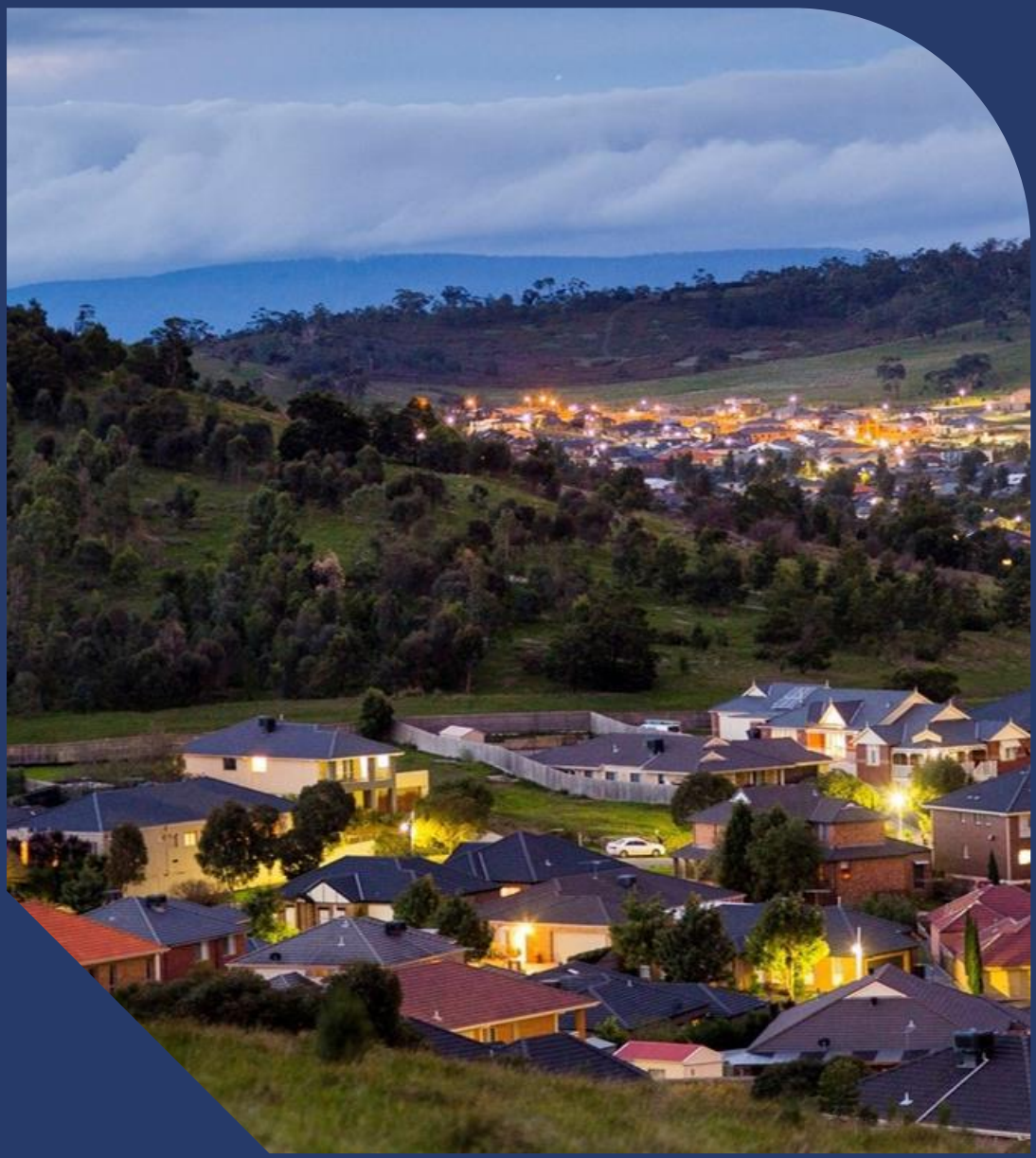
AusNet

Maintaining reliable transmission network services at South Morang Terminal Station

Regulatory Investment Test for Transmission (RIT-T)

Project Specification Consultation Report

June 2024



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1. Executive summary

South Morang Terminal Station (SMTS) is owned and operated by AusNet Services and is located 23 km north of Melbourne. SMTS is part of the main 500 kV transmission network in Victoria with transmission lines that connects generation from the Latrobe Valley and the interconnector to Tasmania, the Victoria-South Australia interconnector and the interconnector between Victoria and New South Wales. SMTS also provides transformation capacity to lower voltages that supply Metropolitan Melbourne.

