Maintaining supply reliability in the Red Cliffs area

Project Specification Consultation Report

Regulatory Investment Test - Transmission

Expected Publication - April 2021

mission zero

AusNet services

Important notice

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

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Executive summary

AusNet Services is initiating this Regulatory Investment Test for Transmission (RIT-T) to evaluate options for maintaining supply reliability in Red Cliffs and the surrounding area. Options investigated in this RIT-T are intended to mitigate the risk of an asset failure at Red Cliffs Terminal Station.

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)[1] and section 4.2 of the RIT-T Application Guidelines[2]. AusNet Services is also exploring opportunities to accelerate the RIT-T process for this project as allowed by NER clause 5.16.4(z1).

Red Cliffs Terminal Station is owned and operated by AusNet Services and is located in Red Cliffs in northern Victoria. It was commissioned in the early 1960's and serves as the main transmission connection point for distribution of electricity to approximately 28,500 Powercor customers. Peak demand at the station during the summer of 2018/19 reached 128 MW at 66 kV and 41 MW at 22 kV.

Identified need

The transformers and circuit breakers at Red Cliffs Terminal Station have been in service for an extended time and the condition of the assets has deteriorated to a level where there is a material risk of asset failure, which could have an impact on electricity supply reliability, safety, environment, and potential costs of emergency replacements. The 'identified need' this RIT-T intends to address is to maintain supply reliability in Red Cliffs and the surrounding area and mitigate risks from asset failures.

AusNet Services estimates that the present value of the baseline risk costs associated with maintaining the existing assets in service is more than $21 million – the largest component is the supply interruption risks borne by electricity consumers. AusNet Services is therefore investigating options that could allow continued delivery of safe and reliable electricity supply.

Credible options

AusNet Services estimates that network or non-network investments are likely to deliver more economical and reliable solutions to maintaining supply reliability in Red Cliffs and the surrounding area, compared with keeping the existing assets in service. The following credible network solutions could meet the identified need:

- Option 1 – Retire two 220/22 kV transformers, install a 220/66 kV transformer, reconfigure the existing three winding transformers that presently supply the 66 kV load to supply the 22 kV load and replace switchgear that are in poor condition in an integrated project; or
- Option 2 – Staged replacement of Option 1, with the switchgear replacement deferred; or
- Option 3 – Staged replacement of Option 1, with the transformer retirement/installation deferred.

AusNet Services welcomes proposals from proponents of non-network options (stand-alone or in conjunction with a network solution), that may meet the identified need, such as:

- options that defer the need to replace at least one 220/22 kV transformer, by addressing short-term supply shortfalls in an event of a 220/22 kV transformer outage and/or

[1] Australian Energy Market Commission, *"National Electricity Rule version126,"* available at https://www.aemc.gov.au/regulation/energy-rules/national-electricity-rules/current, viewed on 7 November 2019.
[2] Australian Energy Regulator, *"Application guidelines Regulatory investment test for transmission,"* available at https://www.aer.gov.au/system/files/AER%20-%20Final%20RIT-T%20application%20guidelines%20-%2014%20December%202018_0.pdf, viewed on 7 November 2019.

simultaneous outage of both 220/22 kV transformers at the terminal station; and

- options that allow for one or more of the 22 kV distribution feeders to become self-sufficient in islanded operation by providing local supply or demand curtailment in conjunction with local supply options.

Assessment approach

AusNet Services will investigate the costs, economic benefits, and ranking of options in this RIT-T assessment. The robustness of the ranking and optimal timing of options will be investigated through sensitivity analysis which involves variation of assumptions around the base case values.

Options assessment and draft conclusion

AusNet Services' cost-benefit assessment of the identified credible options indicates that the integrated replacement that includes replacement of two aged "L" transformers and switchgear (Option 1) is the most economic option and provides the highest present value of net economic benefits. This option will not only maintain supply reliability, but also mitigates safety, environmental, and emergency replacement risk costs from deteriorating assets at Red Cliffs Terminal Station.

Therefore, AusNet Services concludes that delivery of Option 1 is the most economical and thus the preferred option to address the identified need at Red Cliffs Terminal Station. The optimal timing of delivery of the preferred option is 2023/24.

Submissions

AusNet Services welcomes written submissions on the credible options presented in this PSCR and invites proposals from proponents of potential non-network options.

Submissions should be emailed to rittconsultations@ausnetservices.com.au on or before xx July 2021. In the subject field, please reference 'RIT-T PSCR Red Cliffs Terminal Station.'

Next steps

In the event that no additional credible options that could deliver a material market benefit are identified during the 12-week consultation period, AusNet Services intends to invoke an exemption from publication of a Project Assessment Draft Report (PADR) as per NER clause 5.16.4(z1) and produce a Project Assessment Conclusions Report (PACR) before xx July 2021. If additional credible options are identified, this exemption will no longer apply and AusNet Services, in accordance with NER clause 5.16.4(z1)(4), will assess all credible options and aim to produce a PADR before xx July 2021.

Table of Contents

Figures

Tables

1. Introduction

AusNet Services is initiating this Regulatory Investment Test for Transmission (RIT-T) to evaluate options to maintain supply reliability in Red Cliffs and the surrounding area to mitigate the risk of asset failure at Red Cliffs Terminal Station (RCTS).

Publication of this Project Specification Consultation Report (PSCR) represents the first step in the RIT-T process[3] in accordance with clause 5.16 of the National Electricity Rules (NER)[4] and section 4.2 of the RIT-T Application Guidelines.[5]

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 specific categories of market benefits that are unlikely to be material in this RIT-T.

The need for investment to address risks from the deteriorating assets is presented in AusNet Services Asset Renewal Plan, published as part of AEMO's 2019 Victorian Transmission Annual Planning Report (VAPR)[6].

1.1. Making submissions

AusNet Services welcomes written submissions on the credible options presented in this PSCR and invites proposals from proponents of potential non-network options. Submissions should be emailed to rittconsultations@ausnetservices.com.au on or before xx July 2021. In the subject field, please reference 'RIT-T PSCR Red Cliffs Terminal Station.'

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 lodgment.

[3] A RIT-T process will assess the economic efficiency and technical feasibility of proposed network and non-network options.

[4] Australian Energy Market Commission, *"National Electricity Rule version126,"* available at https://www.aemc.gov.au/regulation/energy-rules/national-electricity-rules/current, viewed on 7 November 2019.

[5] Australian Energy Regulator, *"Application guidelines Regulatory investment test for transmission,"* available at https://www.aer.gov.au/system/files/AER%20-%20Final%20RIT-T%20application%20guidelines%20-%2014%20December%202018_0.pdf, viewed on 7 November 2019.

[6] Australian Energy Market Operator, *"Victorian Annual Planning Report,"* available at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Victorian-transmission-network-service-provider-role/Victorian-Annual-Planning-Report, viewed on 7 November 2019.

2. Identified need

The role of the Red Cliffs Terminal Station in providing electricity supply services and the condition of key assets are discussed below. Quantification of the risk costs associated with the deterioration of these assets, and the need for the investments are also presented.

2.1. Supply to Red Cliffs and the surrounding area

Red Cliffs Terminal Station is owned and operated by AusNet Services and is in Red Cliffs, in northern Victoria. Since it was commissioned in the early 1960's, Red Cliffs Terminal Station has served as the main 220/66 kV and 220/22 kV transmission connection point for distribution of electricity, via the Powercor distribution network, to communities in the towns of Red Cliffs, Colignan, Werrimull, Merbein, Mildura and Robinvale.[7]

