Risk Based Proactive Pole Replacement Program

RIT-D Final Project Assessment Report

02 May 2025

Essential Energy

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1. Executive Summary

This Final Project Assessment Report (FPAR) has been prepared by Essential Energy as the final step in the process of submitting a regulatory investment test for distribution (RIT-D) for addressing increased risk of destruction of assets by bushfire due to climate change. As part of the 2024-29 regulatory submission, Essential Energy proposed to proactively replace high risk timber poles with composite (fibreglass) manufactured poles for the purpose of improving network resilience in rural areas, which are expected to experience an increasing bushfire failure rate due to climate change over the coming decades[1]. By this FPAR, Essential Energy is proposing to allocate approximately $83 million to pursue proactive intervention of high-risk poles with a composite replacement which meet the criteria of being resilience driven.

Essential Energy has a network of 1.42 million poles that, according to climate change modelling undertaken, is showing an increasing risk of failure predominately due to bushfires. Assets have been identified that are located in areas of this increased bushfire risk,[2] which Essential Energy is seeking to actively manage. A proactive approach in identifying and replacing these assets will ensure Essential Energy provides adequate customer supply now and into the future by improving network resilience. This investment is one component of a broader program of works being undertaken by Essential Energy to address resilience including; Stand Alone Power Systems (SAPS), undergrounding of powerlines in high risk locations, microgrids, mobile temporary assets and community support programs[3]. A number of these other programs have been investigated as alternative options for this program, in addition to their current committed expenditure as part of the overall package of resilience investment.

Essential Energy is applying this RIT-D to consider and test all Credible Options that address the Identified Need, to "provide adequate customer supply by improving network resilience (destruction due to increasing bushfire risk from climate change)". Essential Energy has previously published a non-network screening notice which outlines why Essential Energy believes that no non-network options are a viable solution to solve this problem and sets out the reasons why an Options Screening Report was not required in this scenario. This FPAR will demonstrate the basis of selecting the Preferred Option

Four options were compared to the ongoing business as usual (BAU) approach (Base Case). For clarity, Options 1 through 4 would be delivered in addition to the Base Case. The options considered include:

- **Base Case -** To continue with the current pole condition-based inspection and replacement program only, including a transition to composite poles over the 2024-29 regulatory period
- **Option 1 -** Composite Poles
- **Option 2 -** Replace with like for like or other materials (Steel or Concrete)
- **Option 3 -** SAPS
- **Option 4 –** Undergrounding

A cost benefit analysis as well as Net Present Value (NPV) and sensitivity analysis were carried out for all options and Option 1 was selected as the Preferred Option due to the highest NPV benefits as well as being the best case scenario in addressing the Identified Need.

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[1] 10.06.01 Resilience Risk Based Pole Replacement Investment Case (https://www.aer.gov.au/documents/resilience-investment-cases-100601-100606)
[2] 6.01 Climate Impact Assessment – KPMG Essential Energy - Attachments to Ch 6 - 601 and 602 | Australian Energy Regulator (AER))
[3] 10.06 Resilience Expenditure Overview Essential Energy - Attachments to Ch 10 - 10-01-10-09 | Australian Energy Regulator (AER))

Table 1 - Summary of Options (FY25 Nominal $)

OPTION	DESCRIPTION	PROJECT CAPEX COSTS	WACC RATE	NUMBER OF YEARS ANALYSED FOR NPV	NET PRESENT VALUE BENEFITS (NPV)	BENEFIT COST RATIO	RANK
Option 1	Composite Poles	$82.66M	3.54%	120	$105M	1.27	1
Option 2	Other materials (Steel / Concrete)	$82.66M	3.54%	120	$34M	0.41	2
Option 3	SAPS[4]	$1.50B	3.54%	40	-$1.77B	-1.18	4
Option 4	Undergrounding	$482M	3.54%	120	-$316.8M	-0.65	3

A summary of all options is provided in the above table 1. Option 1 presented the highest NPV of market benefits in our analysis. The assessment period of NPV was set at 120 years for composite and steel/concrete considering it was the lowest common multiple of asset lifetimes (60 years for composite and 40 years for steel and concrete). This analysis also considered replacement of composite assets twice in a 120-year period compared to three times for steel and concrete. Undergrounding NPV analysis was similarly done for a period of 120 years considering an asset life of 60 years. SAPS analysis was restricted to 40 years considering the NPV value was already in the order of negative $1.77 billion at the end of 40 years and therefore further analysis would not have materially improved on this option.

A sensitivity analysis was also conducted to test the robustness of the assessment against underlying key variables. The analysis showed the options were only sensitive to discount rates and capital expenditure (CAPEX). The analysis derived a high vs central vs low case benefit scenarios for varying CAPEX, risk/benefits and discount rates which is explained further in section 8.3 below.

Essential Energy considers that option 1 satisfies the regulatory investment test for distribution. The detailed analysis supporting this view is set out in this FPAR.

Capitalised terms not otherwise defined in this FPAR have the meaning given to them in the *National Electricity Rules* (NER).

2. Introduction

Essential Energy has a network of 183,000km of overhead powerlines of which 162,000km are in designated bushfire zones[5]. The overhead powerlines are supported by a network of 1.4 million power poles. During the 2019-20 bushfire season, 2,600 of Essential Energy's timber poles were subject to functional failures with over 3.4 million hectares of land inside the network footprint impacted as a result of these failures. Third party climate change modelling has predicted that pole failures from bushfires are expected to increase by 10.95% by 2050 compared to baseline 2022 scenario under Representation Concentration Pathway (RCP) 4.5[6]. This has required Essential Energy to assess more pole materials that can withstand fire more effectively compared to timber poles.

[4] SAPS has been included as an option in this report to further demonstrate the unfeasibility of the option
[5] Essential Energy Annual Report 2023-24 (Essential Energy Annual Report 2023-24)
[6] Climate Impact Assessment- KPMG

This FPAR is the final step in the RIT-D process and is published subsequent to the Non-Network Options Screening Notice[7] and Draft Project Assessment Report (DPAR) for this project.

2.1 About Essential Energy

Essential Energy is a New South Wales (NSW) state owned electricity distribution network provider that builds, operates and maintains one of Australis largest electricity distribution networks, providing vital service to approximately 890,000 customers and covers 95% of NSW and parts of southern Queensland. The company also owns and operates water and sewerage systems in the Broken Hill region, providing services to customers through Essential Water. Customers rely on Essential Energy to supply safe and reliable electricity and water services in remote, rural and regional areas of NSW.

3. Identified Need

The Identified Need for this RIT-D is for Essential Energy to "***provide adequate customer supply by improving network resilience (destruction due to increasing bushfire risk from climate change)".*** This Identified Need is for Reliability Corrective Action, being an investment by Essential Energy in respect of its distribution network for the purpose of meeting the service standards in Applicable Regulatory Instruments. The relevant service standards within Applicable Regulatory Instruments are set out below along with the reasons why the Reliability Corrective Action is necessary.

As noted in Essential Energy's Regulatory submission attachment 6.02 Resilience plan[8], Essential Energy has an obligation under the *Electricity Supply (Safety and Network Management) Regulation 2014* (NSW) (ES Safety Regulation) to take all reasonable steps to ensure that the design, construction, commissioning, operation and decommissioning of our network is safe.[9] This regulation also enforces the application of *Australian Standard AS 5577—2013, Electricity network safety management systems*, which states that 'the Network Operator cannot delegate its accountability for the safety and integrity of the electricity network'.[10] This requires distribution network service providers (DNSPs) to consider network operations for abnormal conditions, such as those experienced due to climate change.

Furthermore, a condition of our distributors' licence issued under the *Electricity Supply Act 1995* (NSW)[11] is to have and maintain *Australian Standard AS ISO 55001:2014 Asset Management – Management Systems – Requirements* certification. This international standard for asset management systems requires effective allocation and management of resourcing and materials to deliver risk management practices and optimise lifecycle value from assets.

Under the *National Electricity (NSW) Law* (NEL) framework, distributors are regulated to advance the National Electricity Objective (NEO). The NEO is:

"to promote efficient investment in, and efficient operation and use of, electricity services for the long-term interests of consumers of electricity with respect to:

a. price, quality, safety and reliability and security of supply of electricity; and
b. the reliability, safety and security of the national electricity system; and

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[7] Essential Energy RIT-D Projects
[8] 6.02 Resilience Plan 2024-29 (Essential Energy - Attachments to Ch 6 - 601 and 602 | Australian Energy Regulator (AER))
[9] ES Safety Regulation, r 5.
[10] AS5577-2013 "Electricity network safety management systems" Section 1.2 "Fundamental Principles"
[11] INSTRUMENT OF VARIATION OF CONDITIONS OF DISTRIBUTOR'S LICENCE ELECTRICITY SUPPLY ACT 1995 (NSW) (Distribution Licence-Essential Energy-22 September 2023)

c. the achievement of targets set by a participating jurisdiction-
i. for reducing Australia's greenhouse gas emissions; or
ii. that are likely to contribute to reducing Australia's greenhouse gas emissions."

The *Security of Critical Infrastructure Act 2018* (Cth) also obligates us and other entities responsible for critical infrastructure to effectively manage risks to service interruption. Measures are in place to abide by this legislation to ensure risk management, preparedness, prevention and resilience are part of our everyday business.

Each of the aforementioned service standards (which are contained within Applicable Regulatory Instruments) extend to improving network resilience in the context of increasing bushfire risk from climate change. By addressing this Identified Need and actioning this Reliability Corrective Action, electricity consumers can expect a sufficiently resilient network which accords with our regulatory obligations.

