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Managing expected demand in the Panorama area

RIT-T – Project Specification Consultation Report

Region: Central West New South Wales

Date of issue: 7 December 2022

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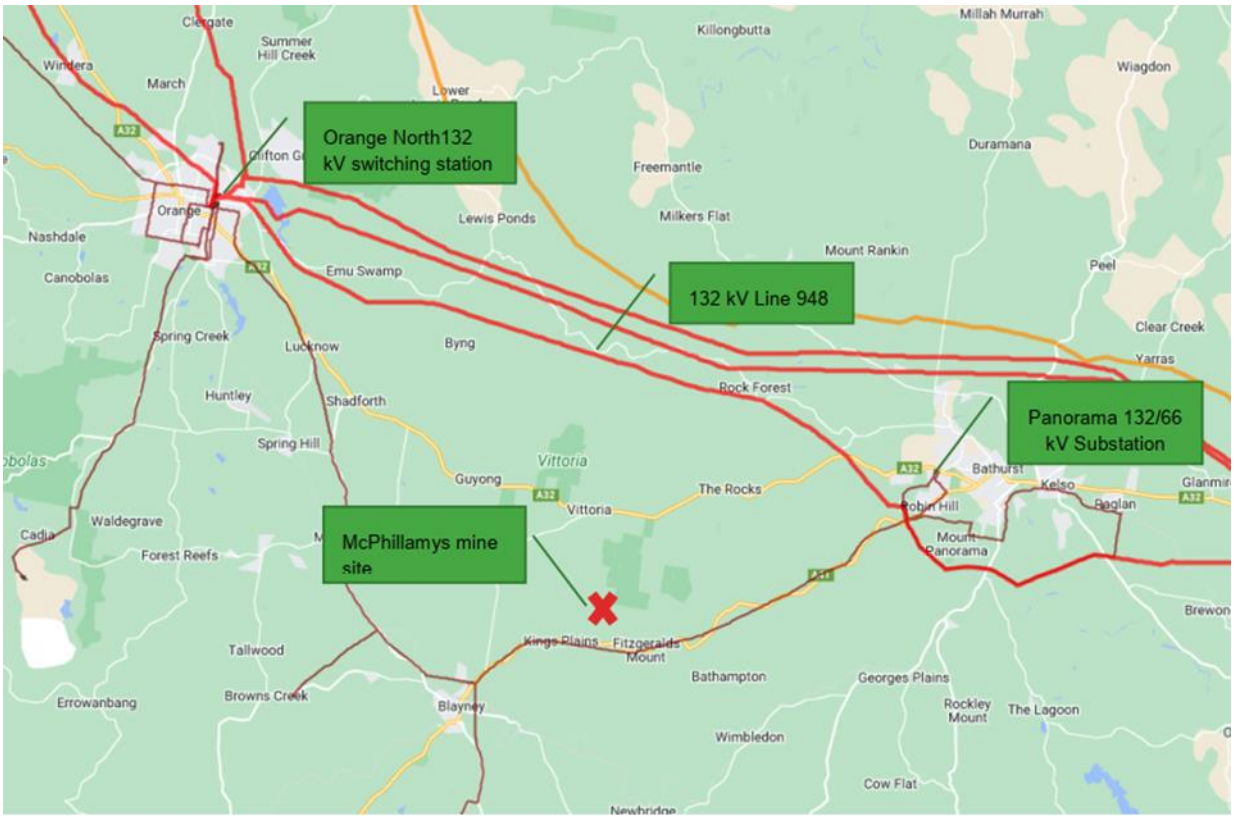
Executive summary

This Project Specification Consultation Report (PSCR) represents the first step in the application of the Regulatory Investment Test for Transmission (RIT-T) to options for addressing constraints on the transmission and distribution networks in the Panorama region of New South Wales. The constraints are expected to arise from the connection of a new spot load (McPhillamys Gold Mine) to Essential Energy's distribution network, and recent increases in the demand expected from this load. While the mine will be connected to the distribution network, the supply to the distribution network will be drawn from our nearby upstream Panorama bulk supply point (BSP).

There are currently two BSPs between our transmission network and Essential Energy's distribution network in the area, at Orange North and Panorama, as shown in Figure E-1.

Figure E-1 Location of the McPhillamys Gold Mine project relative to the Panorama and Orange North Bulk Supply Points



The identified need for this investment is to ensure adequate supply to Essential Energy's distribution network from the transmission network, to address constraints arising from the connection of McPhillamys Gold Mine

The McPhillamys Gold Mine is expected to be ready to connect from 2023/24 onwards, initially at 26MVA but forecast to grow to 35MVA by 2028/29. The expected additional demand from the mine will exceed the capacity of existing transmission and distribution infrastructure to supply the mine and the load in the general Panorama area, including the current capacity of the Panorama BSP.

We are required under the National Electricity Rules (NER) to perform joint planning with the relevant distribution network service provider to manage demand and provide prescribed transmission services. In particular, the relevant transmission and distribution network service providers must "assess the adequacy

of existing transmission and distribution networks and the assets associated with transmission-distribution connection points over the next five years and [..] undertake joint planning of projects which relate to both networks".[1] This requirement includes the identification of any limitations or constraints that affect the networks of both transmission and distribution network service providers.[2]

The identified need for this investment is for us to ensure adequate supply to Essential Energy's distribution network from the transmission network and address constraints that would otherwise arise from the connection of McPhillamys Gold Mine. Given the NER requirements for joint planning, we consider that this is a reliability corrective action identified need.

Three credible options have been developed and assessed in this PSCR

We have developed three credible options that meet the identified need by ensuring adequate capacity on our transmission network so that demand from McPhillamys Gold Mine connected to Essential Energy's distribution network can be met. Option details, including capital cost, commissioning year and option descriptions, are set out in Table E-1.

Table E-1 Credible options considered in the PSCR that meet the identified need

Option	Option description	Capital cost	Build period	Commissioning
Option 1	66kV Connection at Panorama: New 66kV switch bay and two new 20MVAr/132kV capacitor banks	$22.4 million	32 months	2025/26
Option 2	132kV Connection at Panorama: New 132kV switch bay and a new double-circuit transmission line	$28.0 million	43 months	2025/26
Option 3	New connection point on Line 948: New three circuit-breaker switching station	$15.8 million	36 months	2025/26

We have also examined the potential for non-network options to meet the identified need, but do not consider non-network options can assist with meeting the identified need in a way that is economically feasible. A non-network option would effectively need to be able to meet the load of the mine that would otherwise be unserved on a continuous basis, 24 hours a day over its life at a cost that is lower than the most cost-effective network option. Given the relatively low cost of the network options and the extent of potential unserved energy, we do not consider that non-network options are likely to be economically feasible.

Three scenarios have been considered including a scenario that has lower forecasts for the future mine load

Three reasonable scenarios have been developed to assess the credible options considered. A key variable affecting the timing and extent of future constraints on the network is the forecast level of demand from the mine. The latest forecasts provided by Essential Energy show the mine ready for connection from 2023/24 onwards, initially at 26MVA but forecast to grow to 35MVA in 2028/29. We have adopted this forecast growth in the central and high scenarios but have also examined a low scenario in which demand from the mine remains at 26MVA.

[1] NER, rule 5.14.1(d)(1).
[2] NER, rule 5.14.1(d)(3).

In addition to differences in forecast demand, the scenarios also vary capital costs, the value of customer reliability and the discount rate. The different parameters have been combined to derive a central scenario (which is considered the most likely) as well as low and high benefits scenarios, reflect future states of the world which represent the lower and upper bounds of reasonable net benefit outcomes. The weighting of each scenario has been informed by feedback from the Transgrid Advisory Council.[3] A summary of the scenarios and the weighting applied is presented in Table E-2.

Table E-2 Summary of scenarios

Variable	Central	Low net economic benefits	High net economic benefits
Capital costs	Base estimate	Base estimate + 25%	Base estimate – 25%
Eventual spot load from the McPhillamys Gold Mine[4]	35MVA	26MVA	35MVA
VCR[5]	$38.42/kWh	$26.89/kWh	$49.95/kWh
Discount rate	5.50%	7.50%	2.30%
Scenario weighting	90%	5%	5%

Based on the weighted outcomes of the assessment, Option 3 is found to provide the highest net benefit, as shown in the figure below, on account of the option having the lowest capital costs out of the options considered. This result is robust with Option 3 being the top ranked option in all scenarios and across the sensitivity tests conducted.

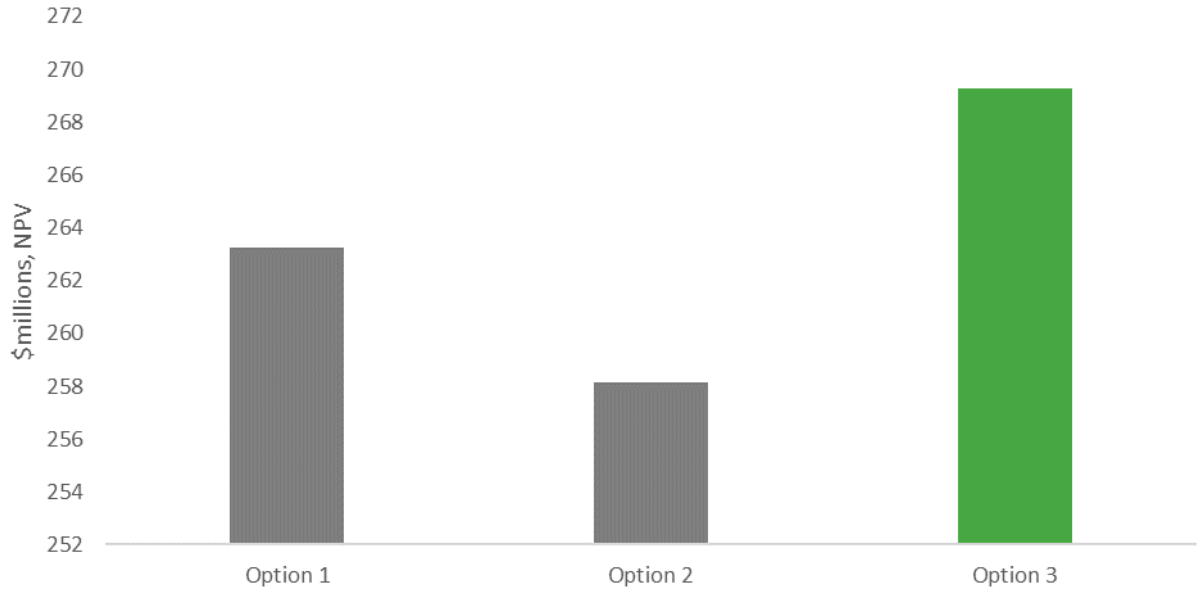
[3] The Transgrid Advisory Council is our principal stakeholder engagement forum. Its representatives are listed on our website.

[4] Maximum demand in 2028/29. The demand forecasts and assumed ramp-up rate over time for the McPhillamys mine are discussed in section 2.3.1.

[5] The calculation of the VCR estimate and the associated high and low estimates are discussed in section 6.1.2.

Option 3 has the highest net benefits on a weighted basis and is identified as the preferred option

Figure E- 2 Summary of the estimated net benefits, weighted across the three scenarios



We therefore considers Option 3, establishing a new three circuit-breaker switching station on 132kV Line 948, is the preferred option to meet the identified need.

Exemption from preparing a Project Assessment Draft Report

Subject to additional credible options being identified during the consultation period, publication of a Project Assessment Draft Report (PADR) is not required for this RIT-T as we consider its investment in relation to the preferred option to be exempt from that part of the process under NER clause 5.16.4(z1).

Production of a PADR is not required due to:

- the estimated capital cost of the proposed preferred option being less than $46 million;[6]
- the PSCR identifying:
  - the proposed preferred option (including reasons for the proposed preferred option)
  - that the RIT-T is exempt from producing a PADR
  - that the proposed preferred option and any other credible option will not have material market benefits[7] except for voluntary load curtailment and involuntary load shedding

Submissions and next steps

The purpose of this PSCR is to set out the reasons we propose that action be undertaken, present the options that address the identified need, outline the technical characteristics that non-network options would need to provide, present the results from our cost benefit analysis of the options, identify a preferred option and allow interested parties to make submissions and provide input to the RIT-T assessment.

[6] Varied from $43 million to $46 million based on the AER *Final Determination: Cost threshold review*, November 2021.
[7] As per clause 5.16.1(c)(6)

We welcome written submissions on the material contained in this PSCR. Submissions are due on 10 March 2023. Submissions should be emailed to our Regulation team via regulatory.consultation@transgrid.com.au.[8]

In the subject field, please reference 'Managing expected demand in the Panorama area.'

At the conclusion of the consultation process, all submissions received will be published on our website. If you do not wish for your submission to be made public, please clearly specify this at the time of lodgement.

Should we consider that no additional credible options were identified during the consultation period, we intend to produce a Project Assessment Conclusions Report (PACR) that addresses all submissions received including any issues raised in relation to the proposed preferred option or alternative options. Subject to no additional credible options being identified, Transgrid anticipates publication of a PACR in May 2023.

Box E-1 AER determination of disputes relating to North West Slopes and Bathurst Orange Parks RIT-Ts

We note the publication on 29 November 2022 of the AER's decision on the disputes relating to the North West Slopes and Bathurst, Orange and Parkes RIT-Ts. The AER's decision has potential implications for the assessment in this RIT-T in terms of the specification of the scenarios adopted. We are currently working through the implications of the AER's decision for the approach adopted for our RIT-Ts generally, which will include discussions with the AER to confirm that any changes in our approach are consistent with the AER's decision. We will update the assessment presented in this PSCR to reflect the outcomes of that deliberation as part of the PACR.

[8] TransGrid is bound by the Privacy Act 1988 (Cth). In making submissions in response to this consultation process, TransGrid will collect and hold your personal information such as your name, email address, employer and phone number for the purpose of receiving and following up on your submissions. If you do not wish for your submission to be made public, please clearly specify this at the time of lodgement.