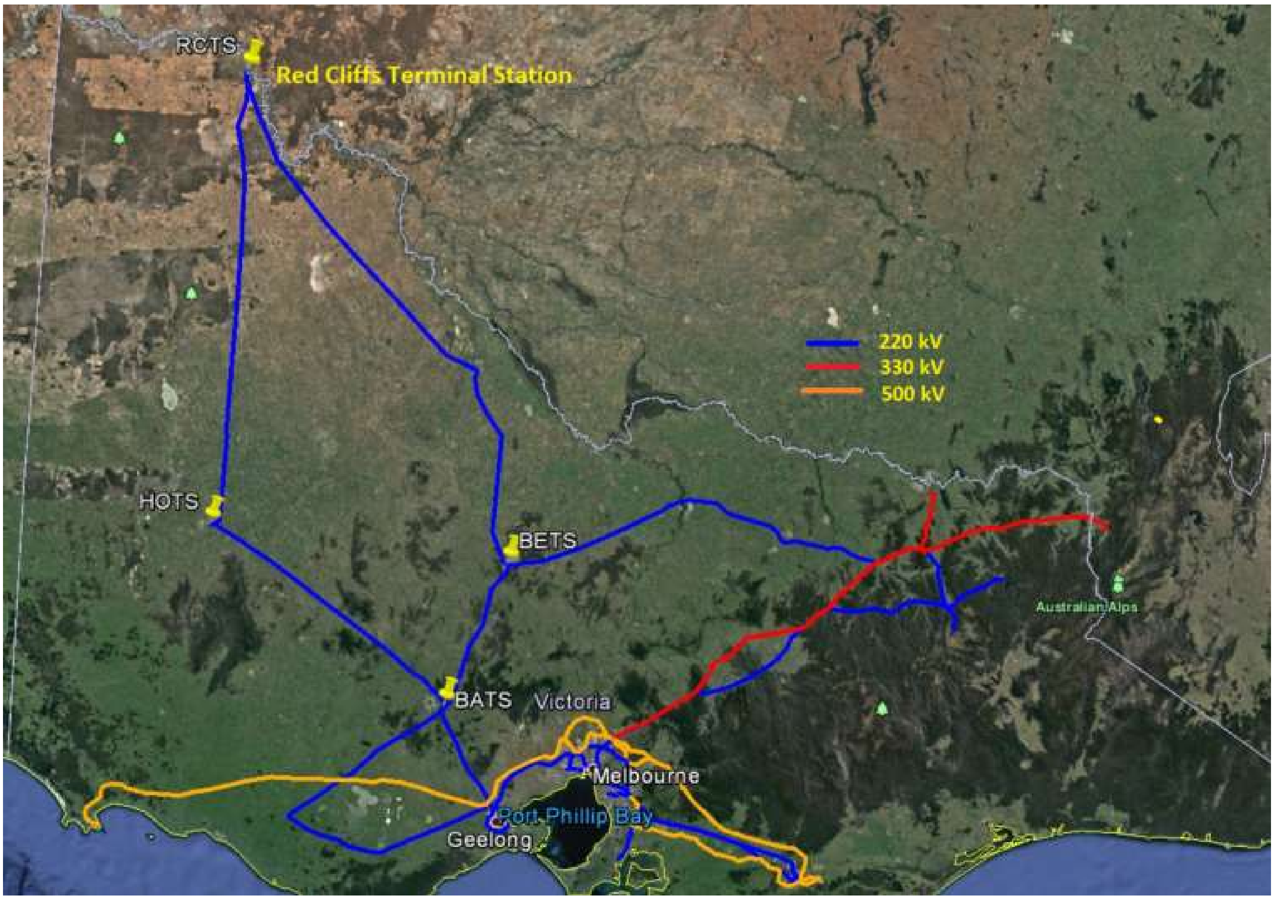

Figure 1 – Transmission network supplying Red Cliffs Terminal Station

Electricity demand

Approximately 28,500 customers depend on Red Cliffs Terminal Station for their electricity supply. The majority of total annual energy at Red Cliffs Terminal Station is consumed by Commercial customers (46.9%) and Residential customers (29.0%) with the remainder consumed by Industrial and Agricultural customers as illustrated in Table 1.

[7] Distribution of electricity to relevant communities is supported by Powercor.

Table 1 - Customer demand composition

Customer type	Share of consumption (%)
Commercial	46.9%
Residential	29.0%
Industrial	16.9%
Agricultural	7.2%
Total	100%

During the 2018/19 summer, peak demand at Red Cliffs Terminal Station reached 128 MW on the 66 kV, and 41 MW on the 22 kV.

The Australian Energy Market Operator (AEMO) forecasts[8] that peak demand at Red Cliffs Terminal Station will remain at present levels over the next ten years. Figure 2 and Figure 3 show the 10% probability of exceedance (POE10)[9] and the 50% probability of exceedance (POE50)[10] forecasts for peak demand during summer and winter periods[11] for the Red Cliffs Terminal Station 66 kV and 22 kV networks respectively.

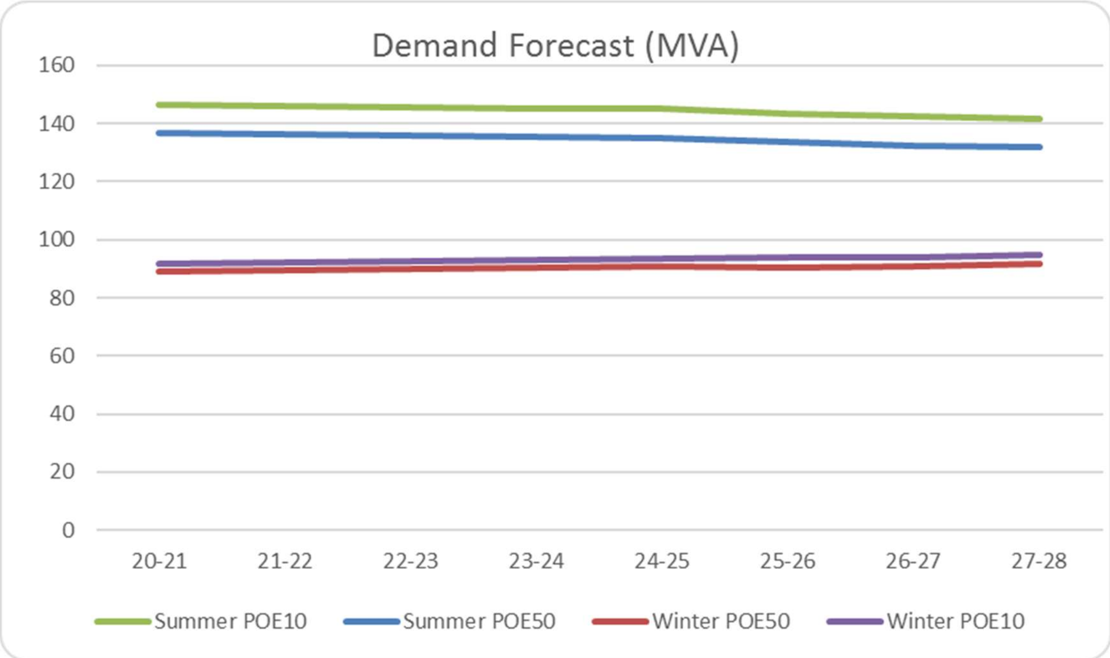

Figure 2 - Demand forecasts for Red Cliffs Terminal Station 66 kV network

[8] Australian Energy Market Operator (AEMO), *"2018 Transmission Connection Point Forecast for Victoria,"* available at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting/Victoria, viewed on 7 November 2019.

[9] A POE10 forecast indicates a level where there is 10 % likelihood that actual peak demand will be greater.

[10] A POE50 forecast indicates a level where there is 50 % likelihood that actual peak demand will be greater.

[11] Victorian electricity demand is sensitive to ambient temperature. Peak demand forecasts are therefore based on expected demand during extreme temperature that could occur once every ten years (POE10) and during average summer condition that could occur every second year (POE50).

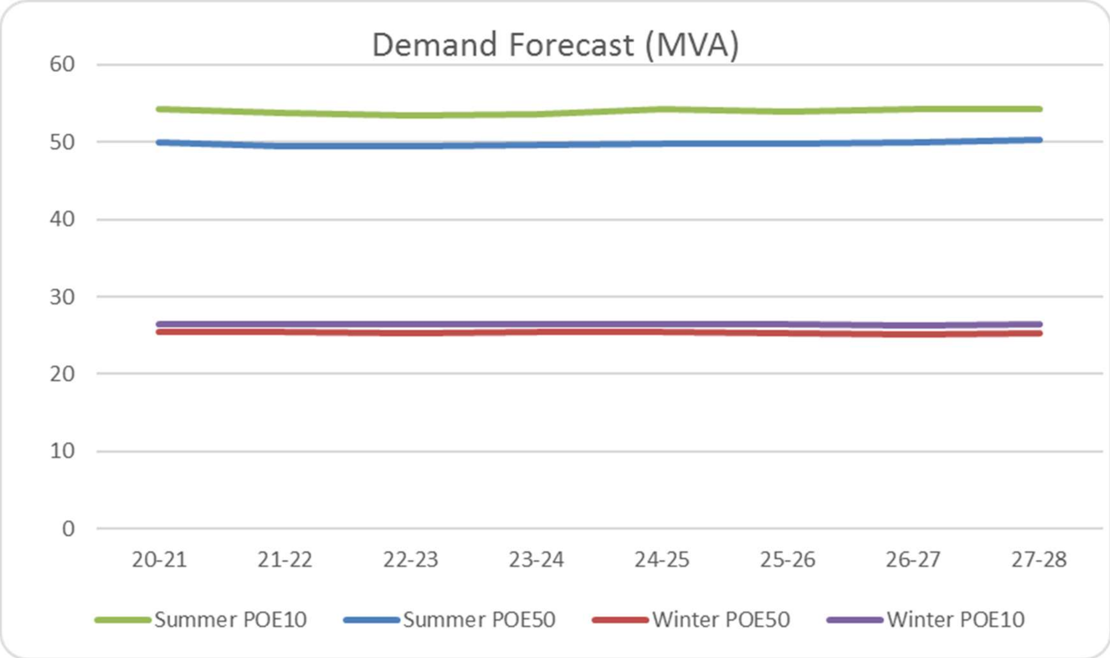

Figure 3 - Demand forecasts for Red Cliffs Terminal Station 22 kV network

AEMO and Powercor forecasts confirm there is an ongoing need for electricity supply services to communities in Red Cliffs and the surrounding area as reflected in the official demand forecast for Red Cliffs Terminal Station.

