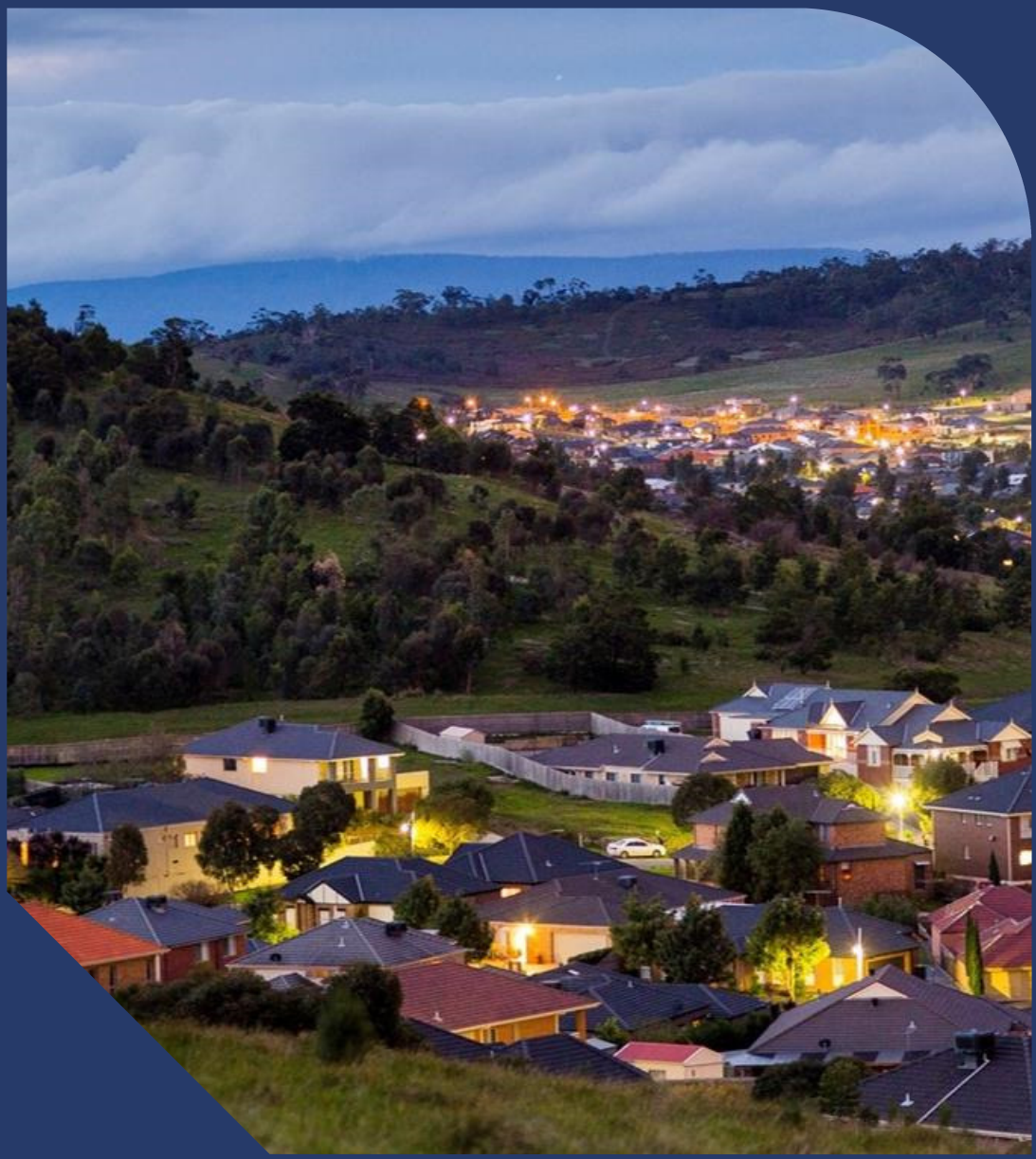
AusNet

South West Network Communications Replacement

Regulatory Investment Test for Transmission

Project Assessment Conclusions Report

Wednesday, 19 October 2022



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1. Executive summary

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.

