Tower Strengthening: Murray Switching Station to Dederang Terminal Station

Regulatory Investment Test for Transmission

Project Specification Consultation Report

Note: Photo above is not from MSS-DDTS 330 kV circuit

Published 28 April 2022

ISSUE/AMENDMENT STATUS

Issue	Date	Description	Author	Approved
1	28/04/2022	First Issue	Francis Lirios	Dasun DeSilva

Purpose

AusNet Services has prepared this document to provide information about potential limitations in the Victoria transmission network and options that could address these limitations.

Disclaimer

This document belongs to AusNet Services and may or may not contain all available information on the subject matter this document purports to address.

The information contained in this document is subject to review and AusNet Services may amend this document at any time. Amendments will be indicated in the Amendment Table, but AusNet Services does not undertake to keep this document up to date.

To the maximum extent permitted by law, AusNet Services makes no representation or warranty (express or implied) as to the accuracy, reliability, or completeness of the information contained in this document, or its suitability for any intended purpose. AusNet Services (which, for the purposes of this disclaimer, includes all of its related bodies corporate, its officers, employees, contractors, agents and consultants, and those of its related bodies corporate) shall have no liability for any loss or damage (be it direct or indirect, including liability by reason of negligence or negligent misstatement) for any statements, opinions, information or matter (expressed or implied) arising out of, contained in, or derived from, or for any omissions from, the information in this document.

Contact

This document is the responsibility of AusNet Services.

Please contact the indicated owner of the document with any inquiries.

Francis Lirios
AusNet Services
Level 31, 2 Southbank Boulevard
Southbank, Victoria 3006
Ph: (03) 9695 6000

TABLE OF CONTENTS

1 Introduction ... 4

1.1 Overview ... 4

1.2 Consultation ... 4

2 Background ... 5

3 Identified need ... 7

3.1 Description of the identified need ... 7

3.2 Assumptions ... 7

3.2.1 Supply risk costs ... 7

3.2.2 Safety risk costs ... 7

3.2.3 Financial risk costs ... 8

4 Credible options considered ... 9

4.1 Option 1: Reinforcement of transmission towers to current design standards ... 9

4.2 Option 2: Pre-emptive full replacement of towers ... 10

5 Economic assessment of the credible options ... 11

5.1 Market benefits and assessment approach ... 11

5.2 Preferred option ... 12

6 Next steps ... 13

1 Introduction

1.1 Overview

AusNet Services owns and operates the electricity transmission network in Victoria, which transports electricity from coal, gas and renewable generators across Victoria and interstate, to terminal stations that supply large customers and the distribution networks.

The Regulatory Investment Test for transmission (RIT-T) is an economic cost-benefit test used to assess and rank potential investments capable of meeting the identified need. The purpose of the RIT-T is to identify the credible option that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the National Electricity Market (the preferred option).

The 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 4.1 of the AER's RIT-T Application Guidelines[1]. In accordance with those requirements, this document sets out:

- the identified need that AusNet Services is seeking to address, together with the assumptions used in identifying this need;
- a description of the credible network options that may address the identified need, including our reasons why there are no credible non-network options;
- the technical characteristics of each credible option;
- the classes of market benefits that AusNet Services considers are unlikely to be material, together with our reasoning;
- the estimated construction timetable and commissioning date; and
- the total indicative capital and maintenance costs for each option.

1.2 Consultation

In accordance with section 4.1 of the AER's Application Guidelines, we are seeking submissions on the matters set out in this PSCR. Notification of our request for submissions will be provided to Registered Participants, AEMO, non-network providers, interested parties and persons on our demand side engagement register as required by the NER. We will also publish this report and closing date for submissions on our website.

Submission should be sent to rittconsultations@ausnetservices.com.au by 122nd July 2022 and telephone enquiries can be directed to Francis Lirios on (03) 9695 6000.

Submissions will be published on AusNet Services' website. If you do not wish to have your submission published, please clearly stipulate this at the time of lodging your submission.

[1] Australian Energy Regulator, Application Guidelines, Regulatory Investment Test for transmission, August 2020.