Embedded generation

There are two major embedded generators – the Karadoc Solar Farm (112 MW) and the Yatpool Solar Farm (106 MW) - connected at Red Cliffs Terminal Station 66 kV.

Electricity network

Red Cliffs Terminal Station sources its electricity supply from the 220 kV transmission network in the northern part of Victoria, as shown in Figure 1. It is also connected to the New South Wales (NSW) electricity network via Buronga. Red Cliffs Terminal Station supplies five 66 kV feeders (Powercor) that distribute electricity to customers, as shown in Figure 4. The zone substations supplied from Red Cliffs Terminal Station include Merbein (MBN), Karadoc Solar Farm (KSF), Mildura (MDA), Robinvale (RVL) and Yatpool Solar Farm (YSF).

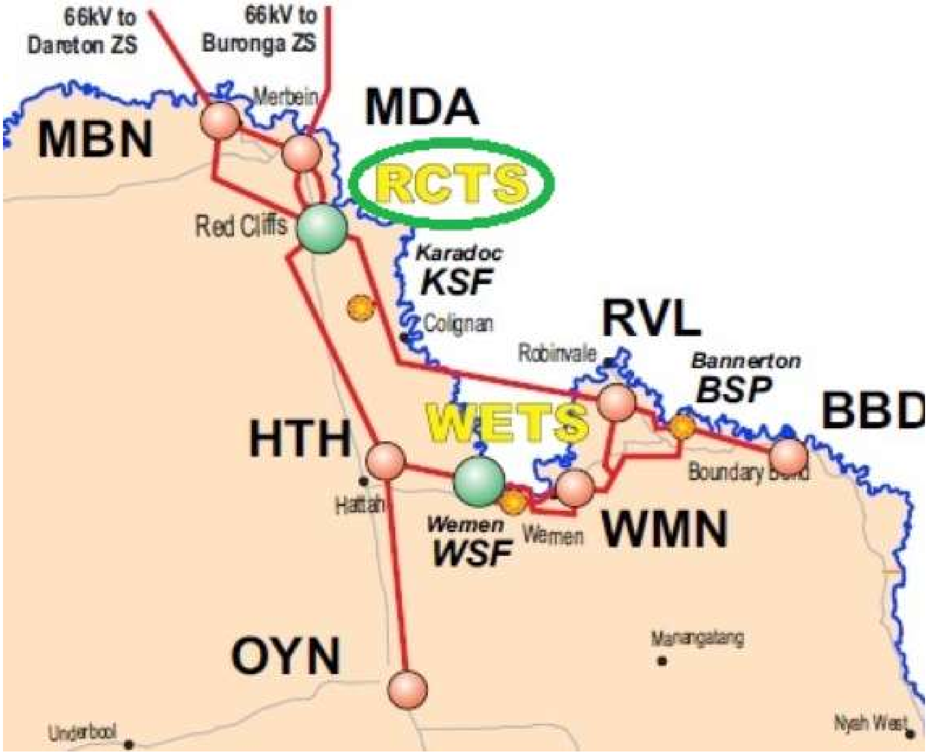

Figure 4 - Distribution network supplied from Red Cliffs Terminal Station

2.2. Asset condition

Several primary (power transformers and circuit breakers) and secondary (protection and control) assets at Red Cliffs Terminal Station are in poor condition as expected of assets that have been in service for a long time.

AusNet Services classifies asset condition using scores that range from C1 (initial service condition) to C5 (extreme deterioration) – as set out in Appendix C. The latest asset condition assessment for Red Cliffs Terminal Station was conducted in 2019 and reveals some assets at the terminal station are in poor condition (C4) or very poor condition (C5). For the affected assets, the probability of failure is high, and is likely to increase further if no remedial action is taken. Table 2 provides a summary of the condition of relevant major equipment.

Table 2 - Summary of major equipment condition scores (quantity of assets)

Asset class	Condition scores				
	C1	C2	C3	C4	C5
Power transformers	1		2	2	
220 kV current transformers	5	3	6	7	2
66 kV circuit breakers	3	2	6		2
66 kV current transformers	2	11	4	7	10
66 kV voltage transformers				2	
22 kV circuit breakers					3
22 kV current transformers	3	1	8	5	1
22 kV voltage transformers	6			2	

Power transformers

There are five 220/66/22 kV transformers (named B1, B2, B3, L1 and L2) at Red Cliffs Terminal Station. The B1 and B2 transformers are rated at 70 MVA each, and together with the B3 (140 MVA) transformer they supply the 66 kV load at Red Cliffs. All three B transformers are in good condition.

The smaller L1 and L2 transformers providing 22 kV supply, are in poor condition (C4) and require remedial action within the next five years. The probability of a L transformer failure is forecast to increase over time as the condition of these two transformers deteriorates further.

Circuit breakers

There are two 66 kV circuit breakers and three 22 kV circuit breakers at Red Cliffs Terminal Station that are in poor condition or have suffered extreme deterioration and are approaching their end of serviceable life. The 66 kV circuit breakers will be replaced as part of an existing committed project.

This RIT-T intends to address the risks associated with the three 22 kV circuit breakers that are in poor condition, failure of these assets would impact the 22 kV supply reliability at Red Cliffs. All three 22 kV breakers identified for replacement are transformer circuit breakers.

Instrument transformers

Several instrument transformers (220 kV, 66 kV and 22 kV current transformers and voltage transformers) at Red Cliffs Terminal Station are assessed to be in poor condition and are in an advanced deterioration phase (C4 and C5). Management of safety risks from potential explosive failures[12] of instrument transformers is costly due to the need for regular oil sampling and partial discharge condition monitoring. These instrument transformers need to be replaced for correct functioning of the protection systems and to maintain supply reliability to consumers.

2.3. Description of the identified need

Red Cliffs Terminal Station provides electricity supply to Red Cliffs and surrounding area. The services that the terminal station provides will continue to be required as the demand for electricity is forecast to remain at present levels over the next ten year period. The poor and deteriorating condition of some of the components at the terminal station has increased the likelihood of asset failures. Such failures would result in prolonged supply outages.

Without remedial action, other than ongoing maintenance practice (business-as-usual), affected assets are expected to deteriorate further and more rapidly. Further increase in the probability of failure will result in a higher likelihood of electricity supply interruptions, heightened safety risks due to potential explosive failure of the assets, environmental risks from possible oil spillage, collateral damage risks to adjacent plant, and the risk of increased costs resulting from the need for emergency asset replacements and reactive repairs.

Therefore, the ‘identified need’ this RIT-T intends to address is to maintain supply reliability in Red Cliffs and surrounding area and to mitigate risks from relevant asset failures.

AusNet Services calculated the present value of the baseline risk costs to be more than $21 million over the forty-five year period from 2020/2021. The key elements of these risk costs are shown in Figure 5. The largest component of the baseline risk costs is the supply interruption risk, which is borne by electricity consumers.

[12] Since 2002, two current transformers of this type have failed explosively in the Victorian network.