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Contents

1. Introduction

This Project Specification Consultation Report (PSCR) represents the first step in the application of the Regulatory Investment Test for Transmission (RIT-T) to options for addressing constraints on the transmission and distribution networks in the Panorama region of New South Wales (NSW). The constraints are expected to arise from the connection of a new spot load (McPhillamys Gold Mine) and recent increases in the forecast demand from this load.

Essential Energy entered into a connection services agreement with McPhillamys Gold Mine[9] in mid 2021, which lead to a DNSP work request on 18 August 2021 that requested we investigate the feasibility of different connection options.

The DNSP work request requested we investigate feasibility and connection options to accommodate the new spot load from the mine. While the mine will be connected to the distribution network, the supply to the distribution network will be drawn from our transmission network, either at the Panorama bulk supply point (BSP) or from elsewhere in the 132kV network. The options Essential Energy requested to be investigated were all 132kV options.

We submitted a technical feasibility report to Essential Energy in October 2021 in response, that outlined feasible options to facilitate connection of the McPhillamys Gold Mine. The technical feasibility report examined both 66kV and 132kV options reflecting different credible approaches to facilitate connection of the mine.

Two additional communications were subsequently received from Essential Energy that triggered this RIT-T process and clarified the scale of additional demand:

- a second DNSP work request was received on 7 March 2022 requesting options to facilitate the connection of the mine load to the distribution network by building a new 132kV BSP; and
- further correspondence on 19 July 2022, where Essential Energy advised us of an increase in the eventual demand forecast for the mine to 35MVA from 26MVA.

The changes in demand advised by Essential Energy meant that the options set out in the earlier technical feasibility report were no longer adequate, and provided the impetus for considering alternative options. The options now being considered to facilitate connection of the McPhillamys Gold Mine to Essential Energy's network require the RIT-T to be applied.

As the prospective connection affects both the distribution and transmission networks, we are required under the National Electricity Rules (NER) to perform joint planning with the relevant distribution network service provider (DNSP) to manage demand and provide prescribed transmission services. In particular, the relevant TNSP and DNSP must "assess the adequacy of existing transmission and distribution networks and the assets associated with transmission-distribution connection points over the next five years and [..] undertake joint planning of projects which relate to both networks".[10] This requirement includes the identification of any limitations or constraints that affect both the TNSP's and DNSP's network.[11]

[9] https://regisresources.com.au/our-assets/nsw-projects/mcphillamys/
[10] NER, rule 5.14.1(d)(1).
[11] NER, rule 5.14.1(d)(3).

Relevant to this RIT-T, we concluded a separate Bathurst, Orange and Parkes RIT-T in June 2022, that looked at addressing voltage issues in a similar geographic area. The interactions between this RIT-T and the Bathurst, Orange and Parkes RIT-T is discussed in Box 1-1 below.

Box 1-1 Interaction with the recent RIT-T for the Bathurst, Orange and Parkes areas

We published a Project Assessment Conclusions Report (PACR) in June 2022 for maintaining reliable supply to the Bathurst, Orange and Parkes areas in order to address significant under-voltage conditions forecast as a result of substantial load growth in the area. The PACR found that augmenting the transmission network at Panorama was part of the preferred option. Specifically, that RIT-T identified the preferred option involved a non-network solution provided through a new Battery Energy Storage System (BESS) and static synchronous compensators (STATCOMs) at Parkes and Panorama or a synchronous condenser at Parkes in the near-term.[12] The non-network solution for that RIT-T is expected to provide up to 30MVAr of dynamic reactive support at Panorama by 2025 to manage voltage variations during high demand periods.

The preferred option identified in the Bathurst, Orange and Parkes PACR addresses voltage constraints on the shared transmission network associated with expected load growth from several possible spot loads that are considered likely to eventuate, including the McPhillamys Gold Mine. The Bathurst, Orange and Parkes RIT-T however, did not take a view on where or how those spot loads were to connect apart from those loads being located in the general Bathurst, Orange and Parkes area which would require us to augment the transmission network to address voltage issues.

Subsequent to the initial DNSP work request (received on 18 August 2021) and the publication of the Bathurst, Orange and Parkes PACR, we were notified by Essential Energy in July 2022 that the expected demand from the McPhillamys Gold Mine (as reflected in Essential Energy's demand forecasts for its distribution network) had increased from a load of 26MVA to a load of 35MVA. We have assessed that the higher demand now expected to eventuate does not change the identified need or the preferred option in the Bathurst, Orange and Parkes PACR given that voltage issues driving the Bathurst, Orange and Parkes RIT-T continue to remain at the same scope and scale.

Notwithstanding that the additional load does not affect the investment needed to manage voltage constraints, it does affect the ability for the new mine to connect to the existing networks without being constrained. This is particularly due to expected constraints at the existing Panorama BSP and within the distribution network. This Panorama RIT-T has therefore been initiated to consider options to address these constraints and facilitate supply to the McPhillamys Gold Mine.

The economic assessment for this Panorama RIT-T includes the preferred option identified in the Bathurst, Orange and Parkes PACR in the base case. The benefits and costs quantified in the Panorama RIT-T are therefore incremental to the costs and benefits quantified in the Bathurst, Orange and Parkes PACR, to ensure double counting of benefits or costs does not occur between the two RIT-T projects.

Under this approach, McPhillamys Gold Mine is assumed to connect into Essential Energy's distribution network under the base case but supply would be limited to 19MVA as it is constrained by the capacity of the distribution network to supply the mine. Although the distribution constraint can be addressed by augmentation works, supply to the mine would still have to be limited due to voltage constraints at the Panorama BSP given the level of forecast demand.

Considering that this project is being triggered by a major customer requesting network connection to Essential Energy's network, we understand that specific tariff arrangements will be established by Essential Energy to recover the locational element of the shared transmission augmentation from beneficiaries,

[12] https://www.transgrid.com.au/media/4bliiii3/transgrid-pacr_supply-to-bathurst-orange-and-parkes.pdf

taking into account their share in the capacity added to the network. We understand that the cost recovery mechanism will be part of the customer connection agreements and acts as a means of mitigating against the risk of having stranded network assets. It is noted also that the customer will directly fund the dedicated assets associated with their connection to the distribution network.

1.1. Exemption from producing a Project Assessment Draft Report

NER clause 5.16.4(z1) provides for a TNSP to be exempt from producing a PADR for a particular RIT-T application, in the following circumstances:

- if the estimated capital cost of the preferred option is less than $46 million;[13]
- if the TNSP identifies in its PSCR its proposed preferred option, together with its reasons for the preferred option and notes that the proposed investment has the benefit of the clause 5.16.4(z1) exemption; and
- if the TNSP considers that the proposed preferred option and any other credible options 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), with the exception of market benefits arising from changes in voluntary and involuntary load shedding.

We consider that this investment is exempt from producing a PADR under NER clause 5.16.4(z1) as all three circumstances listed above apply to this RIT-T. In light of this exemption, this PSCR therefore:

- sets out the reasons why we propose that action be undertaken (that is, the 'identified need');
- presents the options that we currently considers addresses the identified need,
- outline the technical characteristics that non-network solutions would need to provide, whilst setting out why we consider that non-network solutions are unlikely to be able to contribute to meeting the identified need for this RIT-T;
- identifies that a reduction in expected unserved energy (EUE) is expected to be the only market benefit from the various credible options;
- presents the results of the NPV analysis for each of the credible options assessed;
- describes the key drivers of these results, and the assessment that has been undertaken to ensure the robustness of the conclusion; and
- identifies the preferred option at this stage of the RIT-T, i.e., the option that is expected to maximise net market benefits; and
- allows interested parties to make submissions and provide input to the RIT-T assessment.

1.2. How to make a submission and next steps

We welcome written submissions for this PSCR. Submissions are due on or before 10 March 2023.

Submissions should be emailed to our Regulation team via Regulatory.Consultation@transgrid.com.au.[14] In the subject field, please reference 'Managing expected demand in the Panorama area'.

[13] Varied from $43m to $46m based on the *AER Final Determination: Cost threshold review* , November 2021.

[14] Transgrid is bound by the *Privacy Act 1988 (Cth)*. In making submissions in response to this consultation process, Transgrid will collect and hold your personal information such as your name, email address, employer and phone number for the purpose of receiving and following up on your submissions. If you do not wish for your submission to be made public, please clearly specify this at the time of lodgement.

At the conclusion of the consultation process, all submissions received will be published on our website. If you do not wish for your submission to be made public, please clearly specify this at the time of lodgement.

Should we consider that no additional credible options were identified during the consultation period, we intend to produce a PACR that addresses all submissions received including any issues in relation to the proposed preferred option raised during the consultation period. Subject to submissions received on this PSCR and no additional credible options being identified, a Project Assessment Conclusions Report (PACR), is expected to be published by May 2023.

We note the publication on 29 November 2022 of the AER's decision on the disputes relating to the North West Slopes and Bathurst, Orange and Parkes RIT-Ts.[15] The AER's decision has potential implications for the assessment in this RIT-T in terms of the specification of the scenarios adopted. We are currently working through the implications of the AER's decision for the approach adopted for our RIT-Ts generally, which will include discussions with the AER to confirm that any changes in our approach are consistent with the AER's decision. We will update the assessment presented in this PSCR to reflect the outcomes of that deliberation as part of the PACR.

[15] AER, North West Slopes and Bathurst, Orange and Parkes RIT-T disputes, November 2022

2. The identified need for this RIT-T

This section outlines the identified need for this RIT-T, as well as the assumptions and data underpinning it. It first provides background on the Panorama and wider Central West area and the current capabilities of the transmission network.

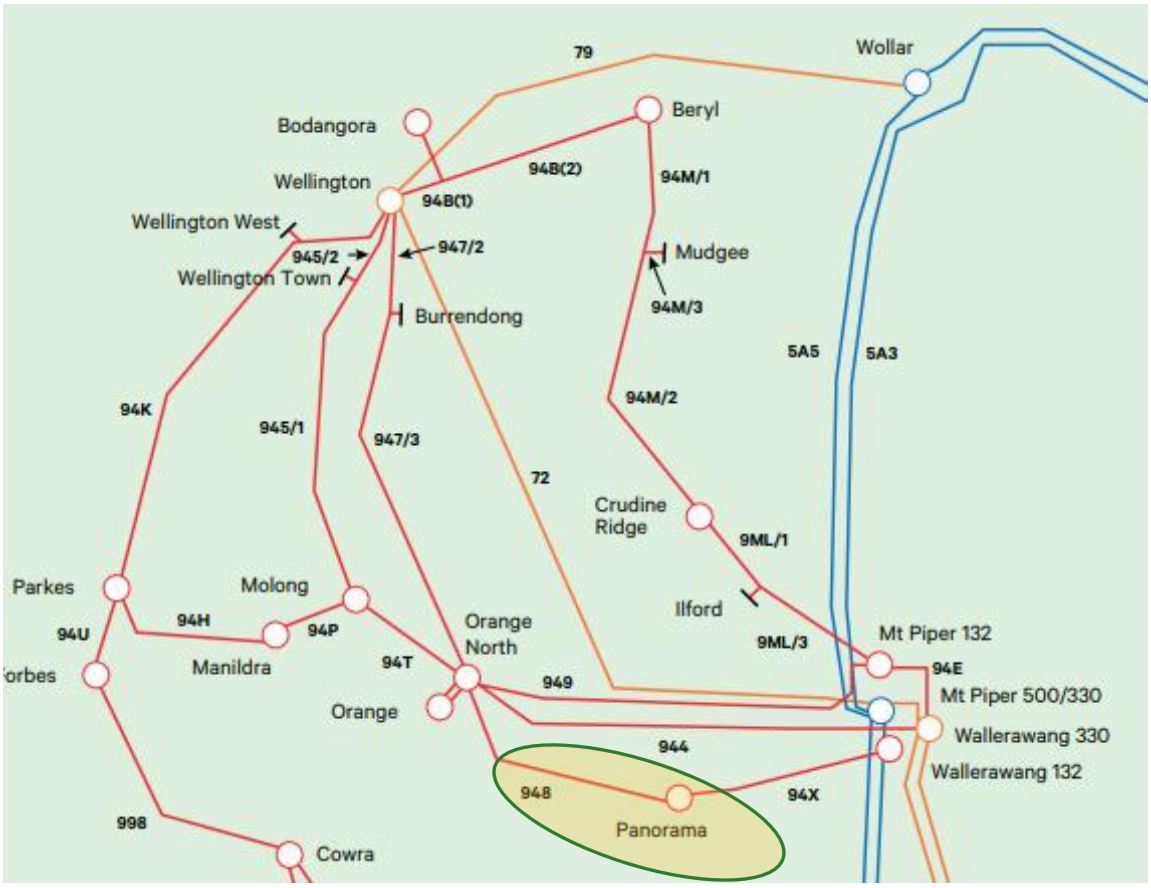
2.1. Background to the identified need

The Central West transmission subsystem consists of 132kV interconnection between Mt Piper and Wellington. The subsystem connects a number of BSPs and several solar and wind generators in a meshed arrangement.

The interconnection between the Wallerawang and Orange North substations is operated through the 132kV transmission lines 94X and 948 via the Panorama 132/66kV substation. At Panorama there is a 66kV BSP to Essential Energy's distribution network, whilst at Orange North there are both 132kV and 66kV BSPs to Essential Energy's distribution network.