2 Background

Steel lattice structures make up approximately 97 per cent of the towers on our transmission network. Lattice structures consist of angled galvanised steel members connected with bolts. These structures generally support either single-circuit or double-circuit lines, including three different phase conductors per circuit. The phase conductors are protected from lightning strike by single or multiple ground wires situated on the peaks of the structures.

The earliest constructed towers are single circuit towers which transport electricity from one terminal station to another. Later towers were designed to carry two circuits, which improved reliability of supply whilst marginally increasing the cost.

There are generally four types of towers on the transmission network, i.e. light suspension, heavy suspension, light strain and heavy strain, with an expected service life of approximately 70 years, depending on the environmental conditions of the site. Strain structures carry a combination of vertical and horizontal loads from conductors and its ancillary hardware. These structures allow conductors to be terminated or strained off with the insulators in line with the conductor axis.

Figure 1 shows the 330 kV strain tower on the Murray Switching Station (MSS) to Dederang Terminal Station (DDTS) circuit.

Figure 1: T080 MSS-DDTS No. 2 330 kV strain tower

The towers along the MSS-DDTS circuit were design and constructed from 1959 to 1965 using the State Electricity Commission of Victoria's design codes that applied at that time. As explained below, this design is no longer applied as Standards Australia has released the latest overhead line design code, AS/NZS 7000 which addresses the risks associated with high intensity winds.

In 1981, there was a major tower failure on the MSS-DDTS No 2, 330kV line due to windstorms. There have been two subsequent failures in 1999 and 2009, which resulted in failures of four tower structures that were similar in design to the towers on MSS-DDTS. The 1999 failure event was due to high intensity winds, while the 2009 was caused by a windstorm exacerbated by the convection effects of the fires which burnt along the Strathewen area during the 2009 Black Saturday Bushfires.

The Bendigo to Kerang 220kV line, which was constructed during the same period as MSS-DDTS, has also experienced similar tower collapse events due to structural design inadequacy against extreme wind events called downburst wind[2]. A total of 18 towers have failed on that line from four separate events in 1979, 1993, 2010 and 2014. These tower failures provide further evidence that the original tower design applied along the MSS-DDTS circuit requires improvement.

In 2010, a new line design code, AS/NZS 7000-2010, was published which addresses high intensity wind loading from thunderstorms and downburst/downdraft winds. This design code, which was subsequently updated in 2016, also considers the risk of cascade failures (i.e. multiple tower collapses during a single event). The design code uses reliability-based principles to achieve a tower strength that is consistent with the target design life or expected remaining asset life of the relevant structure.

The age of the towers along the MSS-DDTS circuit means that they were not constructed to current overhead line design standards (AS/NZS7000-2016). As a result, the towers are at risk of failure during an extreme weather event, which would lead to a significant loss of supply and safety risks. A number of these towers are located adjacent to road crossings, which exposes road users to the risk of serious injury or death in the event of a tower collapse. The level of health and safety risk posed by a potential tower failure or conductor drop event near road crossings is not acceptable to AusNet.

[2] Downburst wind is a strong ground-level wind system that emanates from a point source above and blows radially in straight lines in all directions from the point of contact at the ground.

3 Identified need

3.1 Description of the identified need

The towers along the MSS-DDTS circuit were constructed from 1959 to 1965 using the State Electricity Commission of Victoria's design codes that applied at that time, which are inferior to the current overhead line design standards. The current design standard, AS/NZS 7000-2016, accounts for the risks associated with high intensity wind loading from thunderstorms and downburst winds, and the risk of cascade failures (i.e. multiple tower collapse during a single event). The development of the new overhead line design standard is a response of Standards Australia and Standards New Zealand to the experience of tower failures on our networks.

The design of the existing towers on the MSS-DDTS circuit drives a need to mitigate the risks and potential consequences of tower failure. These risks and consequences are:

- adverse safety outcomes for our employees, contractors and the general public; and
- loss of electricity supply to customers.
- In addition to the need for remedial action to mitigate these risks and consequences, AusNet Services must also ensure that it complies with its regulatory obligations, which include the Electricity Safety Act 1998. This Act requires AusNet Services to minimise hazards and risks to the safety of any person as far as reasonably practicable. In relation to the towers along the MSS-DDTS circuit, compliance with this Act (and other regulations) contribute to the identified need.