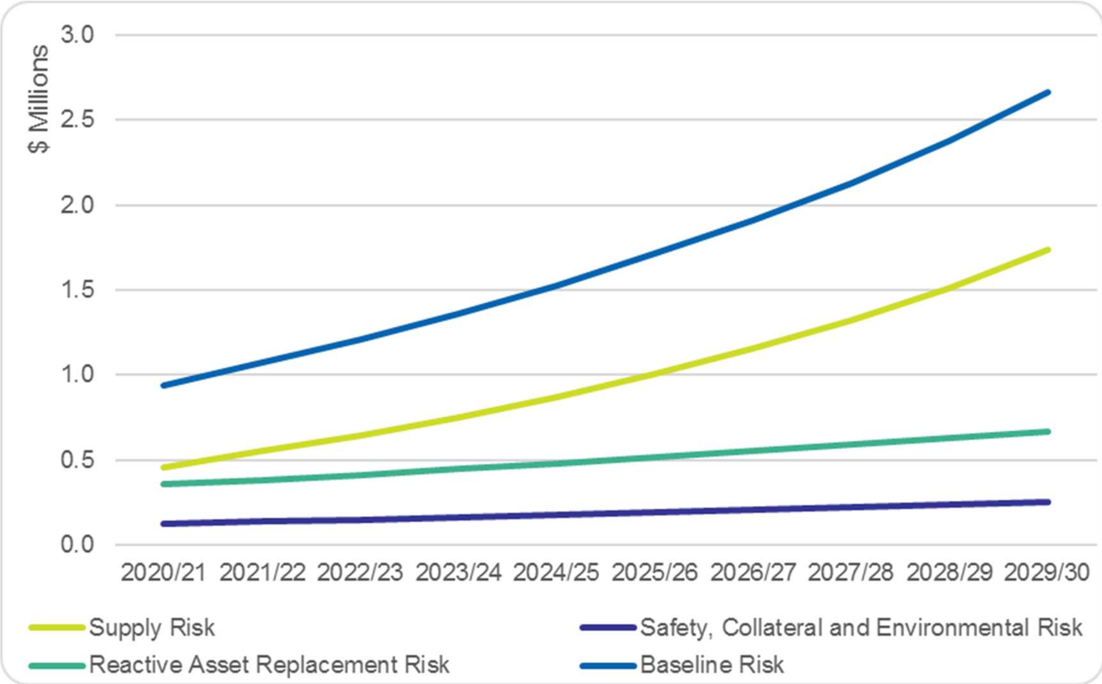

Figure 5 - Baseline risk costs

By undertaking the options identified in this RIT-T, AusNet Services will be able to maintain supply reliability in Red Cliffs and surrounding area and mitigate safety and environmental risks, as required by the NER and Electricity Safety Act 1998[13].

2.3.1. Assumptions

In addition to the failure rates (determined by the condition of the assets) and the likelihood of relevant consequences, AusNet Services has adopted assumptions to quantify the risks associated with asset failure. These assumptions are detailed in the following subsections.

Supply risk costs

In calculating the supply risk costs, AusNet Services has estimated the unserved energy based on the most recent AEMO demand forecasts for Red Cliffs Terminal Station,[14] and has valued this expected unserved energy with the latest AER Value of Customer Reliability (VCR)[15]. The choice of VCR value is based on those published by the AER and the composition of customers supplied by the terminal station. The resulting estimate of the weighted VCR applicable for affected customers at Red Cliffs Terminal Station is $40,591/MWh.

The total supply risk cost is calculated by estimating the impacts of different combinations of relevant forced outages to reliability of supply and weighting them by their probabilities of occurrence.

Safety risk costs

[13] Victorian State Government, Victorian Legislation and Parliamentary Documents, *"Energy Safe Act 1998,"* available at http://www.legislation.vic.gov.au/domino/Web_Notes/LDMS/LTObject_Store/ltobjst9.nsf/DDE300B846EED9C7CA257616000A3571/1D9C11F63DEBA5E2CA257E70001687F4/%24FILE/98-25aa071%20authorised.pdf, viewed on 7 November 2019.

[14] Australian Energy Market Operator (AEMO), *"2019 Transmission Connection Point Forecast for Victoria,"* available at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting/Victoria, viewed on 7 November 2019.

[15] In dollar terms, the Value of Customer Reliability (VCR) represents a customer's willingness to pay for the reliable supply of electricity. The values produced are used as a proxy, and can be applied for use in revenue regulation, planning, and operational purposes in the National Electricity Market (NEM).

The Electricity Safety Act 1998[16] requires AusNet Services to design, construct, operate, maintain, and decommission its network to minimize 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 asset failures, AusNet Services uses:

- a value of statistical life[17] to estimate the benefits of reducing the risk of death;
- a value of lost time injury[18]; and
- a disproportionality factor[19].

AusNet Services notes this approach, including the use of a disproportionality factor, is consistent with the practice notes[20] provided by the AER.

Financial risk costs

As there is a lasting need for the services that the Red Cliffs Terminal Station provides, the failure rate-weighted cost of replacing failed assets (or undertaking reactive maintenance) is included in the assessment.[21]

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 $30,000 per event while risks from transformers with oil containing poly-chlorinated biphenyls (PCB) are valued at $100,000 per event.

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16 Victorian State Government, Victorian Legislation and Parliamentary Documents, *"Energy Safe Act 1998,"* available at http://www.legislation.vic.gov.au/domino/Web_Notes/LDMS/LTObject_Store/ltobjst9.nsf/DDE300B846EED9C7CA257616000A3571/1D9C11F63DEBA5E2CA257E70001687F4/%24FILE/98-25aa071%20authorised.pdf, viewed on 7 November 2019.

17 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, viewed on 7 November 2019.

18 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, viewed on 7 November 2019.

19 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.

20 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, viewed on 7 November 2019.

21 The assets are assumed to have survived and their condition-based age increases throughout the analysis period.

3. Credible network options

AusNet Services will consider both network and non-network options to address the identified need caused by the deteriorating assets at Red Cliffs Terminal Station.

The network options AusNet Services has identified are presented below and the technical requirements that a non-network option would have to provide are detailed in the next chapter.

3.1. Option 1 – Replace transformers and switchgear in an integrated project

Option 1 includes the following scope of work:

- Installation of one standard "B" (150 MVA 220/66/22 kV) transformer;
- Retiring the two L transformers and then using the tertiary windings of the two B transformers to supply the 22 kV load;
- Replacement of three 22 kV circuit breakers; and
- Replacement of selected 220 kV, 66 kV and 22 kV instrument transformers and associated primary and secondary equipment.

The estimated capital cost of this option is $22.89 million with no material change in operating cost and an estimated delivery lead time of three to four years.

After the project, the new B transformer (150 MVA 220/66/22 kV) will be used to supply the 66 kV demand with the existing B3 transformer (140 MVA 220/66/22 KV) while the existing B1 and B2 transformers (70 MVA 220/66/22 kV) will be used to supply 22 kV demand of the Red Cliffs Terminal Station.

3.2. Option 2 – Staged replacement with switchgear replacement deferred

Option 2 is a staged replacement option to reduce the asset failure risk in stages. The transformer replacements and changes as described in Option 1 will be completed in the first stage.

The switchgear (circuit breakers, instrument transformers and associated primary and secondary equipment) that are in poor condition will then be replaced around five years after completion of the first stage.

The estimated capital cost of the first and second stage of this option is $11.51 million and $12.52 million respectively with no material change in operating cost and an estimated delivery lead time of three to four years.

3.3. Option 3 – Staged replacement with transformer replacement deferred

Option 3 is another staged replacement option. Selected switchgear (circuit breakers, instrument transformers and associated primary and secondary equipment) that are in poor condition will be replaced in the first stage, and the transformer replacements are deferred with five years.

The estimated capital cost of the first and second stage of this option is $11.58 million and $12.44 million respectively with no material change in operating cost and an estimated delivery lead time of three to four years.

3.4. Options considered and not progressed

Retirement of aging plant such as the L transformers may avoid emergency reactive replacement, environment, and safety risk costs, but will also reduce the terminal station's capacity and increase supply risk costs as illustrated in Figure 6.

