relevant to calculating an updated return on debt. A specific averaging period for each regulatory year in the regulatory control period (1 July 2018 to 30 June 2023) is set out in Confidential Attachment 6.2 to this submission.

[86] NER, clause 6A.6.2, paragraph (l).

6.5 Value of imputation credits

A TNSP's required revenue is to include, as one of its building blocks, the estimated cost of corporate income tax.[87]

Clause 6A.6.4 of the NER requires that the cost of corporate income tax be estimated for each year of a regulatory control period using the formula:

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

where ETC_t is the estimated cost of income tax in year t; ETI_t is an estimate of the taxable income for regulatory year t that would be earned by a benchmark efficient entity as a result of the provision of prescribed transmission services if such an entity, rather than the service provider, operated the business of the service provider; and r_t is the expected statutory income tax rate in year t.

Clause 6A.6.4 defines γ (gamma) as "the value of imputation credits".

The Rate of Return Guideline proposes estimation of gamma as the product of two parameters. These two parameters are:

- the distribution rate – the proportion of imputation credits generated that is distributed to investors; and
- the value, per dollar to investors, of imputation credits distributed (the utilisation rate, or theta).

The Rate of Return Guideline proposes a value of gamma of 0.5, which is the product of an estimate of 0.7 for the distribution rate, and an estimate of theta of 0.7.

Murraylink has adopted an estimate for gamma of 0.25 for its revenue proposal.

6.5.1 Estimation of gamma in the AER's recent decisions

In its recent regulatory decisions, the AER has advised that there is a widely accepted approach to estimating the distribution rate.[88] However, as outlined below, there is no single accepted approach to estimating theta (the utilisation rate).

---

[87] NER, clause 6A.5.4, paragraph (a)(4).

[88] See, for example, Australian Energy Regulator, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, September 2016, p 4-23.

AER estimation of the distribution rate

The widely accepted approach to estimating the distribution rate uses statistics published by the Australian Taxation Office. The estimate made, and which continues to be made, using those statistics is 0.7. That estimate of the distribution rate has previously been regarded as an estimate arrived at on a reasonable basis, and as representing the best estimate possible in the circumstances. It was the estimate proposed in the Rate of Return Guideline.

Since the Rate of Return Guideline was made and published, the AER has re-examined estimation of the distribution rate. In a number of decisions, the AER has made reference to the views of:

- Associate Professor John Handley, that the estimate of the distribution rate should be made using only the credits generated and distributed by listed entities, resulting in a higher estimate of the distribution rate of 0.8; and
- Dr Martin Lally, who considers that the best estimate of the distribution rate is 0.83, calculated using data for the 20 largest ASX-listed companies.[89]

The AER has advised that, when estimating both the distribution rate and the value of distributed imputation credits, consideration must be given to whether the data used should be for all companies and their investors ("all equity"), or only for listed companies and their investors ("only listed equity"). When the distribution rate was estimated on an only listed equity basis, the result was an estimate of 0.75.[90]

AER estimation of theta

The evidence relevant to the estimation of theta (the utilisation rate), the AER advises, includes:

- the proportion of Australian equity held by domestic investors ("equity ownership approach");
- the reported value of credits utilised by investors in Australian Taxation Office (ATO) statistics ("tax statistics"); and

[89] Australian Energy Regulator, *Draft Decision Powerlink transmission determination 2017-22*, Attachment 4, September 2016, p 4-23

[90] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, September 2016, pp 4-31 – 4-33.

- studies that seek to infer from market prices the value to investors of distributed imputation credits ("implied market value studies").[91]

Each approach is briefly described.

Equity ownership approach

The AER assumes that the utilisation rate for eligible investors – the value, per dollar, of imputation credits distributed to those investors, is 1; the utilisation rate for investors who are ineligible to use the credits is 0. The AER therefore contends that the value-weighted proportion of domestic investors in the Australian equity market is a reasonable estimate of the theta.

This approach to estimation of theta – the equity ownership approach – seems to be the approach on which the AER places most reliance.[92] It has led to a range of 0.38 to 0.55 for the estimate of theta.[93]

Tax statistics

The AER advises that it has had regard to the evidence from tax statistics when considering estimates of theta. Those statistics have indicated an estimate of 0.48.[94] However, the AER has concerns about limitations in the statistics themselves. The AER, therefore, places a degree of reliance on estimation of theta using tax statistics that is less than that placed upon the equity ownership approach.[95]

Implied market value studies

Implied market value studies estimate the value of distributed imputation credits from market prices. Dividend drop off studies are a common type of implied market value study. In dividend drop off studies, the prices of securities with entitlements to dividends are compared with the prices

---

[91] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, September 2016, p 4-24.

[92] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, September 2016, p 4-28.

[93] Australian Energy Regulator, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, , Table 4-4.

[94] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, September 2016, Table 4-3.

[95] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, September 2016, p 4-37.

without the dividend entitlements. Econometric techniques are then used to infer the value of the imputation credits attached to the dividends.[96]

These studies, the AER concludes, produce a wide range of estimates for theta – between 0 and 1.[97]

Implied market value studies and, in particular, dividend drop off studies, are the AER contends, subject to limitations arising from the data used, from the econometric techniques employed, and from the need to interpret the results (since only the value of the combined package of dividends and imputation credits can be observed).

The AER is therefore of the view that little reliance can be placed on the results of implied market value studies. The equity ownership approach and tax statistics provide more direct and simpler evidence; they, and not implied market value studies, should inform estimation of theta.[98]

AER estimation of gamma

A reasonable estimate of the range for gamma, the AER contends in its most recent decisions, is 0.3 to 0.5. [99] From within this range, the AER has chosen an estimate of 0.4, observing that:

- its preferred equity ownership approach to estimation of the utilisation rate indicates a value of gamma between 0.28 and 0.47 when gamma is calculated using matched distribution and utilisation rates for all equity and for only listed equity, respectively;
- tax statistics, on which less reliance is placed, suggest a value of around 0.34 based on a utilisation rate of 0.48 and an economy wide distribution rate of 0.7;
- the evidence from implied market value studies, evidence on which even less reliance is placed, suggests an estimate of gamma between 0 and 0.75, with the results of SFG's dividend drop off study suggesting a value in

[96] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, September 2016, p 4-39.

[97] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, September 2016, Table 4-4.

[98] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, September 2016, p 4-39.

[99] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, September 2016, p 4-28.

the range 0.26 to 0.30, which is at the bottom end of the equity ownership approach range of 0.28 to 0.47. [100]

The AER has not reflected the outcome of the February 2016 Australian Competition Tribunal decision (discussed below) in its most recent decision, noting that It considers that the Tribunal erred in reaching its conclusion and that the regulator has sought review of the Tribunals decision in the Federal Court.[101]

6.5.2 *Tribunal reviews of the AER's approach to estimation of gamma*

The Tribunal has reviewed the estimation of gamma on three occasions in the past year. In each case, the Tribunal examined applications in which service providers contended that an estimate of 0.4 involved error, and that an estimate of gamma 0.25 was to be preferred in accordance with the requirements of the NGR.

In October 2016, in a decision on an application from SA Power Networks, the Tribunal examined arguments advanced by the AER that, in the academic literature, there were different theoretical perspectives on the way in which imputation credits might impact on share prices. In broad terms, one perspective saw the average value of imputation credits as affecting share prices. The other perspective saw share prices as being affected by the value of the credits to the marginal investor. The AER, the Tribunal found, did not err in choosing to adopt an average value perspective, and using methods to estimate gamma (in particular, using the equity ownership approach to estimate theta) which were appropriate to the perspective it had adopted.