Protection, control, SCADA and operational communication of the South Western Victorian Transmission network is currently enabled by a communication asset known as Synchronous Digital Hierarchy / Plesiochronous digital hierarchy (SDH/PDH) and 5-hop microwaves. SDH/PDH technology has served the business for over 35 years and is now considered a legacy technology. The need for replacement is illustrated by 22 communication equipment failures over the past 6 years. AusNet expects that communication services will continue to be required for the protection, control and SCADA of 500 kV and 220 kV lines in this region and as demand for new generators increases in the long term.

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).

This Project Assessment Conclusions Report (PACR) follows the publication of the Project Specification Consultation Report (PSCR), which is the first step in the RIT-T process. As explained in the PSCR, the South West Communications project can proceed to the final stage of the RIT-T process, being the PACR, in accordance with clause 5.16.4(z1) of the Rules, for the following reasons:

- the preferred option, has a capital cost of less than $46 million, which is below the threshold amount;
- the PSCR identified the preferred option and explained our reasons for selecting it; and
- the credible options will not have a material class of market benefits except for those specified in clause 5.15A(b)(4)(ii).

We did not receive any submissions in response to the PSCR.

The analysis presented in this PACR explains that the preferred option is to replace the SDH/PDH communication technology and radio with Multiprotocol Label Switching - Transport Profile (MPLS-TP) technology and fibre cable. This option will not only maintain transmission reliability, but allows for ease of maintenance and provides sufficient bandwidth to accommodate the implementation of the Renewable Energy Zone (REZ). This option mitigates the emergency replacement risk costs arising from deteriorating assets in the South Western Victorian Transmission network.

The preferred option has a total cost of $22.86 million (nominal). We propose to commence construction in November 2022. The project In-service date is expected to be early 2025.

If you have any questions about this PACR or the proposed project, please send your queries to ritdconsultations@ausnetservices.com.au or contact Thoai Ton on (03) 9695 6000.

2. Background

Protection, control, SCADA and operational communication of the South Western Victorian Transmission network is currently enabled by a communication asset known as SDH/PDH and 5-hop microwaves. SDH/PDH technology has served the business for over 35 years and is now considered a legacy technology.

Since being commissioned, the SDH/PDH communication assets have served the following Victorian Electricity Transmission lines in the South Western Region:

- 220kV lines from Moorabool to Terang;
- 220kV lines from Ballarat to Terang;
- 500kV lines from Moorabool to Heywood;
- 500kV lines from Heywood to Portland Alcoa APD; and
- 275kV lines from Heywood to SESS (interconnection to South Australia).

The communications services across the South Western Transmission network in Victoria are owned and operated by AusNet. This is currently enabled by a combined of SDH/PDH loop on Optical Ground Wire (OPGW) from Moorabool Terminal Station through to APD Portland, 5 hop microwaves between Alcoa Portland and Terang Terminal Station, and OPGW from Terang Terminal Station back to Moorabool.

