AusNet

Maintaining reliable 330/220 kV transformation network services at South Morang Terminal Station

Regulatory Investment Test for Transmission (RIT-T)

Project Specification Consultation Report

August 2024

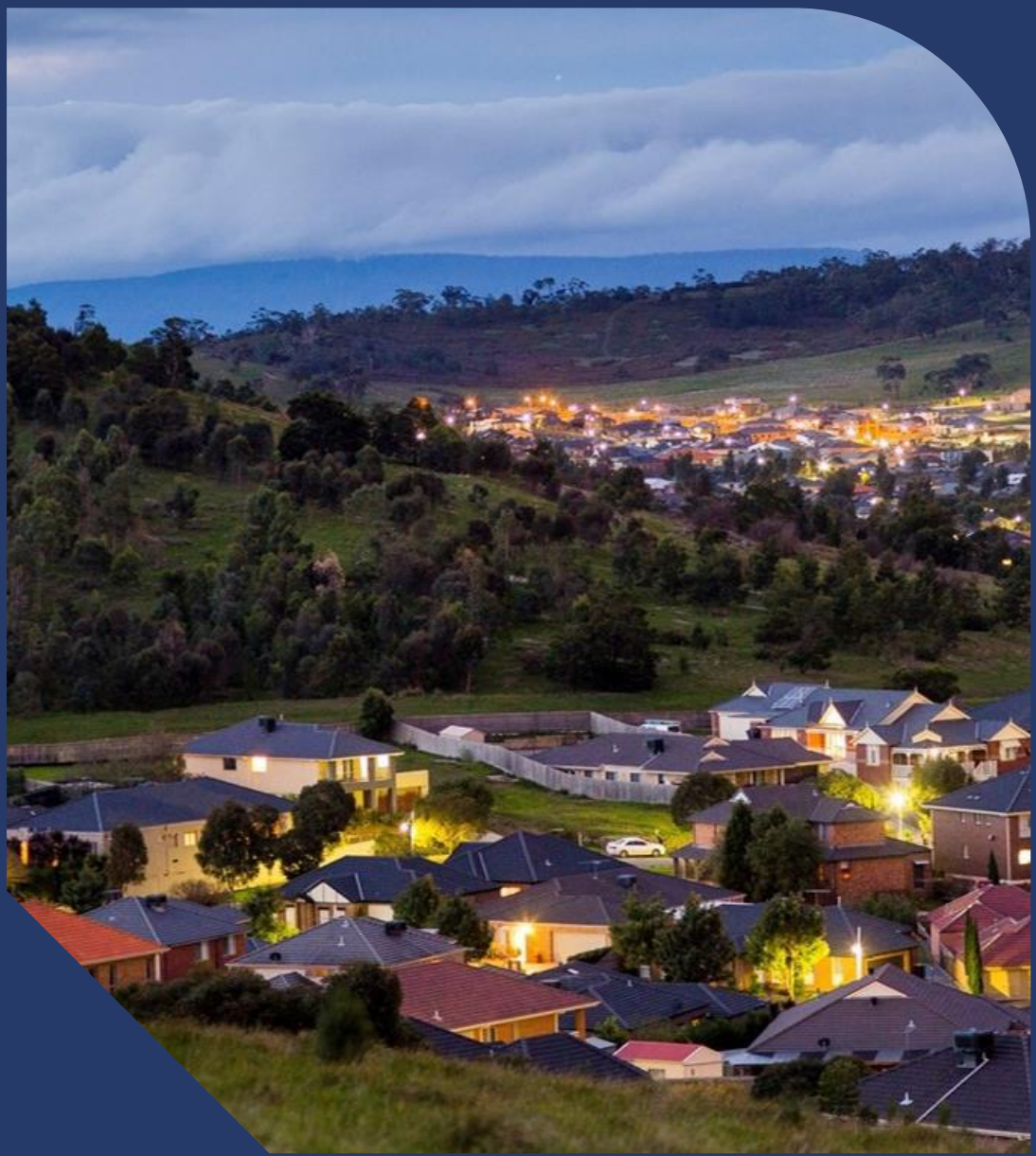


Table of contents

1. Executive summary 2
2. Introduction 3
3. Background 4
   - 3.1. Victorian transmission network 4
   - 3.2. Asset condition 4
4. Identified need 5
   - 4.1. Description 5
   - 4.2. Assumptions 5
5. Credible Options 7
   - 5.1. Option 1: Replaces the H1 and H2 transformers with an in-service and a hot spare transformer 7
   - 5.2. Option 2: Replaces the H1 and H2 transformers with an in-service transformer and a cold spare single-phase transformer 7
   - 5.3. Material inter-regional network impact 7
6. Non-network options 8
7. Economic assessment of the credible options 9
   - 7.1. Material classes of market benefits 9
8. Next steps 10
   - 8.1. Request for submissions 10
   - 8.2. Next stage of RIT-T process 10

Appendix A – Asset probability of failure methodology 11

Appendix B – RIT-T assessment and consultation process 12

1. Executive summary

South Morang Terminal Station (SMTS) is owned and operated by AusNet and is in South Morang northwest of Melbourne's CBD. It forms part of the main Victorian 500 kV, 330 kV and 220 kV transmission network with ties to Tasmania and major generation in the Latrobe Valley, the Victoria-South Australia interconnector, the interconnector between Victoria and New South Wales and the Melbourne metropolitan 220 kV network.

AusNet is initiating this Regulatory Investment Test for Transmission (RIT-T) to investigate options that could allow continued delivery of safe and reliable transmission services. Publication of this Project Specification Consultation Report (PSCR) represents the first step in the RIT-T process in accordance with clause 5.16 of the National Electricity Rules (NER) and section 4.2 of the RIT-T Application Guidelines.

Two credible network options to replace the H1 and H2 330/220 kV transformers that are likely to deliver an economical solution to the identified need are considered in this RIT-T.

- Option 1 – Replace the H1 and H2 transformers with an in-service and a hot spare transformer
- Option 2 – Replace the H1 and H2 transformers with an in-service and a cold spare single-phase transformer