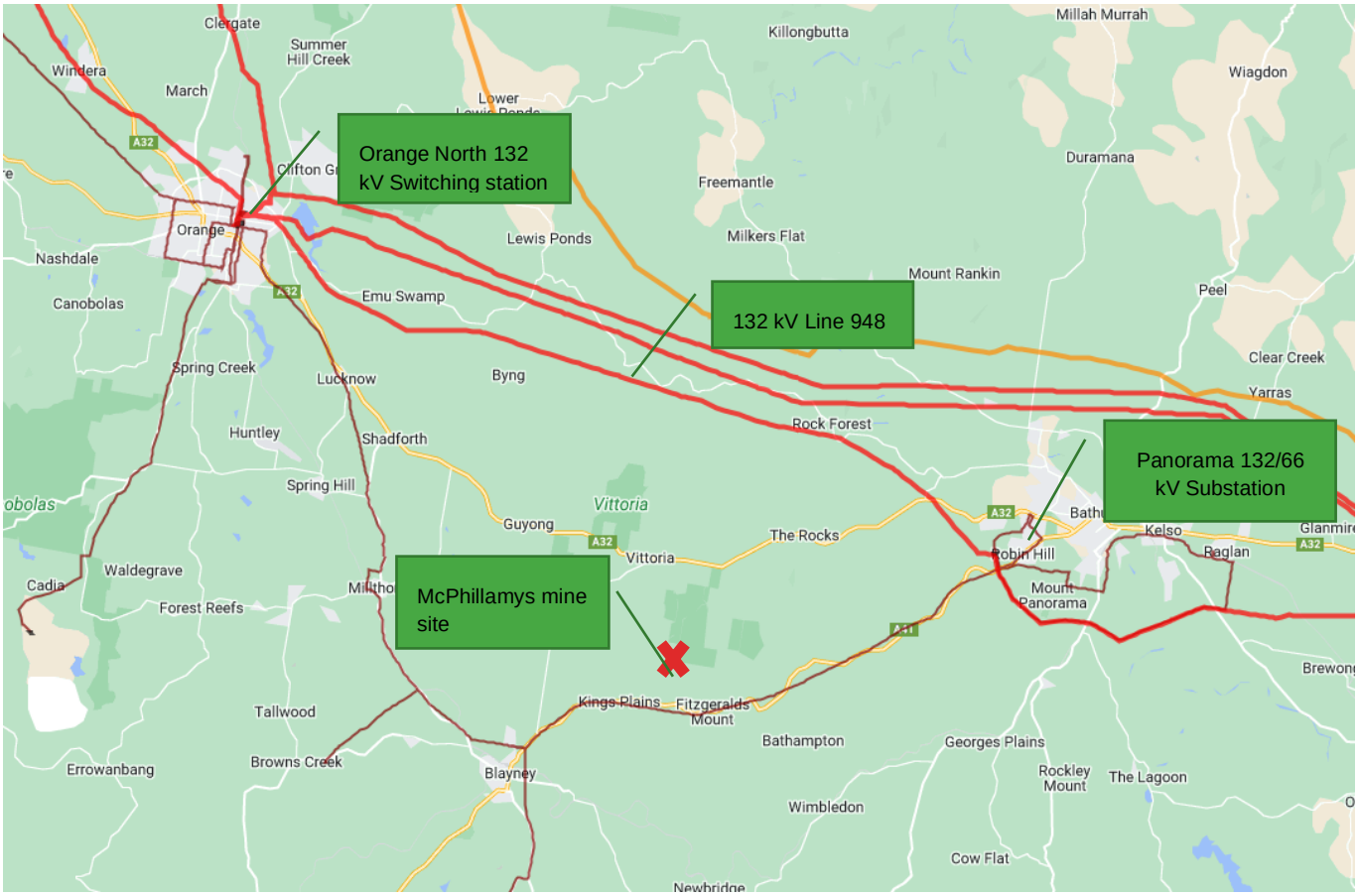
Figure 2-1 provides a simplified schematic diagram of the Central West 132kV subsystem and indicates the location of the Panorama 132/66kV substation that serves the Panorama area.

Figure 2-1 The Central West 132kV subsystem



The McPhillamys Gold Mine project is located in the Central Tablelands region of NSW, 20km west of Bathurst and 27km south-east of Orange. Its location is shown in Figure 2-2 below, along with its proximity to both the Panorama 132/66kV substation and the Orange North 132kV switching station.

Figure 2-2: Location of the McPhillamys Gold Mine project relative to the Panorama 132/66 kV Substation and Orange North 132 kV Switching Station



The mine is planning to connect to Essential Energy's distribution network, which is supplied via our Panorama BSP nearby.

2.2. Description of the identified need

We are required under the NER to perform joint planning with the relevant DNSP to manage demand and provide prescribed transmission services. In particular, the relevant DNSP and TNSP must "assess the adequacy of existing transmission and distribution networks and the assets associated with transmission-distribution connection points over the next five years and [..] undertake joint planning of projects which relate to both networks".[16] This requirement includes the identification of any limitations or constraints that affect both the TNSP's and DNSP's network.[17]

Essential Energy entered into a connection services agreement with McPhillamys mine in mid 2021. The mine load on the distribution network is expected to increase demand at the Panorama BSP or draw on

[16] NER, rule 5.14.1(d)(1).
[17] NER, rule 5.14.1(d)(3).

other parts of the transmission network as soon as it is connected. The project is currently in an advanced stage, with a full connection agreement expected to be put in place in the near future.

We received a DNSP work request from Essential Energy on 18 August 2021 to investigate connection options for the mine load. The options requested by Essential Energy to be investigated were all 132kV options.[18] In response, we submitted a technical feasibility report to Essential Energy outlining options to connect to the existing transmission network. The technical feasibility report examined both 66kV and 132kV options to cover different credible approaches to facilitate connection of the mine.

A further DNSP work request was subsequently received from Essential Energy on 7 March 2022 to provide a 132kV supply to the Panorama BSP to enable connection of the mine load into Essential Energy's distribution network.

Further, updated demand forecasts received in July 2022 from Essential Energy indicate that demand from the mine is expected to start at 26MVA when the mine begins its first year of operation, and then to ramp up to 35MVA by 2028/29. Forecast demand from the mine cannot currently be met by the existing distribution and transmission networks, and therefore the increase in load is expected to result in significant amounts of unserved energy from the mine being constrained in the base case if no action is taken.

This RIT-T assesses and consults on options for facilitating the additional demand on our transmission network arising from the connection of the McPhillamys Gold Mine to Essential Energy's distribution network. In light of the NER joint planning requirements, we consider this RIT-T to have a 'reliability corrective action' identified need.

2.3. Assumptions underpinning the identified need

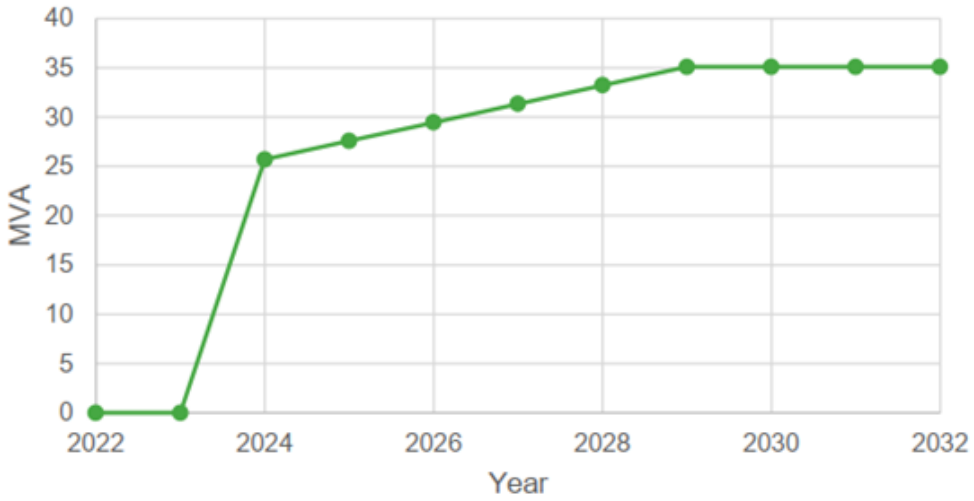
The key assumptions underpinning the identified need for this RIT-T relate to load forecasts associated with the McPhillamys Gold Mine and the current capacity of the Panorama BSP to supply the distribution network hosting the mine.

2.3.1. Forecast demand from the mine

Figure 2-3 below illustrates the current timing and amount of demand forecast for the McPhillamys Gold Mine based on information provided by Essential Energy. The mine is expected to be ready to come online in 2023/24, initially requiring around 26MVA and increasing to 35MVA by 2028/29.

[18] Complexity in augmenting the distribution network to supply the mine load of 26MVA is likely to have driven the request to investigate 132kV options which would provide a higher connection capacity.

Figure 2-3 Current demand forecast for the McPhillamys Gold Mine



GHD has undertaken an independent review of these demand forecasts and concluded that it "is satisfied Transgrid, and Essential Energy, have utilised the available proposed mine loading data appropriately to develop a realistic load forecast for use in the OER[19] for Panorama region of NSW. Transgrid have been open with the provision of data for this analysis as well as providing details of the process that was used to develop a realistic assessment of the load forecast."[20] GHD's report on its independent review of demand forecasts is provided as an attachment to this PSCR.

However, the demand from the mine is not certain and may vary, depending on its development. Therefore, we have adopted three scenarios for this RIT-T, where demand from the mine is a key variable:

- the low benefits scenario assumes mine demand remains at the initial 26MVA, and does not grow further; and
- the central and high benefit scenarios both assume the mine demand ramps up from 26MVA in 2023/24 to reach 35MVA by 2028/29, in line with current forecasts.

The scenarios do not consider variations for when load from McPhillamys Gold Mine comes online as the timing is primarily driven by the mine's development, with mining operations expected to be ready to begin in 2023/24 based on information from Essential Energy. We understand from Essential Energy that further increases in demand from the mine beyond 35MVA is possible if McPhillamys Gold Mine operations expands to adjacent mine leases or underground operations. However, higher demand exceeding 35MVA would occur only in the mid 2030s if at all and is speculative at this time. We have elected to adopt a more conservative approach to the development of scenarios by assuming demand under the high benefits scenario is equal to demand under the central scenario.

Apart from the spot load demand from the McPhillamys Gold Mine, general demand in the Panorama area is forecast to be largely flat into the future. The impact on the transmission network from any increase in demand in this area (excluding the mine) is expected to be managed through the network support contracts and investments made under the Bathurst Orange Parkes RIT-T.

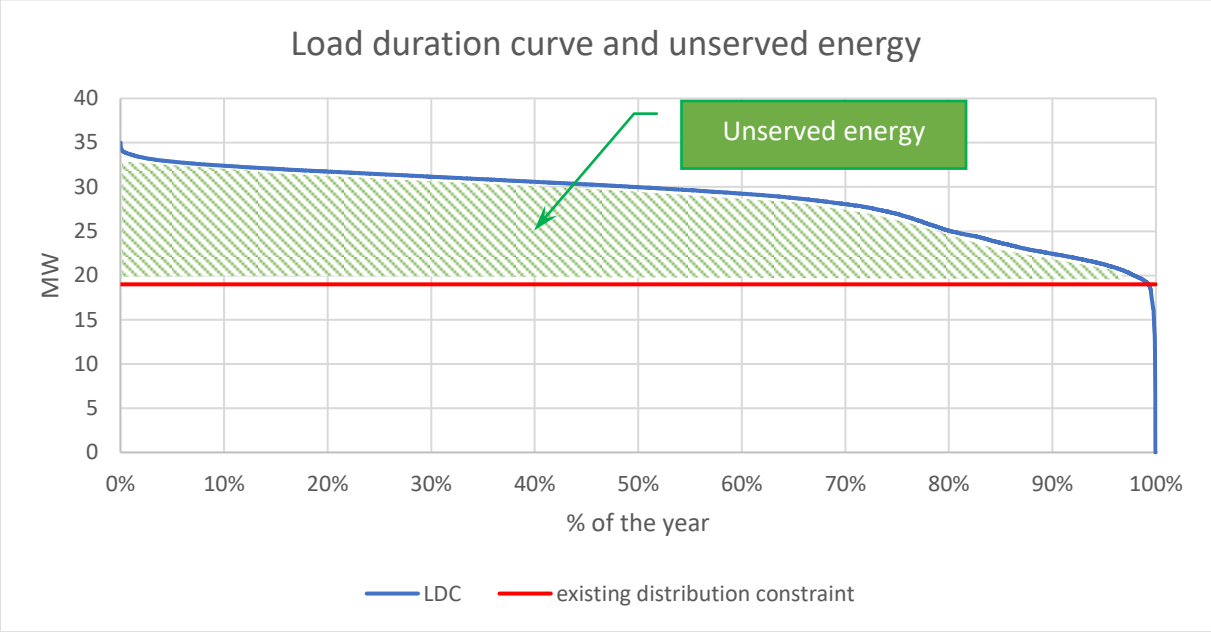
[19] OER refers to Transgrid's Options Evaluation Report, which adopts the same load forecasts used in this PSCR.
[20] GHD, *Supply to Panorama – Demand Forecast Independent Verification and Assessment*, November 2022 p 6.

2.3.2. Current network capacity in the Panorama area and the likely level of unserved energy

Both transmission and distribution networks serving the Panorama area will constrain supply to McPhillamys Gold Mine.

