Transgrid

People. Power. Possibilities.

Managing voltage control in Inner Sydney Metropolitan area

RIT-T Project Specification Consultation Report

Region: Greater Sydney

Date of issue: 14 July 2026

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Executive summary

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options for mitigating risks caused by the deteriorating condition of Sydney East No.1 132 kV reactor. This will ensure that the Greater Sydney network meets the voltage limits stipulated in Transgrid's Connection Agreement with Ausgrid, as well as Power Frequency Voltage standard in Schedule S5.1a.4 of the National Electricity Rules (NER). This Project Specification Consultation Report (PSCR) represents the first step in the application of the RIT-T.

Voltage is the electric potential between two points that gives rise to the flow of electricity. Network service providers undertake voltage control to ensure that voltage is kept within technical limits, thereby safeguarding the security and reliability of the power system. Voltage is controlled by managing the production and absorption of reactive power (residual power flowing forwards and backwards between connection points, which is juxtaposed by active power which services a load).[1]

Reactors play an important role in maintaining the safe and reliable transmission and distribution of electricity. Their operation assists in reducing system voltages during periods of low demand and, from a network perspective, supports the maintenance of voltages within acceptable operating limits, thereby reducing the risk of broader system disturbances. From a customer perspective, reactors also support the maintenance of customer voltages within the limits prescribed by Australian Standards, thereby helping to protect customer equipment. If the Sydney East reactor fails and is not replaced (or an equivalent reactive power solution is not implemented), local voltages at 132 kV will exceed the permissible range in some credible operating conditions. This will leave the system with no redundancy and will lead to loss of load during subsequent outages.

As part of our condition assessment, Sydney East No.1 132 kV reactor has been identified as a reactor which is reaching its end of life, with an increasing risk of failure. These condition issues, if not remediated, will lead to reactor failure. The condition issues are outlined below:

Table E-1: Condition issues associated with Sydney East Reactor, their potential impact and consequences

Issue	Potential Impact	Consequence
Oil Impregnated Paper (OIP) Bushings	The 132 kV OIP bushings were installed in 1986 and are equipped with porcelain insulators and a condenser-based core. Their advanced age makes them susceptible to failures from over voltages, thermal stresses and humidity ingress.	Increases the probability of reactor failure which will risk Transgrid's compliance with NER Power Frequency Voltage standard and associated network performance requirements in Schedule s5.1a.4 and increase safety and
Thermal heating <300°C	Dissolved Gas Analysis (DGA) shows high levels of methane (CH4) and ethane (C2H6) in the main tank of the reactor. This typically indicates thermal fault in the paper or oil at low temperatures below 300 °C.	
Paper Insulation Moisture	The reactor insulation system is based on special papers impregnated with insulating oil. The papers provide insulation and support the structure of the reactor winding. Moisture acts to increase the rate of degradation of the paper insulating system and the paper may become brittle. At high levels, it may compromise the insulation. This may progress to the point where a mechanical shock caused by a fault can result in electrical failure.	

[1] AEMO, 2023 Power System Stability Guidelines, October 2023

Corrosion resulting in loss of oil due to leaks	Corrosion resulting in leaks or leaking gaskets can cause loss of oil within the reactor resulting in a catastrophic failure. Moisture and oxygen can also enter the reactor resulting in accelerated aging of the insulation resulting in failure.	environmental risks.

With increasing distribution network voltages due to the capacitive nature of the load and increasing rooftop PV, Ausgrid's zone substation voltage set points are continually being lowered. However, based on Ausgrid's observed tap distributions, this is no longer possible if supply voltages remain high, resulting in possible voltage non-compliance at the customer terminals. The ability to manage voltages in the downstream network is expected to worsen in subsequent years as minimum demand decreases even further. The existing in service reactor provides benefits in managing voltages across the electricity supply chain, and this ability is lost if it fails and is not replaced.

Transgrid's Connection Agreement with Ausgrid for the Sydney East Bulk Supply Point (BSP) stipulates a maximum voltage of 135.5 kV at a load of 800 MVA. Our joint planning[2] with Ausgrid indicates that in 2025, with the reactor in service 132 kV voltages were above the Connection Agreement limit less than 2% of the time. However, with the reactor out of service, voltages were above the Connection Agreement limit for more than 80% of the time. Furthermore, in 2025, the reactor was utilised for approximately 70% of the year. During the times the reactor was not being utilised, Ausgrid zone substation transformer taps in the subjected area reached minimum tap for approximately 4% of the year.

