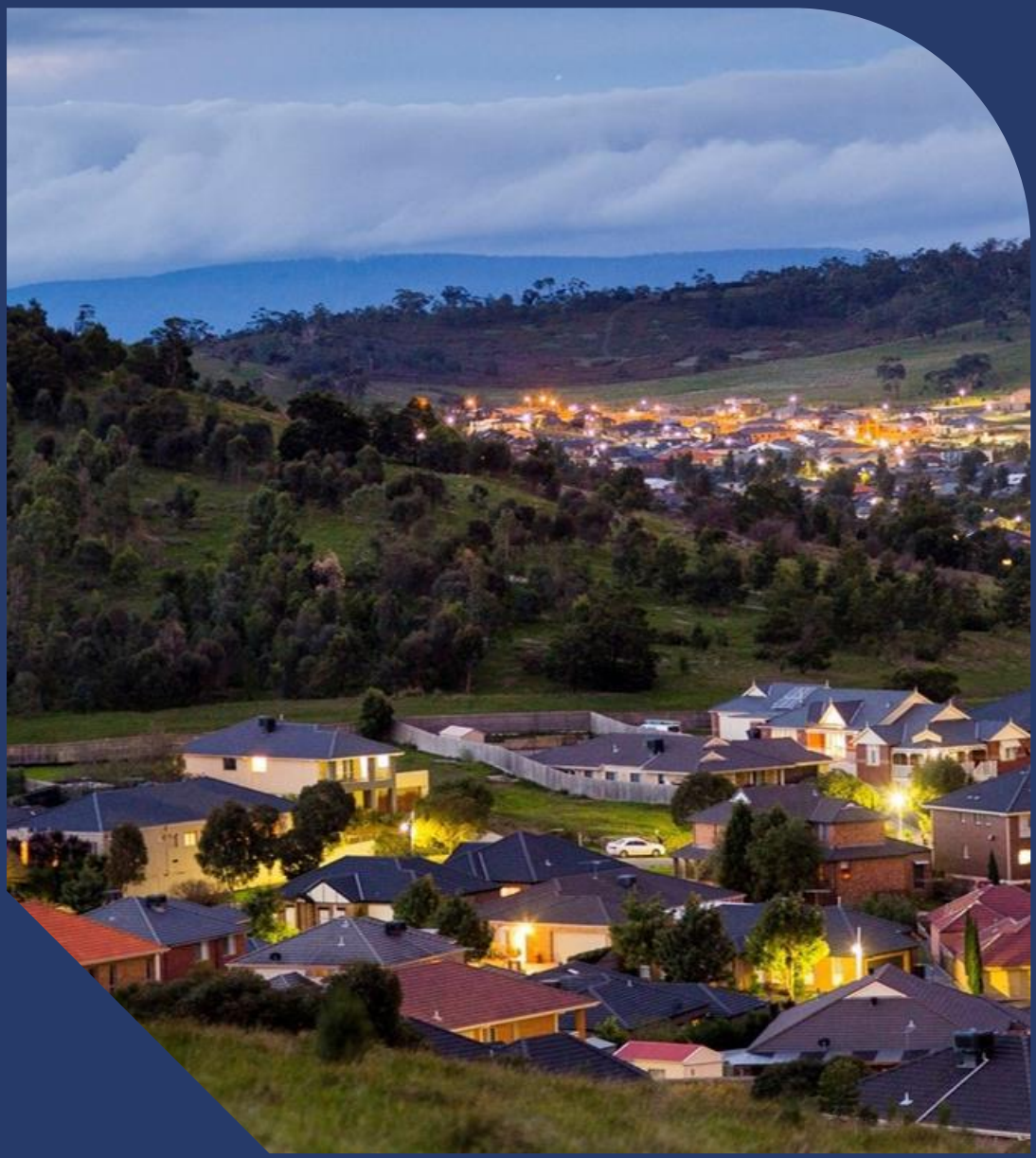
AusNet

Maintaining reliable transmission network services at Keilor Terminal Station

Regulatory Investment Test for Transmission (RIT-T)

Project Specification Consultation Report

July 2024



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1. Executive summary

Keilor Terminal Station (KTS) is owned and operated by AusNet Services and is in Keilor northwest of Melbourne's CBD. It was commissioned in 1970 and forms part of the main Victorian 500 kV and 220 kV transmission system with transformation from 500 kV to 220 kV and 220 kV to 66 kV.