Moreover, through extensive customer engagement during the 2024-29 regulatory submission process, customers showed strong support for Essential Energy addressing resilience risks through targeted investments. An overview of the customer engagement process and the outcomes is provided at section 4.2.

In alignment with the above, and as a result of forecasting the impact of climate change on network safety and integrity, we recognise the need for proper resilience management to meet both regulatory requirements and customer expectations. The increase in bushfire risk within the network footprint has led Essential Energy to identify high risk locations and is using this RIT-D to assist in identifying the best Credible Option which maximises the Net Economic Benefits and improves network resilience.

4. Background

4.1 Modelling

4.1.1 CLIMATE CHANGE MODELLING

20% of Essential Energy's power poles are located within areas previously impacted by bushfires. As mean temperatures rise, the threat of bushfires is expected to increase further as well as increased fire danger days. In 2022, KPMG conducted a detailed climate impact assessment for Essential Energy on three major hazards; bushfire, flood, and windstorm[2]. The assessment aimed to determine the potential impacts of these hazards on Essential Energy's assets and customers. The results showed that our network is highly vulnerable to all hazards, with the number of asset failures and outage hours projected to increase under future climate scenarios. The report captures the predicted probabilities of network asset impacts under climate change scenarios defined by RCP4.5 and RCP8.5. These climate change scenarios are widely accepted by the Intergovernmental Panel on Climate Change (IPCC)) and are shown in Figure 1 below.

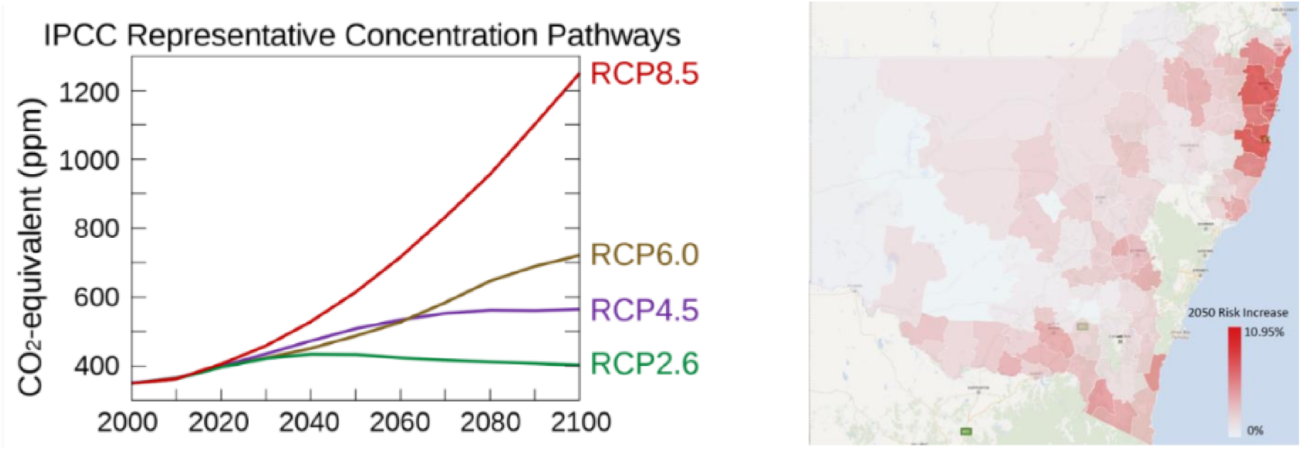

Figure 1 - (a) - RCP CO2 PPM , (b) - 2050 Risk increase in poles compared to no climate change impact

The primary peril impacting the asset class of poles is bushfire. The total network impact on poles from bushfires is predicted to increase by more than 10.95% by 2050 under RCP4.5, compared to the baseline scenario (2022 calibrated probability of failure (PoF)) of no climate change impact (see Figure 1(b)). Figure 2 below shows the average annual probability of a Copper Chrome Arsenate (CCA) pole being burnt within each depot area under the current and RCP4.5 2090 scenarios.

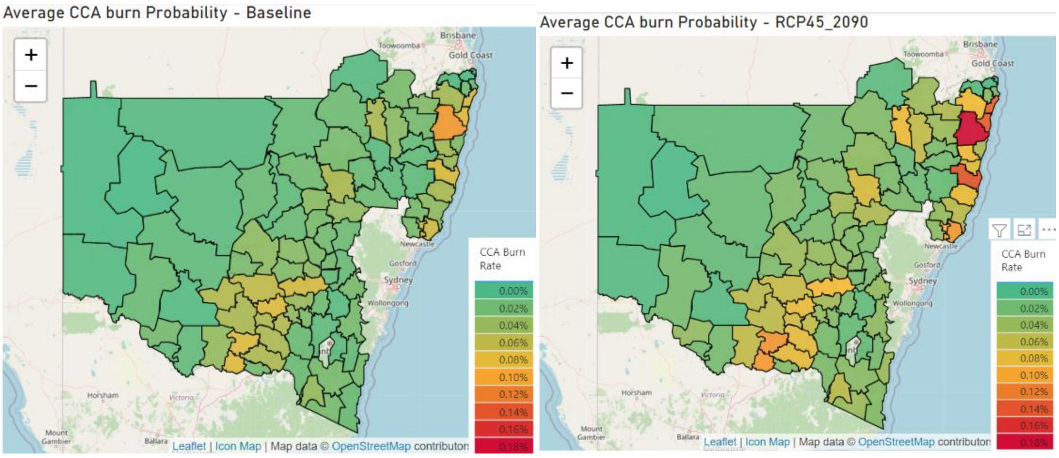

Figure 2 - Current and RCP4.5 - 2090 climate modelling for bushfire failures. These visuals show the average annual probability of a CCA pole being burnt within each depot area under the two climate snapshots shown.

Over the period of 2013 to 2024, 3,213 of Essential Energy's poles were subject to functional failures due to fire, averaging 269.25 failures per annum. Using the climate change modelling under RCP 4.5, it has been projected that probabilistically Essential Energy will experience asset failures increasing to 290 per annum by 2070.

4.1.2 BUSHFIRE MODELLING

To meet the requirements of Industry Safety Steering Committee Guide for the Management of Vegetation in the Vicinity of Electricity Assets (ISSC3:2016), Essential Energy has completed enhanced fire risk modelling across the entire network using the University of Melbourne's Phoenix RapidFire fire consequence model. The modelling has resulted in a material shift in where the areas of highest bushfire start risk exist on the Essential Energy network – refer to Figure 3. The highest risk zones are designated P1 (priority 1), medium risk as P2, low risk as P3 and urban density areas are P4. The priority (P) zones represent the relative bushfire risk across the network. P1 zones are those locations that, if a powerline-initiated fire were to start in these areas, it would cause the greatest impact (consequence) in terms of modelled loss of houses, property, and loss of life relative to the other priority zones in the network.

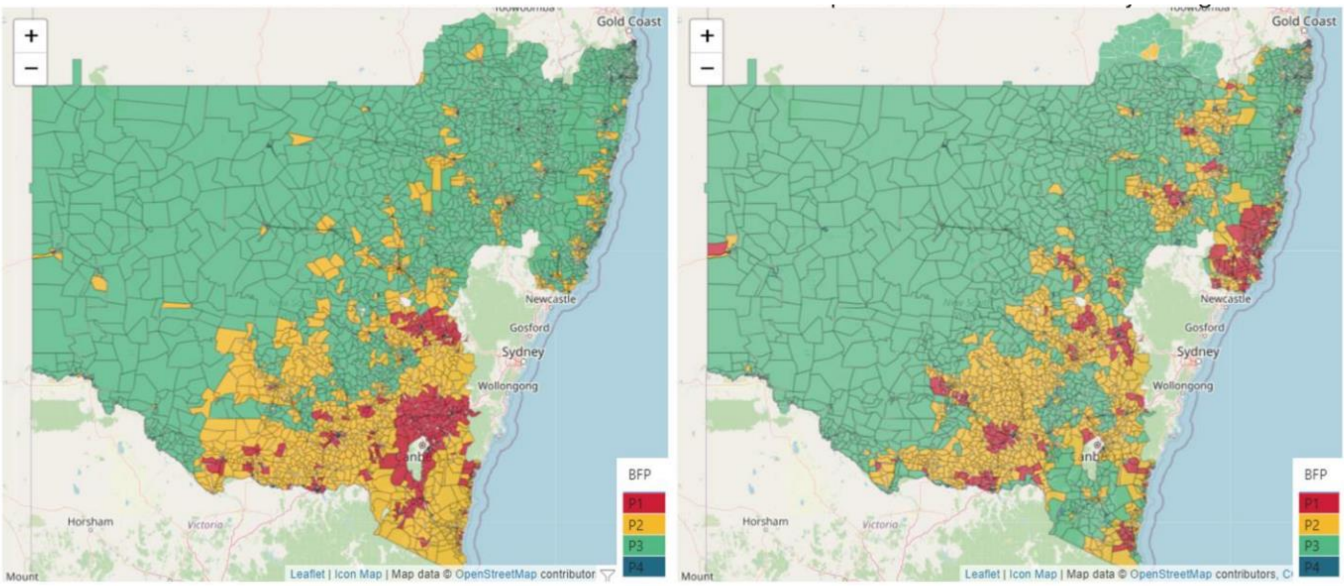

Figure 3 - Map of previous Bushfire risk priority areas (left) and updated bushfire risk priority areas (right)

This modelling is utilised to manage bushfire start risk over a short to medium period of time, through maintenance and capital expenditure. This modelling differs from the climate change modelling in that the climate change modelling assessed the risk of Essential Energy asset damage from fire, as opposed to this modelling evaluating the risks and consequences of network-initiated fires.