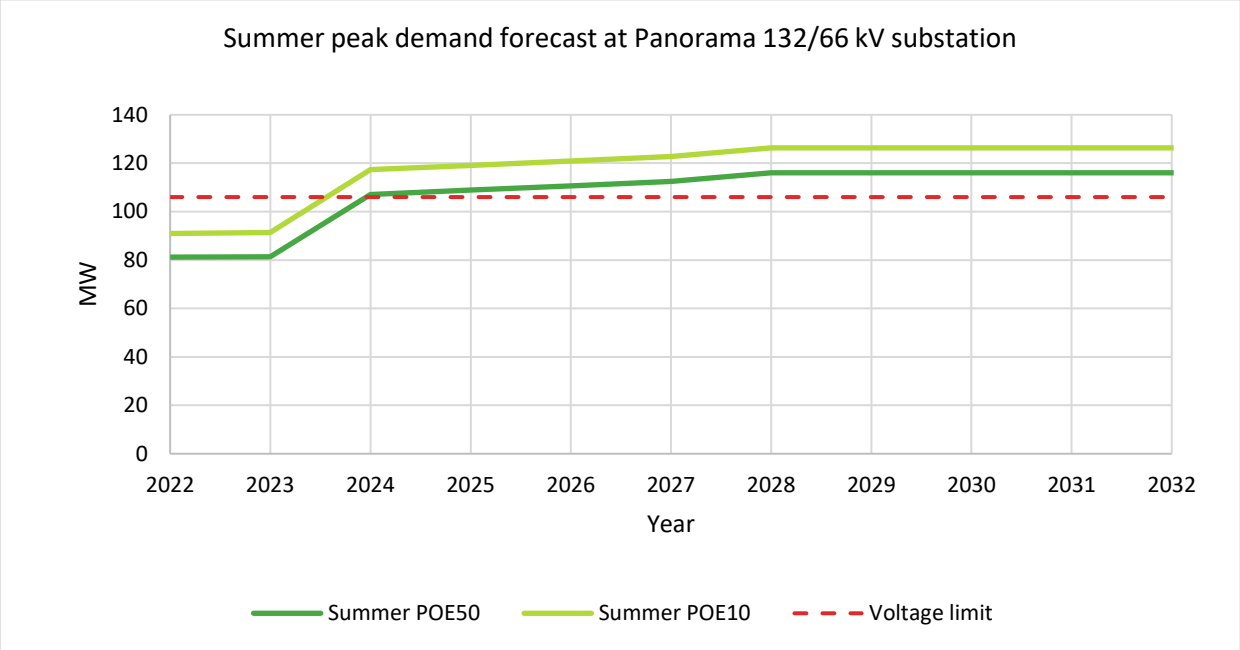
The most immediate constraint is the 66kV feeder limit on the distribution network, which limits supply to the mine to 19MVA. This would result in an approximately 16MVA shortfall (ie, the difference between the mine's projected load of 35MVA and 19MVA), driving unserved energy. This is illustrated in Figure 2-4 below where the area between the load duration curve (blue line) and the 19MVA constraint (red line) represents unserved energy. Expanding supply to accommodate 35MVA load would require Essential Energy to augment its feeders if a 66kV option is selected.

Figure 2-4 Load duration curve and unserved energy at the distribution network level



At the transmission level, our Panorama 132/66kV substation will also constrain supply to the mine at the substation level, due to voltage limitations, even if the distribution level constraint is resolved. Figure 2-5 illustrates the capacity of the Panorama 132/66kV substation (red dotted line) compared to summer demand with the mine load included from 2023/24 onward. It is expected that the capacity of the substation will be exceeded for both POE50 and POE10 forecasts in 2023/24 when the mine is expected to be ready to connect.

Figure 2-5 Summer peak demand forecast at the Panorama 132/66kV substation



These constraints on the 66kV distribution network and at the Panorama 132/66kV substation arising from suppling the new mine load can be avoided by instead supplying the distribution network using the 132kV Line 948 in our 132kV network. However, this would require augmentation of Line 948. The options considered in this RIT-T therefore consider both 66kV solutions as well as solutions that involve augmentation of the 132kV Line 948. The options are discussed in the following section.

3. Options that meet the identified need

We have considered three credible options for this RIT-T assessment. Each of these options are technically and commercially feasible to meet the identified need driven by the connection of the McPhillamys Gold Mine, as soon as it is practicable. None of the options will have a material inter-network impact.

This section provides more information on the scope and cost of these options. It also outlines options considered but not progressed.

3.1. Option 1 – 66kV Connection at Panorama: New 66kV switch bay and two new 20MVAr/132kV capacitor banks

Option 1 involves establishing a new 66kV switch bay at the existing Panorama 132/66kV substation to which Essential Energy could connect a new 66kV line to supply the mine load. In addition, two 20MVAr/132kV capacitor banks would be required to be installed at Panorama to provide adequate voltage support in the area to accommodate the demand increase from the mine.[21]

Figure 3-1 shows the existing general arrangement at the Panorama 132/66kV substation and the proposed works for Option 1. Currently there is adequate space for a new 66kV switch bay on the existing substation bench. An additional bench extension modification to the 132kV busbar arrangement would be required to install the proposed capacitor banks.

[21] The need for voltage support in addition to that which will provided as a result of the Bathurst Orange Parkes RIT-T is specific to Option 1 involving the 66kV network, as lower voltage options require more voltage support compared to higher voltage options. Additional voltage support is not required for the other two options considered in this RIT-T, as the voltage support provided by the investments made under the Bathurst Orange Parkes RIT-T would be sufficient.

Figure 3-1 Indicative location of the proposed works at Panorama 132/66kV substation for Option 1

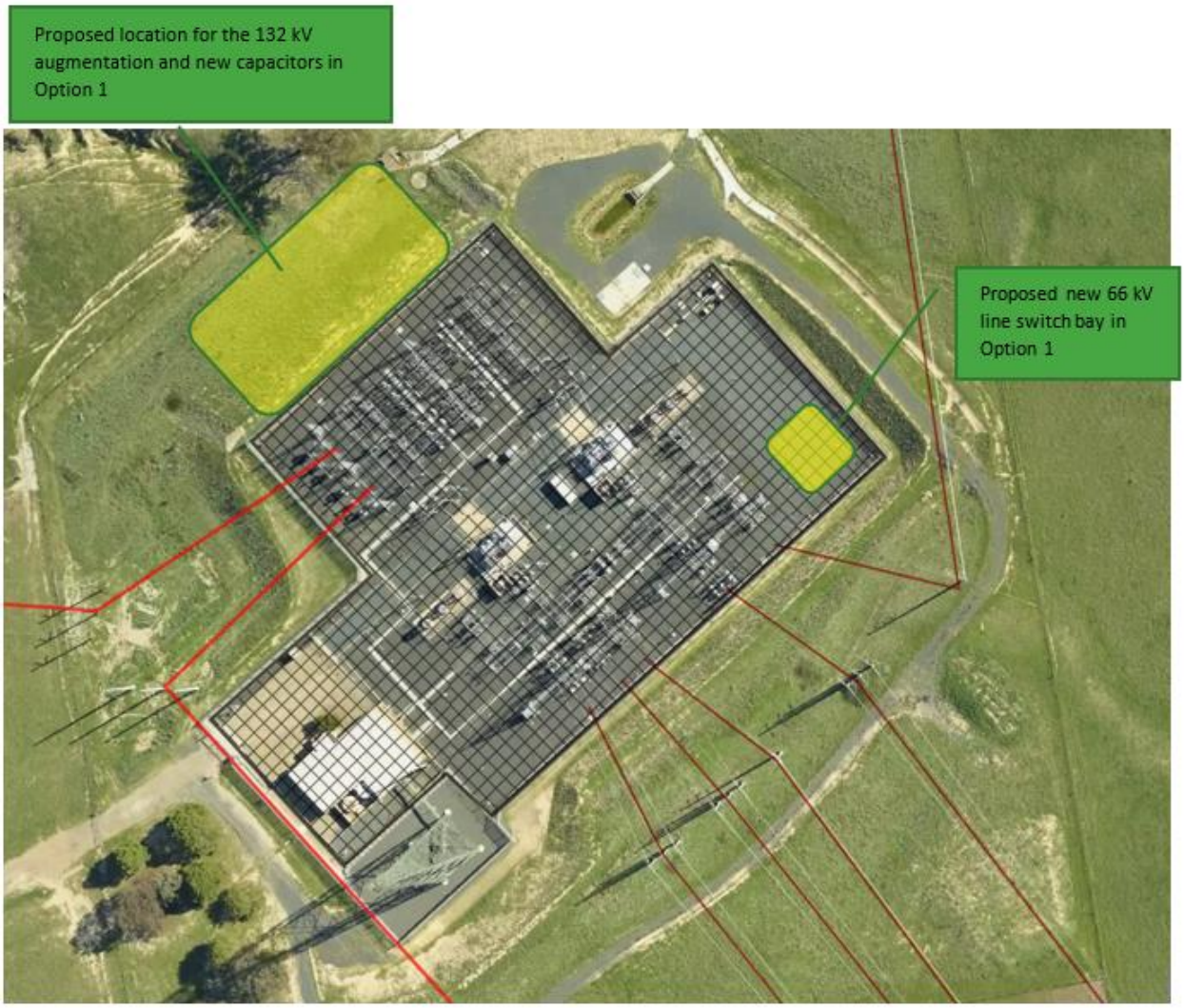
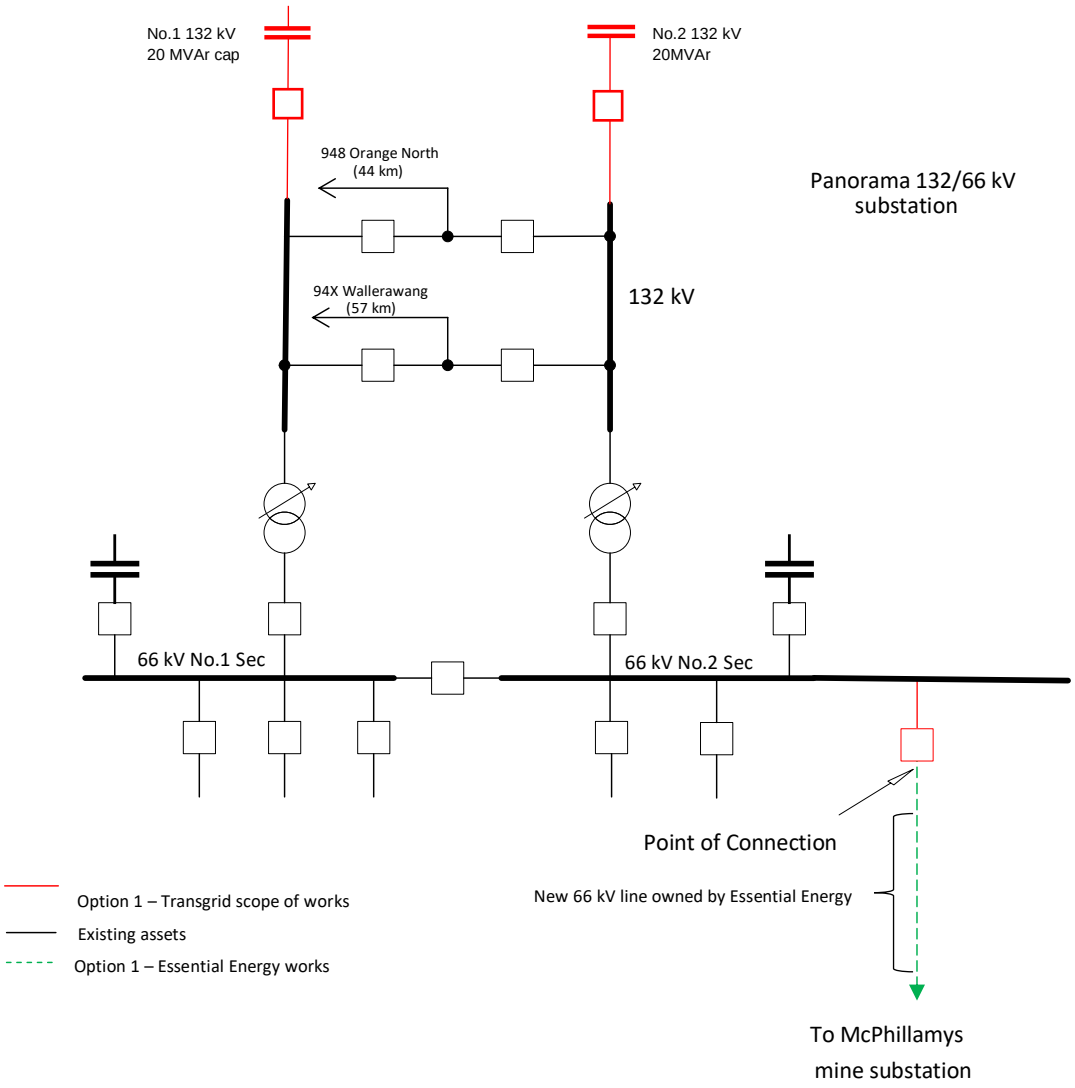


Figure 3-2 shows a simplified single line diagram indicating the proposed works under Option 1 and the connection arrangement of the new 66kV feeder which would be owned and operated by Essential Energy. The proposed point of connection would be on the load side of the switch bay for the 66kV feeder at the Panorama substation.

Figure 3-2 High-level schematic diagram for Option 1



The estimated capital cost of this option is approximately $22.4 million (of which $0.6 million relates to land and easements). The option would have a build period of 32 months starting in 2022/23 and commissioning expected in 2025/26.

A breakdown of the main components for Option 1 and the capital costs are set out Table 3-1 below.

Table 3-1 Option 1 components and capital costs, $2021/22 dollars

Component	Capital cost
66kV switchbay	$1.2 million
Two 20MVAr/132kV capacitor banks	$17.7 million
Feeder upgrade (Essential Energy)	$3.0 million
Land and easements	$0.6 million
Total capital cost	**$22.4 million**

Annual routine operating costs are assumed to be 2 per cent of capital costs.

3.2. Option 2 – 132kV Connection at Panorama: New 132kV switch bay and a new double-circuit transmission line

Option 2 involves establishing a new 132kV line switch bay, a new 132kV double-circuit overhead line connected to the new switch bay and re-building the existing 132kV Line 948 for approximately 18km from the west towards Orange North.

The proposed new double circuit 132kV feeder would be joined with a newly built Essential Energy owned 132kV overhead line, with one circuit that would run down to the McPhillamys mine substation while the other circuit would continue to Orange North. The rebuilt Line 948 section from Panorama to the end of the double circuit would be connected to the existing Line 948 section towards the Orange North 132kV switching station.