In respect of Networks NSW, ActewAGL and Jemena, the AER approached the estimation of gamma in the way outlined in section 6.5.1 above (although with some slightly different values for the component estimates of the distribution rate and theta). In responding to the service providers' applications for merits reviews of the AER's decisions, the Tribunal required (in its decisions handed down on 26 February 2016), that the AER's decisions on the value of imputation credits be set aside.

The Tribunal found:

[100] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, September 2016, pp 4-28 – 4-31.

[101] AER, Draft Decision Powerlink transmission determination 2017-18 to 2021-22, Attachment 4 – Value of imputation credits, September 2016, pp 4-28 – 4-29.

- in the absence of sufficient explanation for an alternative measure of the distribution rate (a measure using data from only listed equity), it is appropriate to follow past practice (estimation of the distribution rate from data for all equity);[102]
- the equity ownership approach overstates the redemption of distributed imputation credits by eligible investors; it may be useful only as providing an upper bound which, like the upper bound suggested by tax statistics, can provide a check on other estimates;[103]
- the equity ownership and tax statistics approaches make no attempt to assess the value of imputation credits to shareholders, and ignore the likely existence of factors, such as the 45 day rule, which, across all eligible shareholders, reduce the value of imputation credits to those shareholders below the face value assumed by the AER; the equity ownership and tax statistics approaches are inconsistent with a proper interpretation of the Officer framework underlying clause 6.5.3 of the NER;[104]
- the equity ownership and tax statistics approaches can only provide upper bounds for an estimate of theta; estimation of theta must, therefore, rely on market studies which best capture the considerations that investors make in determining the worth of imputation credits to them; and[105]
- the best estimate of theta, from an updated SFG study before the Tribunal, was 0.35.[106]

The Tribunal remitted the decisions to the AER, directing the regulator to remake them using an estimated cost of corporate income tax calculated from an estimate of gamma of 0.25.

---

[102] Applications by Public Interest Advocacy Centre Ltd and Ausgrid Distribution [2016] ACompT 1, February 2016, [1106].

[103] Applications by Public Interest Advocacy Centre Ltd and Ausgrid Distribution [2016] ACompT 1, February 2016, [1093].

[104] Applications by Public Interest Advocacy Centre Ltd and Ausgrid Distribution [2016] ACompT 1, February 2016, [1095].

[105] Applications by Public Interest Advocacy Centre Ltd and Ausgrid Distribution [2016] ACompT 1, February 2016, [1096].

[106] Applications by Public Interest Advocacy Centre Ltd and Ausgrid Distribution [2016] ACompT 1, February 2016, [1103], [1113].

In March 2016, following these decisions in respect of the New South Wales network service providers, the AER raised the issue of gamma in its application to the Federal Court for broad ranging judicial review of whether the grounds of review were properly established by the service providers, and whether these were had been correctly applied by the Tribunal.

Murraylink understands that the Federal Court is expected to make a decision in April 2017 (prior to the AER's draft decision on Murraylink's revenue proposal).

Subsequent to the Tribunal's decisions in respect of the New South Wales service providers, and the AER's application for review to the Federal Court, the estimation of gamma was raised in an application by ATCO Gas Australia Pty Ltd seeking merits review of a decision by the ERA to set gamma at 0.4. The Tribunal's reasoning for its determination, in this case, that gamma should be 0.25, was as follows:

> *684. The ERA considered the Tribunal's reasons for decision in PIAC and Ausgrid.*
>
> *685. The ERA accepted that it would undermine the effectiveness of the regulatory regime and would be against the public interest in consistency of decision-making for it to re-argue matters that have recently been considered and decided by the Tribunal in that matter, notwithstanding that aspects of the PIAC and Ausgrid decision relating to the value of imputation credits are currently the subject of an application for judicial review before the Federal Court.*
>
> *686. For the purpose of this application, and applying the reasons of the Tribunal in PIAC and Ausgrid, the ERA accepted that:*
>
> *(1) the ERA has made a reviewable error in its decision to apply a gamma of 0.4 in its rate of return determination in the Amended Final Decision; and*
>
> *(2) the best estimate of gamma on the basis of the material before the ERA at the time of its Amended Final Decision was 0.25.*
>
> *687. The Tribunal accepts, on the basis of the material before it, that a gamma value of 0.25 should be adopted and that the ERA erred in adopting the alternative figure of 0.4.*[107]

6.5.3 *Murraylink's estimation of gamma*

Murraylink has estimated gamma as the product of the distribution rate and theta.

---

107 Application by ATCO Gas Australia Pty Ltd [2016] ACompT 10.

For the distribution rate, Murraylink has used an estimate of 0.7, which has been made from Australian Taxation Office data for all equity, and which has previously been regarded as an estimate arrived at on a reasonable basis, and as representing the best estimate possible in the circumstances. It was the estimate proposed in the Rate of Return Guideline.

For theta, Murraylink has used the estimate of 0.35 from the updated SFG study which was before the Tribunal in February 2016.

Murraylink has, therefore, used an estimate of 0.25 (= 0.7 x 0.35) for gamma in its revenue proposal.

Murraylink is of the view that, at the present time, this is best possible estimate of gamma.

In successive decisions since *Energex* in 2011, the Tribunal has determined that gamma should be 0.25. Only in October 2016, has the Tribunal supported a different result.

In using an estimate of 0.25, Murraylink recognises that a Federal Court decision pertaining to gamma is still pending. However, even then, the matter will be open further scrutiny. The academic literature which is the source of the two perspectives discerned by the Tribunal is confined to a small number of papers which warrant more consideration than has currently been given to them.

6.6 Forecast inflation

Murraylink has adopted an inflation forecast of 2.0 per cent which is the midpoint of the inflation forecast for 2017 from Table 6.1 of the Reserve Bank of Australia's November 2016 Statement on Monetary Policy).

7 Forecast capital expenditure

7.1 Introduction

This chapter contains Murraylink's capital expenditure forecasts for each year of the 2018-23 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. Finally, a contingent project during the new regulatory control period is outlined in section 7.8.4.

The resulting forecast capital expenditures are set out in the AER's Cost Information template, which forms Attachment 1.1 to this Proposal.

7.2 Rules

The information and matters relating to capital expenditure that must be provided in Murraylink's Proposal are set out in Rules 6A.6.7 and schedule S6A. 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. These are set out in 7.8.4.

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

7.2.1 Capital expenditure objectives

Murraylink's forecast capital expenditure is capital expenditure that is considered to be required in order to meet the capital expenditure objectives. Rule 6A.6.7(a) sets out the capital expenditure objectives which are:

- meet or manage the expected demand for prescribed transmission services over that period;
- comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;
- to the extent that there is no applicable regulatory obligation or requirement in relation to:
    - the quality, reliability or security of supply of prescribed transmission services; or
    - the reliability or security of the transmission system through the supply of prescribed transmission services,
- to the relevant extent:
    - maintain the quality, reliability and security of supply of prescribed transmission services; and
    - maintain the reliability and security of the transmission system through the supply of prescribed transmission services; and
- maintain the safety of the transmission system through the supply of prescribed transmission services.

Murraylink considers that this revenue proposal achieves the capital expenditure objectives set out in Rule 6A.6.7. Murraylink 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

7.2.2 *National Transmission Network Development Plan*

The AEMO 2016 National Transmission Network Development Plan (NTNDP) for the National Electricity

Market notes that:

- a high-level pre-feasibility study into inter-regional augmentations found multiple credible solutions with positive net market benefits; and
- a combination of services (providing system strength, inertia, FFR, and frequency regulation) could comprise a lower-cost alternative approach

to improving South Australia's resilience without additional interconnection. [108].