From reviewing both models it can be seen that there is a general synergy in the location of increasing climate change risk and where the largest risks and consequences of bushfire starts are evaluated to occur.

4.2 Social Licence

In Essential Energy's customer engagement program as part of the 2024-29 regulatory proposal, we engaged with customers over four phases. During the first phase conducted in October/November 2021, customers were predominately polled on risks associated with the operation of the Essential Energy distribution network and how we value these. Customers supported our risk metrics and placed a high level of importance on reliability, bushfire prevention and safety.

During our second phase of engagement in February 2022 the concept of resilience was introduced to customers and how it differs from 'standard' reliability. Customers were offered a variety of scenarios to understand their appetite for investment in resilience across four options from a "change nothing" to large scale expenditure across many intervention types. In the options several investment methods were introduced, composite poles being one of the interventions identified. The outcome of this phase of engagement resulted in broad support for proactively addressing resilience, with 91% of support across the two most aggressive and expensive options. In relation to composite poles specifically, this outcome related to an option around broad use of composite poles and a usage of higher penetration. It must be noted that this stage of engagement was a directional decision process to understand a willingness to pay to assist in the development of more detailed options for subsequent engagement sessions.

Our third phase of engagement in May 2022 specifically addressed individual intervention types with high level numbers to understand customer willingness to pay per intervention type. Overall, customers and stakeholders supported a move to composite poles in higher-risk areas.

67% of customers wanted to see all 25,000 poles in areas with high bushfire risk replaced with composite poles by 2040, demonstrating strong support for accelerated transition.

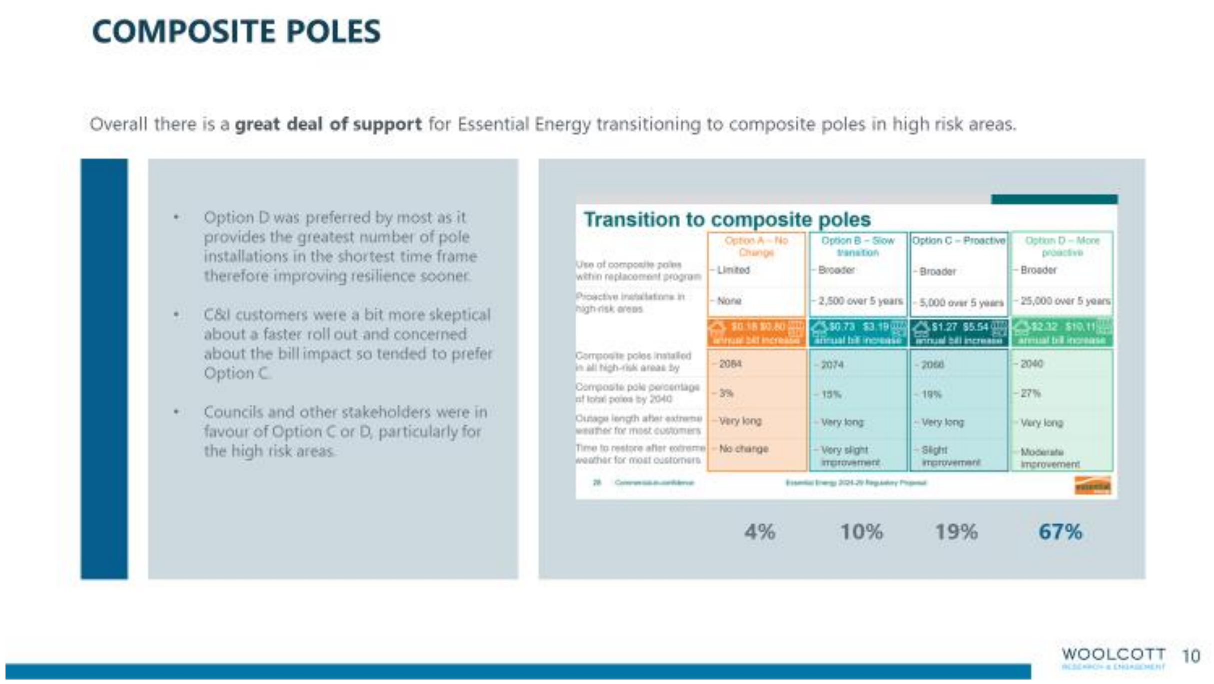

Figure 4 - Customer engagement results for development of the 2024-29 regulatory proposal

5. Non-Network solutions assessment

On 07 Feb 2025, Essential Energy published a non-network screening notice for this project, in accordance with clause 5.17.4(d) of the NER. We determined that there is no Non-Network Option or SAPS option that is a Potential Credible Option or that could form a significant part of a Potential Credible Option to address the Identified Need.

The case of SAPS and reasons why it is not a viable solution for the risk based proactive pole replacement program has been explained in detail in the non-network screening notice. Essential Energy does not consider any non-network option would meet the criteria of being commercially and technically feasible and also acknowledges that the cost of Non-Network Options, that would enable poles to be decommissioned rather than replaced, will be excessively expensive compared to the proposed network solution.

6. Options considered

Essential Energy investigated the options to better support resilience of the network to bushfires. As per NER clause 5.15.2(a), a Credible Option is defined as an option that addresses an Identified Need, is (or are) commercially and technically feasible and can be implemented in sufficient time to meet the Identified Need. Based on this, four options were assessed in addition to the BAU base case against the growing risk of bushfire impacts, as to their suitability for mitigation, their cost viability and the breadth of their impacts across the customer base.

6.1 Base case

The base case approach is the current BAU approach whereby Essential Energy continues with the current conditional pole replacement program. Planned pole replacement is currently delivered through a condition-based inspection program where the overhead asset inspection cycle inspects all poles on the network at 4.5

year intervals. Poles which are inspected and found not to meet serviceability criteria are condemned and scheduled for conditional replacement. The conditional pole replacement program shown in Figure 5 consists of approximately 8,000 pole replacements with a capital cost of just over $50 million per annum, which is forecasted to increase approximately 20% over the 2024-29 regulatory period. However, this replacement program does not address the increasing bushfire risk from climate change and customer expectations to mitigate this risk.

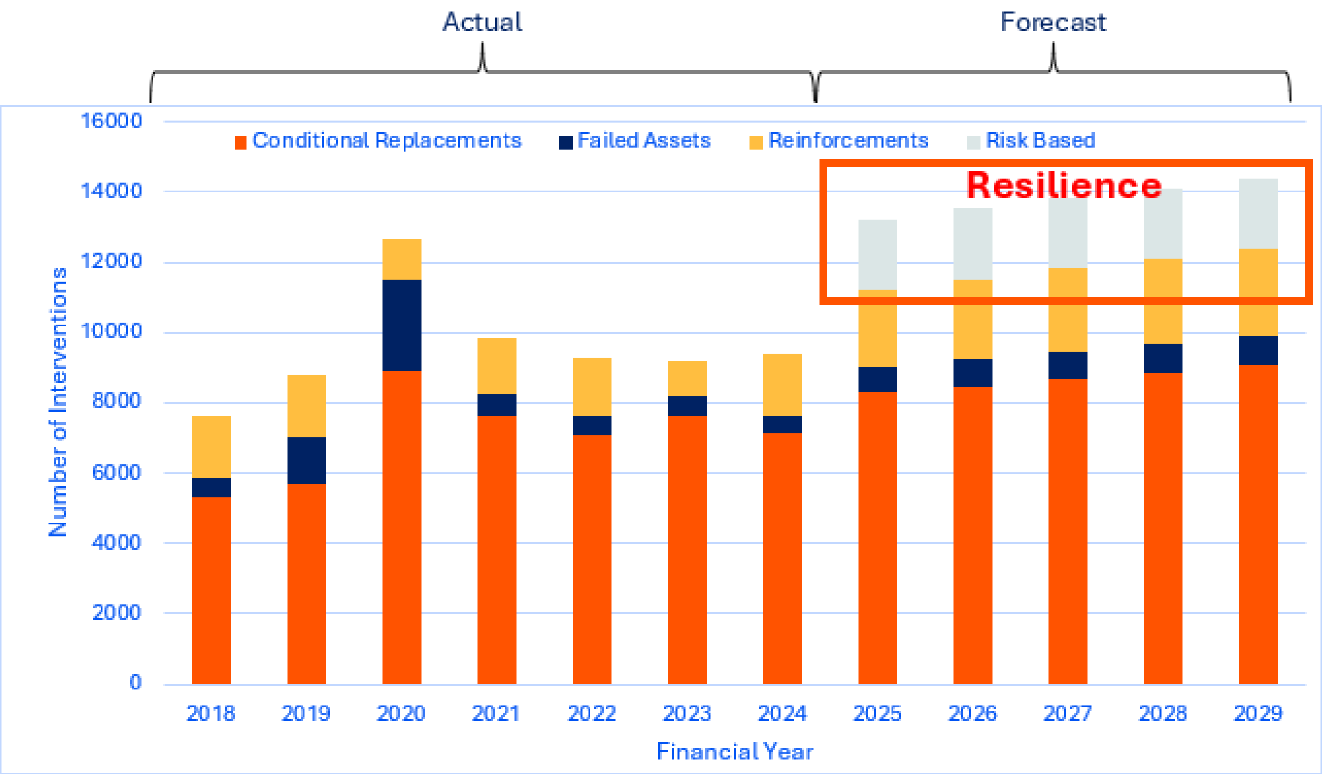

Figure 5 - Actual and forecast pole intervention volumes[1].