AusNet Services 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 that are likely to deliver economical solutions to the identified need are considered in this RIT-T.

- Option 1 – Replace 500 kV GIS with outdoor switchyard
- Option 2 – Deferred replacement of 500 kV GIS with outdoor switchyard

AusNet Services 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 for this RIT-T. Submissions should be emailed to rittconsultations@ausnetservices.com.au on or before 30 August 2024. In the subject field, please reference 'RIT-T PSCR South Morang Terminal Station 500 kV GIS Project.' Submissions will be published on AusNet Services' 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 before October 2024.

2. Introduction

AusNet Services 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 500 kV gas-insulated switchgear (GIS) at SMTS are reaching the end of its 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 Services 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 Services 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 500 kV GIS at SMTS has been included in AusNet Services' revenue proposal for the 2022 to 2027 regulatory control period. This specific investment need is also identified in AusNet Services 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 Services and is located 21 km north of Melbourne. It is part of the main 500 kV transmission network with ties to Tasmania and major generation in the Latrobe Valley, the Victoria-South Australia interconnector and the interconnector between Victoria and New South Wales.

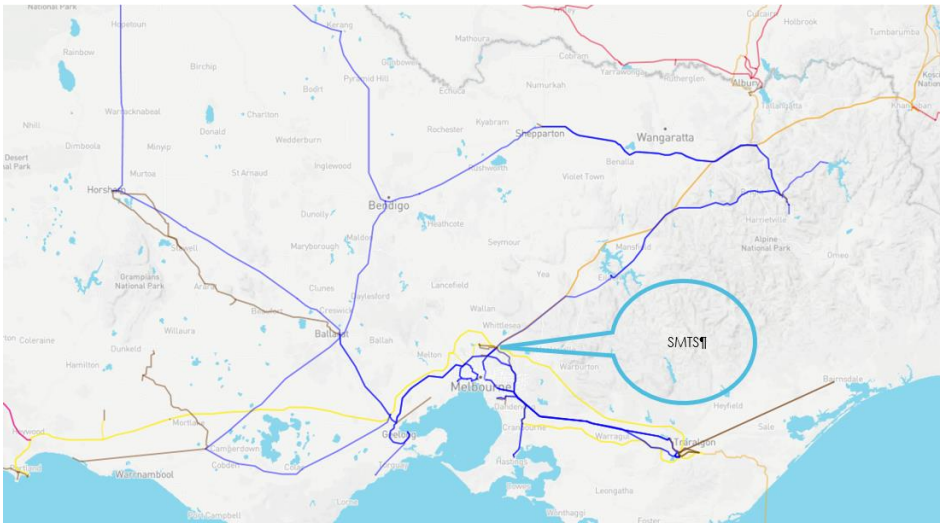


Figure 1 – SMTS and the Victorian transmission network

SMTS includes four voltage levels and the following transmission connections and transformers:

- Two 500 kV lines to Hazelwood, one 500 kV line to Rowville, one 500 kV line to Keilor and two 500 kV lines to Sydenham terminal stations
- Two 1,000 MVA 500/330 kV transformers with one spare phase
- Two 330 kV lines to Dederang Terminal Station (DDTS)
- Three 700 MVA 330/220 kV transformers
- Two 220 kV lines to Thomastown Terminal Station (TTS)
- Two 225 MVA 220/66 kV transformers

Figure 2 shows the SMTS 500 kV primary assets as the other voltages are not included in the scope of this RIT-T.