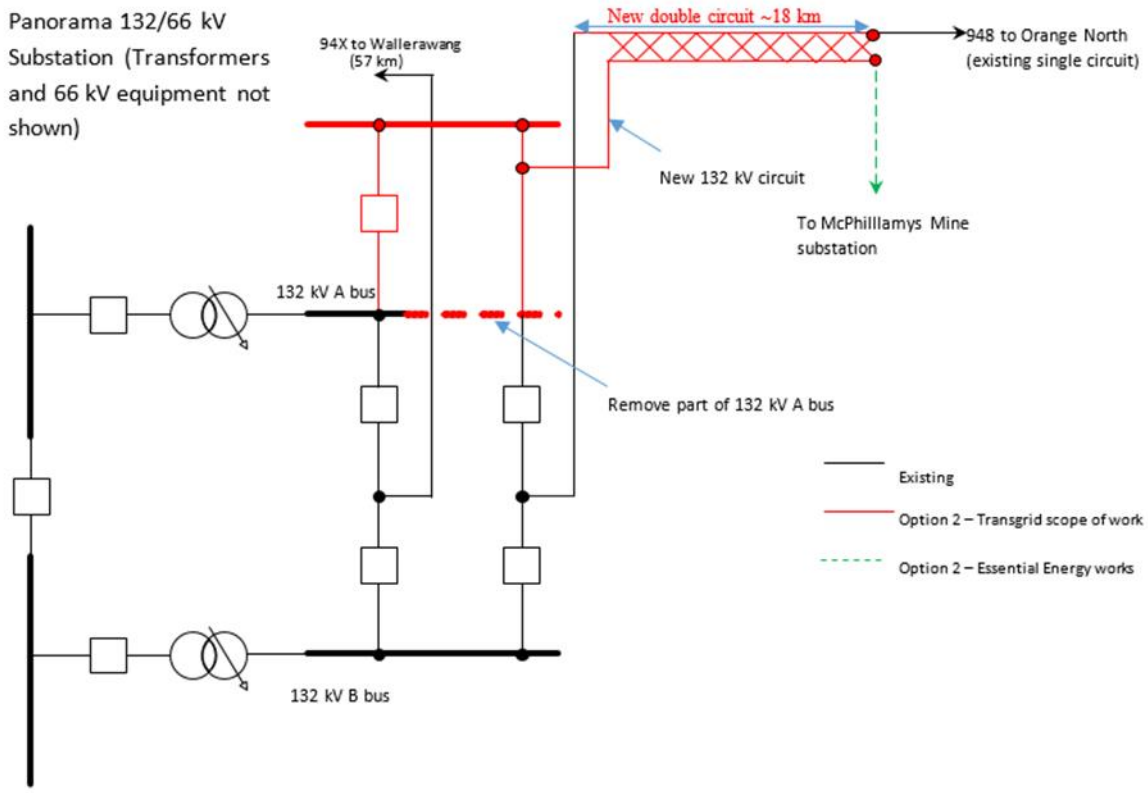
The proposed double circuit line from Panorama to the turning point towards the mine site is indicatively illustrated as the red line to the left in Figure 3-3, which also illustrates the proposed works at Panorama 132/66 kV substation under this option. The indicative location of the proposed 132kV double circuit line is shown in Figure 3-4.

Figure 3-3 Indicative location for the proposed works at Panorama 132/66 kV substation under Option 2

Figure 3-4 Line to be rebuilt as a double circuit line under Option 2

A high-level schematic diagram of the proposed works at the Panorama 132/66kV substation under Option 2 is illustrated in Figure 3-5.

Figure 3-5 High-level schematic diagram for Option 2



The estimated capital cost of this option is approximately $28.0 million (of which approximately $5.5 million relates to land and easements). The option would have a build period of 43 months starting in 2022/23 with commissioning expected in 2025/26.[22]

The main components of Option 2 and the associated costs are set out in Table 3-2.

Table 3-2 Option 2 components and capital costs, $2021/22 dollars

Component	Capital cost
132kV double circuit line	$8.7 million
132kV switch bay	$13.8 million
Land/easements	$5.5 million
Total capital cost	**$28.0 million**

Annual routine operating costs are assumed to be 2 per cent of capital costs.

[22] Commissioning of Option 2 in 2025/26 has been assumed for the purposes of the analysis in this PSCR. The assumption represents the earliest that the option can be commissioned based on the estimated build period. However, commissioning may occur in 2026/27, depending on the build period and whether delays occur (see section 7.4.2). A delayed commissioning in 2026/27 is not material to the outcomes of the PSCR analysis.

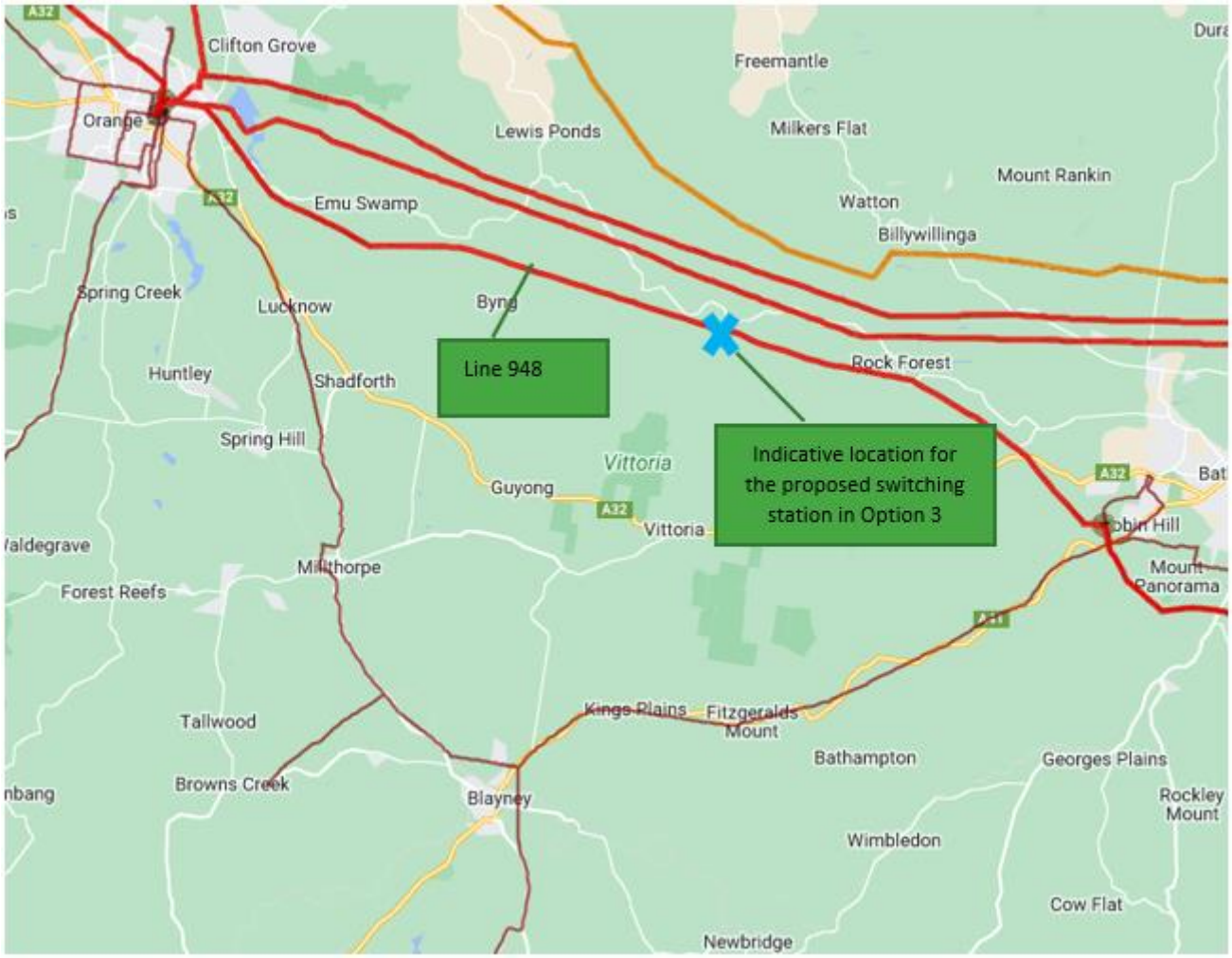
3.3. Option 3 – New connection point on Line 948: New three circuit-breaker switching station

Under Option 3, the 132kV Line 948 would be cut into to establish a loop in/out arrangement and construction of a three circuit breaker switching station at a location approximately 18km west of the our Panorama substation. The new switching station would be built on Transgrid-owned land (that we would need to procure) and would be operated by us as a regulated asset.

The three circuit breaker arrangement would continue to provide an acceptable level of reliability and security to existing customers.

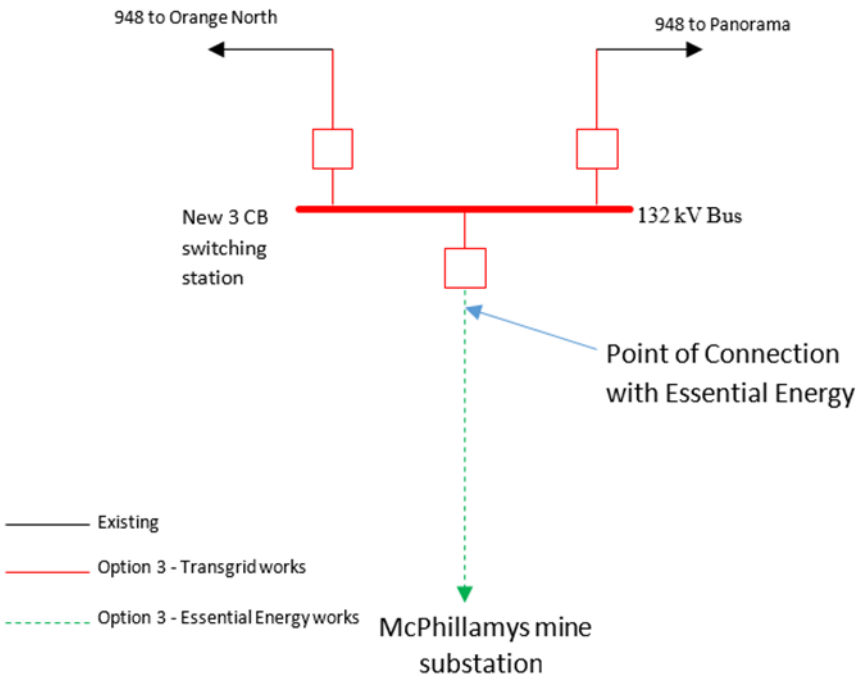
An indicative location for the proposed switching station is shown in Figure 3-6. The proposed point of connection with Essential Energy's distribution network would be the switch bay for the 132kV feeder at the new switching station. From this new switching station, a new 132kV distribution line would be required to be established by Essential Energy to connect the switching station to the mine site.

Figure 3-6 Indicative location of the new 132kV switching station under Option 3



A high-level schematic diagram of the proposed works under Option 3 is provided in Figure 3-7

Figure 3-7 High-level schematic diagram for Option 3



The estimated capital cost of this option is approximately $15.8 million (of which approximately $0.3 million relates to land and easements). The option would have a build period of 36 months starting in 2022/23 with commissioning expected in 2025/26.

Table 3-3 Option 3 components and capital costs, $2021/22 dollars

Component	Capital cost
Three circuit breaker switching stations	$15.5 million
Land/easements	$0.3 million
Total capital cost	**$15.8 million**

Annual routine operating costs are assumed to be 2 per cent of capital costs.

3.4. Options considered but not progressed

We have also considered whether other options could meet the identified need. An additional option considered and the reason this option was not progressed is summarised in Table 3-4. No other options were considered able to meet the identified need.

Table 3-4: Options considered but not progressed

Option	Reason(s) for not progressing
New 132kV switch bay at Orange North and a new double-circuit transmission line between Orange North and the line cut in (for approximately 33km)	This option is similar to Option 2 but involves a longer distance for the double-circuit transmission line component. This option is therefore not considered economically feasible as the longer distance would result in a higher capital cost but would not provide any additional benefit.
Non-network options	See section 4.

Non-network options are not expected to be able to meet the identified need, as set out in section 4.

4. Non-network options

We do not consider that non-network options can assist with meeting the identified need for this RIT-T due to the nature of the need. This is driven by several considerations:

- a non-network option would effectively need to be able to meet the load of the mine that would be otherwise unserved on a continuous basis, 24 hours a day over its life at a cost that is lower than the most cost effective network option.
- the extent of unserved energy at the mine and the relatively low cost of the preferred network option ($15.8 million) suggest non-network options at the scale required are unlikely to be cost competitive compared to network options (ie, non-network options are unlikely to be economically feasible).
- We have undertaken studies that show a non-network solution could provide the voltage support required to manage the mine load if it was available at required service levels. However, the 132kV network would still likely be needed to provide supply to the mine, incurring additional cost without additional benefits. For 66kV options, non-network options could only replace capacitors but connection costs would be considerable making non-network options not economically feasible.

However, we invite any prospective proponents that wish to propose a non-network option that can meet the identified need, in whole or in part, to provide a submission to this PSCR. Any solution, including non-network solutions, would need to satisfy the following technical characteristics as set out in Table 4-1.

Table 4-1: Technical characteristics of the identified need

Technical characteristics of the identified need	Details
The size of the load reduction or additional supply	7MVA initially, increasing to 16MVA
Location	At the McPhillamys Gold Mine site
Operating profile	Due to the nature of the load, the non-network option would need to operate 24 hours a day throughout the year

Details on how submissions should be provided are provided in section 1.2.

5. Ensuring the robustness of the analysis

The investments considered as part of this RIT-T involve long-lived assets, and it is important that the recommended preferred option does not depend on a narrow view of future outcomes, given that the future is inherently uncertain.

Uncertainty is captured under the RIT-T framework using reasonable scenarios, which reflect different assumptions about factors that are expected to affect the relative market benefits of the options being considered. The use of scenarios tests the robustness of the RIT-T assessment to different assumptions about how key variables affecting costs and benefits may develop in the future.

The robustness of the outcome is also investigated through the use of sensitivity analysis in relation to key input assumptions.

5.1. The assessment considers three 'reasonable scenarios'

The RIT-T is focused on identifying the top ranked credible option in terms of expected net benefits. However, uncertainty exists in terms of estimating future inputs and variables (termed future 'states of the world').