6.2 Option 1 – Composite poles – Preferred Option

Composite poles are manufactured using fibreglass and vinyl ester resin materials. The surface of the pole is coated with a UV stabilised coating. This coating provides stability against the long-term effects of UV radiation maintaining the integrity of the pole surface and preventing composite fibre surface blooming issues over time. Composite poles have been designed and manufactured to meet Essential Energy's existing design standards which account for (but not limited to) environmental, operational and structural performance requirements.

This option is to utilise composite poles to replace timber assets, where increased bushfire risk has been identified due to climate change. Despite the higher upfront material cost of composite compared to timber, composite poles include many operational benefits as explained in Section 8.2. Composite pole utilisation to address future resilience was endorsed by customers (67% of respondents) during the 2024-29 regulatory engagement process (see section 4.2). Composite poles were chosen out of the options presented as they best achieved the goal of providing network resilience at scale, integrating well with existing programs and supply chain, and offered a range of deployments that could be scaled up or down based on customer appetite and external factors. It is expected that this option will result in at least 700,000 saved customer minutes lost (CML) per annum by 2044.

CCA treated timber poles have been the primary distribution and sub-transmission pole material with composite (woven fibreglass) poles also used as an alternate option. Timber poles are not bushfire resistant and can be subject to termite and fungal decay. Previous alternate pole materials utilised, such as concrete and steel, are affected by corrosion, have additional earthing requirements as they are conductive materials, and cost around 2.5 times that of timber poles for a similar asset life. Composite poles are expected to outperform timber in extended wet and dry weather extremes which are likely to be more prevalent and increase in severity as climate change progresses. As part of the 2024-29 regulatory submission, Essential Energy proposed broad adoption of composite poles to be included in like-for-like replacement as part of the conditional replacement program.

Operationally, this option would be planned to be delivered internally utilising Essential Energy's standard business investment delivery for Standard Control Capex. A portion of the program will be delivered as part of standard maintenance works packages where volumes of replacements are low. Where a concentration or large number of poles have been identified projects will be raised to ensure efficiency and deliverability considering other network constraints that may exist in these locations. Depending on internal resource capacity and allocation, approximately 2,200 poles per annum is planned to be replaced under the program from 2025 to 2030.

Based on feedback from the Australian Energy Regulator (AER) to Essential Energy's 10.06.01 Resilience Risk Based Pole Replacement Investment Case[12], Essential Energy has undertaken further modelling to improve site selection based on climactic modelling. A final population of poles were identified by limiting eligibility criteria to:

- Location - non-urban and required to be in either P1 or P2 Bushfire priority zones and in a location exhibiting a likely increase in bushfire risk due to climate change.
- Lack of alternative supply - high voltage (HV)/low voltage (LV) distribution and radial sub-transmission assets only
- Economic - economically viable to replace, based on probability of failure and consequence of failure (risk) of the existing asset
- Material Type - natural round timber poles
- Lack of viable alternatives to address risk - assets flagged for potential SAPS have been excluded.

The final population of eligible assets and their location in respect to modelled climate change risk are illustrated in Figure 6. Due to the eligibility criteria listed above, some areas experiencing a higher relative impact have lower interventions identified. In particular, these areas have a lower average pole age and are not located in P1 or P2 areas.

[12] 10.06.01 Resilience Risk Based Pole Investment Case (Resilience Investment Cases 10.06.01 to 10.06.06 | Australian Energy Regulator (AER))

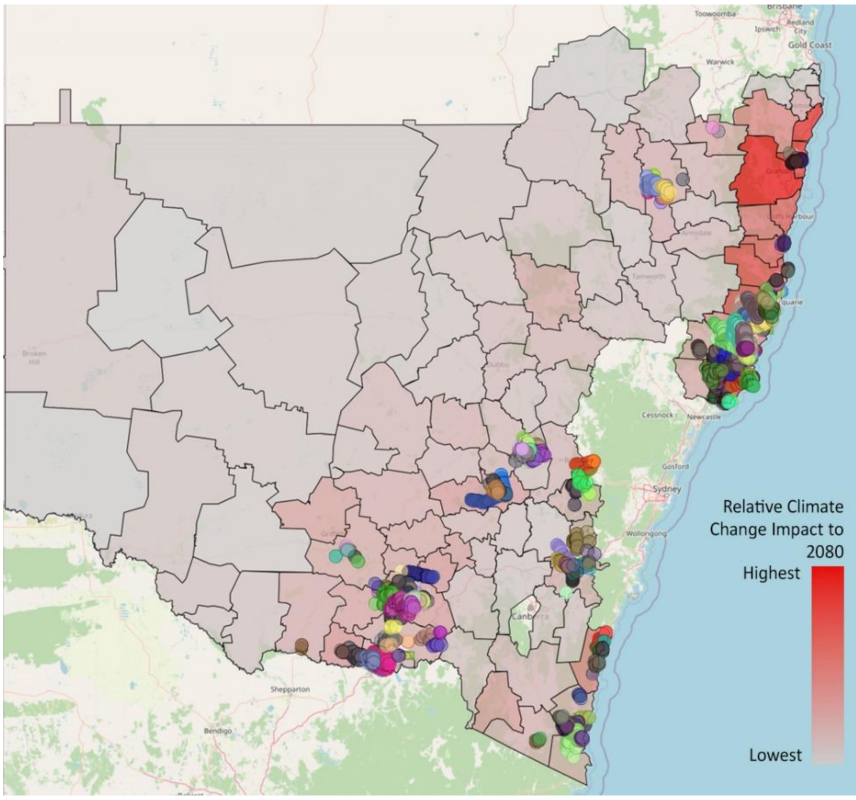

Figure 6 - Location of assets for risk-based replacement

6.3 Option 2 – Replace with like-for-like or similar materials (Steel/Concrete)

Under option 2, Essential Energy considered replacing timber assets with like-for-like timber assets or similar materials which includes steel and concrete. Replacing timber with timber does not address the increasing bushfire risk and only reduces the age risk. In the event of a bushfire, timber poles can be damaged or be fully destroyed, concrete can exhibit spalling and cracking due to thermal expansion, and steel has its yield stress and modulus of elasticity reduced due to increased temperatures. As submitted by Essential Energy previously in its composite pole transition business case, analysis has shown that replacing timber with composite poles provides the lowest total life cycle costs due to a variety of benefits. Replacing timber with timber does not address the increasing bushfire risk and is not a feasible solution.

Concrete poles (even though the material pricing is competitive to composite) require higher transport costs due to factory locations being in Victoria and increased weight, which results in a higher overall unit cost. The increased weight also poses issues to Essential Energy fleet and at sites with difficult access requirements. They also have restrictions for use in acid sulphate soils. Concrete poles have a lifespan of 40 years.

Steel poles have a similar life span of 40 years and come with additional costs due to extra earthing requirements and concrete encasement. They are also not suitable for acid sulphate soils (a large portion of Essential Energy's network) unless the footing is concrete encased (higher cost), limiting their use on the network. They are imported and may possess an increased supply risk moving forward compared to composite and concrete, which are produced locally. Due to currency exchange rate and shipping cost fluctuations, there is also the potential for more volatile and variable long-term pricing.

Operationally, this option would be planned to be delivered internally utilising Essential Energy's standard business investment delivery for Standard Control Capex. A portion of the program will be delivered as part of standard maintenance works packages where volumes of replacements are low. Where a concentration or large number of poles have been identified projects will be raised to ensure efficiency and deliverability considering other network constraints that may exist in these locations. Depending on internal resource capacity and allocation, approximately 2,200 poles per annum is planned to be replaced under the program from 2025 to 2030.

6.4 Option 3 – Stand Alone Power Systems (SAPS)

Essential Energy's current SAPS strategy is focused on high cost-to-serve single customer installations. Over the regulatory period it is forecast that we will complete approximately 400 SAPS installations. This is expected to be at the upper limit of supplier and third-party construction companies' availability for installation. The scale required to convert customers to SAPS for the assets included in this proactive pole replacement program would far exceed available supply and installers.

An additional hurdle for the usage of SAPS is that the current rollout requires customer agreement to transition. Therefore, where large customer bases are involved, it is unlikely that all customers would agree to replacement of traditional 'poles and wires' with SAPS. Customer engagement research identified 43% of customers would be 'interested to very interested' in transitioning to SAPS - Essential Energy's current SAPS project conversion rate is sitting at 31%.

It is important to note that the analysis undertaken on this option would not constitute a complete alternative to other options considered, as it has only considered sites where the practical implementation of SAPS would be viable (refer 8.3.4). This option would therefore offer a considerably lower resilience outcome for customers.

Also, as explained in Essential Energy's non-network screening notice, SAPS are not a viable solution and the cost of implementing SAPS to replace the portions of network identified is unrealistic. This is not a feasible option due to supply and cost constraints. Further details are explained in Section 3 of the non-network screening notice.

6.5 Option 4 – Undergrounding

Due to the large cost of undergrounding, this option is only viable in the highest risk cost where the benefits outweigh the cost. Many regions where the overhead network is most at risk due to bushfires, also corresponds with higher costs of undergrounding due to site conditions such as rock, access, and site sensitivity. There is a separate program of works related to undergrounding a small proportion of network (approximately 20km) over the 2024-29 regulatory period where the risk value is sufficient to justify its usage as submitted to the AER previously in Resilience Undergrounding High Risk Locations Investment Case (10.06.02)[13]. Our resilience programs will complement each other to ensure the most cost-effective solution is utilised given the particular locational conditions. Due to the high costs involved in undergrounding, replacing all 11,220 identified risk- based poles with the method of undergrounding is not a feasible option.