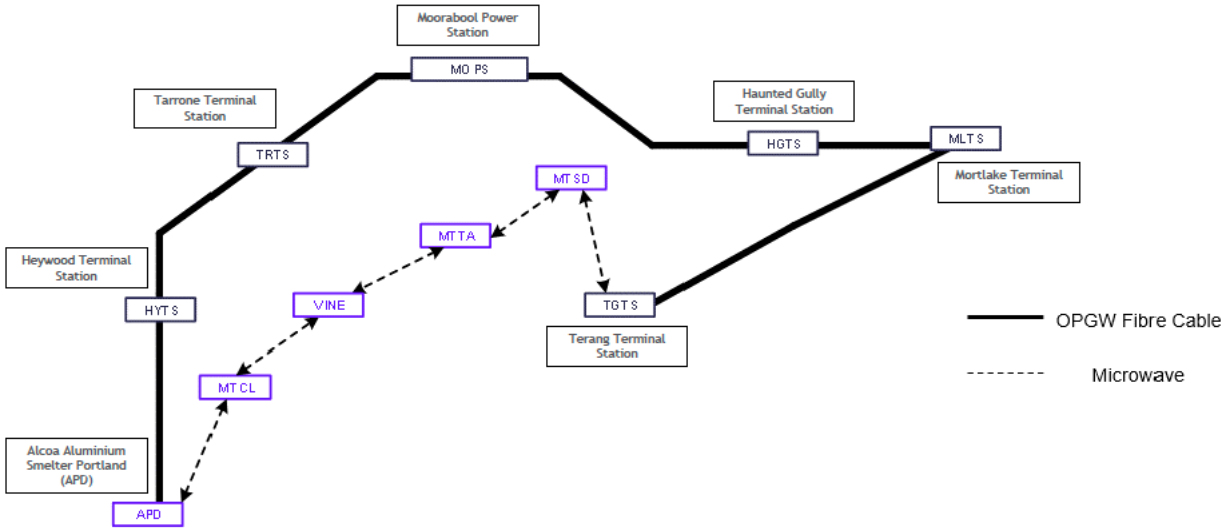

Figure 1: OPGW fibres from Moorabool to Portland and 5 hop microwaves between Portland and Terang

As part of AusNet asset management approach, asset condition scores, that range from C1 (very good condition) to C5 (very poor condition), are applied to each asset. The SDH/PDH technology used in the South West Transmission Network is in poor (C4) or very poor (C5) condition. The asset condition of the communications equipment is primarily determined by the level of support provided by the equipment vendor. The SDH/PDH equipment used by AusNet can no longer be sourced locally or overseas.

Over the past 6 years, the equipment has experienced 22 communication failures within the region. SDH and PDH technology has been in use for more than 35 years in the power industry, but the equipment is now becoming harder to source, making maintenance problematic.

3. Identified need

3.1. Description

The need for replacement has been identified by AusNet having experienced 22 communication equipment failures over the past 6 years in the region of South West Victoria. AusNet expects that communication services will continue to be required for the protection, control and SCADA of 500 kV and 220 kV lines in this region and as demand for new generators increases in the long term.

Existing protection and control schemes on the South Western Transmission loop have limited bandwidth due to the use of microwave technology. This has resulted in the inability to install solar and wind farm connections on the existing SDH/PDH and 5 hop microwave loop.

To enable the installation of variable renewable energy (VRE) generation and energy storage in Victoria, the transmission network now requires additional high bandwidth digital telecommunications systems. Installing fibre optic network to replace the radio will provide scalable bandwidth to meet long term future demand. Due to the high number of renewable generation projects within the area covered by this loop, the Victorian Department of Environment, Land and Planning (DELWP) is seeking ongoing updates on AusNet' plans to deliver an upgraded communications network to support these generators.

DELWP released a directions paper in February 2021 that includes a Renewable Energy Zone Development Plan (RDP). This plan proposes transmission projects to support the connection of up to 10 GW of renewable energy across Victoria. The South West Network Communication Project was identified as a critical project to support the connection of new renewables projects in South West Victoria. This project is included in Stage 1: Immediate priority projects resolving the network connection issues to support REZs, and has a current deadline of December 2024.

In relation to the existing assets, without remedial action there would be an increased likelihood of the following adverse outcomes:

- An inability to purchase new equipment due to a lack of supply;
- An inability to maintain existing and obsolete network equipment due to lack of spares;
- Increased costs from emergency replacement and repairs; and
- Increased costs from future generator expansion.

Therefore, the 'identified need' is to maintain supply reliability in the South Western Victorian Transmission network, mitigate risk of asset failures, and provide for additional network capacity that meets the bandwidth for future requirements including the REZ. By delivering the preferred option identified in this RIT-T, AusNet will be able to maintain reliable transmission network services and mitigate safety and environmental risks, as required by the Rules and Electricity Safety Act 1998.