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 to replace the existing three 750 MVA 500/220 kV transformers and that are likely to deliver economical solutions to the identified need are considered in this RIT-T.

- Option 1 – Replace with three 750 MVA transformer banks
- Option 2 – Replace with three 1000 MVA transformer banks

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 3 October 2024. In the subject field, please reference 'RIT-T PSCR Keilor Terminal Station transformer replacement 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 around 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 Keilor Terminal Station (KTS). The 500/220 kV and one of the 220/66 kV transformers at KTS are reaching the end of their 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 transformers at KTS 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

KTS is owned and operated by AusNet Services and is in the northwest of Greater Melbourne. KTS is one of the major terminal stations in Victoria with three voltage levels – 500 kV, 220 kV and 66 kV. Three 750 MVA 500/220 kV transformer and five 150 MVA 220/66 kV transformers are in services at KTS. KTS 66 kV supplies a total of approximately 211,800 customers in the areas of Sunbury, Sydenham, Tullamarine, Airport West, St. Albans, Woodend, Gisborne, Pascoe Vale, Essendon and Braybrook

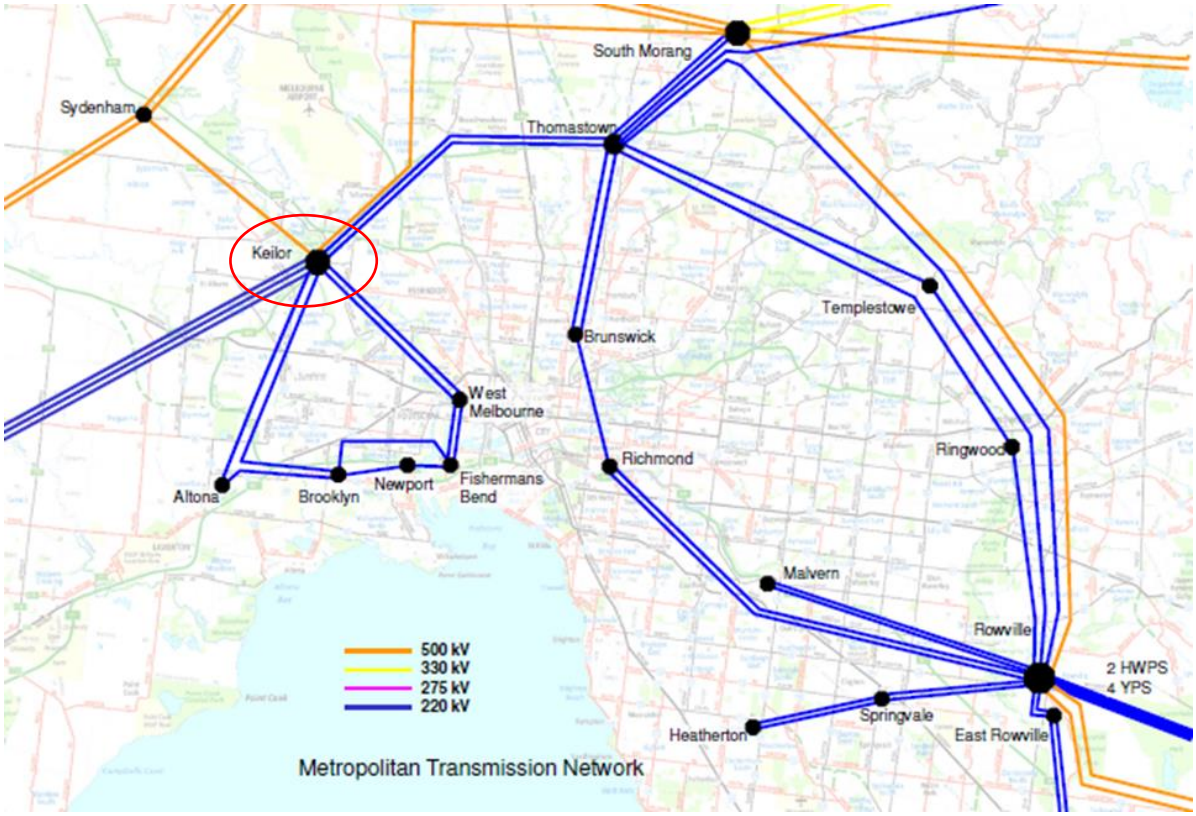


Figure 1 – KTS and the Victorian transmission network

3.2. Asset condition

The condition of the three 500/220 kV transformers (A2, A3 and A4) and one of the 220/66 kV transformers (B4) is in poor to very poor condition with increased risk of failure. Refurbishment is not an option as the core and windings of these transformers have been assessed to be in a poor to very poor condition.

4. Identified need

4.1. Description

AusNet Services expects that the services that the terminal station provides will continue to be required given the transmission network developments that are foreshadowed in AEMO's Integrated System Plan and Victorian Annual Planning Report (VAPR) as well as the Distribution Business' Transmission Connection Planning Report (TCPR).

The poor condition of some of the components at the terminal station has increased the likelihood of asset failures. Such failures would result in prolonged outages.