A summary of all options is provided in Table 2 below;

[13]Resilience Undergrounding High Risk Locations Investment Case 2024-29 Regulatory submission (Resilience Investment Cases 10.06.01 to 10.06.06 | Australian Energy Regulator (AER))

Table 2 - Option Summary

OPTION	DESCRIPTION	RESULT
Base Case - Continue with the current conditional pole replacement program	‣ Current BAU Approach. ‣ Planned pole replacement delivered through condition based inspection program. ‣ Overhead asset inspection cycle inspects poles at 4.5 year intervals. ‣ Poles inspected and found not to meet serviceability criteria are scheduled for conditional replacement. ‣ This does not target locations with high bushfire risk specifically. ‣ Currently transitioning to composite - 100% usage for new constructions by 2029.	‣ Current program has approximately 8,000 pole replacements per year. ‣ Current capital cost is just over $50M p.a. and forecast to increase over the 2024-29 regulatory period due to the composite transition. ‣ Concerns over speed of roll out of composite poles in bushfire prone areas.
1 - Composite poles	‣ Considered replacing timber assets in areas with increased bushfire risk, with composite poles. ‣ Integrated well with existing programs. ‣ Despite higher upfront material cost, compared to timber, composite poles have lower life cycle costs and the following operational benefits – reduced weights, manual handling, safety, transport/installation efficiencies, lower operational costs, higher life expectancy. ‣ Replacing with composite poles provides the lowest total life cycle costs.[14] ‣ NPV calculations have shown that composite poles provide higher value than steel and concrete over a 120 year period; composites have a higher life span (60+ years) compared to steel/concrete (~40 years). ‣ High customer support (67%) during the 2024-29 regulatory proposal engagement; support for full composite usage for conditional replacement, plus up to 25,000 additional risk-based proactive replacements.	✓ Proactive risk based replacement of up to 11,220 poles at a cost of $82.6M with an NPV of $105M. ✓ Increase in network resilience. ✓ Increase in network reliability.

[14] 10.02.24 Composite poles transition business case (Plant, poles, substations Investment Cases 10.02.01 to 10.02.24 \| Australian Energy Regulator (AER))

OPTION	DESCRIPTION	RESULT
2 - Replace like-for-like or other materials	‣ Considered replacing timber assets in areas with increased bushfire risk, with like-for-like timber pole or other material. ‣ Timber usage does not address the increasing bushfire risk. ‣ Customers supported investment into a more resilient network as part of 2024-29 regulatory proposal engagement – replacing timber with timber, only reduces the age risk and does not meet customer expectations regarding improving network resilience. ‣ Steel and Concrete ranked second in the NPV analysis over a 120 year period, with an NPV of $34M compared to composite which had an NPV of $105M.	☒ Timber not a feasible option given move to composite poles is to address increased bushfire risk arising from climate change. ☒ Lower levels of benefit for Steel/Concrete usage.
3 - SAPS	‣ Considered replacing timber assets in areas with increased bushfire risk, with SAPS on a case-by-case basis. ‣ Essential Energy's current SAPS strategy is focused on high cost-to-serve single customer installations. ‣ Over the 2024-29 regulatory period, Essential Energy is forecasting to complete approximately 400 SAPS installations which is expected to be at the upper limit of supplier and third-party construction companies' installation availability. ‣ The scope for this program would far exceed the market capacity for SAPS installations. ‣ Replacing poles and wires with SAPS requires customer agreement from all customers on a line to be removed. When multiple customers impacted, this is unlikely – given current SAPS conversion rate is at 31%.	☒ Not a feasible option given estimated cost and supply constraints, plus customer agreement requirements for SAPS.

OPTION	DESCRIPTION	RESULT
4 - Undergrounding	‣ Considered replacing timber assets in areas with increased bushfire risk, with undergrounding of cables. ‣ Very expensive method of electricity distribution. ‣ Only viable in areas of highest risk – the high cost of this solution means a higher hurdle to be NPV positive. ‣ Also worth noting that areas with overhead network risk are also prone to hard terrains thereby further increasing the costs of undergrounding due to rocks, sensitivity or access requirements. ‣ Separate program of works relating to undergrounding approximately 20km over the 2024-29 regulatory period, will complement the composite pole risk-based transition to ensure the most cost-effective solution is utilized given the particular locational conditions.	☒ Broad undergrounding adoption not a feasible option given estimated cost.

7. Market benefit assessment methodology

NER clause 5.17.1(b) states the purpose of the RIT-D is to identify the Credible Option that maximises the present value of the Net Economic Benefit (the Preferred Option). The Preferred Option may, in the relevant circumstances, have a negative Net Economic Benefit (that is, a net economic cost) where the Identified Need is for Reliability Corrective Action. As mentioned in section 3, the Identified Need is a Reliability Corrective Action.

The RIT-D requires that Essential Energy consider whether each Credible Option could deliver the classes of market benefits as set out in clause 5.17.1(c)(4) of the NER. However, the RIT-D also clarifies that where the Credible Option is for a Reliability Corrective Action (as is the case here), the requirement to consider or quantify market benefits will only apply insofar as the market benefit delivered by that Credible Option exceeds the minimum standard required for Reliability Corrective Action.

Nonetheless, the RIT-D also notes that Essential Energy may quantify each class of market benefit set out in clause 5.17.1(c)(4) of the NER where Essential Energy considers that:

(a) any applicable market benefits may be material; or

(b) the quantification of market benefits may alter the selection of the Preferred Option.

7.1 Market benefits

For all options included in this FPAR, the market benefits (if any) delivered by each option do not exceed the minimum standard required for the Reliability Corrective Action. Each option is designed to meet the existing regulatory standards described in section 3 above applied in the context of increasing bushfire risk from climate change. To this end, Essential Energy has identified a final population of 11,220 poles for proactive replacement by using targeted eligibility criteria (see section 6.2 above). No option seeks to proactively replace poles beyond these identified pole populations (so as to exceed the regulatory requirements).

Despite the above conclusion, in accordance with the RIT-D, Essential Energy has considered the materiality of the market benefits listed in rule 5.17.1(c)(4) of the NER and whether quantification may alter the selection of the Preferred Option.

None of the market benefits listed in rule 5.17.1(c)(4) are material. Table 3 below sets out Essential Energy's reasoning with respect to each market benefit.

Essential Energy also considers that the quantification of any of such market benefits would not alter the selection of the Preferred Option. Therefore, Essential Energy has not quantified any of the market benefits.

Table 3 - Market Benefit Analysis

CLASS OF MARKET BENEFIT	ANALYSIS
Changes in voluntary load curtailment.	Risk based proactive pole replacement due to increased bushfire risk, by its nature, is not expected to lead to any changes in voluntary load curtailment.
Changes in involuntary load shedding and customer interruptions caused by network outages, using a reasonable forecast of the value of electricity to customers.	As the RIT-D project is resilience driven and only involves proactive replacement of assets, there won't be any changes in involuntary load shedding and customer interruptions caused by network outages.
Changes in costs for parties, other than the RIT-D proponent, due to differences in: (a) the timing of new plant; (b) capital costs; and (c) the operating and maintenance costs.	Risk based proactive pole replacement due to increased bushfire risk will only impact Essential Energy's costs.
Differences in the timing of expenditure.	This will not result in any changes in timing of the expenditure.
Changes in load transfer capacity and the capacity of distribution connected units to take up load.	Risk based proactive pole replacement due to increased bushfire risk, by its nature will not impact on the capacity of distribution connected units to take up load.
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 NEM.	The value of risk based proactive pole replacement due to increased bushfire risk, is clear. No additional option value not already contemplated is expected to be gained or foregone in respect to likely future investment needs of the NEM.
Changes in electrical energy losses.	Risk based proactive pole replacement due to increased bushfire risk, by its nature, will not result in changes to electrical energy losses.
Changes in Australia's greenhouse gas emissions	Risk based proactive pole replacement due to increased bushfire risk, will not result in any material changes in Australia's greenhouse gas emissions (refer 7.1.1).
Any other class of market benefit determined to be relevant by the AER.	We do not consider any other class of market benefit as relevant to the selection of the Preferred Option.

7.1.1 EMISSIONS REDUCTION ACROSS CREDIBLE OPTIONS

To date there has been no Australian studies directly comparing the lifecycle emissions of poles given different material types. However, a study by the University of NSW (UNSW) on composite utilisation for crossarms compared with timber concluded that composite material usage resulted in lower greenhouse gas emissions over the life of the asset[15].

An international study conducted in Sweden compared the lifecycle of different pole material types to assess environmental impacts, this included timber, steel, concrete and composite poles[16]. This study concluded that the lowest carbon footprint material was timber followed by composite then other materials following. Unlike the UNSW study, the analysis performed assumed equal service life across all material types (50 years). Given the increase in service life of a composite material asset compared to the other material types analysed, it could be considered that composite materials would likely outperform timber and would increase the gap further with other material types.

Given the absence of definitive research and the expected low materiality between options, a Value of Emissions Reductions (VER) has not been calculated as part of the Cost Benefit Analysis (CBA). It is anticipated given the information at hand, that the Preferred Option of composite material utilisation will have the lowest emissions of all Credible Options.