To deal with this uncertainty, the NER requires that costs and market benefits for each credible option are estimated under reasonable scenarios and then weighted based on the likelihood of each scenario to determine a weighted ('expected') net benefit.[23] It is this 'expected' net benefit that is used to rank credible options and identify the preferred option.

The credible options have been assessed under three scenarios as part of this PSCR assessment, which differ in terms of the key drivers of the estimated net market benefits.

The three scenarios are characterised as follows:

- a 'low net economic benefits' scenario, involving a number of assumptions that gives a 'lower bound', conservative estimate of the present value of net economic benefits;
- a 'central' scenario based on a central set of variable estimates and reflects the most likely scenario; and
- a 'high net economic benefits' scenario that reflects a set of assumptions selected to investigate an 'upper bound' of net economic benefits.

Table 5-1 below summarises the specific key variables that influence the net benefits of the options under each of the scenarios considered. The assumptions made about future demand at the mine are discussed further in section 2.3.

[23] The AER RIT-T Application Guidelines explicitly refer to the role of scenarios as the primary means of taking uncertainty into account. See: AER, *RIT-T Application Guidelines*, December 2018, p. 42.

Table 5-1: Summary of scenarios

Variable	Central	Low net economic benefits	High net economic benefits
Network capital costs	Base estimate	Base estimate + 25%	Base estimate - 25%
Eventual spot load from the McPhillemys Gold Mine[24]	35MVA	26MVA	35MVA
VCR[25]	$38.42/kWh	$26.89/kWh	$49.95/kWh
Discount rate	5.50%	7.50%	2.30%

In addition, to the scenario testing, we also undertake sensitivity testing focussed on the central scenario (being the most likely outcome), which varies one variable at a time to test the robustness of the preferred option to alternate assumptions regarding that variable alone.

5.2. Weighting the reasonable scenarios

We consider that the central scenario is the most likely, since it is based primarily on a set of expected/central assumptions. We have assigned this scenario a weighting of 90 per cent, with the other two scenarios being weighted equally at 5 per cent each given they represent more extreme combinations of assumptions. This weighting reflects feedback from the Transgrid Advisory Council that suggested the weightings used in earlier Transgrid RIT-T assessments[26] has over-emphasised low and high benefit scenarios.

We note that the appropriate weightings applied to the high and low scenarios is a matter which is currently being considered by the AER, as part of disputes lodged by PIAC to both the Bathurst Orange Parkes and North West Slopes RIT-Ts.[27] Alternative weightings may be adopted in the PACR if the AER determines that the above scenario weightings adopted are not consistent with the RIT-T requirements.

However, we note that the highest-ranking option is consistent across all three scenarios (as well as the weighted outcome of those scenarios), which demonstrates that the identification of the preferred option is insensitive to the assumed scenario weights.

5.3. Sensitivity analysis

In addition to the scenario analysis, we have also considered the robustness of the outcome of the cost benefit analysis through undertaking a range of sensitivity testing, focused on the central scenario (as being the most likely outcome).

The range of factors tested as part of the sensitivity analysis in this PSCR are:

- lower and higher assumed VCRs;
- lower and higher capital costs of the credible options;

[24] Maximum demand in 2028/29. The demand forecasts and assumed ramp-up rate over time for the McPhillamys mine are discussed in section 2.3.1.
[25] The VCR estimate and the associated high and low VCR values are discussed further in section 6.2.
[26] Earlier RIT-T assessments have typically assigned a 50 per cent weighting to the central scenario, with 25 per cent weightings to the high and low scenarios.
[27] See: https://www.aer.gov.au/communication/aer-receives-notification-of-rit-t-dispute-from-piac

- alternate commercial discount rate assumptions;
- lower demand at McPhillamys Gold Mine; and
- full unserved energy inputs.

The above list of sensitivities focuses on the key variables that could impact the identified preferred option. The results of the sensitivity tests are set out in section 7.4.

6. Overview of the assessment approach

This section outlines how the net market benefits have been estimated for this PSCR.

6.1. Avoided involuntary load shedding in the Panorama area

We consider that the only relevant category of market benefits prescribed under the NER for this RIT-T relates to changes involuntary load shedding or unserved energy.

Unserved energy is the amount of energy that customers request to utilise but cannot be supplied due to a network capacity limitation. A reduction of unserved energy from the credible option, relative to the base case, results in a positive contribution to market benefits.

We have run system studies to estimate the unserved energy in the Panorama area under each of the three base cases and each of the credible options.

6.1.1. Unserved energy in the base case

Consistent with the RIT-T requirements, the assessment undertaken compares the costs and benefits of each option to a base case 'do nothing' option. The base case is the (hypothetical) projected case if no action is taken.

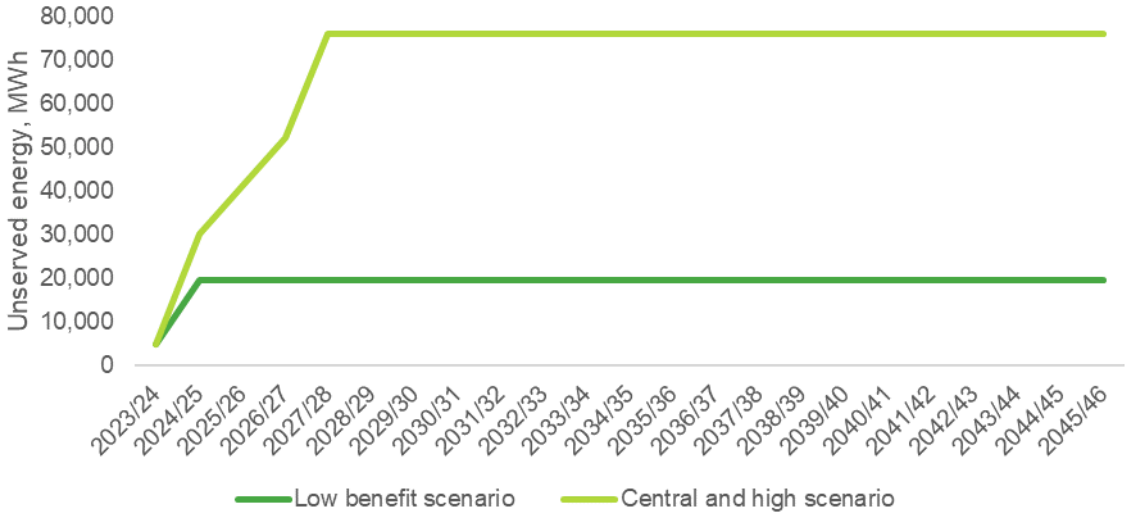
Under the base case, the McPhillamys Gold Mine is assumed to connect to Essential Energy's distribution network, which in turn is supplied via our 66kV Panorama substation. The base case also assumes the preferred option identified in the Bathurst, Orange and Parkes PACR is implemented, which addresses the voltage impact on the shared network from a range of additional spot loads in Essential Energy's network.[28] With these assumptions in the base case, supply to the mine will be limited to approximately 19MVA and will result in significant levels of unserved energy for any demand above that level (see Figure 2-4).

The assumed demand from the mine in the base case varies depending on the scenario. Figure 6-1 shows that under the central and high benefit scenarios, there would be unserved energy of up to approximately 76,000MWh per year in the base case by 2027/28. Under the low benefits scenario unserved energy would be approximately 19,000MWh per year.[29]

[28] The preferred option identified in the Bathurst, Orange and Parkes PACR includes a non-network solution provided through a Battery Energy Storage System at Parkes and Panorama along with the installation of static synchronous compensators at Parkes and Panorama or a synchronous condenser at Parkes in the near term.

[29] The high levels of unserved energy in the base case reflects a constant mine load profile and binding network constraints throughout the day, giving rise to large levels of unserved energy.

Figure 6-1 Annual unserved energy in the base case under each scenario, MWh



While this is not a situation we or Essential Energy plan to encounter, and this RIT-T has been initiated specifically to avoid it, the RIT-T assessment uses this base case as a common point of reference when estimating the net benefits of each credible option.

Given that the levels of unserved energy under the base case are extremely high, they have the potential to overshadow other important aspects of the analysis (e.g. we estimate that unserved energy in the base case will be approximately $3 billion annually by 2027/28 under the central scenario). We have therefore not adopted the full extent of expected unserved energy under the base case shown in Figure 6-1. As each option will address the constraints and avoid largely the same amount of unserved energy i.e., quantifying the full extent of avoided involuntary load shedding under each option will not assist in identifying the preferred option under the RIT-T.

We considered capping the level of unserved energy at 2026/27 levels consistent with practice in previous RIT-T projects that involved very high levels of unserved energy.[30] However, the level of unserved energy is still very large even if it is capped (approximately $2 billion annually if capped at 2026/27 levels under the central scenario) and would still overwhelm any differences between the options.

Consequently, we have adopted an arbitrary adjustment to unserved energy inputs by taking only 1 per cent of unserved energy (ie dividing annual unserved energy estimates by 100) to allow differences between options to be more prominent. This analysis is complemented by a sensitivity test that uses the full amount of unserved energy inputs to demonstrate that the level of unserved energy does not affect RIT-T outcomes in terms of option rankings and the identification of the preferred option.

6.1.2. Avoided involuntary load shedding in the option cases and VCR value

As noted above, we have run system studies to estimate the unserved energy in the Panorama area under each of the credible options. Each option is assumed to be able to avoid the whole amount of unserved energy in the base case once commissioned, noting that Option 2 has a slightly longer build period and

[30] See Maintaining Reliable Supply to the North West Slopes Area PACR as an example. This approach also reflects earlier views from the AER's consultants, eg, in relation to the earlier Powering Sydney's Future RIT-T, Dr. Biggar suggested it is not correct to allow unserved energy costs to increase to arbitrarily high levels and that they should be capped, which allows a more meaningful comparison between options.

therefore sightly later commissioning, which results in more unserved energy compared to the other two options.

Avoided unserved energy for each option has been valued using the estimated VCRs published by the AER.[31] Specifically, we have used the AER's VCR estimate for mining load, adjusted for inflation to $38.42/kWh for the central scenario,[32] as the Expected Unserved Energy (EUE) would exclusively be related to the McPhillamys Gold Mine.[33] We have then applied VCR estimates that are 30 per cent lower and 30 per cent higher for the low and high scenarios, respectively, consistent with the AER's ± 30 per cent confidence interval.[34]

6.2. All other categories of market benefit are not material for this RIT-T assessment

We do not consider that any other categories of market benefit are relevant for this RIT-T.[35]

None of the credible options assessed address network constraints between competing generating centres and are therefore not expected to result in any change in dispatch outcomes and wholesale market prices. We therefore consider that the following classes of market benefits are not material for this RIT-T assessment:

- changes in fuel consumption arising through different patterns of generation dispatch;
- changes in voluntary load curtailment (since there is no impact on wholesale prices);
- changes in costs for parties, other than for TransGrid (since there will be no deferral or avoidance of generation or storage investment);
- changes in ancillary services costs;
- competition benefits; and
- Renewable Energy Target penalties.

In addition to the classes of market benefits listed above, NER clause 5.16.1(c)(4) requires us to consider the following classes of market benefits in relation to each credible option: differences in the timing of unrelated transmission investment; option value; and changes in network losses. We consider that none of these classes of market benefit are material for this RIT-T assessment for the reasons set out in Table 6-1.

[31] The VCR values have been taken from the most recent VCR update from the AER, i.e.: AER, *Annual update – VCR review final decision – Appendices A – E*, December 2021.

[32] AER, Values of Customer Reliability – Annual adjustment summary, December 2021, p 2. VCR for mines is $36.47/kWh in September 2021 dollars. We have inflated this amount to September 2022 dollars using the CPI index for Australia published by the ABS.

[33] Given that all of the EUE relates to mining load, there is no need to construct a load-weighted VCR estimate for this RIT-T.

[34] AER, *Values of Customer Reliability – Final Report on VCR values*, December 2019, p. 84.

[35] Under NER clause 5.16.4(b)(6)(iii), the PSCR should set out the classes of market benefit that the NSP considers are not likely to be material for a particular RIT-T assessment.

Table 6-1:Reasons why other non-wholesale market benefit categories are considered immaterial

Market benefits	Reason
Differences in the timing of expenditure	None of the options considered in this RIT-T affect decisions to undertake unrelated expenditure in the network, or the timing of other network expenditure. Consequently, material market benefits will neither be gained nor lost due to changes in the timing of expenditure from any of the options considered. This includes the investments being progressed following the Bathurst Orange Parkes RIT-T, which are not affected by the options being considered for this RIT-T (and which are included in the base case for all options and scenarios under this RIT-T).
Option value	No material option value is expected from the options considered. If demand from the mine turns out to be materially higher than currently forecast, all options would require additional capital investment.
Changes in network losses	There is not expected to be any material difference in transmission losses between options.

6.3. General modelling parameters adopted

The RIT-T analysis adopts a 25-year assessment period from 2022/23 to 2046/47.

Where the capital components of the credible options have asset lives extending beyond the end of the assessment period, the NPV modelling includes a terminal value to capture the remaining asset life. This ensures that the capital cost of long-lived options over the assessment period is appropriately captured, and that all options have their costs and benefits assessed over a consistent period, irrespective of option type, technology or asset life. The terminal values are calculated as the undepreciated value of capital costs at the end of the analysis period and can be interpreted as a conservative estimate for benefits (net of operating costs) arising after the analysis period.

A real, pre-tax discount rate of 5.50 per cent has been adopted as the central assumption for the NPV analysis presented in this PSCR, consistent with the assumptions adopted in AEMO's 2022 Integrated System Plan (ISP).[36] The RIT-T requires that sensitivity testing be conducted on the discount rate and that the regulated weighted average cost of capital (WACC) be used as the lower bound. We have therefore tested the sensitivity of the results to a lower bound discount rate of 2.30 per cent.[37] We have adopted an upper bound discount rate of 7.50 per cent (i.e., the upper bound proposed for the 2022 ISP).[36]

[36] AEMO, *2022 Integrated System Plan, June 2022*, p 91.

