AusNet

Transmission Insulator Replacement 500kV & 220kV

Regulatory Investment Test for Transmission

Project Specification Consultation Report

Thursday, 6 March 2025

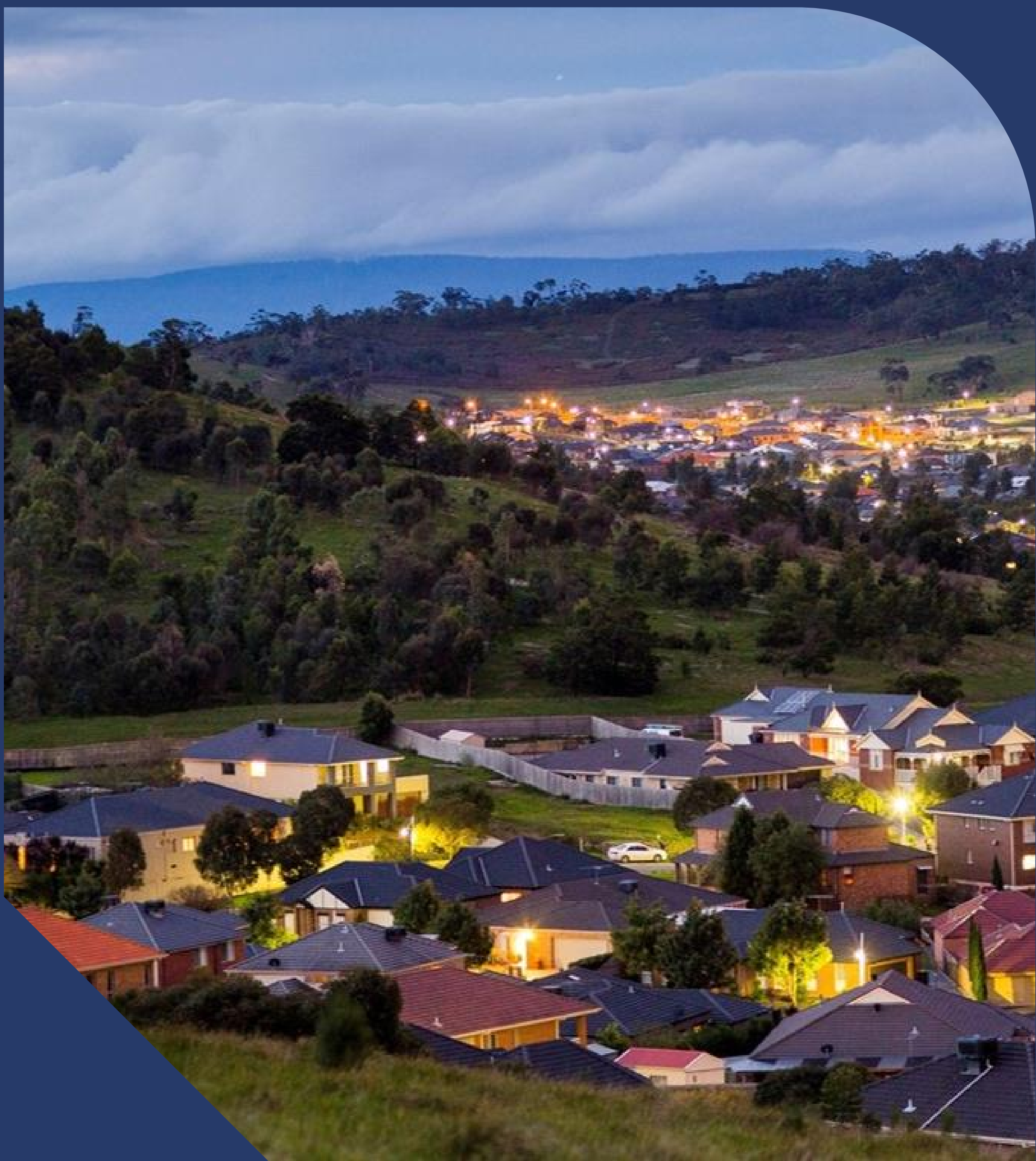

Table of contents

1. Introduction

1.1. Overview

AusNet owns and operates the electricity transmission network in Victoria, which transports electricity from large 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 an '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. It relates to AusNet's plans to replace deteriorated porcelain disc and end of life composite insulators which serve to safely support/connect the transmission line phase conductors on the transmission towers. This project is focused on the replacement of Doulton type insulators, following a failure in January 2024 along the HWTS-SMTS 500kV #2 line which caused a conductor drop and line outage. As explained in this PSCR, there are no non-network options that could address the identified need.