AusNet invites proposals from proponents of non-network solutions that could be implemented on a stand-alone basis or in conjunction with a network option to meet or contribute to meeting the identified need of this RIT-T. Submissions should be emailed to rittconsultations@ausnetservices.com.au on or before 15 November 2024. In the subject field, please reference 'RIT-T PSCR South Morang Terminal Station 330/220 kV transformer replacement project.' Submissions will be published on AusNet and AEMO's websites. If you do not wish for your submission to be made public, please clearly stipulate this at the time of lodgement.

Assessments of the options and responses to this PSCR will be presented in the Project Assessment Draft Report (PADR) that is intended to be published by December 2024.

2. Introduction

AusNet is initiating this Regulatory Investment Test for Transmission (RIT-T) to evaluate options to maintain reliable transmission network services at South Morang Terminal Station (SMTS). The 330/220 kV H1 and H2 transformers and associated switchgear at SMTS are reaching the end of serviceable life which is driving the need for this investment.

Publication of this Project Specification Consultation Report (PSCR) represents the first step in the RIT-T process in accordance with clause 5.16 of the National Electricity Rules (NER) and section 4.2 of the RIT-T Application Guidelines.

This document describes:

- the identified need that AusNet is seeking to address, together with the assumptions used in identifying this need;
- credible network options that may address the identified need;
- the technical characteristics that would be required of a non-network option to address the identified need;
- the assessment approach and scenarios AusNet is intending to employ for this RIT-T assessment; and
- the materiality of each class of market benefit considered in this RIT-T.

The need for investment to address asset failure risks from deteriorating transformers at SMTS has been included in AusNet's revenue proposal for the 2022 to 2027 regulatory control period. This specific investment need is also identified in AusNet's Asset Renewal Plan, published as part of AEMO's 2023 Victorian Transmission Annual Planning Report (VAPR).