The Murraylink revenue proposal describes a contingent project that has the potential to augment the interconnection capacity between South Australia, Victoria and NSW which would relieve network constraints in the adjacent transmission networks as well as contributing to the inertia of the South Australian system.

7.2.3 *Explanation of variations in forecast capital expenditure from historical capital expenditure*

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. Murraylink considers that this is a meaningful requirement in a mature, steady state system with recurrent capital expenditure programs. However, Murraylink 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. It should also be noted that Murraylink is facing a number of end-of-life projects, notably the replacement of the obsolete control system, which was not included in the historical capital expenditure.

7.2.4 *Asset Management System*

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

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

The purpose of the AMP is:

- To provide a comprehensive understanding of the current management approach relating to the assets, their condition and their utilisation;
- To identify strategic recommendations for future utilisation;

---

108 AEMO, National Transmission Network Development Plan for the National Electricity Market, November 2016, p.74.

- To provide a platform for approval of work programs by providing discussion of the options available and recommendations; and
- To identify specific issues affecting the assets and the proposed remediation for budget consideration.

The objective of this AMP is to ensure that a strong focus on safety and reliability is maintained in relation to the operation and management of the EII assets. In developing the operating and maintenance procedures incorporated within the AMP, the Operator (being APA Operations EII) has considered the approved policies and procedures of the APA Group.

Suitable safety management systems are in place and operating to ensure that the risks relating to the operation of all EII assets are effectively managed to keep risks as low as reasonably possible. The APA HSE Management System is called 'Safeguard' and provides a framework by which the processes relating to EII's HSE activities are written, approved, issued, communicated, implemented and controlled. Additionally, the management system is also subject to review and improvement to ensure objectives and obligations are continually satisfied.

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

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

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

A copy of the Murraylink AMP is included in attachment 7.1

7.2.5 *Cost escalation*

Murraylink is not proposing any real cost escalation beyond adjustments for consumer price inflation. There are no step changes in input costs for capital expenditure.

7.3 Capital expenditure categories

The demand for Murraylink's service will remain equal to its maximum capability throughout the 2018-23 regulatory control period. The capital expenditure described in this proposal is therefore not growth related, although the contingent project that would increase the capability of the interconnection to transfer power forms part of this submission. 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 major items of plant that comprise Murraylink: the convertor equipment; transformers; harmonic filters; and cable; have been maintained in serviceable condition in accordance with the manufacturer's recommendations. There is therefore no capital expenditure anticipated on these major items during the new regulatory control period.

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

- ***Augmentation/Expansion:*** This is capital expenditure that is associated with the augmentation or expansion of the capacity of the Murraylink Network;
- ***Replacement/refurbishment:*** The refurbishment or replacement of items of auxiliary equipment, necessary for the continued reliable and secure operation of the link. The replacement of the control system is a major project in this category; and
- ***Non System:*** This is capital expenditure that is associated with the provision of network services but is not directly on the network itself.

To assist the AER's understanding of the capital expenditure program, capital expenditure projects have been subdivided into categories that reflect these principal drivers.

7.4 Forecasting methodology

Murraylink's forecast of capital projects in the Replacement/refurbishment categories was developed in the context of its asset management practices,

These management practices and a description of the associated projects are discussed in section 7.2.4

The 2017 Murraylink Asset Management Plan follows the strategic direction established in the Asset Management Strategy[109]. The Plan contains detail of asset management processes developed in accordance with standard PAS 55-1 and lists individual maintenance and improvement projects.

This document has been supplemented with a document outlining the business cases for the significant projects that are expected to be required during the course of the regulatory control period, in Attachment 7.2.

[109] APA Group, Murraylink Asset Management Plan ML-DO-06, 9 January 2017.

7.5 Key inputs and assumptions

7.5.1 Asset replacement/refurbishment framework

Murraylink'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 reliability and availability performance of the link;
- Maintenance costs escalate, to the point where it becomes economic to replace or refurbish the equipment; and
- Equipment associated with auxiliary systems becomes obsolete, with the potential to jeopardise the availability performance of the link due to unavailability of spares.

7.5.2 Project scope, cost and timing estimates

Murraylink's approach to estimating the scope, cost and timing of the projects that comprise the capital expenditure program is set out in Table 7.1.

Table 7.1 – Project scope and costs estimates

Expenditure Category	Refurbishment	Compliance	Capability(Contingent)
Project Scope	All projects are relatively small in scope and readily specified.		Not able to be fully determined at this stage
Project Timing	Based on equipment condition.	As soon as is reasonably practicable.	Pending detailed analysis, not able to be determined at this stage.
Project Cost Estimate	**Based on similar minor works carried out for Murraylink, or by obtaining a quotation for the work from existing service providers.**		**Not able to be accurately estimated at this stage, based on generic estimating procedures.**

7.6 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, which also explains how each project meets the capital expenditure objectives and capital expenditure criteria set out in the Rules at clauses 6A.6.7(a) and 6A.6.7(c). These significant projects are set out below. Business cases for these projects are provided in attachment 7.2.

7.6.1 *Control systems replacement*

The control and protection systems that are necessary for Murraylink to function have been in service for just under 15 years at the time of this proposal. The manufacturer, ABB, has announced its intention to no longer support the systems from 2021. Moreover, components of the system are failing with increasing frequency and spares have become difficult to source.

The equipment manufacturer ABB has already made key components of the control system obsolete and announced the withdrawal of support for the version of the control system currently used by Murraylink in 2021. The continued maintenance and repair of the existing system to enable the reliable functioning of Murraylink will become impracticable.

In order to avoid increasing outage frequency and downtime, a control and protection upgrade is proposed, at a capital cost of $27.2 M. This will replace the superceded and obsolete system and enable the link to provide high levels of reliability and availability.

Table 7.2 - Capital expenditure control and protection systems replacement ($'000 real 2018)

	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Control systems replacement	4,149	12,229	9,511	1,359	-	27,248

7.6.2 *Critical equipment spares*

To maintain the reliability of Murraylink, failed items of equipment such as the electronic switching devices (Insulated Gate Bipolar Transistors) and harmonic filter capacitors need to be replaced from time to time. The estimated number of spares required during the forecast regulatory control period is based on historical failure rates, which, as noted in 4.2.3, increased in the current regulatory control period compared to the previous period.

Compatible replacement spares must be obtained from the original equipment manufacturer ABB.

The Insulated Gate Bipolar Transistors replacement program is forecast to require 42 spares in the first year, 21 in the second year, then 22 spares per annum in the remaining years, , a total of 129 during the regulatory control period, with a total cost of $1.5 M.

A total of 293 spare capacitors of five different types are forecast to be required, involving a total expenditure of $1.8 M.

Table 7.3 – Capital expenditure critical equipment spares ($'000 real 2018)

	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Critical equipment spares	845	1,053	488	494	494	3,375

7.6.3 *Maintenance surveillance cameras*

Whilst Murraylink is operating, the AC and DC filter yards cannot be safely entered. It is proposed to install visual and infrared camera surveillance of these areas, to permit the equipment to be continuously monitored and incipient failures to be identified.

This equipment is expected to result in improved maintenance scheduling and reduced downtime. The surveillance equipment will cost $0.6 M.