In accordance with clause 5.16 of the National Electricity Rules (**NER**) and section 4.2 of the AER's RIT-T Application Guidelines[1], this PSCR sets out:

- the identified need that AusNet 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 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 clause 4.2 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 as required by the NER. We will also publish this report on our website. The closing date for submissions is 13 June 2025.

Any questions regarding this report should be directed to: rittconsultations@ausnetservices.com.au or please contact to Alex De Young on (03) 9695 6000.

[1] Australian Energy Regulator, Application Guidelines, Regulatory Investment Test for transmission, November 2024.

2. Background

Overhead bare conductors are insulated by the surrounding air, with the insulator strings preventing the conduction of electrical current to the steel structure that supports the transmission wire. Insulators are required at points where they are supported by poles or transmission towers. They are also required where the wire enters buildings or electrical assets such as transformers or circuit breakers.

Approximately 89,000 insulator strings are in service on AusNet's transmission network. Most insulator strings comprise several linked discs made from either porcelain or glass with steel pins and steel caps to form a continuous string. Over time the condition of these assets deteriorates due to the environmental conditions that cause corrosion and mechanical loading.

Insulators are currently assessed by visual inspection during tower climb based condition assessment. Insulators are rated by qualified Linesmen and given a C1 to C5 condition score, with C4 being a poor condition and C5 a very poor condition rating.

AusNet has developed risk-based models to assist with the application of formal risk assessments as required by the Electrical Safety (Management) Regulations 2019. Implementation of this selective replacement strategy, addressing both failure frequency and consequences is necessary to maintain public safety and assist in meeting the safety objectives set out in AusNet's Mission Zero strategy.

This PSCR relates to the final component of AusNet's target to replace 2,268 insulator strings between April 2023 and March 2027. In this regard, project TD-0009879 Insulator Replacement is in progress to replace 773 insulator strings by mid-2025. This PSCR is concerned with the next phase of the replacement program, which focuses predominately on Doulton type insulators following a failure in January 2024 along the HWTS-SMTS 500kV #2 line that caused a conductor drop and line outage. This incident was reported to Energy Safe, under our obligations to report significant safety incidents.

Figure 1 below shows the HWTS-SMTS 500kV line which experienced the insulator failure.

Figure 1: Doulton Insulator Failure T076 HWTS-SMTS #2

In late November 2024, a sample of 232 Insulator Discs from T076 and two other towers were also replaced. The initial findings from this sample revealed more insulator discs with severe corrosion of pins, with reduced cross-sectional area of their pins and reduced mechanical strength. As explained in the next section, the subsequent investigation and forensics have identified this type of insulator should be replaced because of a design feature that can result in hidden and accelerated pin corrosion.

3. Identified need

3.1. Description

Following the failure of the insulator along the HWTS-SMTS 500kV #2 line in January 2024, a design feature has been identified in relation to Doulton brand insulators, which led to the severely corroded pin as shown in Figure 2 below.

Figure 2: Severely corroded pin causing line drop

The investigation on the failed disc identified pin corrosion as the root cause of the failure. This failure was caused by cracking to the sealant installed at the ceramic-pin/bitumen interface, which over time, has allowed moisture to be trapped under the sealant. Once inside, the moisture has accelerated pin corrosion, resulting in the mechanical failure of the string. Given the safety implications arising from insulator failures, AusNet has concluded that there is a need to replace the Doulton insulators, starting at the highest risk locations.

Figure 2 shows the 500kV transmission network with in-service Doulton insulators. There are approximately 523 towers with Doulton insulators, 110 of which have been identified as being highest risk and in need of replacement in this project. In addition, there are 71 220kV towers on various circuits with porcelain or composite insulators that also need to be replaced.