3. Background

3.1. Victorian transmission network

SMTS is owned and operated by AusNet and is in the northwest of Greater Melbourne. SMTS is one of the major terminal stations in Victoria which connects six other terminal stations and has four voltage levels – 500 kV, 330 kV, 220 kV and 66 kV. The 500 kV side connects three 500 kV lines from hazelwood and Rowville terminal stations in the east and three 500 kV lines to Sydenham and Keilor terminal stations in the west. Two 1,000 MVA transformers steps the voltage down from 500 kV to 330 kV. There are three 700 MVA transformers (H1, H2 and H3) that steps the voltage down again from 330 kV to 220 kV and two transformers that step the voltage down from 220 kV to 66 kV.

The H3 transformer was installed in 2018 to address the risk of a transformer failure given that AusNet does not have a suitable spare transformer. It was the first stage of a staged replacement of the 330/220 kV transformers.

Figure 1 – SMTS and the Victorian transmission network

3.2. Asset condition

AusNet conducted a condition assessment of the H1 and H2 Transformers where the components were evaluated across a range of criteria including physical condition; spares availability; estimated rate of deterioration; and manufacturer support. The assessment revealed that the H1 and H2 transformers are in poor or very poor condition as expected of assets that have been in service for more than 56 years.

No alternative maintenance strategies have been identified that would materially reduce the failure rate or address the lack of manufacturer support for these two transformers.

4. Identified need

4.1. Description

SMTS is part of the main transmission network which provides major transmission network services in Victoria.

The poor condition of the H1 and H2 330/220 kV transformers has increased the likelihood of asset failure. Without remedial action, other than ongoing maintenance practice (business-as-usual), the assets are expected to deteriorate further and more rapidly. This will increase the market impact risk due to prolonged outages of the 330/220 kV transformers. In addition, there is also increased safety, environmental, collateral damage and emergency replacement risks due to the poor condition of these assets.

Therefore, the 'identified need' this RIT-T intends to address is to maintain reliable 330/220 kV transformation network services at SMTS and to mitigate risks from asset failures.

4.2. Assumptions

The identified need is underpinned by several assumptions, including the risk of asset failure (determined by the condition of the assets), the likelihood of the relevant consequences, and several assumptions adopted from the latest Inputs Assumptions and Scenarios Report (IASR). These assumptions are outlined below, noting that the detailed assessment will be provided in the PADR.

4.2.1. Failure rate and repair time

Both quantitative and qualitative analysis is used to assess the condition of the asset so that an estimate of how long an asset can remain in service can be made. Figure 2 shows the failure rates applied in this analysis.

Circuit	Start up Year	2024	2025	2026	2027	2028	2029	2030	2031
H1 TR B/PH	1967	0.086	0.088	0.091	0.093	0.095	0.097	0.099	0.102
H1 TR R/PH	1967	0.086	0.088	0.091	0.093	0.095	0.097	0.099	0.102
H1 TR W/PH	1967	0.086	0.088	0.091	0.093	0.095	0.097	0.099	0.102
H2 TR B/PH	1968	0.084	0.086	0.088	0.090	0.093	0.095	0.097	0.099
H2 TR R/PH	1968	0.084	0.086	0.088	0.090	0.093	0.095	0.097	0.099
H2 TR W/PH	1968	0.084	0.086	0.088	0.090	0.093	0.095	0.097	0.099
H3 TR B/PH	2018	0.003	0.004	0.004	0.005	0.006	0.007	0.008	0.010
H3 TR R/PH	2018	0.003	0.004	0.004	0.005	0.006	0.007	0.008	0.010
H3 TR W/PH	2018	0.003	0.004	0.004	0.005	0.006	0.007	0.008	0.010

Figure 2 – 330/220 kV Transformer Probability of failure

The mean time to replace a transformer with a spare following a major failure has been assumed to be 12 months when no spare is available.

4.2.2. Market impact costs

Market modelling and network studies are used to assess the market impact of transformer failures at SMTS. These studies use the latest modelling assumptions from AEMO's Inputs Assumptions and Scenarios Report (IASR) which includes NEM operational demand forecasts, generation cost forecasts, generation retirement schedules, and forecast transmission developments. Involuntary load shedding is valued at the latest Value of Customer Reliability (VCR)[1].