Table 7.4 – Capital expenditure maintenance surveillance cameras ($000 real 2018)

	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Maintenance surveillance cameras	-	296	296	-	-	591

7.6.4 *Variable Speed Drive refurbishment*

The Insulated Gate Bipolar Transistors in each convertor are water-cooled, with variable speed drives that adjust the water circulation to maintain appropriate Insulated Gate Bipolar Transistors temperatures as the link power transfer levels vary. There is a total of four such pump installations at the two convertor stations and two battery supplied backup pumps for use when main supply to the link is not available. ABB has notified that this equipment will become obsolete and the current level of support for it terminated at the end of 2018. In order to preserve the reliability and availability of the link, new variable speed drives are proposed, at a cost of $0.6 M.

Table 7.5 – Capital expenditure variable speed drive replacement ($'000 real 2018)

	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Variable speed drive refurbishment	-	-	290	290	-	581

7.7 Forecast capital expenditure

The forecast capital expenditure required to maintain the prescribed transmission services by Murraylink during the 2018-23 regulatory control period is set out in Table 7.6.

Table 7.6 – Forecast capital expenditure 2018-23 by asset class ($'000 real 2018)

	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Switchyard	278	-	-	-	-	278
Transmission line	303	406	277	283	283	1,552
Easements	-	-	-	-	-	-
Control systems	4,149	12,229	9,511	1,359	-	27,248
Ancillary30	-	-	-	-	-	-
Pressure vessel	-	-	-	-	-	-
Test equipment	-	296	296	-	-	591
Other operating assets	1,049	925	755	752	685	4,166
Office machines	-	-	-	-	-	-
Total	5,779	13,855	10,838	2,394	969	33,835

Table 7.7 – Forecast capital expenditure 2018-23 by asset driver ($'000 real 2018)

	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Augmentation/Expansion	-	-	-	-	-	-
Replacement/Refurbishment	5,779	13,855	10,838	2,394	969	33,835
Non-network	-	-	-	-	-	-
Total	5,779	13,855	10,838	2,394	969	33,835

7.8 Proposed contingent capital expenditure project

The power transfer capability of the Murraylink interconnection is frequently constrained, not by the capacity of the DC link, but by transmission system capability connected to its converter stations in both South Australia and Victoria.

The South Australian Riverland area, the north-western Victorian and the south-western NSW regional transmission networks are all nearing the time when they will need to be reinforced to improve system security and reliability, as well as to provide for the continued effective contribution of Murraylink. The Annual Planning Reports of ElectraNet[110], AEMO (Victoria) [111] and TransGrid[112] all describe plans for the staged reinforcement of these regional portions of their networks.

APA has developed a conceptual proposal with three stages, which would be capable of addressing the capacity constraints in the regional transmission networks as well as providing increased South Australian interconnection capacity, as follows.

7.8.1 *Removal of the Murraylink transmission constraint in South Australia*

The first stage would reinforce the connection between Murraylink and the Electranet transmission system.

A new double circuit 275 kV transmission line between Robertstown and Berri, would initially be strung on one side. This line would link ElectraNet's substation at Robertstown to a single 275/132 kV transformer substation located near Berri, with a 132 kV connection to Murraylink's western terminal at Monash.

The cost of this first stage would be approximately $276 M.

7.8.2 *Duplication of Murraylink*

Both circuits of the Robertstown – Berri 275 kV line would connect to an expanded two transformer substation at Berri. From there, a new DC link (Murraylink 2) with cable and overhead sections would connect between Berri and Buronga in NSW, thereby bypassing the constrained Victorian transmission network.

---

110 AEMO, Victorian Annual Planning Report Electricity - Transmission Network Planning For Victoria, June 2016, p. 19, 38.

111 Electranet, South Australian Transmission Annual Planning Report, June 2016, p. 74.

112 TransGrid, Transmission Annual Planning Report 2016, p. 59.

Murraylink 2 would provide about 300 MW of additional interconnection capacity for export from South Australia and would operate in parallel to the existing link. It would also provide additional import capability to South Australia from NSW and increase the level of support to the regional transmission networks.

Stage 2 of the contingent project would involve an expenditure of approximately $477 M.

7.8.3 Capacity upgrade to Darlington Point

The capacity of Murraylink 2 to both import to and export from South Australia would be limited by the capacity of and losses in the existing 220 kV line between Buronga and Darlington Point.

There are a number of AC and DC options that could be considered to upgrade this connection to a higher capacity. Of these, an estimate of the cost of constructing an additional Buronga – Darlington Point DC line in parallel with the existing line, with a convertor station at Darlington Point.

Stage 3 of this contingent project has been estimated to cost $399 M.

7.8.4 Contingent Project

An estimate of the capital expenditure is set out in Table 7.8. These projects are incremental in that each is reliant on the previous increment to provide the capacity stated.

Table 7.8 – Capital expenditure of contingent projects($m real 2018)

Project	Total
Removal of the Murraylink transmission constraint in South Australia	266
Duplication of Murraylink	477
Capacity upgrade to Darlington Point	399
Total if all three projects are undertaken	994

This expenditure has not been included in the forecast of capital expenditure in this proposal. It is foreseen that this development could become justified during the next regulatory control period and accordingly it has been included as a contingent project.

It is proposed that the trigger event for this contingent project will be:

- The completion of a RIT-T consultation and cost-benefit analysis that justifies any one, or more than one element of the contingent project to upgrade the capacity of the Murraylink corridor; and

- A financial commitment by the board of Energy Infrastructure Investments Pty Limited to undertake an element of the project.

This arrangement would ensure that any expenditure committed at the time would reasonably reflect the capital expenditure criteria, and take into account the capital expenditure factors.

8 Forecast Operating Expenditure

8.1 Introduction

In this chapter Murraylink outlines its proposed forecast operating expenditure for the 2019 to 2023 period. The approach outlined by Murraylink is consistent with the rules in particular rule 6A.6.6. The rules requirements are discussed in more detail in section 8.2.

The approach is also consistent with the AER's Framework and Approach for Murraylink[113] and Murraylink's expenditure forecast methodology[114].

8.2 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 Murraylink'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.

8.2.1 *Operating expenditure objectives*

The operating expenditure that Murraylink has proposed is required to:

- meet or manage the expected demand for *prescribed transmission services* over that period;
- comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

[113] AER, Framework and approach for Murraylink: For regulatory control period commencing 1 July 2018, July 2016,

[114] Murraylink, Proposed Forecasting Methodology, July 2016

- to the extent that there is no applicable *regulatory obligation or requirement* in relation to:
  - the quality, reliability or security of supply of *prescribed transmission services*; or
  - the reliability or security of the *transmission system* through the supply of *prescribed transmission services*,
- to the relevant extent:
  - maintain the quality, reliability and security of supply of *prescribed transmission services*; and
  - maintain the reliability and security of the *transmission system* through the supply of *prescribed transmission services*; and
- maintain the safety of the *transmission system* through the supply of *prescribed transmission services*.

Murraylink's operating expenditure forecast has been prepared in line with the operating expenditure objectives as defined in the Rules. Murraylink considers that this revenue proposal achieves the operating expenditure objectives, having regard to these factors.

8.3 Types of expenditure and key drivers

8.3.1 Operations and Maintenance

Routine

This expenditure is the recurrent maintenance activities undertaken by Murraylink.

The materials and spare parts associated with routine maintenance are also included in this category of expenditure.

The majority of the routine maintenance activities for Murraylink equipment are currently carried under the Agreement with APA, as a contractor. All routine maintenance on the link equipment, is in accordance with the manufacturer's recommendations.

Fault and condition

This is expenditure undertaken in response to the condition of the asset. That is the condition of the asset is such that that operating expenditure is necessary to enable it to continue in or return it to operating service. Logically, the main driver of this activity is the condition of the assets and their likelihood of failing.