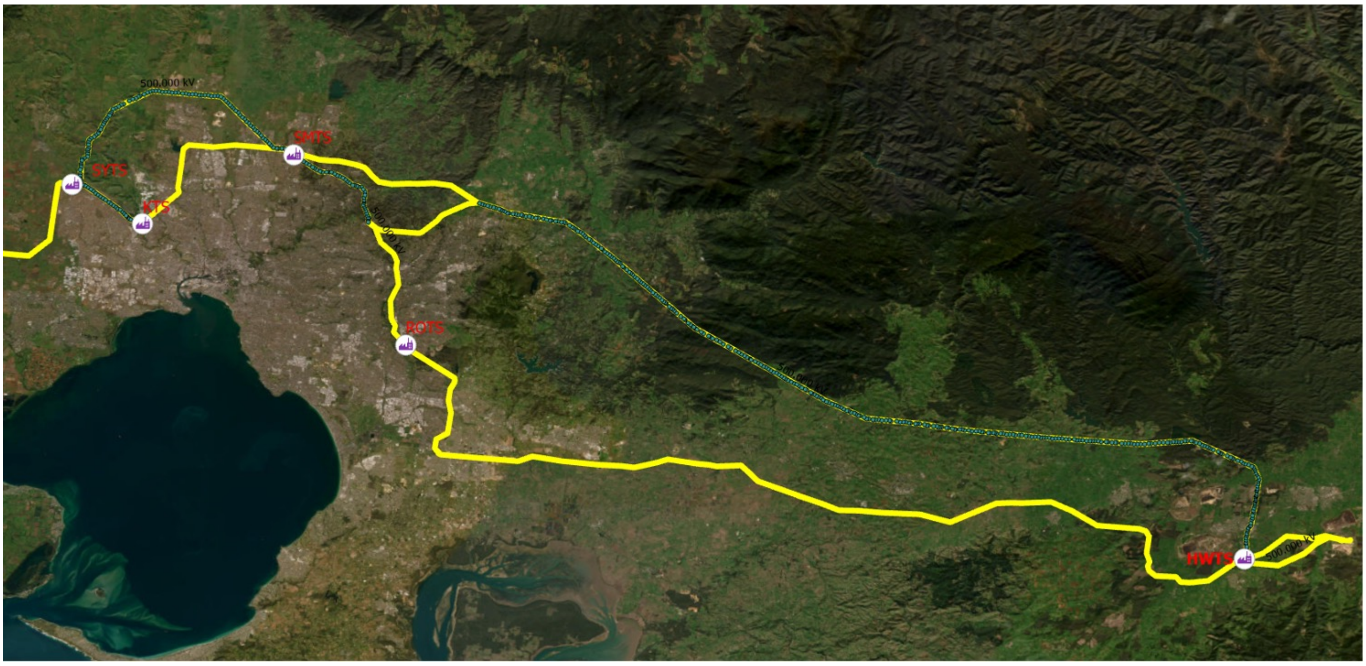

Figure 3: 500kV transmission towers containing In-service Doulton insulators (Shown in Green)

3.2. Assumptions

This section summarises the assumptions that have led to the identified need, focusing in particular on the consequences of the risk of an insulator failure.

3.2.1. Health and safety risks

The Electricity Safety Act 1998 requires AusNet 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. Evidently, this obligation requires AusNet to take action to mitigate the risk of insulator failures.

In relation to conducting a cost-benefit analysis, AusNet is able to attribute a cost to the safety risks from asset failures by considering:

- the value of statistical life to estimate the benefits of reducing the risk of death;[2]
- the value of lost time injury;[3] and
- applying a disproportionality factor.[4]

AusNet's approach to assessing the risk and consequence of asset failure, such as a Doulton type insulator, is consistent with the guidance provided by the AER.[5]

3.2.2. Bushfire risk costs

Faults on transmission lines can result in line drops which are capable of igniting ground fires due to the flashover arcing. Some transmission lines are situated in easements through high density fuel loads in grasslands and forests. In extreme weather conditions ground fires started close to such fuel loads can develop into widespread bushfires.

Bushfire loss consequence modelling performed by Dr. Kevin Tolhurst of Melbourne University has enabled the establishment of quantitative bushfire consequence values for transmission line assets. AusNet has regard to this analysis in assessing the potential consequences from bushfire ignition. In light of historical events and the known risks associated with insulator failures, AusNet Services regards a proactive asset inspection and replacement program as essential in continuing to minimise bushfire risk in accordance with our regulatory obligations and community expectations.