Without remedial action, other than ongoing maintenance practice (business-as-usual), affected assets are expected to deteriorate further and more rapidly. This will increase the probability of asset failure resulting in a higher likelihood of an impact on users of the transmission network, heightened safety risks, increased environment risks, increased collateral damage risks to adjacent plant, and the risk of increased costs resulting from the need for emergency asset replacements and reactive repairs.

The 'identified need' this RIT-T intends to address is to maintain reliable transmission network services at KTS 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 3 shows the failure rates applied in this analysis.

Circuit	Voltage	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
A2 TR BANK	500/220kV	6.5%	7.1%	7.8%	8.6%	9.4%	10.3%	11.2%	12.2%	13.3%	14.4%
A3 TR BANK	500/220kV	7.2%	8.0%	8.7%	9.5%	10.4%	11.4%	12.4%	13.4%	14.5%	15.7%
A4 TR BANK	500/220kV	7.0%	7.7%	8.5%	9.3%	10.1%	11.0%	12.0%	13.0%	14.1%	15.3%
B4 TR	220/66/11kV	6.6%	7.3%	8.0%	8.8%	9.6%	10.5%	11.4%	12.4%	13.5%	14.6%

Figure 3 – Probability of failure of transformers

The mean time to replace a transformer with a spare following a major failure has been assumed to be one month when a spare is available and 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 KTS. 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 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

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"
4 Safe Work Australia, "The Cost of Work-related Injury and Illness for Australian Employers, Workers and the Community: 2012-13"

- 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 at KTS 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.

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 with three 750 MVA transformer banks

Option 1 replaces the three 500/220 kV transformer banks with the same size and includes one spare phase. The B4 220/66 kV transformer is replaced with the same size transformer. The estimated capital cost of this option is $140 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: Replace with three 1000 MVA transformer banks

Option 2 replaces the three 500/220 kV transformer banks with 1000 MVA units. A spare is not needed as the larger units will allow for in-service spare capacity and a shared spare phase is also available from Moorabool Terminal Station. The estimated capital cost of this option is $150 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 KTS 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 KTS is part of the extra high voltage main transmission network backbone with major power transformation and 500 kV and 220 kV transmission lines being switched at KTS.