[37] This is equal to WACC (pre-tax, real) in the latest final decision for a transmission business in the NEM, see: https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/powerlink-determination-2022%E2%80%9327/final-decision

7. Assessment of credible options

This section presents the results of the NPV assessment of the credible options.

The assessment compares the costs and benefits of the option to a base case 'do nothing' option, where no additional investment is made to facilitate the connection of the McPhillamys Gold Mine in Essential Energy's distribution network.

7.1. Gross benefits estimates

The table below summarises the gross benefit estimated for each of the options relative to the 'do nothing' base case in present value terms. The benefit included in this assessment is avoided unserved energy.

Table 7-1: Gross economic benefits relative to the base case, $millions PV

Option/scenario	Central	Low benefit	High benefit
Scenario weighting	90%	5%	5%
Option 1	282.5	561.8	40.9
Option 2	280.6	558.9	40.4
Option 3	282.5	561.8	40.9

Options 1 and 3 have the same levels of benefits from avoided unserved energy (as it is assumed that unserved energy in the base case is fully avoided under each option from 2026/27 onward), while some degree of unserved energy remains for Option 2 in 2026/27 due to the longer build period and later commissioning, resulting in this option having slightly lower gross benefits.

Gross benefits have been calculated for each of the three reasonable scenarios outlined in section 5.1 above and is comprised entirely of avoided unserved energy benefits. The present values presented above reflect different underlying assumed demand growth rates and commercial discount rates, across the scenarios (as set out in Table 5-1).

As discussed in section 6.1.1, the amount of unserved energy avoided has been reduced by a factor of 100 in order to avoid it swamping the net benefit comparison between the options.

7.2. Estimated costs

The table below summarises both capital and operating costs of each option, relative to the base case, in present value terms.

Table 7-2: Gross economic benefits relative to the base case, $millions PV

Option/scenario	Central	Low benefit	High benefit
Scenario weighting	90%	5%	5%
Option 1	21.1	16.5	25.3
Option 2	24.4	18.3	29.5
Option 3	15.1	11.8	18.1

The present value of the cost of the options has been calculated for each scenario using different assumed capital costs and discount rates (as set out in Table 5-1).

7.3. Net market benefits

This section presents the results of the assessment we have undertaken for the credible options considered in this RIT-T.

Figures in this section are presented so that differences between the options are more prominent. Consequently, the scale of y-axis between figures is different (and does not always start at zero).

7.3.1. Central scenario

The central scenario reflects the expected outcome for the key underlying assumptions and is considered the most likely scenario.

Under the central scenario, Option 3 is found to be the top ranked option, delivering approximately $267 million in net benefits. Option 1 is second ranked with net benefits of approximately $261 million, resulting from Option 3 having lower capital and operating costs.

Figure 7-1 Summary of the estimated net benefits under the central scenario[38]

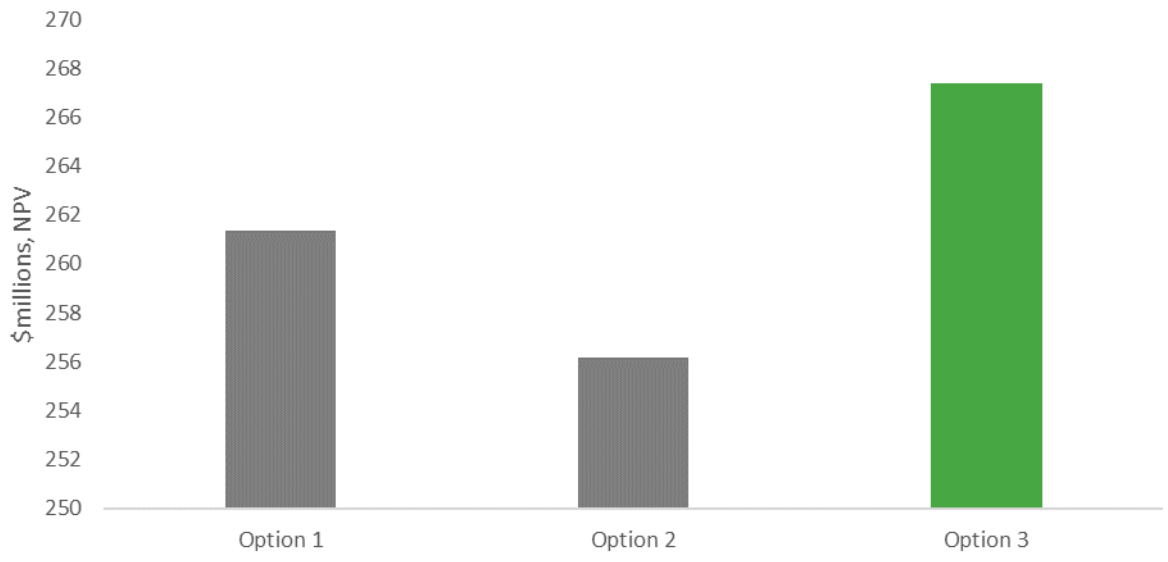
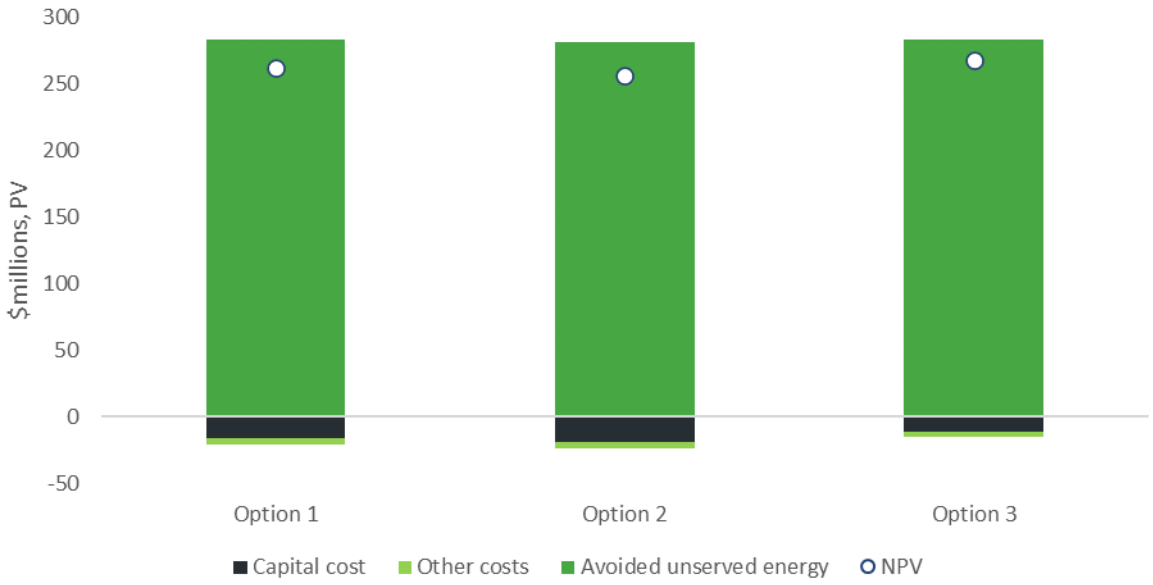


Figure 7-2 presents a breakdown of the costs and benefits in present value terms for each option under the central scenario. Avoided unserved energy benefit is the dominant factor driving the outcome for each option and is slightly lower for Option 2.

Figure 7-2 shows that the costs for Option 3 are the lowest, compared to the two other options, leading to Option 3 being highest ranked under the central scenario.

[38] Note that the y-axis for Figure 7-1 starts at $250 million and is presented this way to highlight differences between options.

Figure 7-2 Breakdown of present value costs and benefits under the central scenario



7.3.2. Low benefits scenario

The low net economic benefits scenario reflects a number of assumptions that give a lower bound and conservative estimate of the net present value of net economic benefits. These assumptions include higher capex costs, low mine demand and a high commercial discount rate estimate.

Under these assumptions, Option 3 is again found to be the top ranked option, delivering approximately $23 million in net benefits as seen in Figure 7-3. Option 1 is second ranked with net benefits of approximately $16 million.

Figure 7-3 Summary of the estimated net benefits under the low benefits scenario

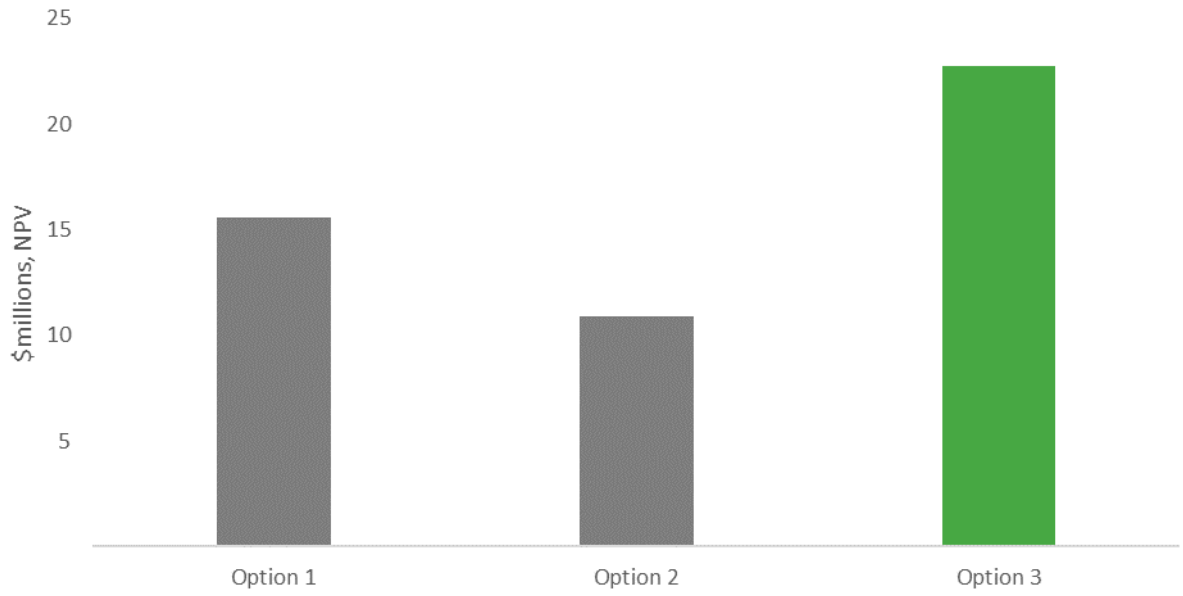
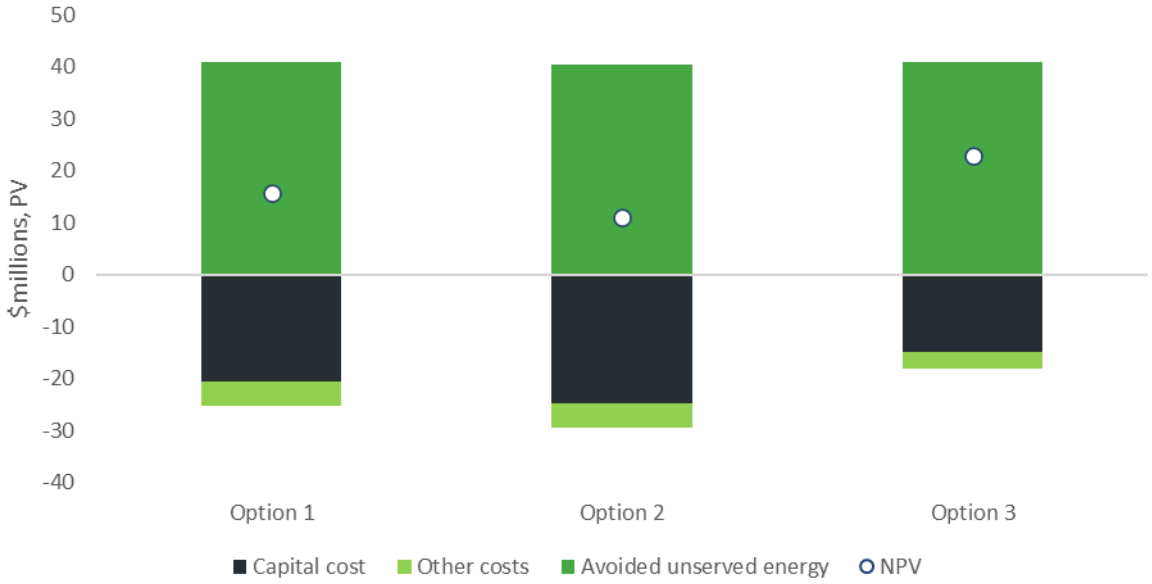


Figure 7-4 presents a breakdown of the costs and benefits in present value terms for each option under the low benefits scenario. Avoided unserved energy benefits are significantly less for each option than in the central scenario. The level of avoided unserved energy across the three options remain similar, with only slightly lower avoided unserved energy for Option 2.

Figure 7-4 also continues to show slightly lower costs for Option 3, compared to the two other options, leading to Option 3 being highest ranked under the low benefits scenario.

Figure 7-4 Breakdown of present value costs and benefits under the low benefits scenario



7.3.3. High benefits scenario

The high net economic benefits scenario reflects a number of assumptions that give an upper bound estimate of net present value of net economic benefits. These assumptions include lower capex estimates and a low commercial discount rate estimate.

Under these assumptions, Option 3 is again found to be the top ranked option, delivering approximately $550 million in net benefits as seen in Figure 7-5. Option 1 is second ranked with net benefits of approximately $545 million.