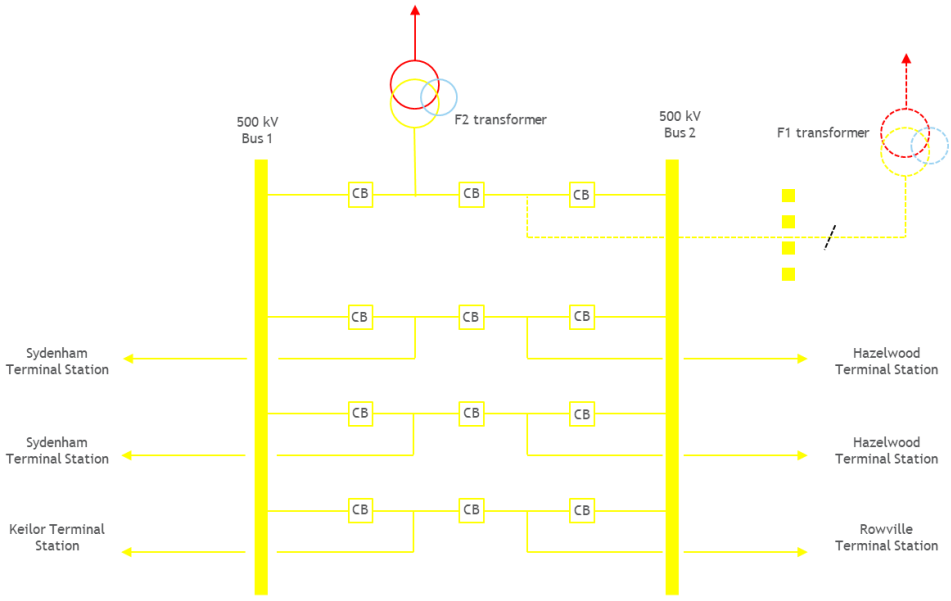


Figure 2 – SMTS 500 kV switching

3.2. Asset condition

AusNet Services conducted a condition assessment of the 500 kV GIS at SMTS 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 GIS are in poor or very poor condition and no longer supported by the manufacturer. The probability of failure for these assets are high, and likely to increase further if no remedial action is taken.

The GIS present challenges due to duty-related deterioration. Common problems are flange corrosion, SF6 leakage and hydraulic mechanism seal deterioration. As the manufacturer no longer support this GIS, AusNet no longer have access to supplier support and new spares, etc.

No alternative maintenance strategies have been identified that would reduce the failure rates or address the lack of manufacturer support.

4. Identified need

4.1. Description

The poor condition of the 500 kV GIS has increased the likelihood of asset failure. Without remedial action, other than ongoing maintenance practice (business-as-usual), the 500 kV GIS is expected to deteriorate further and more rapidly. This will increase the market impact risk due to prolonged outages of the transmission lines and transformers switched at SMTS. In addition, there is also increased safety, environmental, collateral damage, and emergency replacement risks due to the poor condition of the 500 kV GIS.

The 'identified need' this RIT-T intends to address is to maintain reliable transmission network services at SMTS and to mitigate risks from 500 kV switchgear 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

GIS is a mature technology and comparative failure rate trends of GIS over the years has been studied thoroughly and published within GIGRE. 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 3 and 4 shows the failure rates applied in this analysis.