3.2. Assumptions

In assessing the identified need, AusNet must consider the risk of asset failure and the likelihood of potential adverse consequences eventuating.

3.2.1. Safety risk costs

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. By implementing this principle for assessing safety risks from asset failures, AusNet uses:

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

AusNet' approach, including the use of a disproportionality factor, is consistent with the guidance provided by the AER.

3.2.2. Financial risk costs

The existing communications network will have no spare capacity for the additional future services when new generators are established in the region. New generators will be unable to interface with existing transmission assets if they do not provide their own communications services and connections to the network. Generators providing their own communications is considered a piecemeal approach which will result in connection costs for the generators in the order of multi-millions of dollars, with additional costs resulting from communications assets being written off once the loop is closed from the new network.

This financial risk cost is not considered further in detail in this RIT-T. It is noted, however, that the preferred option is best placed to address the requirements of new generators as it has more bandwidth than the other options. For the purpose of this RIT-T, however, it is not necessary to quantify this additional benefit provided by the preferred option.

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 arises from the need to maintain reliable protection, control, SCADA and operational communications on the South Western Victoria transmission network, there are no credible non-network options that could address this identified need.

The credible options are described below. These options will not have an inter-regional impact.

4.1. Option 0: Do Nothing/BAU

The Do Nothing/BAU option assumes that AusNet does not undertake any pro-active investment. It is assumed that the existing assets would be replaced on failure, with the replacement timing being determined by our repex model.

Given the urgent nature of the replacement needs under the BAU option, which is driven by the need to avoid involuntary load shedding, the capital expenditure associated with the BAU option reflects a 60% premium on the costs of delivering Option 1. This premium cost will be offset to some extent by the later timing of the replacement compared to the more pro-active replacement contemplated in Option 1.

The present value of the estimated capital expenditure and operational and maintenance costs for this option are $28.42 million (nominal) and $0.36 million (nominal) respectively.

4.2. Option 1: Replace SDH/PDH and radio with MPLS-TP and fibre cable

Option 1 involves the installation of MPLS-TP technology and the replacement of 5 hop microwaves with optic fibre. As communication equipment types must be consistent and different types cannot be interfaced, certain replaced SDH/PDH equipment will be tested and used as spares for the remaining SDH/PDH equipment that is used elsewhere on the network if deemed suitable.

The present value of the estimated capital expenditure and operational and maintenance costs for this option are $20.33 million (nominal) and $0.11 million (nominal) respectively. The undiscounted capital costs for this option (nominal) principally comprise:

- Design and internal labour, $3.9 million;
- Materials, $8.8 million; and
- Contract costs, $7.5 million.

The remaining costs relate to overheads and an allowance for risk.

The benefits of this option are as follows:

- Allows the replacement of the SDH/PDH assets in the South West region to free up spares to maintain the rest of SDH/PDH network.
- Provides AusNet with the ability to continue to comply with all Rules requirements into the future on an increasingly important part of the transmission network.

- Delivers a long-term communication capability and scalable bandwidth to accommodate the future expansion of our network in this region.
- Delivers a long-term communication capability and scalable bandwidth to accommodate the future connections of non-synchronous generation (addressing the solar and windfarm connections in the South Western Transmission Region).

This is AusNet' preferred option.

4.3. Option 2: Replace SDH/PDH with MPLS/TP and upgrade radio

Option 2 involves the replacement of the existing SDH/PDH with MPLS-TP technology and upgrading the radio. As noted in relation to Option 1, the replaced SDH/PDH equipment will be used as spares for the remaining SDH/PDH equipment that is used elsewhere on the network.

The present value of the estimated capital expenditure and operational and maintenance costs for this option are $23.63 million (nominal) and $0.83 million (nominal) respectively. The undiscounted capital costs for this option (nominal) principally comprise:

- Design and internal labour, $3.5 million;
- Materials, $12.1 million; and
- Contract costs, $7.9 million.