3.2 Assumptions

In assessing the identified need, AusNet Services must consider the risk of asset failure and the likelihood of potential adverse consequences eventuating. In addition to estimating these risk and consequences eventuating, AusNet Services has adopted the following further assumptions to quantify the potential costs of tower failure.

3.2.1 Supply risk costs

In the event of a tower failure along the MSS-DDTS circuit, customers will experience a loss of supply event. The supply risk costs is the probability of an event occurring multiplied by the unserved energy that would result from that event. The cost of unserved energy is determined by the Value of Customer Reliability (VCR), which is estimated by the AER and depends on the composition of customers supplied by the MSS-DDTS circuit.

3.2.2 Safety risk costs

The Electricity Safety Act 1998 requires AusNet Services to design, construct, operate, maintain, and decommission its 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 asset failures, AusNet Services uses:

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

[3] Department of the Prime Minister and Cabinet, Australian Government, "Best Practice Regulation Guidance Note: Value of statistical life," available at https://www.pmc.gov.au/resource-centre/regulation/best-practice-regulation-guidance-note-value-statistical-life.

[4] Safe Work Australia, "The Cost of Work-related Injury and Illness for Australian Employers, Workers and the Community: 2012-13," available at https://www.safeworkaustralia.gov.au/system/files/documents/1702/cost-of-work-related-injury-and-disease-2012-13.docx.pdf.

- a disproportionality factor[5].
- AusNet Services also notes our approach, including the use of a disproportionality factor, is consistent with the guidance provided by the AER[6].

3.2.3 Financial risk costs

In the event of a tower failure, costs will be incurred in replacing the failed assets (and any consequential damage to other assets). The risk of this financial impact may vary for different credible options and, therefore, should be factored into the cost-benefit assessment.

[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 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," available at https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/industry-practice-application-note-for-asset-replacement-planning.

4 Credible options considered

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 timetable 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 for addressing an identified need 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.

As the identified need in this case arises from the design of towers along the MSS-DDTS circuit, which do not comply with the current overhead line design standard, there are no credible non-network options that could address this identified need. In effect, the nature of the risks is asset-related and cannot be mitigated by a non-network option given the significant costs of retiring the assets.

The credible options are therefore:

1. Reinforcement of the transmission towers to achieve the current design standard; and
2. Pre-emptive full replacement of the highest risk towers.

- Neither option is expected to have an inter-regional impact. Each credible option is discussed below.

4.1 Option 1: Reinforcement of transmission towers to current design standards

This option would involve upgrading 56 towers on Murray Switching Station to Dederang Terminal Station (MSS-DDTS) Nos. 1 and 2 circuits to meet the current overhead line design standard. The works would be prioritised to minimise the safety risk of tower failure to road users and the public. The construction would commence in November 2022, with project completion expected by June 2025. The estimated capital cost of this option is $7.6 million[7].

In relation to operating expenditure, we do not expect this option to have a material impact on our future costs i.e. routine maintenance expenditure would be substantially unchanged. The scope of work for this option would include:

- perform site inspection to validate data, verify site conditions including geotechnical investigation;
- perform climb inspection of selected towers to validate the drawing accuracies;
- undertake site inspection to establish traffic management requirements, site access requirements for plant machinery and suitability of live line preparation to minimise outage requirements;
- identify the required loading and undertake structural analysis of the existing towers using site specific conditions to confirm the need for upgrade or the extent of reinforcement;

[7] This estimate does not include overheads or on-costs.

- identify the required loading on foundations and undertake structural analysis of the existing foundations using site specific loading to confirm the need for upgrade and the extent of reinforcement;
- design the required reinforcement using AS/NZS 7000 - 2016 and AS 3995 – 1994;
- procure all required materials including steel members and other hardware, including arrest systems;
- undertake a field audit to confirm all work has been completed to AusNet Services' standards; and
- update SAP with new insulator and structure data, and PLS-CADD model following completion of site works.

4.2 Option 2: Pre-emptive full replacement of towers

Under this option the 15 highest risk towers that are in close proximity to road users would be retired and replaced with AS/NZS 7000-2016 compliant towers. To keep the line energised, a by-pass system would be constructed using the Emergency Restoration System masts. As new towers, the new assets would obtain a Condition Score 1 (which would be superior to Option 1).