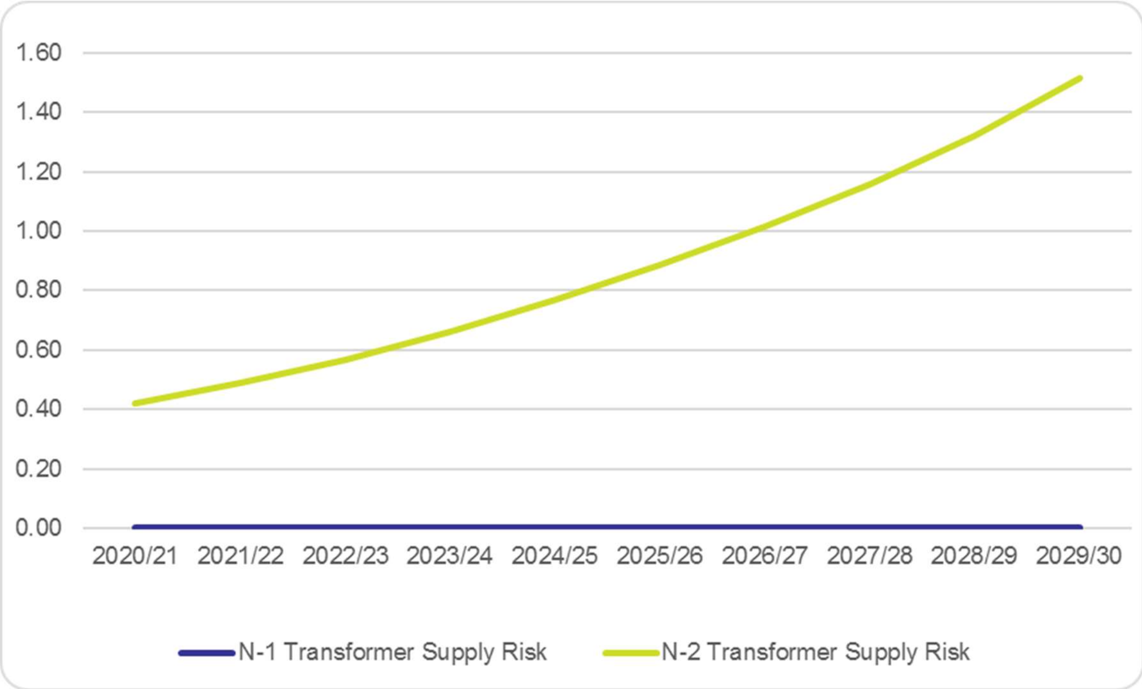

Figure 6 - Supply risk costs if one "L" transformer was retired

Therefore, any option that reduces the terminal station capability is not progressed further.

Refurbishment options do not significantly reduce the failure rates and the risks from asset failure and are therefore not progressed further for this RIT-T.

3.5. Material inter-regional network impact

As the 22 kV supplies from Red Cliffs Terminal Station are electrically radial, and the network impact is confined to Red Cliffs and surrounding area, none of the network options being 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."*

No material inter-regional network impact associated with any option considered in this RIT-T has been identified when applying AEMO's suggested screening test, which requires the investment to be tested against the following criteria:[22]

- a decrease in power transfer capability between transmission networks or in another TNSP's network of no more than the minimum of 3% of the maximum transfer capability and 50 MW
- an increase in power transfer capability between transmission networks or in another TNSP's

[22] Inter-Regional Planning Committee, *"Final Determination: Criteria for Assessing Material Inter-Network Impact of Transmission Augmentations,"* available at https://www.aemo.com.au/-/media/Files/PDF/170-0035-pdf.pdf, viewed on 7 November 2019.

network of no more than the minimum of 3% of the maximum transfer capability and 50 MW

- an increase in fault level by less than 10 MVA at any substation in another TNSP's network
- the investment does not involve either a series capacitor or modification in the vicinity of an existing series capacitor.

4. 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.

Table 3 lists some of the potential non-network services that AusNet Services considers may assist in meeting the identified need:

Table 3 - Potential services that could be provided by non-network options

Non-network option	High-level requirements	Supplementary network requirements
Back-up supply (combined network and non-network solution)	At least 21.5 MW of back-up supply for major transformer failure(s).	This service could defer the need for replacement of the "L" transformers.
	Supply to defer at least one 22 kV transformer circuit breaker replacement at Red Cliffs Terminal Station	Depending on the size and which feeder the non-network option is offered at, this service could reduce the scope of replacement needs and allow deferral of investment while mitigating the failure risks from deteriorating assets.

4.1. Required technical characteristics of a non-network option

A suitable non-network solution should be capable of either removing or postponing the need for replacement of an "L" transformer and/or 22 kV transformer circuit breaker/s. This could be achieved either by providing the non-network support to supply the entire 22 kV load of the feeder/s or part of the load.

Figure 7 shows the typical annual demand profile serviced by Red Cliffs Terminal Station 22 kV transformers and the supportable demand levels for different network outage configurations. Using this reference demand profile, any non-network option would need to be able to reliably and immediately reduce the loading on the terminal station or a 22 kV feeder to be considered as a credible option to defer planned network investments.

Whilst this section provides basic information that proponents of non-network solutions could use to evaluate their proposals, AusNet Services invites a collaborative approach and is open to discussions to maximize the potential benefits from non-network options.

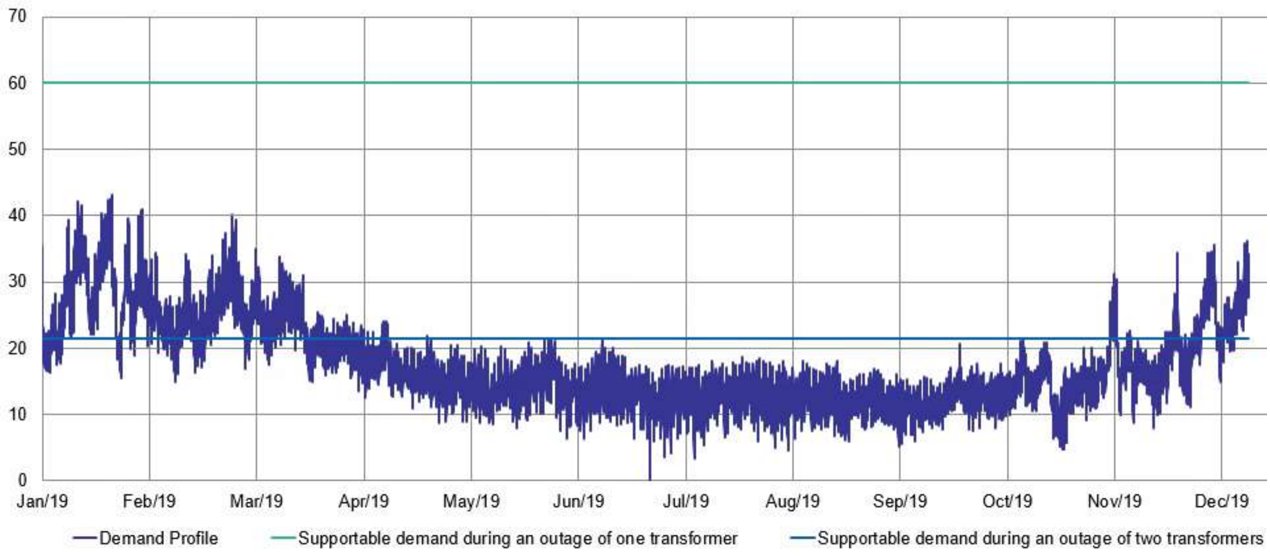

Figure 7 - Typical annual demand profile (MVA) and supportable demand level for a transformer outage