3.2.3. Financial risk costs

In the event of an insulator failure, costs will be incurred in replacing the failed asset (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.

3.2.4. Market impact

The electricity transmission lines in the NEM provide high levels of redundancy under average loading conditions. However, at peak loading periods, a transmission outage caused by an insulator failure may constrain generator connections which requires a re-scheduling of generators and, potentially, load shedding.

Market modelling would be required to estimate the expected adverse impact on dispatch costs as a result of a phase conductor failure. In light of the important safety drivers underpinning the identified need, however, AusNet does not consider it necessary to include an assessment of the potential market impact of an insulator failure for the purposes of this RIT-T. In particular, AusNet considers the identified need and the preferred option both depend on the safety and bushfire risks associated with insulator failures and the extent to which these risks are effectively mitigated.

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2 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.

3 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.

4 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.

5 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. 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 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 condition of insulators, there are no credible non-network options that could address this identified need. In effect, the nature of the risk is asset-related and cannot be mitigated by a non-network option given the significant costs of retiring the assets.

The credible options are:

- Option 1: Option 1 priorities the high risk Doulton insulators, starting their proactive replacement in 2025 and replace all C4 & C5 insulators within the scope of the project by June 2027.
- Option 2: Commencing the immediate replacement of Condition C4 & C5 insulator strings that are within the scope of the project, whilst delaying the start of the replacement of the Doulton insulators until FY2028 with completion by March 2031.

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

4.1. Option 0: Do Nothing/BAU

The Do Nothing/BAU option assumes that AusNet would not undertake any investment, outside of the normal operational and maintenance processes. The Do Nothing/BAU option establishes the base level of risk and provides a basis for comparing other credible options. Whilst the direct capital cost of this option is zero, the continued exposure to residual risks means that this option has significant risk costs associated with it. In relation to this project, 'do nothing' or 'BAU' is not a credible option.

4.2. Option 1: Replace all high risk Doulton insulators as a priority

This option would reduce the risks associated with a potential failure of a deteriorated/corroded insulator resulting in a conductor drop event by replacing the high risk Doulton insulators on the 500 kV and the in-scope C4 & C5 condition Insulators of other brands on the 500kV & 220 kV networks. The planned replacement of insulators is the most efficient and cost-effective method compared to replacing these assets when they fail. Planned replacement allows for the most efficient mobilisation of resources to carry out the replacement, under planned outages or live-line work to assure the safety of line workers.

The scope of work for this option would focus on the high risk Doulton insulators and in-scope C4 & C5 strings, totalling 1,531 poor condition insulator strings in the following locations:

- Doulton road Crossing Towers;
- Doulton towers in field adjacent to the failure that occurred in January 2024;
- Doulton towers from HWTS to T003 (44 Towers); and
- High risk rated C4 & C5 condition insulators of other brands on the 500kV & 220kV.

The total capital expenditure for this option is estimated to be $41.37 million (nominal). 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.

4.3. Option 2: Replace 500 kV and 220 kV insulators in C4 and C5 condition as a priority

Option 2 would only replace insulator strings in observed as C4 or C5 condition and schedule the replacement of the Doulton insulators beginning in FY2028. In effect, this option gives priority to those insulators that are observed as being condition (C4 and C5) and delaying the priority to the replacement of the Doulton insulators. In comparison with Option 1, this option would have an increased capital expenditure of $48.30 million (nominal) and extend the capital expenditure until March 2031, resulting in a lower present value than Option 1. However, the safety and bushfire risks associated with Option 2 are higher than Option 1, particularly as the known defects in relation to Doulton insulators would only be rectified from FY2028. For that reason, Option 1 is the preferred option.

4.4. Preferred option scope, costs and timeframes

For the reasons set out in the previous section, Option 1 is to be the preferred option. The scope of work to deliver this option is summarised below:

- 124 off 500kV Towers comprising:
  - 10 Towers on; HWTS-APD #1 & #2; MLTS-TRTS #1; and MOPS-HYTS #2
  - 38 road crossing towers containing Doulton insulators on CSTS-TSTS; SYTS-KTS; SMTS-SYTS #1; ROTS-SMTS #2; and HWTS -SMTS #2
  - 43 towers on (HWTS up to T003- Doulton insulators) on HWTS - SMTS #2
  - 32 towers adjacent to Jan 2024 failure site T058 to T092 on HWTS - SMTS #2
  - 1 tower (NGK insulator) on HWTS-SMTS #1
- 71 off 220kV Towers on various circuits.