4.2.3. Safety risk costs

The Electricity Safety Act 1998[2] requires AusNet to design, construct, operate, maintain, and decommission the network to minimise hazards and risks to the safety of any person as far as reasonably practicable or until the costs become disproportionate to the benefits from managing those risks.

By implementing this principle for assessing safety risks from explosive failure, AusNet uses:

- a value of statistical life[3] to estimate the benefits of reducing the risk of death;

1 In dollar terms, the Value of Customer Reliability (VCR) represents a customer's willingness to pay for the reliable supply of electricity
2 Victorian State Government, Victorian Legislation and Parliamentary Documents, "Energy Safe Act 1998"
3 Department of the Prime Minister and Cabinet, Australian Government, "Best Practice Regulation Guidance Note: Value of statistical life"

- a value of lost time injury[4]; and
- a disproportionality factor[5].

AusNet notes that this approach, including the use of a disproportionality factor, is consistent with the RIT-T Industry Practice Notes [6] provided by the AER.

4.2.4. Financial risk costs

There is an ongoing need for the services provided at SMTS and emergency asset replacement or repairs would be required to continue the service should a transformer fail. The failure rate weighted emergency asset replacement cost (or undertaking reactive maintenance) is included in the assessment.[7]

4.2.5. Environmental risk costs

Environmental risks from plant that contains large volumes of oil, which may be released in an event of asset failure, is valued at $100,000 per event.

4 Safe Work Australia, "The Cost of Work-related Injury and Illness for Australian Employers, Workers and the Community: 2012-13"
5 Health and Safety Executive's submission to the1987 Sizewell B Inquiry suggesting that a factor of up to 3 (i.e. costs three times larger than benefits) would apply for risks to workers; for low risks to members of the public a factor of 2, for high risks a factor of 10. The Sizewell B Inquiry was a public inquiry conducted between January 1983 and March 1985 into a proposal to construct a nuclear power station in the UK.
6 Australian Energy Regulator, "Industry practice application note for asset replacement planning"
7 The assets are assumed to have survived and their condition-based age increases throughout the analysis period.

5. Credible Options

This section describes the credible options that have been considered to address the identified need, including:

- the technical characteristics of each option;
- the estimated construction time and commissioning date; and
- the total indicative capital and operating and maintenance costs.

The purpose of the RIT-T is to identify the credible option that maximises the net market benefit. An important aspect of this task is to consider non-network and network options on an equal footing, so that the optimal solution can be identified.

None of the options considered are expected to have an inter-regional impact.

5.1. Option 1: Replaces the H1 and H2 transformers with an in-service and a hot spare transformer

Option 1 replaces the H1 and H2 transformers with two new 330/220 kV transformers; utilising one as an in-service unit and the other as a hot spare. The project also replaces associated secondary equipment. The old H1 and H2 transformers will be retired as part of the project. The estimated capital cost of this option is $80 million and the change in operating and maintenance cost is negligible. The estimated project delivery time is 4 to 5 years.

5.2. Option 2: Replaces the H1 and H2 transformers with an in-service transformer and a cold spare single-phase transformer

Option 2 replaces the H1 and H2 transformers with one new 330/220 kV transformers and a cold spare single-phase transformer. The project also replaces associated secondary equipment. The old H1 and H2 transformers will be retired as part of the project. The estimated capital cost of this option is $60 million and the change in operating and maintenance cost is negligible. The estimated project delivery time is 4 to 5 years.

5.3. Material inter-regional network impact

The proposed asset replacements at SMTS will not change the transmission network configuration and none of the network options considered are likely to have a material inter-regional network impact. A 'material inter- regional network impact' is defined in the NER as:

> "A material impact on another Transmission Network Service Provider's network, which may include (without limitation): (a) the imposition of power transfer constraints within another Transmission Network Service Provider's network; or (b) an adverse impact on the quality of supply in another Transmission Network Service Provider's network."

6. Non-network options

AusNet welcomes proposals from proponents of non-network options that could be implemented on a stand-alone basis or in conjunction with a network option to meet or contribute to meeting the identified need for this RIT-T. AusNet will evaluate identified non-network options based on their economic and technical feasibility.