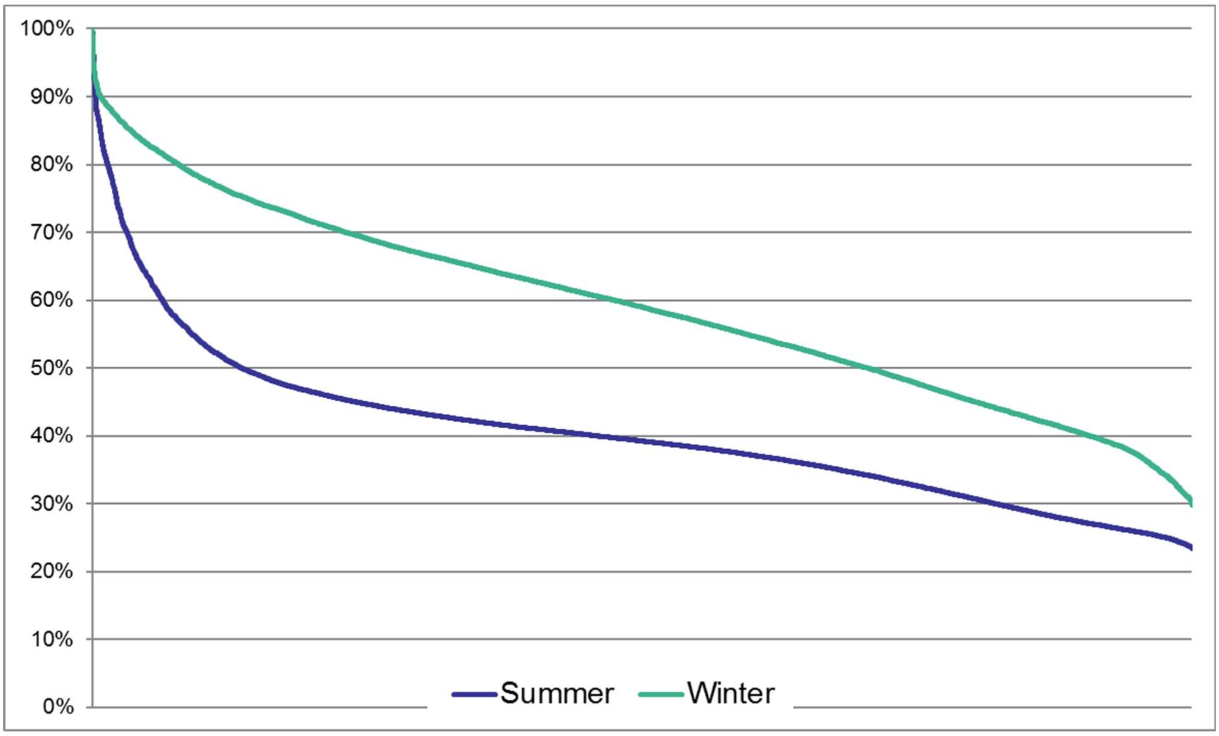

Figure 8 – Red Cliffs Terminal Station summer and winter demand duration curves

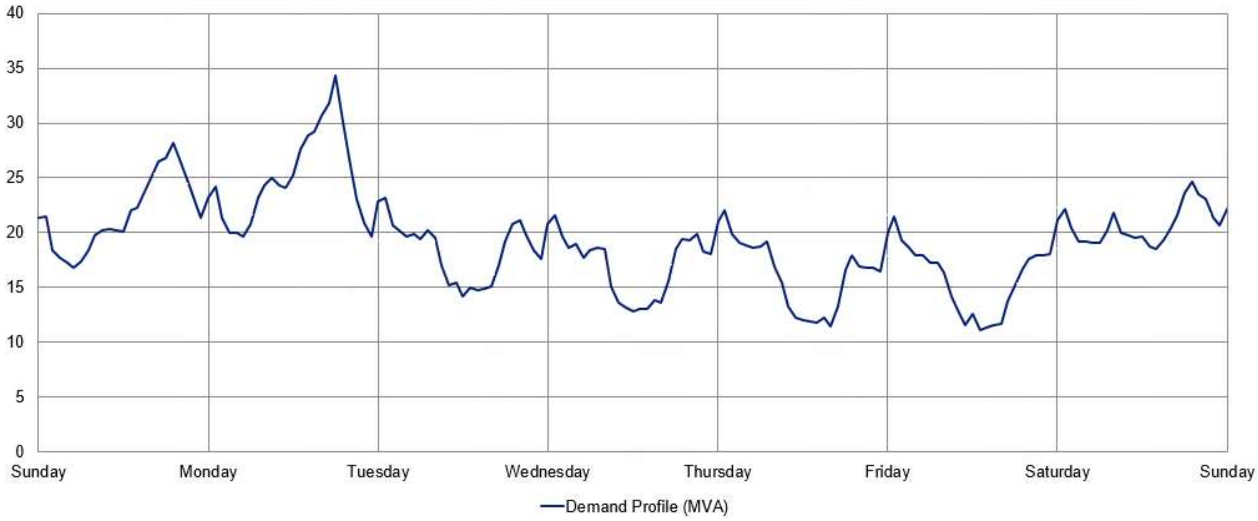

Figure 9 - Red Cliffs Terminal Station typical summer weekly demand profile

4.2. Location of non-network option

Non-network options connected to any of the 22 kV feeders supplied from the Red Cliffs Terminal Station could be effective in addressing the supply shortfall risk.

4.3. Information to be included in non-network solution proposals

Proposals for non-network solutions should preferably be at least 5 MW in size and of proven technology and may include embedded generation, energy storage (including battery system) that injects power into the grid as required, voluntary curtailment of customer demand, and permanent reduction of customer demand (including energy efficiency).

Table 4 shows the relevant parameters that must be included in any proposal for non-network solution.

Table 4 - Required information that a proponent of non-network option must submit

Parameter	Description
Block ID	Block Identifier (e.g. Block 1) of non-network solution
Block capacity	Discrete amount of the non-network option (reduced demand or additional supply) capacity in MW. Sum of block capacities must meet a minimum requirement of 5 MW. AusNet Services may choose to select a subset of blocks it determines that is most economical and reliable to dispatch.
Location	For new generation solutions, details of the proposed sites for the new generators
Availability period	Time periods the blocks are available (months/days/hours)
Call notice period	Minimum period of time before the block can be dispatched
Establishment fee	Setup payment that applies to a block
Availability fee	A fee per month for a block to be made available to be dispatched
Indicative dispatch fee	Fee for a block to be dispatched per MWh

Parameter	Description
Dispatch lead time	Time required (in hours) to activate the non-network service
Timeframe for project delivery	When the block of DR will be available for dispatch
Communications	Proposed dispatch communications protocol with AusNet Services' control room
Metering	Metering equipment installed or to be installed to measure and record the data to be verified
Any other special technical requirements	e.g. terms of commitment and length of service.

Proposals for non-network solutions should be emailed to rittconsultations@ausnetservices.com.au by xx July 2021.

5. Assessment approach

Consistent with the RIT-T requirements and practice notes on risk-cost assessment methodology[23], AusNet Services will undertake a cost-benefit analysis to evaluate and rank the net economic benefits from various credible options. AusNet Services proposes to undertake this assessment over a 45-year period.

All options considered will be assessed against a business-as-usual case where no proactive capital investment to reduce the increasing baseline risks is made.

Optimal timing of an investment option will be the year when the annual benefits from implementing the option become greater than the annualised investment costs.

5.1. Proposed sensitivity analysis and input assumptions

The robustness of the investment decision and the optimal timing of the preferred option will be tested by a sensitivity analysis. This analysis involves variation of assumptions from those employed under the base case.

Table 5 - Input assumptions used for the sensitivity studies

Parameter	Lower Bound	Base Case	Higher Bound
Asset failure rate	AusNet Services assessment – 25%	AusNet Services assessment	AusNet Services assessment + 25%
Demand forecast	AEMO 2019 Transmission Connection Point Forecasts - 15%	AEMO 2019 Transmission Connection Point Forecasts	AEMO 2019 Transmission Connection Point Forecasts + 15%
Value of customer reliability	Latest AER VCR figures - 25%	Latest AER VCR figures	Latest AER VCR figures + 25%
Discount rate	2.58% - a symmetrical adjustment downwards	4.68% - the latest commercial discount rate	6.78% - a symmetrical adjustment upwards

5.2. Material classes of market benefits

NER clause 5.16.1(c)(4) formally sets out the classes of market benefits that must be considered in a RIT-T. AusNet Services estimates that the only class of market benefits that is likely to be material is the change in involuntary load shedding. AusNet Services' proposed approach to calculate the benefits of reducing the risk of load shedding is set out in section 2.3.

5.3. Other classes of benefits

Although not formally classified as classes of market benefits under the NER, AusNet Services expects material reduction in: safety risks from potential explosive failure of deteriorated assets, environment risks from possible oil spillage, collateral damage risks to adjacent plant, and the risk of increased costs resulting from the need for emergency asset replacements and reactive repairs by implementing

[23] 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, viewed on 7 November 2019.

any of the options considered in this RIT-T.

5.4. Classes of market benefits that are not material

AusNet Services estimates that the following classes of market benefits are unlikely to be material for any of the options considered in this RIT-T:

- Changes in fuel consumption arising through different patterns of generation dispatch - as the network is sufficiently radial to the extent that asset failures cannot be remediated by re-dispatch of generation and the wholesale market impact is expected to be the same for all options.
- Changes in costs for parties, other than the RIT-T proponent – there is no other known investment, either generation or transmission, that will be affected by any option considered.
- Changes in ancillary services costs – the options are not expected to impact on the demand for and supply of ancillary services.
- Change in network losses –while changes in network losses are considered in the assessment, they are estimated to be small and unlikely to be a material class of market benefits for any of the credible options.
- Competition benefits – there is no competing generation affected by the limitations and risks being addressed by the options considered for this RIT-T.
- Option value – as the need for and timing of the investment options are driven by asset deterioration, there is no need to incorporate flexibility in response to uncertainty around any other factor.

AusNet Services notes that non-network options of significant size and duration may impact the wholesale electricity market and the materiality of several of the classes of market benefits mentioned above. Where appropriate, AusNet Services will assess the materiality of these market benefits as part of the next step in the evaluation process.

6. Options assessment

This section details the analysis of the costs and benefits from the network options considered in this RIT-T. Any credible option that may arise from submissions in response to this PSCR will be assessed and presented as part of the next step of this RIT-T. If there are no new credible options to assess, AusNet Services intends to progress to the final stage (PACR) of the RIT-T.