7.1.2 VALUE OF NETWORK RESILIENCE

In September 2024, the AER published its first Value of Network Resilience (VNR)[17] for use in cost benefit analysis to complement their existing guidance on network resilience, aiming to better reflect the benefits that customers receive from a resilient network. Essential Energy is still developing probabilistic modelling to forecast outage timeframes to enable the application of the VNR. Given the complexity of such analysis and the relatively recent publication of the VNR, this program has therefore been evaluated utilising the standard Value of Customer Reliability (VCR) rates. This provides a conservative assessment of this program, as it has assumed average asset replacement timeframes - any valuation of VNR (where multiples of VCR would be utilised) would generate larger benefits of the options discussed. It is anticipated that this expected increased benefit would be consistent across the options in this report.

8. Economic Assessment

8.1 Cost Development Across Programs

For the quantification of applicable costs for each credible option, Essential Energy has utilised a variety of methodologies as listed in Table 4 below.

Table 4 - Cost development across options

OPTION	COST DESCRIPTION	COST TYPE	METHODOLOGY USED
Base Case	Unit Rate	CAPEX	Historic unit rate costs
	Ongoing Maintenance	OPEX	Not calculated refer 8.2.4

[15] Composites: Calculating their embodied energy- S.Kara and S.Manmek , UNSW 2009 (Report)
[16] Comparison of the environmental impacts from utility poles of different materials- a lifecycle assessment. Martin Erlandsson, IVL Swedish Environmental Research Institute AB 2012
[17] Value of Network Resilience 2024

OPTION	COST DESCRIPTION	COST TYPE	METHODOLOGY USED
Option 1: Composite	Unit Rate	CAPEX	Historical unit rate for timber pole with escalator from contracted material rates
	Ongoing Maintenance	OPEX	Not calculated refer 8.2.4
Option 2: Other Material	Unit Rate	CAPEX	Historical unit rate costs
	Ongoing Maintenance	OPEX	Not calculated refer 8.2.4
Option 3: SAPS	Unit Rate	CAPEX	Market tender for 't-shirt' sized units
	Vegetation Costs	OPEX	Vegetation cost actuals derived from Vegetation Management Areas (VMA) for a cost per bay
	Ongoing Maintenance	OPEX	- Annual Maintenance; 2% of total asset replacement cost per annum - Inspection; 15 mins per inspection - Fault and Emergency; 231 mins per predicted outage
Option 4: Undergrounding	Unit Rate	CAPEX	Internal estimate from Subject Matter Experts (SME)
	Ongoing Maintenance	OPEX	Assumed same reduction in vegetation and maintenance costs from SAPs options

8.2 Operational benefits of Composite poles

The operational advantages of composite poles over other materials can be compared and is summarised in the following sections.

8.2.1 EVIDENCE OF COMPOSITE POLE PERFORMANCE IN BUSHFIRES

During the 2019/20 bushfires, Essential Energy had a composite pole trial underway at Kosciusko National Park. The fire-exposed composite poles showed far superior fire resistance in temperatures exceeding 600 degrees Celsius compared to timber poles which were burnt to ash – see Figure 7 below for images from composite pole performance in bushfires. The fire impacted composite poles remained structurally intact and required only minor repairs to outer fire retardant gel coat before the next fire. This gives crews performing restoration work valuable time to do higher value supply immediate restoration work (refer Figure 7).



Figure 7 - Left : Timber vs Composite after bushfires , Middle: Timber CCA poles 2019/20 bushfires , Right : Timber pole burnt away, only composite cross arm remaining

As further evidence, in 2023 Essential Energy engaged University of Melbourne to assess the fire performance of power poles when subjected to severe bushfire exposures. A total of seven power poles were provided for the study, comprising one CCA timber pole and six composite poles covering different suppliers and manufacturing methods. The results from the tests showed CCA treated timber poles performed the worst in the test sustaining the fire, exhibiting afterglow and continuing to smoulder and burn over several hours till it was completely structurally destroyed. The six composite pole samples showed varying degrees of charring depth after the test was terminated. The product Essential Energy uses would have sufficient residual strength to keep powerlines up to allow site assessment and planned replacement/repair whereas timber poles would have needed immediate replacement.

No pole material, whether timber, steel, concrete or composite, is completely fireproof for a long-standing sustained fire event. Timber poles will be fully destroyed, concrete can exhibit spalling and cracking due to thermal expansion and steel has its yield stress and modulus of elasticity reduced due to increased temperatures. The VIC roads guideline[18] details concrete permanently loses 40% of its strength at 300 degrees Celsius and above. Steel loses 50% of its strength at 600 degrees Celsius but may recover some of it. While concrete and steel poles are considered fire resistant poles by industry, they are not fireproof. Composite poles are therefore as fire resistant as concrete and steel poles.

While composite poles are fire resistant in their raw form, Essential Energy is working with manufacturers on a fireproof sleeve that can be retrofitted to existing composite poles or come supplied with new composite poles installed in high bushfire risk locations. This option is undergoing development to potentially deliver a lower cost than fire retardants used on timber poles and can handle multiple fire events rather than needing retardant repair after each fire exposure.

8.2.2 COMPOSITE CROSSARM PERFORMANCE DATA

In 2009, Essential Energy transitioned away from treated timber crossarms to adopt composite (fibreglass) as our standard crossarm material. More than 600,000 composite crossarms are installed across the network to date. This population has yet to experience an unassisted failure and has shown good fire resistance. The composite crossarm transition has allowed the use of this material to mature in the field, supporting Essential Energy's natural progression to composite poles.

8.2.3 COMPOSITE LIFE EXPECTANCY DATA

Accelerated ageing testing from two manufacturers and Essential Energy's in-house Quality Assurance (QA) lab indicates composite pole life expectancy to be over 60 years whereas modern timber pole life expectancy is around 40 years. Evidence supports life expectancies of well over 60 years if UV coating is reapplied

[18] Vicroads Technical Note 102 - Fire Damaged Reinforced Concrete – Investigation, Assessment And Repair (Technical Note TN 102 - Fire Damaged Concrete)

following exposure to bushfire. Essential Energy's QA lab has performed a range of destructive and accelerated ageing tests on composite poles including real life accelerated ageing exposure test, standalone UV-B exposure tests and mechanical destruction tests[19]. Composite pole manufacturer's estimate lifetimes of 80 years based on experience of installed poles and weatherproofing coatings. However, Essential Energy is only considering the lifetime to be 60 years as a cautious estimate noting that there is the potential for lifetimes to be longer.

8.2.4 FUTURE OPERATING EXPENDITURE (OPEX) BENEFITS

Composite pole inspections do not require sounding, drilling as timber poles do. This means that the time for each inspection can be reduced. The interval between inspections may also be extended due to the lack of natural degradation mechanisms in composite materials. However, due to the difficulty of programming works and inspections on different intervals for varying material types spread within an area, this benefit cannot be realised until there is greater penetration of the composite material into the network's pole fleet.

It is difficult to precisely define the critical mass at which OPEX savings are visible, but an estimate would be at least 30% of the pole population need to be composite within a given depot area, which will not be achieved until well beyond ~35 years at the current forecast replacement rates. As several factors can change that far into the future and the 35-year figure itself is an estimation, this cost cannot be effectively measured and accordant with the RIT-D, Essential Energy has not considered future OPEX savings in our NPV and Sensitivity analyses as compared to the base case.

8.2.5 OTHER KEY BENEFITS OF COMPOSITE POLES

The other key benefits of composite poles are summarised below:

- Fungal and Corrosion resistant: Composite poles are fungal decay, acidic/alkaline soil and chemical resistant.
- Termite resistant: Composite poles are not subjected to termite attack.
- Higher life expectancy: Accelerated ageing testing from two manufacturers and Essential Energy's in house Quality Assurance lab indicates composite pole life expectancy to be over 60 years whereas modern timber pole life expectancy is around 40 years.
- Fire resistant: The fire-retardant laminate construction performs better than timber and alternate pole materials when exposed to bushfires.
- Lower transport costs and better installation efficiencies: Composite poles are one third of the weight of an equivalent timber pole and have superior transport efficiency (quantity of poles per truck load) - 49 composite vs 36 steel vs 21 timber vs 13 concrete. This weight differential allows for installation efficiency where multi-piece options can be utilised and the minimisation of heavy equipment usage in remote, heavily vegetated and/or difficult access sites.
- Lower maintenance cost: Due to being fungal, corrosion and termite resistant, the ongoing maintenance costs of composite poles will be cheaper and inspection intervals can eventually be made longer than the current 4.5 year intervals.
- Lower unassisted failure rate: Unlike timber poles, composite poles are fungal, corrosion and termite resistant and unassisted failure rates can be reduced between two inspection cycles.
- Better electrical and mechanical protection: Composite poles have similar mechanical strength to timber poles but for a much lower weight. They have better electrical insulation properties than timber poles and

[19] Section 5.2 – 10.02.24 Composite pole Transition Business Case (Plant, poles, substations Investment Cases 10.02.01 to 10.02.24 | Australian Energy Regulator (AER))

therefore classified as 'insulating' in the Electrical Safety Rules (ESR). Personal protective equipotential bonds, which are needed for timber and conductive poles, are not required on composite poles.