8.3.2 *Non System*

This is operating expenditure that relates to the non-system costs of EII and Murraylink. This covers those aspects of the services provided by APA relating to governance, insurance, taxes and accounting.

8.3.3 *Control room costs*

Whilst the flow levels of Murraylink are controlled in response to AEMO requirements, the operation of Murraylink is controlled remotely. This control room is staffed by shift staff and also used for the control of other assets. The control room is operated by ElectraNet and they levy a charge for this service.

8.3.4 *Connection costs*

The connection costs paid to adjacent TNSPs AusNet Services and ElectraNet constitute a very significant component of Murraylink's operating expenditure. These connection costs form part of the regulated revenue of these TNSPs and are due for reset on 1 July 2017 and 1 July 2018 respectively. AusNet's will again be reset in 2022, during the Murraylink regulatory control period. The connection costs will be reset on those dates and will be subject to the AER's future regulatory decisions.

Murraylink is therefore exposed to a significant risk that this large component of operating cost, which has been estimated as part of this proposal, may vary at these or the subsequent reset.

For this reason, Murraylink is proposing that during the 2018-23 regulatory control period, the difference between connection costs estimated in this proposal and those charged by the TNSPs should be subject to an adjustment to Murraylink's annual revenue.

8.3.5 *Methodology or programs to improve performance of transmission network*

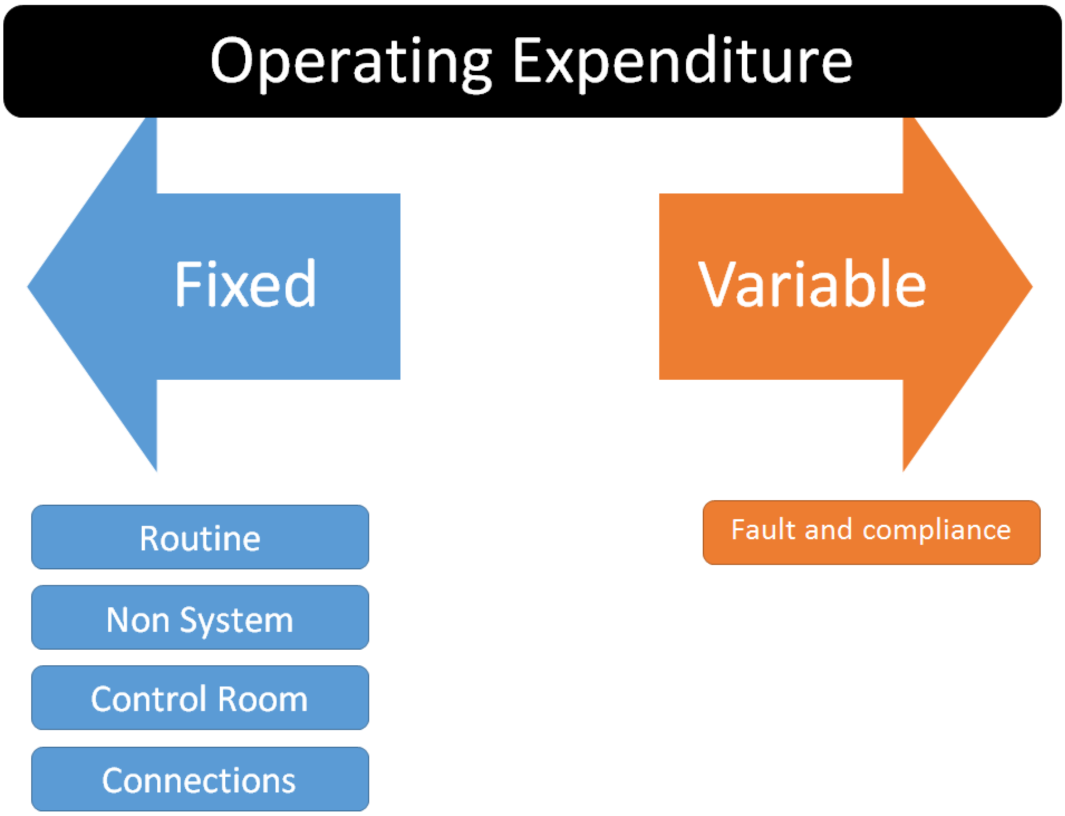
Murraylink already operates at a very high level of reliability.

Murraylink manages its assets in compliance with industry best practice. This approach is consistent with the requirements of the National Electricity Rules. While there will be some incremental improvement in the performance of the transmission network that result from improvements in processes and technology. Murraylink does not have a program specifically aimed at improving the performance of the transmission network.

8.4 Fixed and variable operating costs

Rule S6A.1.2 requires Murraylink 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 8.1.

Figure 8.1 – Fixed and variable operating costs



Consistent with the nature of Murraylink'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 Murraylink has control over the unit cost of electricity, it does not have control over the amount of electricity used.

As outlined above, most 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.

Insurance, governance and taxes do not change with volumes.

8.5 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 an attachment that 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 8.2 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.

8.6 Methodology

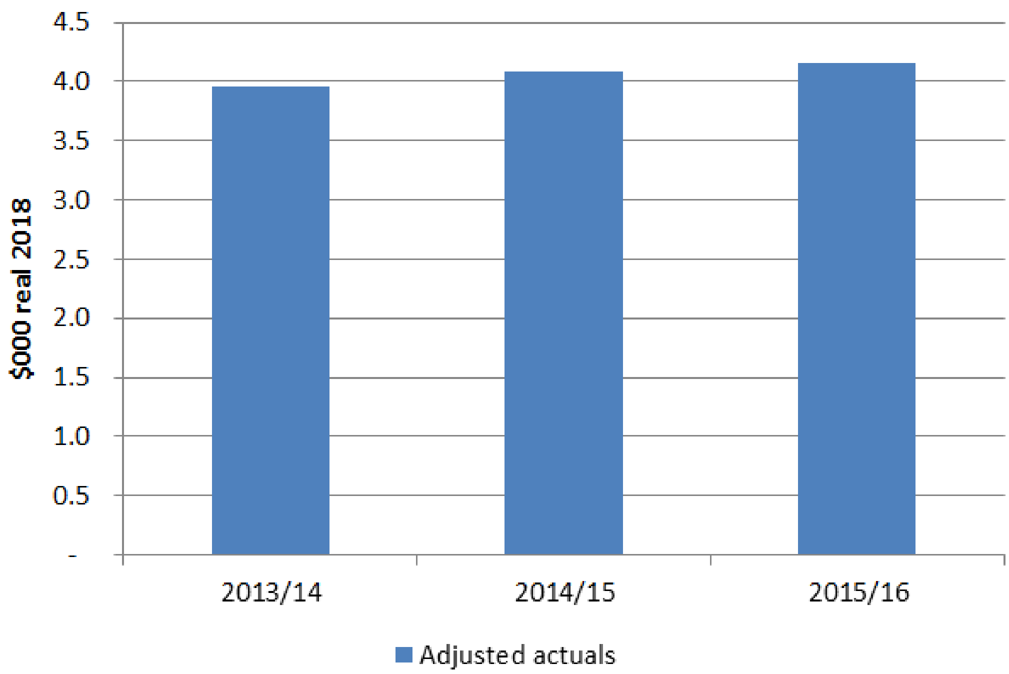
8.6.1 Base Year

Murraylink has selected the 2015/16 financial year as its base year. This year has the following characteristics:

- It is the most recent completed financial year

- It is consistent with the adjusted operating expenditure[115] of previous years see Figure 8.2
- It has no non-recurring costs included; this makes it a transparent starting point for the calculation of forecast operating expenditure.