All the options considered in this RIT-T will deliver a reduction in supply risk, safety risk, environment risk, collateral risk and risk cost of emergency replacement if the asset failed.

6.1. Sensitivity analysis

This section describes the sensitivity of the net economic benefits, ranking of options, and optimal timing of the preferred option for different assumptions of key variables.

Sensitivity of net economic benefits

Using the Central scenario as the reference, the net economic benefits from implementing an option changes with different assumptions of key variables. While the benefits are sensitive, the net economic benefits are still positive in all sensitivities studied and the ranking of options remains similar. This confirms that the selected option (Option 1) presents a robust investment decision and is also the most economical investment option for most of the sensitivities tested, as shown in Figure 10.

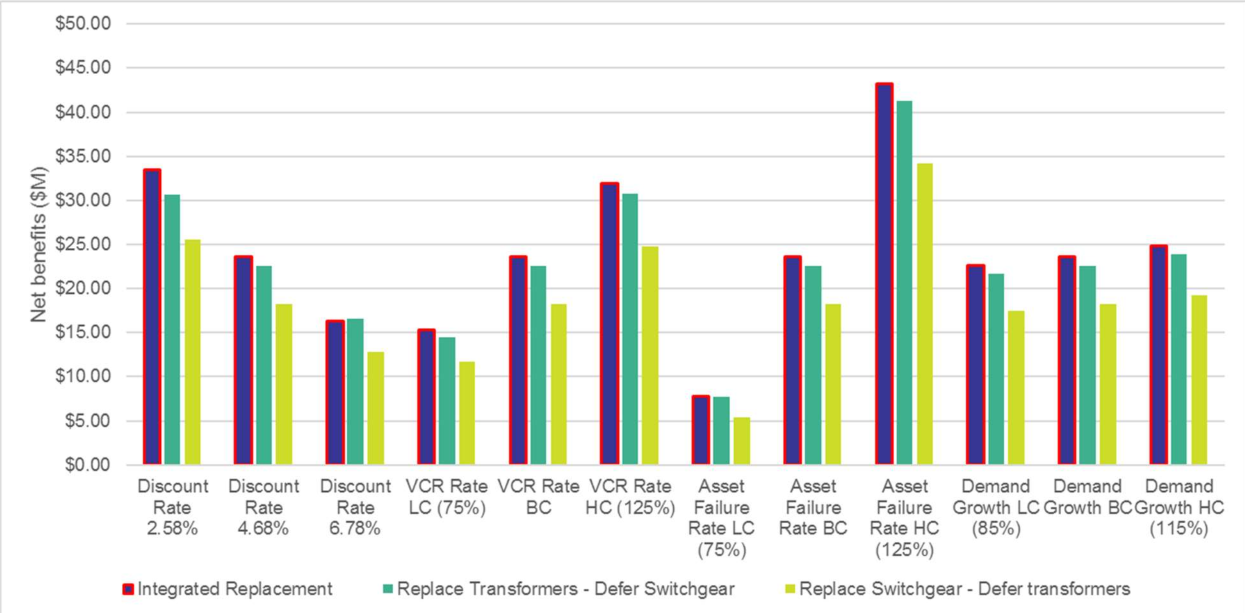

Figure 10 - Sensitivity of the net economic benefits with respect to variation of key parameters

Sensitivity of optimal timing

Figure 11 shows that for the majority of sensitivities investigated, the optimal timing of the preferred option is to complete the project in 2023/24.

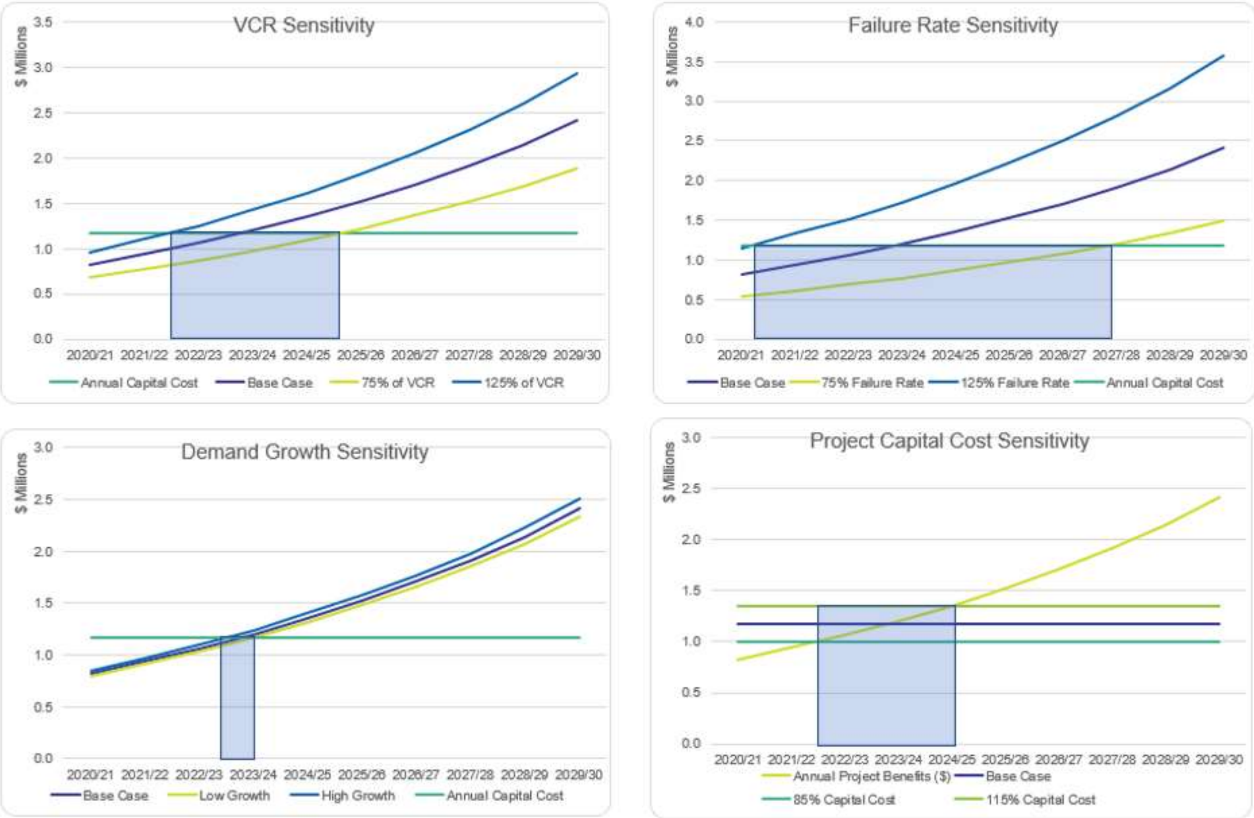

Figure 11 - Sensitivity of the optimal timing with respect to variation of key parameters

7. Draft conclusion and next steps

Amongst the options considered in this RIT-T, Option 1 is the most economical option to maintain supply reliability in Red Cliffs and surrounding area and manage safety, environmental and emergency replacement risks at the Red Cliffs Terminal Station.

This preferred option involves the following scope of work in a single integrated project:

- Installation of one standard "B" transformer; and
- Retiring the two L transformers and then using the tertiary windings of the two B transformers to supply the 22 kV load; and
- Replacement of three 22 kV circuit breakers; and
- Replacement of selected 220 kV, 66 kV and 22 kV instrument transformers and associated primary and secondary equipment.

The estimated capital cost of this option is $22.89 million with no material change to the operating and maintenance cost.

Based on AusNet Services' preliminary analysis, this option is economical to proceed and be completed by 2023/24.

Submissions

AusNet Services welcomes written submissions on the credible options presented in this PSCR and invites proposals from proponents of potential non-network options.

Submissions should be emailed to rittconsultations@ausnetservices.com.au on or before xx July 2021. In the subject field, please reference 'RIT-T PSCR Red Cliffs Terminal Station.'

Exemption from preparing a PADR

Subject to receipt of technically and economically-feasible network or non-network options, publication of a Project Assessment Draft Report (PADR) may not be required for this RIT-T as:

- the preferred option, Option 1, which has a capital cost of less than $43 million, addresses the identified need most economically;
- all credible options will not have a material class of market benefits except for those specified in NER clause 5.16.1(c)(4)(ii), and 5.16.1(c)(4)(iii); and
- this project has the benefit of NER clause 5.16.4(z1);

Should AusNet Services consider that no additional credible options were identified during the 12-week consultation period, AusNet Services intends to produce a Project Assessment Conclusions Report (PACR) before xx July 2021.