- Avoid young timber pole tasks: Material numbers of timber rot, termite treatment and pole replacement tasks have been required on CCA timber poles less than 20 years old. It is believed that this is due to dry climates causing modern timbers grown on the coast to split, allowing termites and fungal decay to bypass the CCA treatment.
- Less Disposal and Re-use costs: Savings are expected in disposal costs due to the reduced weight of pole materials going to land fill.
- More predictable handling- The round and uniform construction of composite poles is easier and more predictable to handle which reduces risk of manual handling and fatigue related accidents.
- Inert Material- Composite poles are a relatively inert material which is safe for contact with humans and animals.
- Non-conductive material: This will make composite poles more resistant to lightning strikes.
- Locally manufactured – Composite, timber, and concrete are locally produced while the steel poles are imported. As such there may be a supply risk for steel poles which may also be subject to variable long-term pricing due to currency exchange rate and shipping cost fluctuations. This also poses challenges to confirm the raw materials and finished quality of the poles until delivered.

8.3 Net Present Value (NPV) and Sensitivity Analysis

8.3.1 OVERVIEW OF THE RISK COST MODELLING FRAMEWORK

A sensitivity analysis is required for modelling the cost-benefit analysis under the RIT-D. In accordance with Essential Energy's Appraisal Value Framework - Quantifying the Cost of Consequence for Network Investments and the requirements of the RIT-D, analysis was done to quantify the risk costs of each pole in the final identified population of 11,220. The derived risk cost is the risk associated with each pole pre-replacement per annum. The Total Risk Cost (TQR) avoided for each pole, as part of proactive replacement is also considered as the corresponding replacement benefit of that particular pole for the first year.

The Total Risk Cost Reductions (TQR) for the entire population of 11,220 poles has been calculated as per the below formula:

$$TQR = \sum_{n=1}^{11,220} \left(PoF_n + PoF_{Climate\_Base} + (t * PoF_{Climate_{Step}}) \right) * (CoF_n)$$

$$where \ (CoF)_n = CoC_n * LoC_n$$

Where,

- TQR = Total Risk Cost reductions is the total quantified risk cost reductions for the population of poles per year
- n = denotes each corresponding pole used for analysis and ranges from 1 to 11,220
- PoF = Probability of failure which is the annual asset probability failure figure per pole. The PoF values have been derived based on actual asset performance (exclusive of bushfire related failures)
- $PoF_{Climate\_Base}$ = A base probability of failure due to bushfire given an assets geographical location (derived from climate change modelling Footnote 2)
- $PoF_{Climate\_Step}$ = An annual linear step change in probability from the base year (2022) corresponding to calculated probability of failure (derived from climate change modelling Footnote 2)
- t = the time differential in years between the year of analysis and the base year (2022)

- CoF = Consequence of failure which is the consequence dollar values of each pole used in post risk calibration. This is obtained as a product of the cost of consequence and the likelihood of consequence of a particular pole failure. This is derived from Essential Energy's Appraisal Value Framework- Quantifying the Cost of Consequence for Network Investments.
- CoC = Cost of consequence of the failure event for each pole. This is a combination of three value measures mainly bushfire (impact to surrounds through bushfire start), safety (cost of injuries or illness), and reliability risk (supply interruptions or inadequate capacity) for each asset. Essential Energy's Appraisal Value Framework defines the cost components of each Network Value Measure and assigns a financial value to different magnitudes of outcome against each of these. The cost components are then aggregated to determine common cost 'scales' for each Network Value Measure, which are aligned with the consequence scale from the corporate risk matrix (Insignificant, Minor, Moderate, Major, Severe). The financial values assigned to each cost component and outcome are determined by considering the available evidence and selecting the most reasonable figure on a case-by-case basis.
- LoC = Likelihood of consequence of failure event for each pole. These values are determined based on a combination of actual and estimated data from Essential Energy database and its peers combined with inputs from Essential Energy Subject Matter Experts (SME's). These values are further calibrated to overall performance levels.

8.3.2 INPUT PARAMETERS AND ASSUMPTIONS

Definition and justification of decided values of various input parameters used for the analysis are explained below:

- **Reasonable Scenarios –** In order to run a sensitivity analysis under the RIT-D, Essential Energy needed to develop reasonable scenarios, being a set of variables or parameters that are not expected to change across each of the Credible Options. As the RIT-D analysis is required to incorporate multiple scenarios, three reasonable scenarios have been utilised in the sensitivity analysis. This includes a "high benefits" scenario including an optimistic set of assumptions, "central benefits" scenario having the base case and a "low benefit" scenario reflecting a very conservative set of assumptions.
- **WACC rate –** 3.54% per annum is Essential Energy's current discount rate for investments and has been adopted as the baseline figure (central benefits). A more aggressive 3.80% (low benefits) and 3.27% (high benefits) scenarios have been used in the sensitivity analysis for better understanding of the RIT-D robustness against underlying key variables.
- **Material Unit Cost –** The material unit cost used in the analysis includes the cost of raw material, build, transport, installation and labour combined. Costs utilised have been derived from internal delivery costs differentiated by construction type (distribution, sub-transmission). As pricing of composite poles is approximately the same as concrete/steel, the same material unit cost has been used for all three materials. The material costs of 20% more than the base case has been used in the "low benefit" scenario and a material cost of 20% less than the base case has been used in the "high benefit" scenario.
- **Climate Scenario –** The climate scenario used to model the number of bushfire failures incurred across the network. As previously discussed, climate change scenario RCP4.5 in 2070 is a reasonably conservative estimate of the expected average bushfire risk to network assets with a 32% increase from current baseline levels.
- **Composite lifetime –** A composite lifespan of 60 years has been used which was derived from testing, manufacturer's specifications and observed excellent performance of composite fibre crossarms on the network compared to their timber counterparts. There is evidence to suggest that this lifetime could be longer, however, a conservative estimate of 60 years provides a strong justification for the transition to this long-life material. Accelerated age testing by manufacturers and Essential Energy suggests a life span of greater than 60 years.

- **Concrete/Steel lifetime** – A concrete/steel lifespan of 40 years has been used which was derived from manufacturer specifications.
- **Analysis Period** – An analysis period of 120 years has been chosen for NPV analysis of composite and Steel/concrete materials due to 120 being the lowest common multiple of asset lifetimes. For SAPS, a period of 40 years has been used due to the NPV value already showing high negative values and it did not make sense to extend the analysis to a period of 120 years. For undergrounding, an analysis period of 120 years has been used.
- **Asset Replacement Timeframe** – For the analysis, in line with the expected lifetime of assets, it has been assumed that a composite pole is to be replaced every 60 years while a steel/concrete pole is to be replaced once every 40 years. Hence over a 120-year NPV window, cost has been allocated for replacement of a composite pole twice, while a steel/concrete pole is to be replaced three times.
- **Risk/Benefit Costs** – For each individual pole, a Consequence of Failure (CoF) and Probability of Failure (PoF) value was identified and the risk value of each pole was calculated as per section 8.3.1. The same risk value is assumed as the replacement benefit for each pole.
- **OPEX Benefit costs** – As discussed in section 8.2.4, future OPEX benefits of pole materials were not considered in our analysis.
- **Cost of compliance** – The risk based proactive pole replacement program is being delivered alongside standard Replacement Expenditure (REPEX) portfolio utilizing existing business systems and processes. Therefore, there is no additional costs for complying with laws, regulations and applicable administrative requirements regarding the construction and operation of the credible option.

A summary of the reasonable scenarios is noted in the below Table 5.

Table 5 - Summary of reasonable scenarios

KEY VARIABLE	SCENARIO 1 LOW BENEFITS	SCENARIO 2 CENTRAL BENEFITS	SCENARIO 3 HIGH BENEFITS
Capital Costs	(+) 20% of Base Case	Base Case	(-) 20% of Base Case
Discount Rates	3.80%	3.54%	3.27%
Benefit/Risk costs	(-) 20% of Base Case	Base Case	(+) 20% of Base Case

8.3.3 NET PRESENT VALUE ANALYSIS – COMPOSITE VS STEEL/CONCRETE

As the upfront material costs of Composite poles are more or less similar to Steel and Concrete, similar material costs have been used for both materials in our analysis. The following inputs were used to perform NPV calculations comparing composite and Steel/concrete pole investments:

- Analysis period of 120 years which is the lowest common multiple for the different material life expectancies (40 years for Steel/concrete and 60 years for Composite)
- Concrete/Steel poles to be replaced every 40 years while Composite to be replaced every 60 years.
- Company discount rate of 3.54%
- Material unit rates differentiated by pole construction – same for both materials – this included the material, build, transport, installation and labour cost.
- Total population identified for pro-active replacement – 11,220

Using the above parameters, an NPV was developed which analysed the benefits of each pole identified for replacement over a 120-year period. A summary of the cumulative benefits is shown in Table 6 below.

Table 6 - NPV analysis Summary - Composite and Steel/Concrete

KEY VARIABLE	SCENARIO 2 - CENTRAL BENEFITS
Number of Pole Candidates	11,220
Discount rate	3.54%
Analysis Period	120 Years
NPV Composite poles (Assuming a replacement every 60 years)	$ 105M
NPV Steel/ Concrete (Assuming a replacement every 40 years)	$ 34M

The above table clearly shows composite poles deliver a higher benefit over a 120 year period compared to equivalent concrete/steel replacements. This is taking into account a composite pole being replaced every 60 years, whereas Essential Energy (through testing and industry knowledge) believes them to last longer than 60 years hence improving the value even further.

The NPV value for both of these options has increased from those included in the DPAR, however the final ranking for all options did not change. This increase in NPV value is due to updates to the PoF modelling, reflecting greater accuracy of the sites and materials identified. Previously a flat 'average' risk profile was utilised to calculate the benefit, however modelling has been updated to better reflect the risk changing over the life of the asset.