Figure 8.2 – Adjusted historic operating expenditure



8.6.2 *Adjustments to base year*

There were no adjustments made to the base year as they are unnecessary given the nature of the forecast.

8.6.3 *Real cost escalation*

No adjustments were made for real cost escalation, output growth or efficiency gains on the basis that the AER rarely accepts the submissions put forward by businesses in this respect and therefore the costs incurred by Murraylink in obtaining a report from a consultant are greater than the overall impact produced by the enhanced accuracy of including these in the forecast.

115 Adjustments were made to 2014/15 to remove non recurrent expenditure associated with two contracts for Grayling Electrical and Energy and Infrastructure Services to make it on a like for like basis with 2015/16.

8.6.4 *Step changes*

Murraylink is proposing to enter into a service agreement with the manufacturer of the systems used by Murraylink.

(confidential)

8.6.5 *Separate Forecasts*

The separate forecasts for Murraylink are all related to non-recurrent expenditure.

8.6.6 *Non recurrent expenditure*

The asset management process for Murraylink identifies a number of non-recurrent activities that is required to keep the network operating. These are outlined in more detail below. In each case the failure to undertake the appropriate maintenance is the risk of unexpected failure of the asset increases with the obvious consequences for reliability and safety. The basis for the forecast frequency for each of these projects is based on manufacturer's recommendations or Murraylink's experience with assets of that type.

Air blast cooler maintenance

Air blast coolers are used to control the temperature of the interconnector. Every two years a comprehensive cleaning is undertaken on the air blast cooler. This involves cleaning of components such as draining of the dry air liquid coolers, filling of the coils; checking the electrical connections cables and fuses; check fans for imbalance and damage; check fan motors for faulty bearings.

However, every 10 years a comprehensive maintenance of the parts in the air blast cooler system is required. This involves the complete overhaul of the motor and fan. This is due in 2022/23.

Circuit Breaker Maintenance

The circuit breaker protects the interconnector electrical components from power surges or trips. Maintenance on the Redcliffe circuit breaker is performed every 6 years. These breakers are outside and require a comprehensive inspection, cleaning and repair. The work needs to be performed by technical specialists and is currently undertaken by ABB.

Disconnector and Earth Switch maintenance

A disconnector is an off-load switching device that electrically isolates selected equipment to permit safe inspection or maintenance. Earth switches are used to electrically connect selected isolated equipment to the general mass of earth via the station earth grid. The combined use of disconnectors and earth switches creates a safe working environment for inspection or maintenance, by preventing the formation of an electrical potential on the selected equipment. The maintenance is undertaken to keep the disconnector and earth switch in operating condition.

Oil filled capacitor maintenance

The oil filled capacitor is used for the temporary storage and rapid release of electricity through the interconnector. These are measured every 3 years to check for degradation and oil leaks, replacement is considered a capital cost.

PLC Filter tuning unit maintenance

The PLC filter tuning unit is a piece of equipment which helps regulate the HVDC light station at both Murraylink sites. Maintenance involves a detailed inspection of the unit.

Uninterruptible power supply

The uninterruptible power supply provides a back-up power source to the Murraylink control system in the event of a black out. This maintenance involves repairing and maintaining the cooling fans of the uninterruptible power supply.

Valve cooling system maintenance

There is standard maintenance performed on the valve cooling system, however every five years the ion exchange vessels need to be dismantled and cleaned.

Other non-recurrent maintenance operating expenditure

There are number of other non-recurrent operating expenditure items that are also included in the forecast. Individually none of these are greater than $5,000 across the forecast regulatory control period. They are

- Capacitive voltage transformer maintenance
- Direct Voltage Divider Maintenance
- Motorised Operating Mechanism maintenance
- Nitrogen Discharge Unit Maintenance
- Outdoor post current transformer

A summary of this operating expenditure is outlined in Table 8.1.

Table 8.1 – Operating expenditure on non-recurrent activities ($'000 real 2018)

Maintenance	2018/19	2019/20	2020/21	2021/22	2022/23
Airblast cooler	3.4	-	3.4	-	123.0
Circuit Breaker	-	-	12.8	-	-
Disconnectors and earth switch	17.1	-	17.1	-	17.1
Oil filled capacitor	-	-	7.3	-	-
PLC filter tuning unit	-	-	-	-	8.1
Uninterruptible power supply	-	-	-	-	14.0
Valve cooling system	0.1	-	0.1	-	0.3
Other non-recurring operating expenditure	1.5	-	6.7	-	8.6
Total	22.1	-	47.3	-	171.0

8.7 Forecast operating expenditure

The proposed total operating expenditure forecast for Murraylink is $21.4 million. This is set out in Table 8.2.

Table 8.2 – Forecast operating expenditure by year ($'000 real 2018)[116]

	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Routine	2,096	2,096	2,096	2,096	2,096	10,482
Fault and Condition	505	505	505	505	505	2,524
Non Recurrent	22	-	47	-	171	240
Non System	750	750	750	750	750	3,748
Connection Charges	1,010	1,010	1,010	1,010	1,010	5,052
Total	4,383	4,361	4,408	4,361	4,532	22,045

Figure 8.3 sets out the historic and forecast operating expenditure for Murraylink.

Figure 8.3 – Historic and forecast operating expenditure ($m real 2018)

116 Excluding Debt raising costs

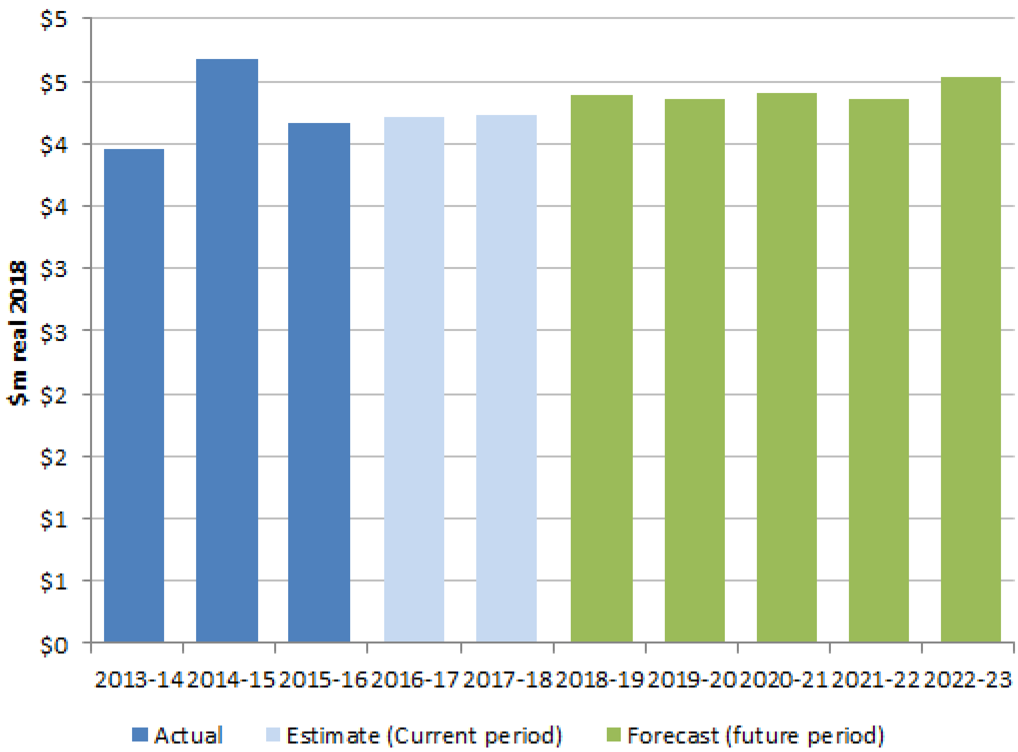


Table 8.3 sets out the forecast operating expenditure and EBSS as entered into the revenue calculation in the AER's post tax revenue model.