In accordance with NER clause 5.16.4(z1)(4), the exemption from producing a PADR will no longer apply if AusNet Services considers that an additional credible option that could deliver a material market benefit has been identified during the consultation period. Accordingly, AusNet Services will aim to produce a PADR which will include assessment of the net economic benefits from each additional credible option before xx July 2021.

Appendix A - RIT-T assessment and consultation process

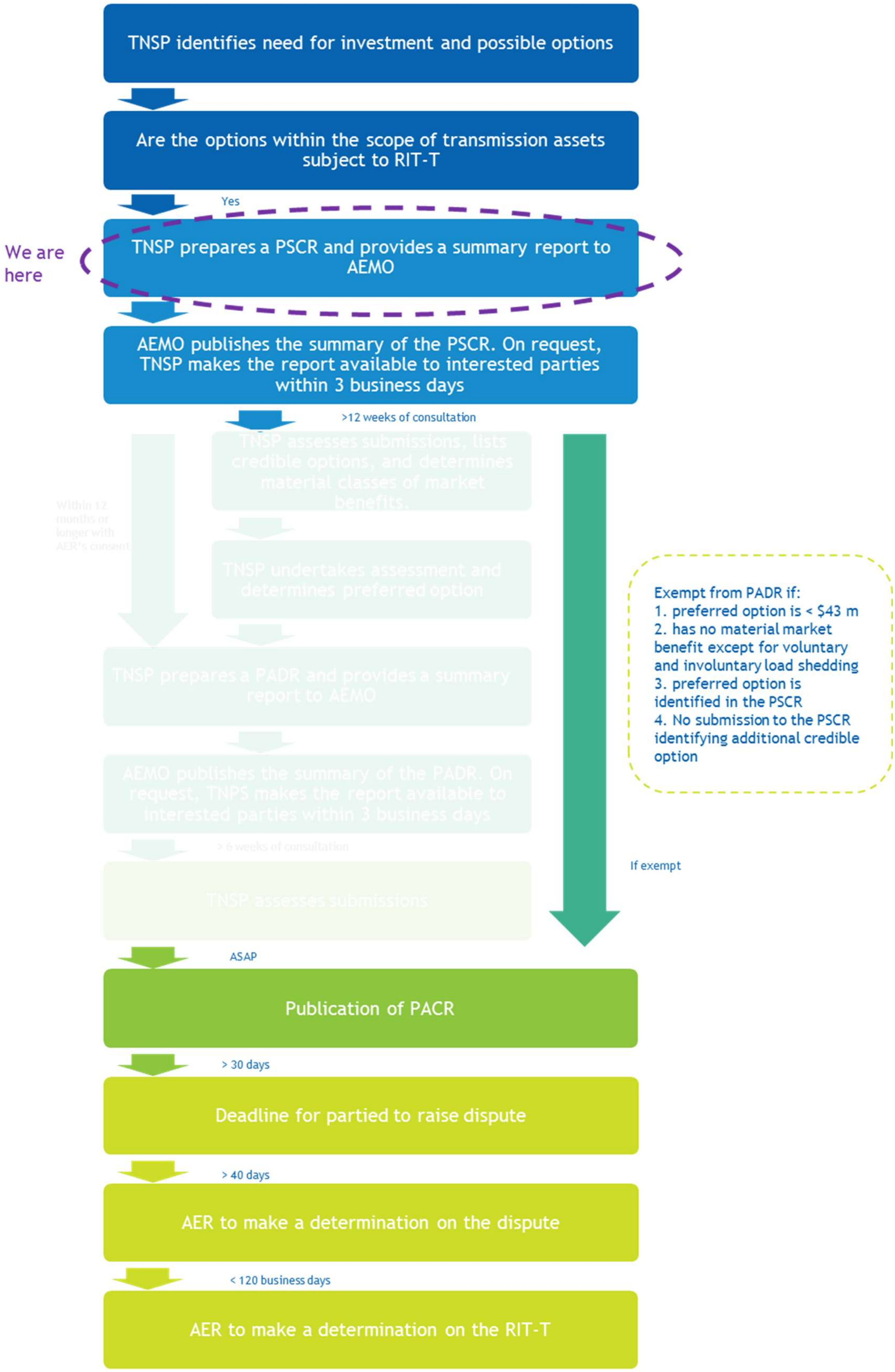

Figure 12 - RIT-T Process

Appendix B - Checklist of compliance clauses

The table below demonstrates the compliance of this PSCR with the requirements of clause 5.16.4(b) of the National Electricity Rules version 126[24], which states that a RIT-T proponent must prepare a PSCR which must include:

Table 6 - Summary of requirements

Requirement	Relevant section
(1) a description of the identified need;	2
(2) the assumptions used in identifying the identified need (including, in the case of proposed reliability corrective action, why the RIT-T proponent considers reliability corrective action is necessary);	2
(3) the technical characteristics of the identified need that a non-network option would be required to deliver, such as: (i) the size of load reduction of additional supply; (ii) location; and (iii) operating profile;	4
(4) if applicable, reference to any discussion on the description of the identified need or the credible options in respect of that identified need in the most recent National Transmission Network Development Plan;	Not applicable
(5) a description of all credible options of which the RIT-T proponent is aware that address the identified need, which may include, without limitation, alterative transmission options, interconnectors, generation, demand side management, market network services or other network options;	3
(6) for each credible option identified in accordance with subparagraph (5), information about: (i) the technical characteristics of the credible option; (ii) whether the credible option is reasonably likely to have a material inter-network impact; (iii) the classes of market benefits that the RIT-T proponent considers are likely not to be material in accordance with clause 5.16.1(c)(6), together with reasons of why the RIT-T proponent considers that these classes of market benefit are not likely to be material; (iv) the estimated construction timetable and commissioning date; and (v) to the extent practicable, the total indicative capital and operating and maintenance costs.	3 and 5
A RIT-T proponent is exempt from paragraphs (j) to (s) if: 1. the estimated capital cost of the proposed preferred option is less than $43 million (as varied in accordance with a cost threshold determination); 2. the relevant Network Service Provider has identified in its project specification consultation report: (i) its proposed preferred option; (ii) its reasons for the proposed preferred option; and (iii) that its RIT-T project has the benefit of this exemption;	7

24 Australian Energy Market Commission, *"National Electricity Rule version126,"* available at https://www.aemc.gov.au/regulation/energy-rules/national-electricity-rules/current, viewed on 7 November 2019.

Requirement	Relevant section
3. the RIT-T proponent considers, in accordance with clause 5.16.1(c)(6), that the proposed preferred option and any other credible option in respect of the identified need will not have a material market benefit for the classes of market benefit specified in clause 5.16.1(c)(4) except those classes specified in clauses 5.16.1(c)(4)(ii) and (iii), and has stated this in its project specification consultation report; and 4. the RIT-T proponent forms the view that no submissions were received on the project specification consultation report which identified additional credible options that could deliver a material market benefit.	

Appendix C - Asset condition framework

AusNet Services uses an asset health index, on a scale of C1 to C5, to describe asset condition. The condition range is consistent across asset types and relates to the remaining service potential. The table below provides an explanation of the asset condition scores used.

Table 7 - Condition scores framework

Condition score	Likert scale	Condition description	Recommended action	Remaining service potential (%)
C1	Very Good	Initial service condition	No additional specific actions required, continue routine maintenance and condition monitoring	95
C2	Good	Better than normal for age		70
C3	Average	Normal condition for age		45
C4	Poor	Advanced deterioration	Remedial action or replacement within 2-10 years	25
C5	Very Poor	Extreme deterioration and approaching end of life	Remedial action or replacement within 1-5 years	15

Asset failure rates

AusNet Services uses the hazard function of a Weibull two-parameter distribution to estimate the probability of failure of an asset in a given year. The asset condition scores are used to establish a condition-based age which is used to calculate the asset failure rates using a two-parameter Weibull Hazard function (h(t)), as presented below.

$$h(t) = \beta . \frac{t^{\beta-1}}{\eta^{\beta}}$$

Equation 1: Weibull Hazard Function

where:

t = Condition-based age (in years)

η = Characteristic life (Eta)

β = Shape Parameter (Beta)

Hazard functions are defined for the major asset classes including power transformers, circuit breakers, and instrument transformers. All assets in the substation risk-cost model use a Beta (β) value of 3.5 to calculate the failure rates. The characteristic life represents that average asset age at which 63% of the asset class population is expected to have failed.

The condition-based age (t) depends on the specific asset's condition and characteristic life (η).