It is considered unlikely that non-network solutions will provide technically feasible alternatives given that SMTS is part of the extra high voltage main transmission network backbone with three major 330/220 kV power transformers rated at 700 MVA each.

A non-network option will have to provide transmission network services that facilitate least cost dispatch of NEM generation and avoid network constraints impacting efficient generation dispatch or the reliability of the transmission network service to end consumers.

7. Economic assessment of the credible options

7.1. Material classes of market benefits

Clause 5.16.4 (b)(6)(iii) of the NER requires the RIT-T proponent to consider whether each credible option provides the classes of market benefits described in clause 5.15A.2(b)(4). To address this requirement, the table below discusses our approach to each of the market benefits listed in that clause for each credible option.

Table 1: Analysis of Market Benefits

Class of Market Benefit	Analysis
(i) changes in fuel consumption arising through different patterns of generation dispatch;	The credible options may affect the costs of dispatch by avoiding network constraints that result in curtailment of renewable generation. Our approach to estimating this market benefit is explained in section 4.
(ii) changes in voluntary load curtailment;	Any changes in voluntary load curtailment will be valued in accordance with any applicable network support agreements that may be in place.
(iii) changes in involuntary load shedding with the market benefit to be considered using a reasonable forecast of the value of electricity to consumers;	The credible options may reduce involuntary load shedding by removing asset failure risk. Our approach to estimating this market benefit is explained in section 4.
(iv) changes in costs for parties, other than the RIT-T proponent, due to differences in: *(A) the timing of new plant;* *(B) capital costs; and* *(C) the operating and maintenance costs;*	There is not expected to be any difference between the credible options.
(v) differences in the timing of expenditure;	There is not expected to be any difference between the credible options.
(vi) changes in network losses;	The credible options are not expected to result in material changes to electrical energy losses.
(vii) changes in ancillary services costs	The credible options will not have any impact on ancillary service costs.
(viii) competition benefits	The credible options will not provide any competition benefits.
(ix) any additional option value (where this value has not already been included in the other classes of market benefits) gained or foregone from implementing the credible option with respect to the likely future investment needs of the National Electricity Market;	There will be no impact on the option value in respect of the likely future investment needs of the NEM.
(x) any other class of market benefit determined to be relevant by the AER.	There are no other classes of market benefit that are relevant to the credible options.

8. Next steps

8.1. Request for submissions

AusNet invites written submissions, on the matters set out in this report, from Registered Participants, AEMO, interested parties, non-network providers and those registered on our demand-side engagement register.

All submissions and enquiries should be directed to: Email: rittconsultations@ausnetservices.com.au

Submissions are due on or before 15 November 2024. Submissions will be published on AusNet's and AEMO's websites. If you do not wish to have your submission published, please clearly stipulate this at the time of lodging your submission.

8.2. Next stage of RIT-T process

Following the conclusion of the PSCR report consultation period, AusNet will, having regard to any submissions received on this report, prepare and publish the PADR which will include:

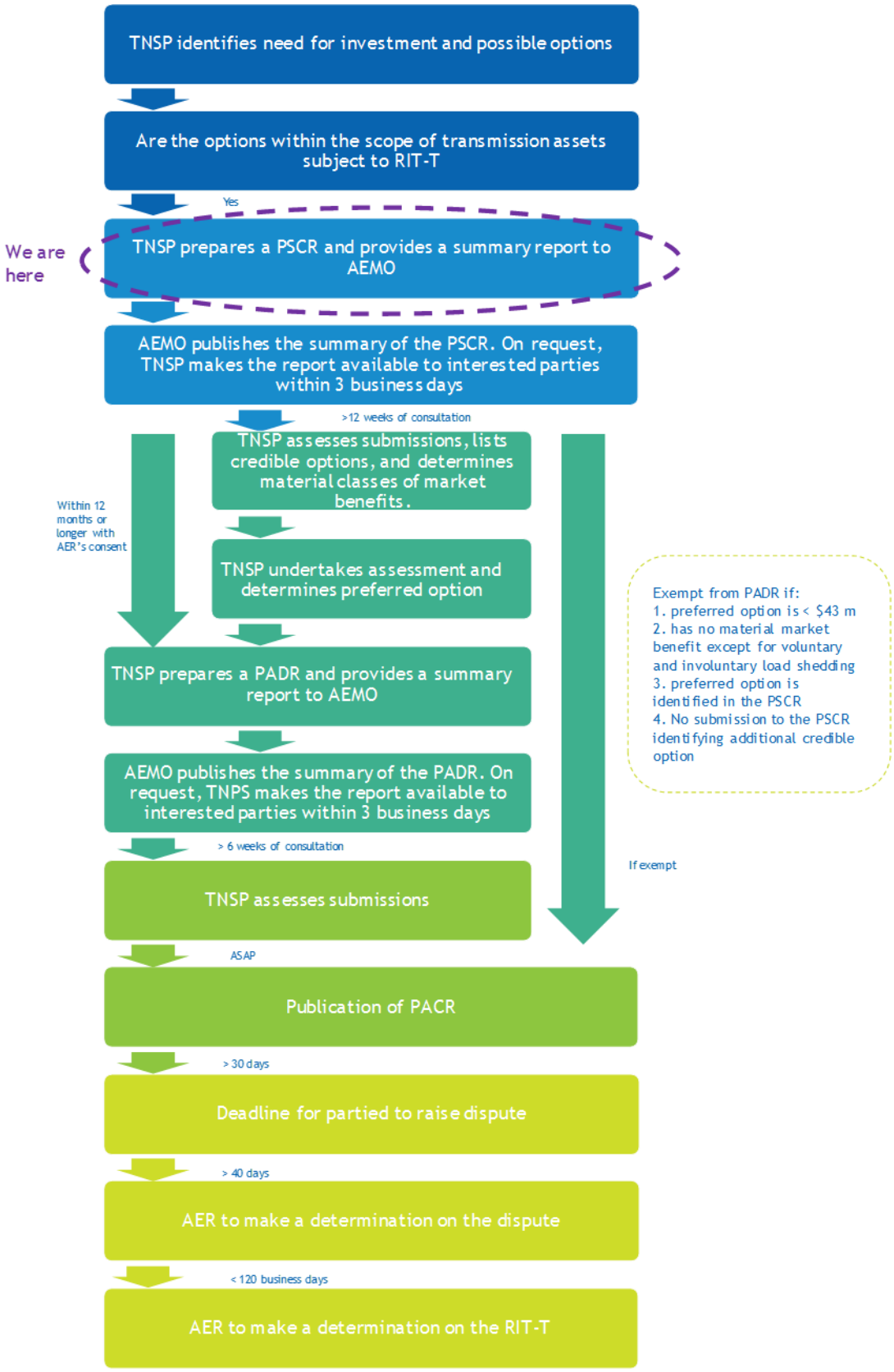
- A summary of, and commentary on, any submissions received.
- A detailed market benefit assessment of the proposed credible options to address the identified need.
- Identification of the proposed preferred option to meet the identified need.

AusNet expects to publish the PADR around December 2024.

Appendix A – Asset probability of failure methodology

Likelihood Estimation - Assessment Categories		
Category	**Description**	**Data Source**
Asset Life	Ratio of current service age to normal expected Life	Design, Maintenance records
Asset Utilisation/Duty factor	Loading, strength, capacity, number of operations	Maintenance records
Location factor	Corrosivity, geographic climate, environment	Design/Operations
Asset Physical Condition	Observed conditions, measured conditions	Inspections/Testing

Appendix B – RIT-T assessment and consultation process



AusNet

Level 31
2 Southbank Boulevard
Southbank VIC 3006
T +613 9695 6000
F +613 9695 6666
Locked Bag 14051 Melbourne City Mail Centre Melbourne VIC 8001
www.AusNetservices.com.au

Follow us on

@AusNetServices
@AusNetServices
@AusNet.Services.Energy

AusNet