The remaining costs relate to overheads and an allowance for risk.

Under Option 2:

- The existing radio links will need to be upgraded and new sites introduced to enable the radios to meet the increased bandwidth requirements of MPLS-TP equipment.
- This option would involve the radios at six sites being upgraded and the introduction of two additional radio sites.
- This option would meet the bandwidth requirements of MPLS-TP technology.
- The additional microwave radio links would meet the higher bandwidth requirements of MPLS-TP technology in the short-term.

AusNet is not progressing with this option.

4.4. Options considered and not progressed

Installation of OPGW fibre cable between Moorabool Terminal Station and APD Portland; and between Moorabool Terminal Station and Terang Terminal Station was also considered. This OPGW fibre option was not considered to be a credible option because:

- it is more expensive than the credible options considered; and
- it would need to be installed on the same towers as the existing OPGW cables which presents a risk of having a single point of failure.

5. Economic assessment of the credible options

5.1. Assessment approach

Consistent with the RIT-T requirements and the AER's Application Practice Notes on risk-cost assessment methodology, AusNet has undertaken a cost-benefit analysis to evaluate and rank the net economic benefits from various credible options.

All options considered have been assessed against a business-as-usual case where no proactive capital investment to reduce the community risk costs is made. The South West Network Communications project is considered to be a replacement project given the identified need principally arises from the condition of the existing communications assets. The BAU option has therefore been assessed our repex model to determine the timing of the asset replacement, assuming that the assets can be replaced on failure. In practice, it is noted that there are significant risks associated with the BAU option, including the risk of significant involuntary load shedding, which means that this option is not credible. Nevertheless, we regard the BAU option as an appropriate baseline from which the other options can be assessed.

Our assessment of the options reflects our best estimate of the capital and operational costs for each option. A nominal pre-tax discount rate of 5.04% was used in the net present value assessments.

5.2. Market benefit

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 each of the market benefits listed in that clause. The table shows that the market benefits are not expected to affect our assessment of the credible options and, therefore, are not estimated in this PACR.

Table 1: Analysis of Market Benefits

Class of Market Benefit	Analysis
(i) changes in fuel consumption arising through different patterns of generation dispatch;	The replacement of the communications services has no effect on the arrangement of the existing South West region transmission network or surrounding generators, and hence will not have an impact on the generation dispatch pattern.
(ii) changes in voluntary load curtailment;	There is no material impact on the wholesale electricity market prices that could arise from the replacement of the communications services that could trigger 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 replacement of the communications services has no effect on the capacity of the existing South West Region transmission network, and hence does not pose a material risk of load shedding.
(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.

Class of Market Benefit	Analysis
(vi) changes in network losses;	Changes in network losses are unlikely to be a material class of market benefits for any of the credible options, given that the replacement of the communications network will not impact the supply or arrangement of the transmission network in the South West region.
(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.

5.3. Cost benefit assessment

For this assessment, the focus is on achieving the least-cost option. As such, the only relevant variables are the capital and operating expenditure estimates and the discount rate. The table below provides an analysis of the options against the BAU case. It shows that Option 1 is preferred.

Table 2: Present value assessment of the credible options ($'000, nominal)

Option	Capex	Opex	Total costs (PV)	Net Benefit
Option 0 (BAU)	28,421	364	**28,784**	-
Option 1	20,333	108	**20,440**	8,344
Option 2	23,634	830	**24,465**	4,319

Source: AusNet

The net benefit of Option 1 is $8.3 million compared to $4.3 million for Option 2, expressed in nominal terms. In this particular cost-benefit analysis, there are no market or other benefits associated with any of the options under consideration. The preferred option is therefore the option with the lowest total cost in present value terms, which is Option 1.