The total capital expenditure for Option 1 is $41.37 million (nominal). The principal capital expenditure elements, expressed in nominal terms, are:

- Design and internal labour, $3.71 million;
- Materials, $7.47 million;
- Plant & equipment, $3.16 million; and
- Contracts, $22.66 million.
- Other, $4.37M

The ‘other’ expenditure relates to an allowance for risk.

Construction would commence in 2025 with project completion expected by 30 June 2027.

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 provide information about the classes of market benefits that the RIT-T proponent considers are likely not to be material in accordance with 5.15A.2(b)(6). 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 may affect the costs of dispatch by avoiding network constraints as a result of an asset failure. However, this market benefit is not expected to change the ranking of the options, which will be determined principally by the need to mitigate safety and bushfire risks in accordance with AusNet's regulatory obligations.
(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 not expected to have a material impact on involuntary load shedding, given the level of redundancy in the transmission network.
(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 in relation to these matters.
(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 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) changes in Australia's greenhouse gas emissions	The credible options will not have any impact on Australia's greenhouse gas emissions.
(ix) competition benefits	The credible options will not provide any competition benefits.
(x) 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.

Class of Market Benefit	Analysis
(xi) 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 and the previous section, the principal driver in identifying the preferred option is the need to minimise safety and bushfire risks in accordance with AusNet's regulatory obligations.

5.2. Identifying the preferred option

As explained in section 4.4, at this stage it is expected that Option 1, which is to replace all high risk Doulton insulators as a priority, is the preferred option. In the next phase of the RIT-T process, AusNet will set out the detailed cost-benefit analysis to determine the preferred option in accordance with the requirement of the RIT-T.

6. Next steps

AusNet intends to publish a Project Assessment Draft Report (PADR) in relation to this project. However, AusNet notes that a PADR may not be required if this project benefits from the exemption provided by clause 5.16.4(z1), which requires that:

- the preferred option, Option 1, has a capital cost of less than $54 million which would be below the threshold amount determined by the AER in November 2024;
- the 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 for the purpose of the RIT-T.

Accordingly, and subject to reviewing the submissions on this PSCR, AusNet may instead publish a Project Assessment Conclusions Report (**PACR**), rather than a PADR. In any event, AusNet expects to publish either the PADR or PACR by July 2025.

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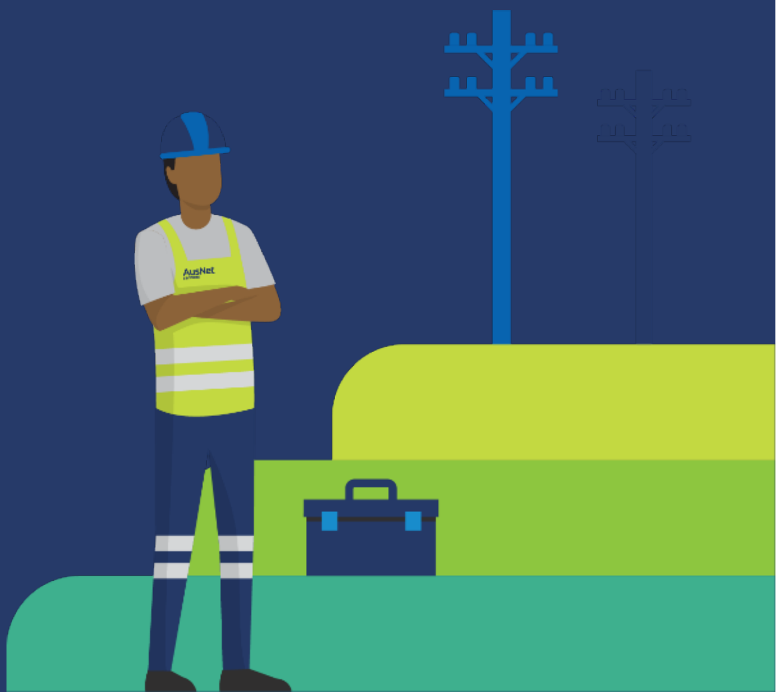

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