Figure 7-5 Summary of the estimated net benefits under the high benefits scenario

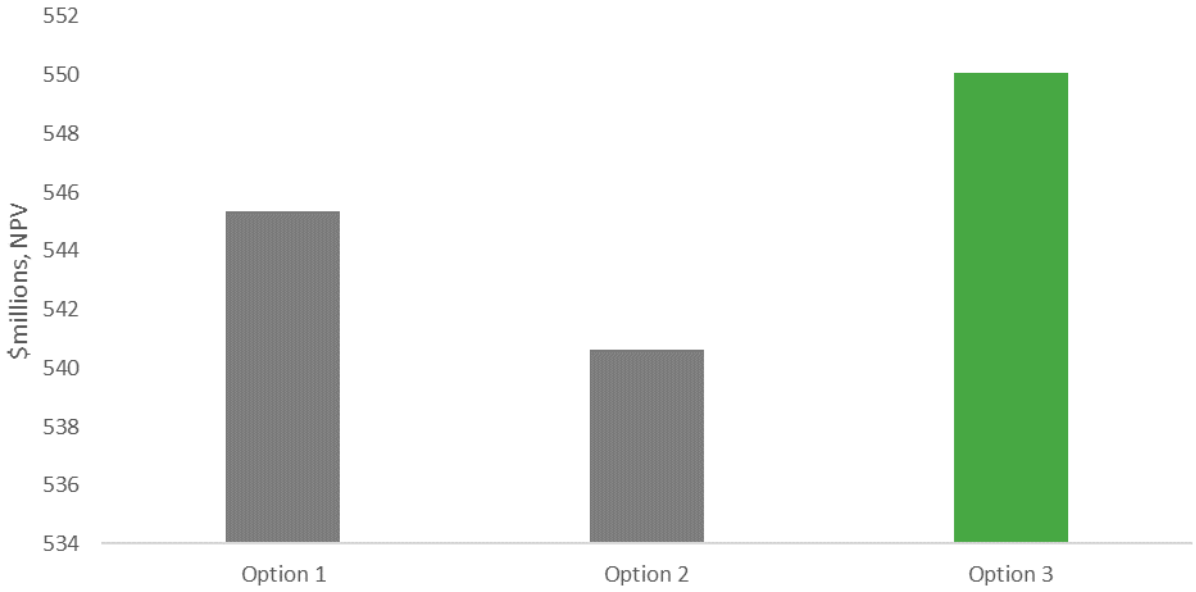
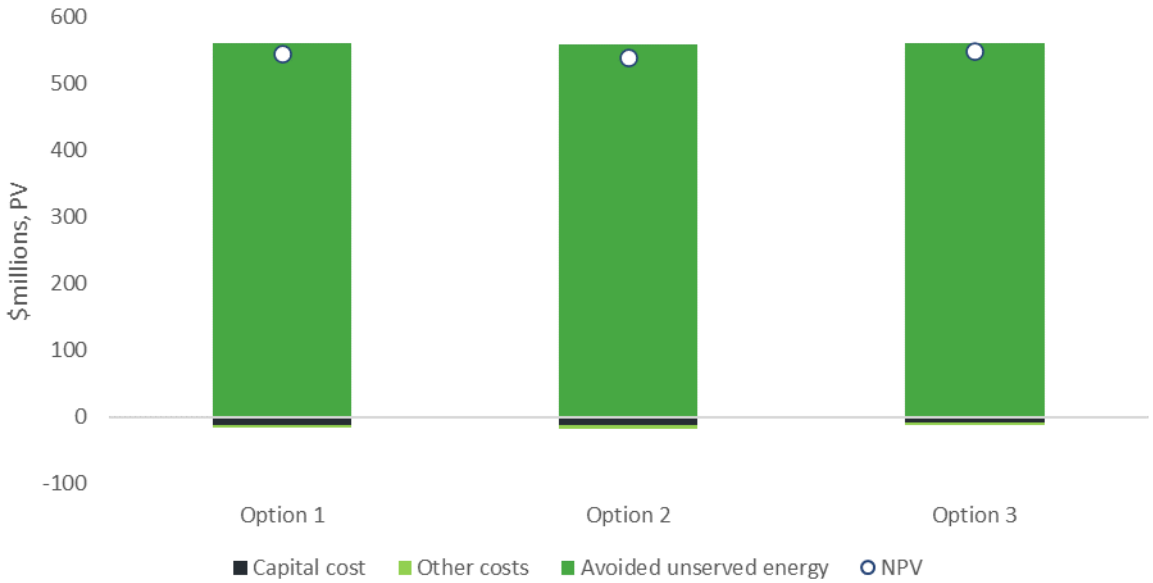


Figure 7-6 presents a breakdown of the costs and benefits in present value terms for each option under the high benefits scenario. Avoided unserved energy benefit is significantly higher for each option than in the central scenario. The level of avoided unserved energy across the three options remain similar.

Figure 7-6 also continues to show slightly lower costs for Option 3, compared to the two other options, leading to Option 3 continuing to be highest ranked under the high benefits scenario.

Figure 7-6 Breakdown of present value costs and benefits under the high benefits scenario

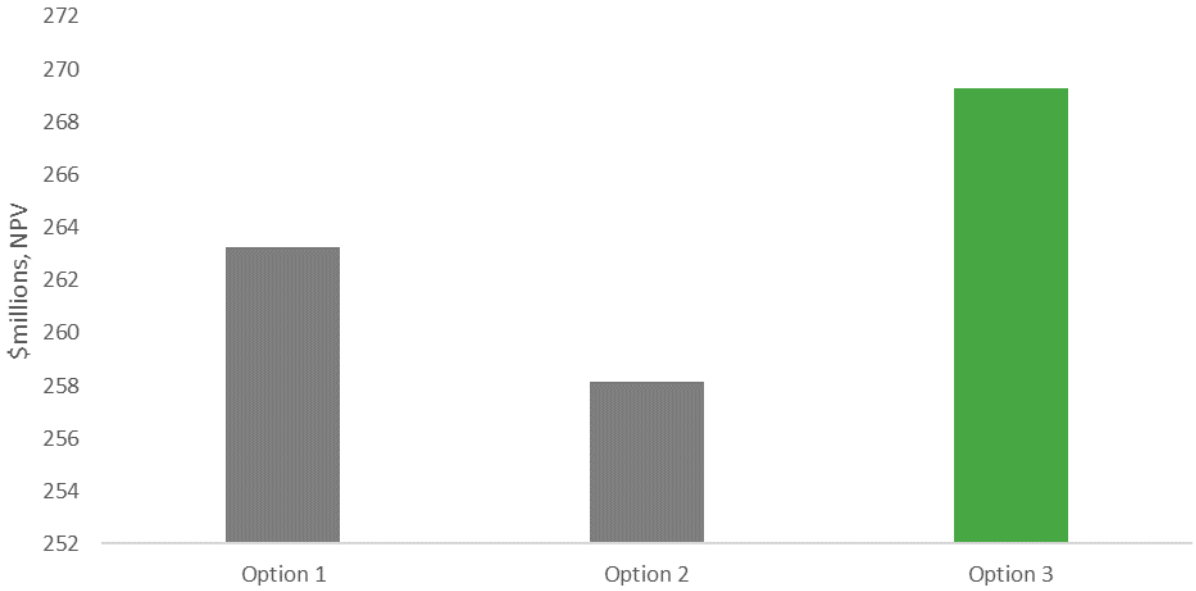


7.3.4. Weighted scenario outcomes

Figure 7-7 shows the estimated net benefits for each of the credible options weighted across the three scenarios investigated (and discussed above) using weightings drawn from Table 5-1.

On a weighted basis, Option 3 is the top-ranked option and delivers approximately $269 million in net benefits. Option 1 is the second ranked option on weighted basis, with $263 million in net benefits.

Figure 7-7 Summary of the estimated net benefits, weighted across the three scenarios



7.4. Sensitivity testing

In addition to the scenario analysis, we have also considered the robustness of the cost benefit analysis outcomes by undertaking a range of sensitivity testing relating to the central scenario.

Specific factors tested as part of the sensitivity analysis in this PSCR are:

- lower and higher assumed VCRs;
- lower and higher capital costs of the credible options;
- alternate commercial discount rate assumptions;
- lower demand at McPhillamys Gold Mine; and
- full unserved energy inputs.

In addition to the sensitivity tests listed above, we have also qualitatively considered the sensitivity around the timing of when options are commissioned.

Threshold testing for capital costs and discount rate assumptions have also been considered. However, it was found that no realistic threshold values exist that would affect the identification of the preferred option.

7.4.1. Sensitivity test for specific factors

The results of each sensitivity test for specific factors is presented in Table 7-3, with the highest ranking option in **bold**.

Table 7-3 Sensitivity tests under the central scenario, $m PV

Sensitivity	Option 1	Option 2	Option 3
Central scenario	261	256	**267**
Lower assumed VCR ($26.89/kWh)	177	172	**183**
Higher assumed VCR ($49.95/kWh)	346	340	**352**
Lower capital costs (Base estimate -25%)	265	261	**270**
Higher capital costs (Base estimate +25%)	257	251	**264**
2.3 per cent discount rate	410	406	**416**
7.5 per cent discount rate	201	196	**207**
26MVA demand at McPhillamys mine	53	49	**59**
Full unserved energy inputs	27,468	27,273	**27,474**

The sensitivity tests show that the option ranking, where Option 3 is the top ranked option, is robust to changes in the parameters tested.

From these results, two sensitivities relating to demand and unserved energy are worth highlighting:

- the sensitivity test of continuing 26MVA demand at McPhillamys mine demonstrates that the option rankings in the central scenario are insensitive to the profile or timing of any ramp up of mine demand from 26MVA to 35MVA.
- the use of full unserved energy inputs (instead of 1/100th of unserved energy inputs as discussed in section 7.3), does not the change option rankings but does change the level of avoided unserved energy benefits significantly.

A sensitivity test for high demand beyond 35MVA was not undertaken, as the options considered would all require additional investment for significantly higher demand. However, the additional investment required for the 132kV options (ie Options 2 and 3) would be lower than the additional investment required for the 66kV option due to the 66kV option requiring significantly more voltage support. It follows that the 132kV options would remain the highest rank options where mine demand is significantly higher than 35MVA.

7.4.2. Sensitivity to delays

A consequence of the high level of unserved energy in the base case means that the preferred option will be sensitive to when commissioning occurs. An option that can be commissioned earlier can avoid significant amounts of unserved energy, while delays in commissioning can result in significant amounts of unserved energy. We have therefore considered the likelihood of delay for each option considered in this PSCR.

Option 1 has the shortest build period among the three options, taking 32 months. However, this is only for our components. Essential Energy would also need to upgrade its distribution network to accommodate the mine load, which we have assumed would take place at the same time, enabling the commissioning of Option 1 in 2025/26. However, we understand from Essential Energy that it is possible that the distribution network components may take until 2026/27 to be commissioned, due to the nature of works required for feeder upgrades. This therefore presents a risk of delay under this option.

Option 2 and Option 3 have build periods of 43 months and 36 months respectively. These options will also have some risks of delay related to the associated Essential Energy works, but these works are less significant for these options and present a lower risk of delay compared to Option 1.

Furthermore, the scope of works for Option 3 is more contained in scope compared to both Option 1 and Option 2. Option 3 only requires an additional circuit breaker switching station. In contrast, Option 1 and Option 2 involves a broader scope including components that involve multiple suppliers and lead times, and engaging with multiple parties to obtain land or easements. The scope under Option 1 and Option 2 is more likely to add complexity and increase the potential for delay.

For these reasons, we consider that Option 3 will have the least risk of delay compared to Option 1 and Option 2 and that the risk of delay is therefore unlikely to materially affect the identification of Option 3 as the preferred option.

8. Draft conclusion and exemption from preparing a PADR

Option 3 is the preferred option at this stage of the RIT-T process and involves installing a new three circuit-breaker switching station on 132kV Line 948.

The estimated capital cost of Option 3 is approximately $15.8 million. Routine operating and maintenance costs are estimated to be approximately $310,000 per year.

We estimate that it will take 36 months to complete Option 3, with commissioning in 2025/26.

Noting that this project is being triggered by a major customer requesting network connection to Essential Energy's network, we understand that specific tariff arrangements will be established by Essential Energy to recover the locational element of the shared transmission augmentation from beneficiaries, taking into account their share in the capacity added to the network. We understand that the cost recovery mechanism will be part of the customer connection agreements and acts as a means of mitigating against the risk of having stranded network assets. It is noted also that the customer will directly fund the dedicated assets associated with their connection to the distribution network.

NER clause 5.16.4(z1) provides for a TNSP to be exempt from producing a PADR for a particular RIT-T application, in the following circumstances:

- if the estimated capital cost of the preferred option is less than $46 million;
- if the TNSP identifies in its PSCR its proposed preferred option, together with its reasons for the preferred option and notes that the proposed investment has the benefit of the clause 5.16.4(z1) exemption; and
- if the TNSP considers that the proposed preferred option and any other credible options 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), with the exception of market benefits arising from changes in voluntary and involuntary load shedding.

We consider that the investment in relation to Option 3 is exempt from producing a PADR under NER clause 5.16.4(z1).

In accordance with NER clause 5.16.4(z1)(4), the exemption from producing a PADR will no longer apply if we consider that an additional credible option that could deliver a material market benefit is identified during the consultation period. Accordingly, if we consider that any additional credible options are identified, we will produce a PADR which includes an NPV assessment of the net market benefit of each additional credible option.

Should we consider that no additional credible options were identified during the consultation period, we intend to produce a PACR that addresses all submissions received including any issues in relation to the proposed preferred option raised during the consultation period.[39]

[39] In accordance with NER clause 5.16.4(z2).

Appendix A – Compliance checklist

This appendix sets out a compliance checklist which demonstrates the compliance of this PSCR with the requirements of clause 5.16.4(b) of the Rules version 189.

Rules clause	Summary of requirements	Relevant section(s) in PSCR
5.16.4 (b)	A RIT-T proponent must prepare a report (the project specification consultation report), which must include:	–
	(1) a description of the identified need;	Section 2.2
	(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);	Section 2.3
	(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;	Section 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;	N/A
	(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;	Section 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.	Section 3 and section 6

Rules clause	Summary of requirements	Relevant section(s) in PSCR
5.16.4(z1)	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 $35 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; (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.	Section 1.1, section 3 and section 4