5.4. Sensitivity testing and scenario analysis

The cost benefit assessment presented in the previous section is relatively simple because each of the options addresses the risk of asset failure without any consideration of market benefits or residual risks (such as safety or environmental risks), which are not relevant to this project. As such, the preferred option is the option that delivers the lowest total cost to customers, which is Option 1.

The identification of the preferred option is sometimes complicated by the fact that the future is uncertain and that various input parameters are 'best estimates' rather than known values. In these cases, sensitivity testing and scenario analysis is employed in the cost benefit assessment.

As recommended by the AER's application guidelines, we use sensitivity analysis to assist in determining an appropriate set of reasonable scenarios. The relationship between sensitivity analysis and scenarios is best explained by the AER's practice note:[1]

> "Scenarios should be constructed to express a reasonable set of internally consistent possible future states of the world. Each scenario enables consideration of the prudent and efficient investment option (or set of options) that deliver the service levels required in that scenario at the most efficient long run service cost consistent with the National Electricity Objective (NEO).
>
> Sensitivity analysis enables understanding of which input values (variables) are the most determinant in selecting the preferred option (or set of options). By understanding the sensitivity of the options model to the input values a greater focus can be placed on refining and evidencing the key input values. Generally, the more sensitive the model output is to a key input value, the more value there is in refining and evidencing the associated assumptions and choice of value.
>
> Scenario and sensitivity analyses should be used to demonstrate that the proposed solution is robust for a reasonable range of futures and for a reasonable range of positive and negative variations in key input assumptions. NSPs should explain the rationale for the selection of the key input assumptions and the variations applied to the analysis."

In applying sensitivities and scenarios to our cost benefit assessment, we have regard to the particular circumstances to ensure that the approach is appropriate. Where our analysis shows that an option is clearly preferred, we will not undertake further testing. This approach is consistent with clause 5.15A.2(b)(2) of the Rules, which states that the RIT–T must not require a level of analysis that is disproportionate to the scale and likely impact of each credible option considered.

In preparing this RIT-T, we have also had regard to AEMO's 2021 Inputs, Assumptions and Scenarios Report and its 2022 Integrated System Plan (ISP). In particular we have considered whether the inputs are relevant to this RIT-T and whether the ISP scenarios should be applied to this RIT-T. Our assessment is that the ranking of the options will be unaffected by sensitivity testing or scenario analysis. This is because the ranking is driven principally by the capital expenditure for each option. Sensitivity analysis relating to the discount rate or the capital costs will not affect the ranking of the credible options. As there are no market benefits or residual risks associated with any of the credible options, scenario analysis will not provide any further insights beyond the information presented in the previous section.

5.5. Preferred option

Option 1 is the preferred option to maintain supply reliability in the South Western Victorian Transmission network, meet future REZ bandwidth requirements and mitigate risks of asset failures.

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

- Install 175km ADSS fibre cable between APD - HYTS - TGTS to replace 5 hop microwaves
- Replace SDH/PDH equipment with the new technology MPLS-TP equipment for the whole loop
- Replace comms batteries and chargers to accommodate the new equipment.

This option satisfies the RIT-T as it maximises net economic benefits by addressing the identified need at the lowest total cost.

5.6. Costs and timeframes

The forecast capital expenditure for the preferred option is $22.86 million (nominal). The operating expenditure is assumed to be the same as the BAU option, until 2025 when the project is commissioned. Beyond this date, the operating expenditure associated with Option 1 is expected to be lower than BAU, although these savings are modest compared to the lower capital expenditure associated with Option 1.

In relation to the timetable for completing the works, we expect the replacement program to commence in November 2022 and the project In-service date is expected to be early 2025.

[1] AER, Industry practice application note, Asset replacement planning, January 2019, page 36.

6. Satisfaction of the RIT-T

In accordance with clause 5.16.4(k)(9)(iv) of the Rules, we certify that the proposed option satisfies the RIT-T. The table below shows how each of these requirements have been met by the relevant section of this report.