Circuit	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
SPARE BBC 500KV GIS CB POLE	3.6%	3.9%	4.2%	4.4%	4.7%	5.1%	5.4%	5.7%	6.1%	6.4%
F1 TRANS NO2 500KV BUS CB	7.2%	7.6%	8.0%	8.4%	8.9%	9.3%	9.8%	10.2%	10.7%	11.2%
ROTS 3 500KV L 2 BUS CB	7.2%	7.6%	8.0%	8.4%	8.9%	9.3%	9.8%	10.2%	10.7%	11.2%
ROTS 3 L/KTS L 500KV CB	8.0%	8.4%	8.9%	9.3%	9.8%	10.2%	10.7%	11.2%	11.7%	12.2%
F1 Trans/F2 Trans 500KV CB	9.0%	9.4%	9.9%	10.3%	10.8%	11.3%	11.8%	12.3%	12.8%	13.4%
HWTS 2 L/SYTS 2 L 500KV CB	6.6%	7.0%	7.4%	7.8%	8.2%	8.6%	9.0%	9.5%	9.9%	10.4%
SYTS 2 500KV L 1 BUS CB	7.2%	7.6%	8.1%	8.5%	8.9%	9.4%	9.8%	10.3%	10.8%	11.2%
F2 TR 1 BUS 500KV CB	6.6%	7.0%	7.4%	7.8%	8.2%	8.6%	9.0%	9.5%	9.9%	10.4%
HWTS 1 L/SYTS 1 L 500KV CB	9.0%	9.4%	9.9%	10.3%	10.8%	11.3%	11.8%	12.3%	12.8%	13.4%
HWTS 1 500KV L 2 BUS CB	9.0%	9.4%	9.9%	10.3%	10.8%	11.3%	11.8%	12.3%	12.8%	13.4%
HWTS 2 500KV L 2 BUS CB	5.9%	6.3%	6.7%	7.1%	7.4%	7.8%	8.3%	8.7%	9.1%	9.6%
KTS 500KV L 1 BUS CB	4.1%	4.4%	4.7%	5.0%	5.3%	5.7%	6.0%	6.4%	6.7%	7.1%
SYTS 1 500KV L 1 BUS CB	9.0%	9.4%	9.9%	10.3%	10.8%	11.3%	11.8%	12.3%	12.8%	13.4%

Figure 3 – Probability of failure of 500 kV GIS

Circuit	Voltage	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
F2 TR BANK	500/330kV	5.4%	5.6%	5.8%	6.0%	6.2%	6.4%	6.6%	6.8%	7.0%	7.2%
SPARE F TR UNIT	500/330kV	5.4%	5.6%	5.8%	6.0%	6.2%	6.4%	6.6%	6.8%	7.0%	7.2%

Figure 4 – Probability of failure of F2 and spare 500/330 kV transformers

The mean time to repair the circuit breaker GIS module has been assumed to be between two and three months as expertise will need to be brought to Australia to help with the repairs and supply restoration given the age of the technology.

4.2.2. Market impact costs

A comprehensive market modelling study is used to assess the market impact of a failure of the GIS and transformer assets at SMTS. The study uses the lates market modelling assumptions used by AEMO 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].

1 In dollar terms, the Value of Customer Reliability (VCR) represents a customer's willingness to pay for the reliable supply of electricity

4.2.3. Safety risk costs

The Electricity Safety Act 1998[2] requires AusNet Services 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 of the affected switchgear, AusNet Services uses:

- a value of statistical life[3] to estimate the benefits of reducing the risk of death;
- a value of lost time injury[4]; and
- a disproportionality factor[5].

AusNet Services 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 by SMTS and asset replacement or repairs would be required to continue the service should the switchgears fail. An emergency asset replacement would require immediate diagnosis and emergency replacement with AIS for major failures where no spares are available as the 500 kV GIS is no longer supported by the supplier.

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.

Leakages of insulation gas – SF6 – used in the 500 kV GIS would be reduced by replacing the 500 kV GIS. AusNet would quantify the economic benefits from reductions of SF6 leakages using the AER Value of Emissions Reduction (VER) as per the guidance published by the AER.

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"
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. Potential 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: Replace 500 kV GIS with Outdoor Switchyard

Option 1 replaces the F2 500/330 kV transformer with the same size and 500 kV outdoor GIS with a modern outdoor AIS solution by2029. The estimated capital cost of this option is $180 million and the change in operating and maintenance cost is negligible. The estimated project delivery time is 5 years.

5.2. Option 2: Deferred replacement of 500 kV GIS with outdoor switchyard

Option 2 replaces the F2 500/330 kV transformer with the same size and 500 kV outdoor GIS with a modern outdoor AIS solution by2034. The estimated capital cost of this option is $180 million and the change in operating and maintenance cost is negligible. The estimated project delivery time is 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 Services 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 Services 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 MLTS is part of the extra high voltage main transmission network backbone with 500 kV and 220 kV transmission lines being switched at MLTS.