Table 8.3 – Forecast operating expenditure including debt raising costs ($m real 2018)

	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Controllable operating expenditure	4.4	4.4	4.4	4.4	4.5	22.0
EBSS	-0.2	-0.2	0.5	-	0.5	0.7
Debt raising costs	0.0	0.0	0.0	0.0	0.0	0.0
Total operating expenditure	4.2	4.2	4.9	4.4	5.1	22.8

9 Depreciation

This chapter sets out how the proposed depreciation allowance for Murraylink has been determined.

9.1 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.

9.2 Standard asset lives

The same standard asset lives are proposed for the forecasting the asset base as were used for the asset base roll forward to the start of the regulatory control period. These are set out in Table 5.2.

9.3 Remaining asset lives

Murraylink has now been in service for approximately 15 years. The major items of equipment thus have a remaining life of approximately 25 years at the commencement of the 2013-18 regulatory control period. The weighted average remaining asset lives are set out in Table 9.1.

Table 9.1 – Weighted average remaining asset lives as at 1 July 2018

Asset class	Useful life
Switchyard	26
Transmission line	25
Easements	n/a
Ancillary 15 - control systems	14
Ancillary 30	29
Ancillary 7 - pressure vessel testing and inspection	4
Test equipment	8
Other operating assets	5
Office machines	3

9.4 Depreciation forecast

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

The forecast regulatory depreciation for Murraylink during the 2019-23 regulatory control period is set out in Table 9.2.

Table 9.2 – Forecast depreciation 2019-23 ($M, nominal)

	2018/19	2019/20	2020/21	2021/22	2022/23
Depreciation	6.7	7.1	7.5	7.8	10.0
Indexation	2.3	2.3	2.5	2.7	2.6
Regulatory depreciation	4.4	4.8	4.9	5.2	7.4

10 Maximum allowable revenue

Murraylink's Revenue Proposal is derived from the post-tax building block approach outlined in the Rules[117] and the AER's PTRM.[118] The completed PTRM forms Attachment 10.1 to this revenue proposal. This chapter summarises the building block approach, the components of which are detailed in the preceding chapters. The Maximum Allowed Revenue (MAR) and X factor for Murraylink are calculated from the PTRM. Future adjustments to the revenue cap are also described.

10.1 Building block approach

The building block formula to be applied in each year of the regulatory control 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 the Rules requirements.[119]

The Rules allow for revenue increments and decrements arising from the Efficiency Benefit Sharing Scheme (EBSS). Murraylink is proposing the EBSS adjustments outlined in section 13.2.

---

117 *National Electricity Rules*, Part C of Chapter 6A, AEMC.

118 AER, Final decision, Amendment - Electricity transmission network service providers Post-tax revenue model, December 2010.

119 AEMC, *National Electricity Rules*, Chapter 6A, clause 6A.6.8.

Any increment or decrement associated with the Service Target Performance Incentive Scheme (STPIS) is not included in this Revenue Proposal, but as a future revenue cap adjustment.

10.2 Building Block components

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

10.2.1 Regulatory asset base

Chapter 5 described the calculation of the estimated RAB of $120.9 million, as at 1 July 2023.

The capital expenditure forecast in Chapter 7 and was used to roll forward the regulatory asset base, using the expected regulatory depreciation detailed in this chapter. The regulatory asset base for the next regulatory control period is set out in Table 10.1.

Table 10.1 – Summary of forecast regulatory asset base ($M, nominal)

	2018/19	2019/20	2020/21	2021/22	2022/23
Opening regulatory asset base	114.2	115.8	125.8	132.6	130.1
plus indexation	2.3	2.3	2.5	2.7	2.6
plus forecast capital expenditure	6.0	14.7	11.8	2.6	1.1
less forecast depreciation	6.7	7.1	7.5	7.8	10.0
less forecast disposals	-	-	-	-	-
less forecast redundant assets	-	-	-	-	-
Closing regulatory asset base	115.8	125.8	132.6	130.1	123.8

10.2.2 Return on capital

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

The post-tax nominal vanilla WACC of 6.54 per cent was established as detailed in chapter 6. Murraylink has calculated the return on capital using the PTRM. This calculation is summarised in Table 10.2.

Table 10.2 – Summary of return on capital forecast ($M, nominal)

	2018/19	2019/20	2020/21	2021/22	2022/23

Return on capital	7.5	7.6	8.2	8.7	8.5

10.2.3 *Return of capital*

Chapter 6 describes how Murraylink 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 10.3.

Table 10.3 – Summary of regulatory depreciation ($M, nominal)

	2018/19	2019/20	2020/21	2021/22	2022/23
Forecast straight line depreciation	6.7	7.1	7.5	7.8	10.0
Forecast Indexation	2.3	2.3	2.5	2.7	2.6
Forecast Regulatory Depreciation	4.4	4.8	4.9	5.2	7.4

10.2.4 *Operating expenditure*

Chapter 8 of this revenue Proposal details Murraylink's operating expenditure requirements in each year of the next regulatory control period. This is summarised in Table 10.4.

Table 10.4 – Summary of forecast operating expenditure ($M nominal)

	2018/19	2019/20	2020/21	2021/22	2022/23
Forecast Operating Expenditure	4.5	4.5	4.7	4.7	5.0

10.2.5 *Tax allowance*

The tax allowance Is calculated by the AER's PTRM based on the tax asset base outline in section 5.4. The forecast tax allowance is summarised in Table 10.5.

Table 10.5 – Summary of tax allowance 2013-18 ($M nominal)

	2018/19	2019/20	2020/21	2021/22	2022/23
Tax allowance	0.9	0.9	1.0	1.1	1.1

10.3 Maximum Allowable Revenue

The total revenue cap and the MAR for each year of the next regulatory control period is provided below. Based on the building blocks outlined in the previous section, the total revenue cap and maximum allowable unsmoothed revenue requirement is summarised in Table 10.6.

Table 10.6 – Summary of unsmoothed revenue requirement ($M, nominal)

	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Return on capital	7.5	7.6	8.2	8.7	8.5	40.4
Return of capital	4.4	4.8	4.9	5.2	7.4	26.7
plus operating expenditure	4.5	4.5	4.7	4.7	5.0	23.4
plus EBSS	-0.2	-0.2	0.6	-	0.6	0.8
plus net tax allowance	0.9	0.9	1.0	1.1	1.1	5.0
Unsmoothed revenue requirement	17.1	17.6	19.4	19.6	22.7	96.4

10.4 X-Factor smoothed revenue

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 Table10.7.

Table10.7 – Smoothed revenue requirement and X factor ($M, nominal)

	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Unsmoothed Revenue	17.1	17.6	19.4	19.6	22.7	96.4
Smoothed Revenue	17.1	18.1	19.2	20.3	21.6	96.3
Xfactors		-3.95%	-3.95%	-3.95%	-3.95%	

10.5 Revenue cap adjustments

In accordance with the Rules,[120] Murraylink's revenue cap determination by the AER is in the CPI-X format, and may be subject to adjustment during the next regulatory control period for the following reasons:

- ***Adjustment for actual CPI*** - Murraylink's revenue cap will be calculated each year using the actual CPI.
- ***STPIS*** – Murraylink's revenue cap will be adjusted by the impact of the STPIS as discussed in section 11;
- ***Pass through*** – Murraylink's revenue cap may be adjusted in the event that an eligible pass through amount is approved by the AER.