8.3.4 NET PRESENT VALUE ANALYSIS – SAPS AND UNDERGROUNDING

Essential Energy's current SAPS program strategy is focussed on high cost-to-serve customer and has already identified 400 sites suitable for SAPS installations as part of the 2024-29 regulatory submissions. The 400 sites identified have been shortlisted after analysing close to 100,000 sites to check if a SAPS solution was a feasible option. The final population of 11,220 resilience pole candidates was chosen after excluding a set of 350 poles which had an overlap with the SAPS program. The 11,220 final chosen pole candidates were analysed further and a set of 1,185 poles were identified which had the potential to be SAPS solutions but provided a grossly negative benefit value (where SAPS was a possible solution but with negative benefits). These 1,185 poles served a total of 1,648 customers across the network.

Essential Energy's analysis of potential SAPS sites was limited to 100,000 sites as only 'spurs[20]' were analysed as potential candidates. The reasoning for this is to allow complete removal of the main feeder backbone would require large conversions of customers to SAPS which given Essential Energy's Explicit Informed Consent (EIC) requirements and current conversion rates (31%) would unlikely be feasible. A large portion of assets associated with this proactive replacement project are on sub transmission and main network backbones, and therefore were excluded from the SAPS analysis. Of the sites identified in this program 1,185 were located on spurs and therefore could be compared with the Credible Options identified in this FPAR.

The total cost of replacing the 1,185 poles with suitable SAPS solution, assuming all 1,648 customers provided their EIC, would mean a total project cost of $1.505 billion. This would mean the average cost per customer would be approximately $913k which is not feasible.

Considering the above, a 40 year NPV performed at a WACC rate of 3.54% gave a grossly negative NPV of -$1.77 billion at the end of the analysis period. Considering the average lifespan of SAPS systems, and their

[20] A spur is defined as a relatively short section of high voltage overhead mains that branch off the main trunk feeder that supply small numbers of customers.

sub-components to be less than 25 years which is considerably less than composite/steel/concrete poles, further analysis was not extended to a period of 120 years as there was no further benefits to be explored.

As the final chosen population of 11,220 poles spans across the Essential Energy network in the high-risk areas of NSW, it is not feasible to replace the entire resilience pole candidates with undergrounding of cables. Essential Energy has a separate undergrounding program that was approved as part of the 2024-29 regulatory proposal and targets undergrounding of network across approximately 20km in very high-risk areas. The cost of undergrounding is extremely expensive estimated at $450,486 per km depending on site conditions. Considering the total km span of 11,220 resilience pole candidates is approximately 1,100km, the cost of undergrounding would likely exceed $482 million with high potential for variation on the estimated unit rate with only a relatively modest improvement in risk on the Credible Options discussed in this report.

Assuming complete removal of asset risk as an idealistic scenario and an asset life of 60 years, the expected NPV over an analysis period of 120 years would be approximately -$316.8 million which given the assumptions of analysis would be a best case scenario for this option.

Table 7 - NPV Analysis Summary - SAPS and Undergrounding

KEY VARIABLE	SCENARIO 2 - CENTRAL BENEFITS
Analysed sample	1,185 poles (SAPS) 1,100 km (Undergrounding)
Discount rate	3.54%
Analysis Period	40 Years (SAPS) 120 Years (Undergrounding)
NPV SAPS	- $ 1.77B
NPV Undergrounding	-$ 316.8M

8.3.5 SENSITIVITY ANALYSIS

Utilising the parameters in section 8.3.2, a sensitivity analysis was performed for each scenario as mentioned in Table 5. For each input parameter, the resulting output parameter was calculated for each "low" vs "central" vs "high" benefit scenarios. A summary of sensitivity analysis is explained in the below Table 8 and Figure 8.

Table 8 - Sensitivity Analysis Summary

KEY VARIABLE	SCENARIO 1 – LOW BENEFITS	SCENARIO 2 – CENTRAL BENEFITS	SCENARIO 3 – HIGH BENEFITS	RANK
Capital Costs	(+) 20% of Base Case	Base Case	(-) 20% of Base Case	
Discount Rates	3.80%	3.54%	3.27%	
Benefit/Risk costs	(-) 20% of Base Case	Base Case	(+) 20% of Base Case	
NPV Composite poles	$33.86M	$ 105.01M	$ 187.67M	1
NPV Steel/Concrete	-$23.54M	$ 34.03M	$98.34M	2

SAPS	*ND[21]	-$ 1.77B	*ND	4
Undergrounding	*ND[21]	-$316.8M	*ND	3

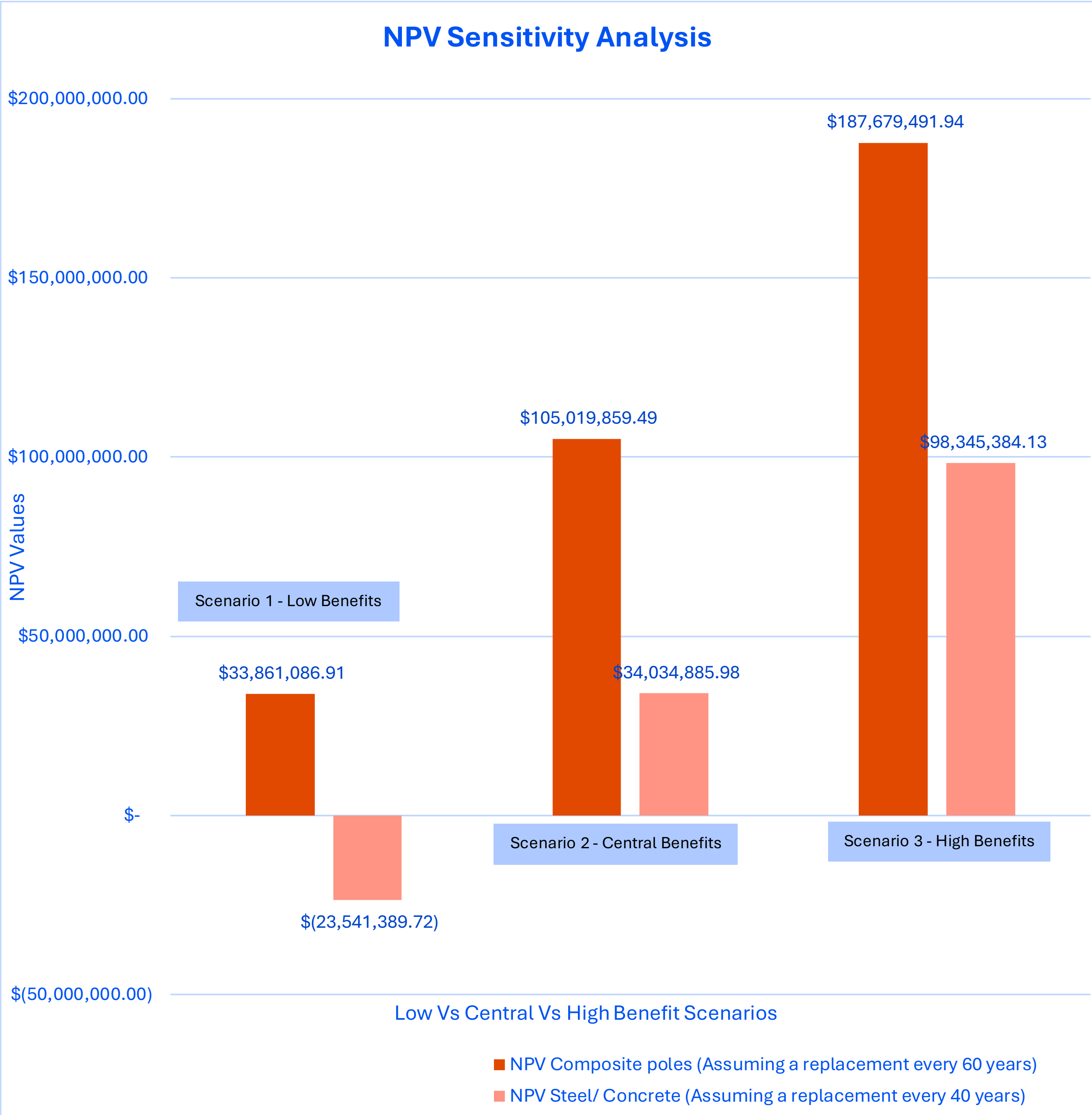

Figure 8 - NPV Sensitivity Analysis

The results of the sensitivity analysis show that the most sensitive parameters are the material cost difference and WACC rates when compared to the overall net market benefits.

[21] ND - Not defined – Low and High benefit Sensitivity analysis for SAPS and Undergrounding were not done due to values being highly unrealistic in central benefit scenario.

9. Completion of RIT-D Process

Essential Energy is publishing this final project assessment report – this is the last stage of the RIT-D process. Essential Energy sought feedback on 12 March 2025 from stakeholders on the preferred option via the Draft Project Assessment Report, and our non-network options screening notice. This included notifying registered participants, the Australian Energy Market Operator (AEMO), non-network providers, interested parties and persons on our demand side engagement register. Submissions were due 23 April 2025.

No submissions were received for the non-network options screening notice or the DPAR.

Table 9 - RIT-D Program Timetable

STEP	DESCRIPTION	STATUS	DATE
Step 1	Publish Non-Network Screening Notice	Completed	05 February 2025
Step 2	Publish Draft Project Assessment Report	Completed	12 March 2025
Step 3	Deadline to receive submissions in response to the Draft Project Assessment Report	Completed	23 April 2025
Step 5	Publish Final Project Assessment Report	Completed	02 May 2025

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