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 3 October 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:

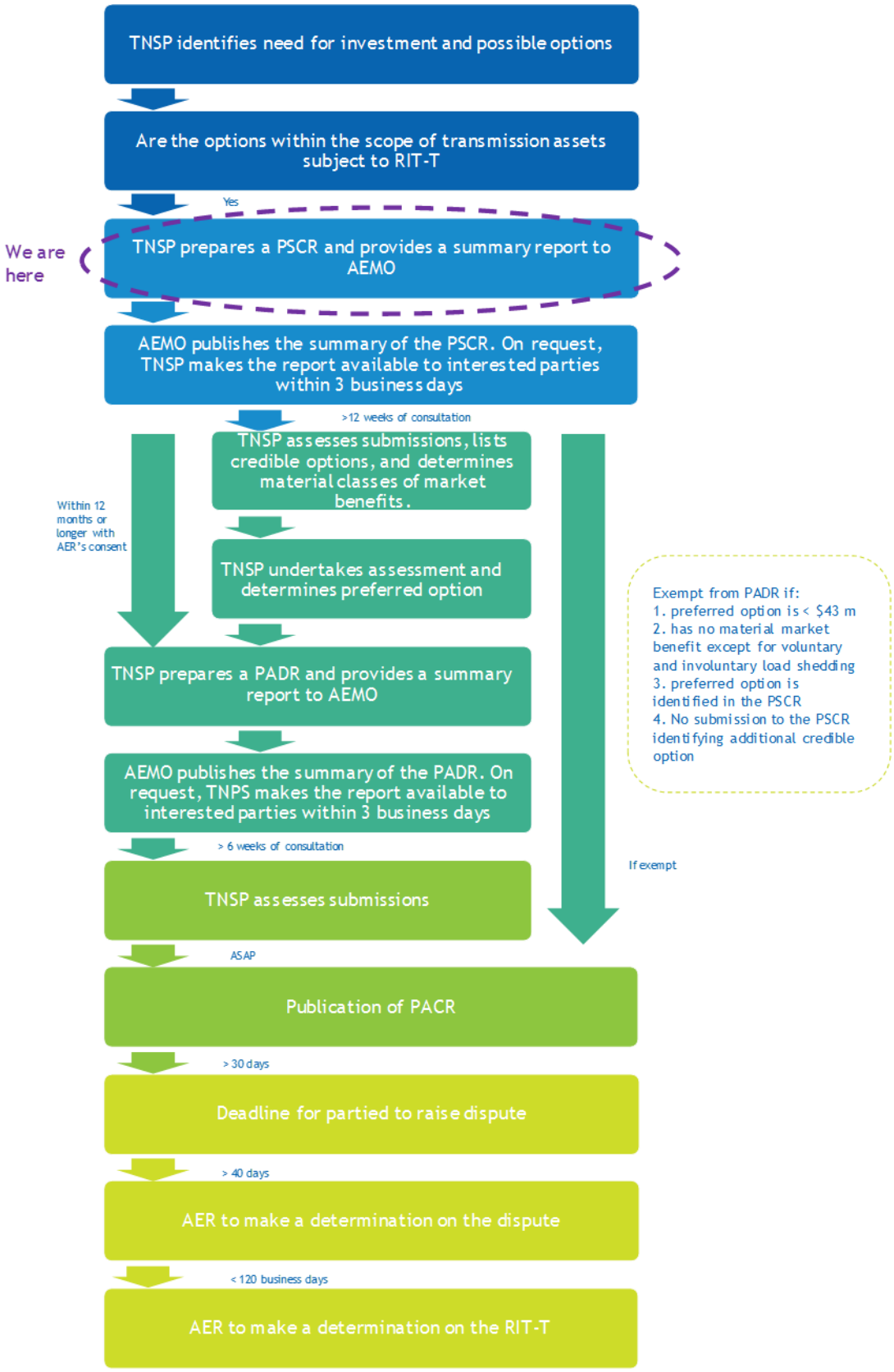
- A summary of, and commentary on, any submissions received.
- A detailed market benefit assessment of the proposed credible options to address the identified need.
- Identification of the proposed preferred option to meet the identified need.

AusNet expects to publish the PADR around 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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