Table 3: Compliance with regulatory requirements

Requirement			Section
5.16.4(v) The project assessment conclusions report must set out the matters detailed in the project assessment draft report as required under paragraph (k) (below).			Noted. See details below.
	(1)	a description of each credible option assessed;	Section 4
	(2)	a summary of, and commentary on, the submissions to the project specification consultation report	No submissions were received
	(3)	a quantification of the costs, including a breakdown of operating and capital expenditure, and classes of material market benefit for each credible option;	Sections 4.1, 4.2 and 5.2
	(4)	a detailed description of the methodologies used in quantifying each class of material market benefit and cost;	Sections 5.1-5.4
	(5)	reasons why the RIT-T proponent has determined that a class or classes of market benefit are not material;	Section 5.2
	(6)	the identification of any class of market benefit estimated to arise outside the region of the Transmission Network Service Provider affected by the RIT-T project, and quantification of the value of such market benefits (in aggregate across all regions);	Not applicable
	(7)	the results of a net present value analysis of each credible option and accompanying explanatory statements regarding the results);	Section 5.3
	(8)	the identification of the proposed preferred option;	Section 5.5
	(9)	For the proposed preferred option identified under subparagraph (8), the RIT-T proponent must provide:	
		(i) details of the technical characteristics;	Section 4.2 and Appendix
		(ii) the estimated construction timetable and commissioning date;	Sections 4.2 and 5.6
		(iii) if the proposed preferred option is likely to have a material inter-network impact and if the Transmission Network Service Provider affected by the RIT-T project has received an augmentation technical report, that report; and	Not applicable
		(iv) a statement and the accompanying detailed analysis that the preferred option satisfies the regulatory investment test for transmission	Section 6 (above)

Appendix – Technical details

The Victorian Electricity Transmission Grid in South Western Region includes:

- 220kV lines from Moorabool to Terang;
- 220kV lines from Ballarat to Terang;
- 500kV lines from Moorabool to Heywood;
- 500kV lines from Heywood to Portland Alcoa APD; and
- 275kV lines from Heywood to SESS (interconnection to South Australia).

SDH/PDH technology has served the business for over 35 years and is now considered a legacy technology. Equipment of this technology is becoming increasingly harder to source from suppliers. The equipment models used by AusNet is no longer supplied and supported in Australia and overseas. The inability to easily purchase additional SDH/PDH equipment means that future requirements for new installations or increased service needs cannot be met. Accordingly, like-for-like replacement of the SDH/PDH equipment would not be prudent, as it would pose an unacceptable risk to the reliability of the transmission network over the long-term.

MPLS-TP is currently the technology of choice to replace SDH/PDH. The technology has been produced and supported by major telecommunication equipment vendors for over ten years. It is being deployed or starting to be deployed by many Australian Transmission and Distribution Utilities - Transgrid, Jemena, Western Power, Energex (trial), National Grid, Scottish Power, and considered by others. The technology is mature and it has been supported by major telecommunication vendors. It is increasingly the technology of choice for Utilities in the replacement of their SDH/PDH networks. We are progressively replacing all SDH/PDH (based on condition) on our network with MPLS/TP equipment.

At a high level, the project scope includes the following activities:

- Install 175km ADSS fibre cable between APD – HYTS – TGTS to replace 5 hop microwaves;
- Replace SDH/PDH equipment with the new technology MPLS-TP equipment for the whole loop; and
- Replace comms batteries and chargers to accommodate the new equipment.

The following assumptions have been made:

- Implementation of MPLS-TP equipment for both X and Y protection;
- Facilities Access Agreement between AusNet and PowerCor will be signed; and
- Several PowerCor Zone Substations will be teeing off to the new HYTS-TGTS Line.

The following has been excluded from the scope and estimate:

- XTRAN MPLS-TP communication links for the following and their services/circuits:
  - MLTS-BATS
  - MLTS-ELTS
  - MLTS-SYTS
  - MLTS-DDTS
  - MLTS-GTS

Further detailed information on the project's technical characteristics can be provided by AusNet on request.

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