10.6 Proposed cost pass through events

Murraylink is proposing a cost pass through event under 6A.6.9 in relation to connection charges. The event is where the connection charge levied by AusNet Services and ElectraNet is different from that incurred in the 2016 base year.

10.6.1 Rationale

AusNet Services and ElectraNet levy connection charges on Murraylink. These charges are material in 2016 they were $1m.

The level of these charges are subject to the revenue determinations made by the AER in relation to these businesses. The regulatory control periods for AusNet Services is 1 April 2017 to 31 March 2022 and for ElectraNet is 1 July 2018 to 30 June 2023.

In both cases this creates a period where Murraylink's revenue is set but the connection fee can change. In relation to AusNet Services this is the period from 1 April 2022 to 30 June 2023 (end of Murraylink's regulatory control period) and for ElectraNet it is the entire regulatory control period unless the AER is to adjust the Murraylink operating expenditure for the outcome of their revenue decision in relation to ElectraNet.

Should these costs rise and Murraylink's revenue not be adjusted then Murraylink would not be able to recover its efficiently incurred costs.

[120] AEMC, National Electricity Rules, Chapter 6A.5.3.

10.6.2 *Rules Requirements*

The nominated pass through event considerations are outlined in Chapter 10 of the National Electricity Rules as:

(a) whether the event proposed is an event covered by a category of pass through event already specified;

(b) whether the nature or type of event can be clearly identified at the time the determination is made for the service provider;

(c) whether a prudent service provider could reasonably prevent an event of that nature or type from occurring or substantially mitigate the cost impact of such an event;

(d) whether the relevant service provider could insure against the event, having regard to:

(1) the availability (including the extent of availability in terms of liability limits) of insurance against the event on reasonable commercial terms; or

(2) whether the event can be self-insured on the basis that:

(i) it is possible to calculate the self-insurance premium; and

(ii) the potential cost to the relevant service provider would not have a significant impact on the service provider's ability to provide network services; and.

(e) any other matter the AER considers relevant and which the AER has notified Network Service Providers is a nominated pass through event consideration.

10.6.3 *Connection charge cost pass through*

The National Electricity rules contain a number cost pass through events:

- Network support pass through;
- A regulatory change event;
- A service standard event;
- A tax change event; and
- An insurance event.

While it is possible that a change in connection charges could be included in a broad definition of a regulatory change event as the change occurs as the result of the AER's revenue determination for AusNet Services and ElectraNet. However, there is uncertainty introduced into this interpretation because it is the TNSP, not the regulator, who levies the connection charge on Murraylink. Due to this uncertainty it is Murraylink's proposal that a separate cost pass through event category be created for changes in connection charges.

A connection charge is a clearly defined event and is levied by AusNet Services and ElectraNet under their connection agreements. However, Murraylink is a recipient of these charges which result from the pricing methodology and revenue determination for each of the TNSPs which is controlled by the TNSP and the AER not Murraylink.

Commercial insurance can't be obtained for a change in the cost of the connection charge nor is it possible to self-insure due to the difficulty of Murraylink calculating a self-insurance premium. While the likelihood of a change is very high (arguably approaching 100 per cent) the expected value can't be calculated due to the unknown cost.

It is the nature of this cost pass through that it would be symmetrical. If the connection charge were to fall then this would be used to reduce the revenue that Murraylink is able to recover.

As demonstrated above, a change in the connection charge cost pass through is consistent with the National Electricity Rules. The formula below sets out how the connection charge change cost pass through would be calculated.

$$CCCCPT_t = (ASCC_{t-1} - 201{,}421) + (ECC_{t-1} - 769{,}795)$$

Where

CCCCPT= Connection charge change cost pass through.

ASCC = the AusNet Services connection charge to Murraylink under the connection agreement or successor agreement

ECC = the ElectraNet connection charge to Murraylink under the connection agreement or successor agreement.

The amount being deducted from the charge in the formula is the amount of that charge in the 2016 financial year (the base year for forecasting operating expenditure).

11 Service Target Performance Incentive Scheme

11.1 Introduction

This chapter comments on the parameters of the STPIS, including the market parameters, to apply for the 2019-23 regulatory control period.

11.2 STPIS during the 2019-23 regulatory control period

There are two components of the STPIS that will apply to Murraylink in the 2019-23 regulatory control period. These are the service component and the market impact component. In setting service component targets for the 2019-23 period Murraylink is proposing applying the AER's latest version of the scheme.[121]

11.2.1 Service component

The service component of the AER's scheme has two sub-parameters. These are:

- Circuit event rate – fault
- Circuit even rate - forced

The AER require that a TNSP must propose the following in relation to these parameter:

- Performance target
- Floor
- Cap

Noting that there is no revenue adjustment associated with the proper operation of equipment Murraylink is not proposing to incur the cost of calculating this parameter.

The table below sets out the proposed parameters for the service target

Table11.1 – Service Target Performance Incentive Scheme parameters

Unplanned circuit outage event rate	Floor	Target	Cap
Circuit event rate – fault	322.00	160.00	79.00
Circuit event rate - forced	820.00	380.00	160.00

[121] AER, Service Target Performance Incentive Scheme version 5 (corrected), October 2015

This based on the average of the calendar years set out in Table11.2. Murraylink currently does not have those results for 2015.

Table11.2 – Historic outcomes for parameters

	2013	2014	2015
Circuit event rate – fault	0%	0%	100%
Circuit event rate - forced	0%	0%	400%

Murraylink is not proposing a change to the parameter weightings outlined by the AER.[122] These weightings are 0.75 and 0.5 respectively.

11.2.2 Market impact component

The AER's market impact component is based on unplanned outages. The AER requires the provision of a performance target, unplanned outage event limit and dollar per dispatch interval incentive.

Murraylink provides this information in Table11.3

Table11.3 – Market impact values

	Target	Event limit	Dollar per dispatch
Unplanned outage dispatch intervals	782.3	0	$221.10

Murraylink is proposing the same target and cap for the market impact component as it was subject to in the current regulatory control period.

[122] AER, Service Target Performance Incentive Scheme version 5 (corrected), October 2015

12 Pricing methodology and negotiating framework

The Negotiating Framework is provided in Attachment 12.1

In satisfaction of clause 6A.10.1(a) of the NER, Murraylink provided a *Pricing Methodology*. The revised Pricing Methodology is attached as Attachment 12.2.

13 Efficiency Benefits Sharing Scheme

13.1 Introduction

Murraylink proposes that a 5-year carryover should be adopted. This would then provide incentive properties for the scheme that matched those of all other NSPs in the NEM.

13.2 Proposed EBSS

Murraylink is also proposing that connection charges and debt raising costs should continue to be excluded from the calculation of the EBSS. Murraylink is proposing excluding connection charges because it is unable to manage the connection charge. Excluding the debt raising costs is consistent with the AER's historic approach for the EBSS. Based on excluding these items from the forecast Murraylink proposes the EBSS operating expenditure set out in Table13.1

Table13.1 – Efficiency Benefit Sharing Scheme Operating Expenditure ($M real 2018)

	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Total Operating Expenditure	4.4	4.4	4.4	4.4	4.5	22.0
Excluded items	1.0	1.0	1.0	1.0	1.0	5.1
Total	3.4	3.3	3.4	3.3	3.5	17.0