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 30 August 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:

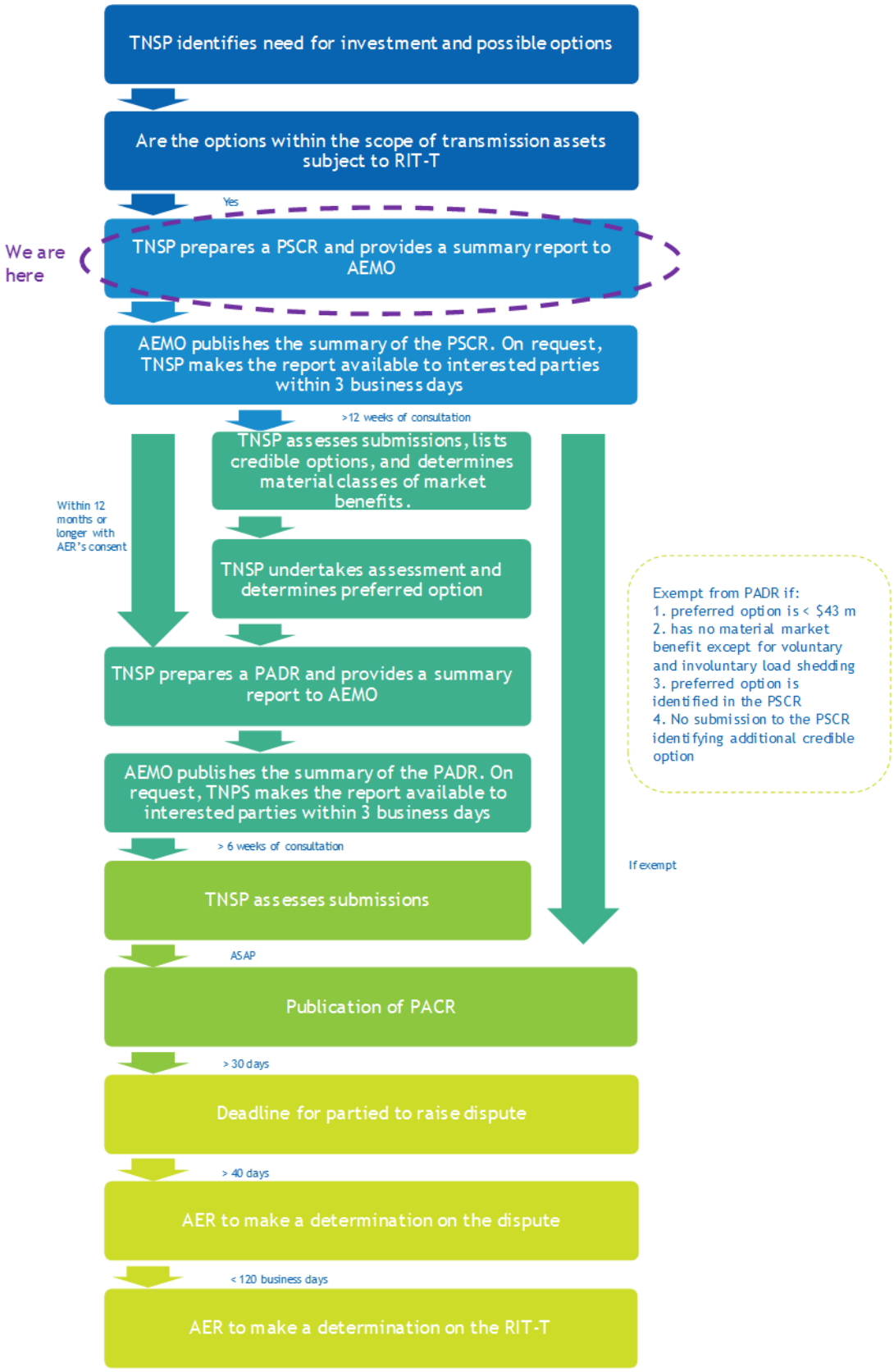
- A summary of, and commentary on, any submissions received.
- A detailed market benefit assessment of the proposed credible options to address the identified need.
- Identification of the proposed preferred option to meet the identified need.

AusNet expects to publish the PADR before end October 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



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