The estimated cost of this option is approximately $36.6 million compared to $7.6 million for Option 1. As noted in relation to Option 1, we do not expect this option to have a material impact on our future operating expenditure. The construction timeframes for this option would be similar to Option 1.

5 Economic assessment of the credible options

5.1 Market benefits and assessment approach

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 both credible options.

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 will not have any impact on fuel consumption.
(ii) changes in voluntary load curtailment;	The credible options are not expected to lead to changes in voluntary load curtailment.
(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 are expected to have a positive impact on involuntary load shedding, by reducing (but not eliminating) the risk of asset failure. The cost benefit analysis will therefore consider the impact of each option on load shedding. AusNet Services applies probabilistic planning techniques to assess the expected cost of unserved energy for each option.
(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 are not expected to be any such impacts on other parties if a credible option proceeds.
(v) differences in the timing of expenditure;	The credible options will not result in changes in the timing of other expenditure.
(vi) changes in network losses;	The credible options will not result in 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.

As explained in the above table, the only market benefit that is relevant to the identified need is the change in involuntary load shedding, which is calculated as follows:

- Energy at risk: This is the amount of energy, weighted by the demand conditions considered (10% POE and 50% POE), that would not be supplied as a result of a tower failure. This statistic provides an indication of the magnitude of energy that would not be supplied in the unlikely event of a tower failure.
- Expected unserved energy: This is the energy at risk weighted by the probability of a tower failure. This statistic provides an indication of the amount of energy, on average, that will not be supplied in a year considering the low probability that a tower failure occurs.
- For the purpose of this RIT-T, our probabilistic planning approach provides a reasonable level of scenario analysis by considering the risk of asset failures and the expected cost of unserved energy under different demand conditions. The impact of different inputs is tested through sensitivity analysis. The assumptions regarding reductions in supply risk were discussed in section 3.2.1 of this PSCR.
- In addition to market benefit of reducing involuntary load shedding, the costs associated with safety risks and financial risks (as discussed in sections 3.2.2 and 3.2.3) must also be factored in the cost-benefit assessment. In effect, each credible option (including the BAU option) will have different costs associated with safety risks and financial risks that will play a role in determining the preferred option.

5.2 Preferred option

Our cost benefit assessment of the options will be presented in the next stage of the RIT-T process. Subject to considering written submissions, however, we are able to confirm that our preferred option is to reinforce the towers (Option 1) as this option delivers the highest net market benefit. This option also involves substantially lower capital costs than the alternative option of replacing the highest risk towers.

The tower reinforcement program (Option 1) will significantly reduce the likelihood of a major event involving tower failure in the network. This reduction in likelihood is achieved by upgrading towers which are in high-risk areas based on the design wind speeds and their location within the network, i.e. across road crossings, rail crossings and high bushfire risk areas. The tower road crossings that will be addressed through this reinforcement project are: the Murray Valley Highway (33 towers); the Omeo Highway (11 towers); and the Kiewa Valley Highway (12 towers).

The BAU option of continuing to maintain the existing towers has a substantially higher cost in present value terms ($85.1 million) compared to Option 1 ($33.8 million) and Option 2 ($51.0 million). Accordingly, Option 1 is the preferred option. As already noted, further detailed information regarding the cost-benefit analysis will be presented in the next stage of the RIT-T, which will take into account any submissions on this PSCR.

6 Next steps

AusNet Services intends to publish a Project Assessment Conclusions Report in relation to this project. In our view, a Project Assessment Draft Report is unlikely to be required as the tower strengthening project benefits from the exemption provided by clause 5.16.4(z1), for the following reasons:

- the preferred option, Option 1, has a capital cost of less than $46 million[8] and is therefore below the threshold amount;
- section 5.2 of this PSCR identifies the preferred option and explains our reasons for selecting it; and
- all credible options will not have a material class of market benefits except for those specified in clause 5.15A(b)(4)(ii).

Accordingly, subject to receiving submissions on this PSCR, AusNet Services intends to produce a Project Assessment Conclusions Report (PACR) in July 2022.

[8] In accordance with the cost threshold in clause 5.16.4(z1)(1), as updated by the AER on 30 July 2021.