Identified need: maintaining voltage control in the Sydney Inner Metropolitan area to comply with Connection Agreement requirements set out in the NER

The identified need for this RIT-T is to maintain voltage levels in the Sydney Inner Metropolitan area by managing the risk of excess voltage levels arising from declining minimum demand. Replacing the reactor will enable us to remain compliant with the conditions set out in our Connection Agreement with Ausgrid. Without investment to address the need, there is also an increasing likelihood of imminent non-compliance with the Power Frequency Voltage standard set out in Schedule S5.1a.4 of the NER.

Consequently, we consider this a 'reliability corrective action' under the RIT-T framework. A reliability corrective action differs from a 'market benefits' driven RIT-T in that the preferred option is permitted to have negative net economic benefits, on account of it being required to meet an externally imposed obligation[3].

The connection voltage specified in our Connection Agreement with Ausgrid has been determined with consideration of our voltage control capabilities and Ausgrid's ability to maintain voltages within prescribed regulatory limits at customer exit points. Any change to the agreed connection voltage, without replacement of the ageing shunt reactor or other shared network voltage support, would compromise voltage control and risk voltages outside acceptable limits at customer connection points. It also has the potential to damage customer equipment.

[2] Joint Planning is the mandatory, collaborative process where Network Service Providers (NSPs) such as Transmission and Distribution Network Service Providers (TNSPs and DNSPs and AEMO- work together to identify technically feasible, cost-effective solutions to network limitations, regardless of asset boundaries (NER Chapter 5, Part D).

[3] As stipulated in clause 5.14A.1 of the NER

In addition to enabling Transgrid to meet compliance obligations outlined above, the investment will allow us to manage and mitigate safety risks that would otherwise arise from a failure of Sydney East No.1 reactor.

One credible option has been considered

We have identified one credible network option that would meet the identified need from a technical, commercial, and project delivery perspective. This option is summarised in Table E-2 below.

Table E-2: Summary of credible option

Option	Description	Estimated capex ($2025/26 +/- 25%)	Operating costs ($2025/26, $ per year)
Option 1	Replacement of Sydney East No.1 reactor	$8.82m	$606[4]

Implementing Option 1 by 2030/2031 will enable us to satisfy relevant regulatory obligations set out in the NER, as well as maintain voltage control in the Sydney Inner Metropolitan area for the long term. Option 1 delivers the highest (least negative) net economic benefits in all scenarios. Accordingly, Option 1 has been identified as the preferred option. Non-network options are not expected to be able to assist in this RIT-T.

We do not consider non-network options to be commercially and technically feasible to assist with meeting the identified need for this RIT-T.

Nonetheless, 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. Details on how to make a submission are provided in section 1.3.

Draft Conclusion

The optimal commercially and technically feasible option identified in this PSCR - Option 1 (replacement of the Sydney East No.1 132 kV reactor) is the preferred option as it represents the most efficient means of addressing the identified need.

This option ensures that the Greater Sydney network meets the voltage limits as stipulated in Transgrid's Connection Agreement with Ausgrid, as well as Power Frequency Voltage standard in Schedule S5.1a.4 of the National Electricity Rules (NER). In doing so, it satisfies Transgrid's regulatory obligations while minimising the risk of voltage excursions under both normal and contingency conditions.

Consistent with the requirements for a reliability corrective action, Option 1 delivers the required service standard at the lowest overall cost of all credible options. The estimated capital cost of the project is $8.82 million (+/-25 per cent), with routine operating and maintenance costs of approximately $606 per annum (incremental relative to the base case). In the absence of alternative credible options capable of meeting the identified need, this option represents the prudent and economically efficient course of action.

Given that only one credible option has been identified to meet the service standard, sensitivity analysis would not alter the identification of the preferred option and has therefore not been undertaken.

[4] Incremental operating costs relative to base case

The project will be delivered over the period 2026/27 to 2030/31. Planning, design, development and procurement (including completion of the RIT-T) will occur between 2026/27 and 2028/29, followed by construction in 2029/30 and commissioning occurring in 2030/31. Final commissioning is expected in 2030/31 ensuring timely delivery of the required voltage control capability.

Exemption from preparing a Project Assessment Draft Report

At this stage, the publication of a Project Assessment Draft Report (PADR) is not required for this RIT-T as the conditions in clause 5.16.4(z1) of the NER have been met. Specifically, a PADR is not required because:

- The estimated capital cost of the preferred option is less than $54 million[5];
- We have identified in this PSCR our proposed preferred option, together with the reasons for the preferred option; and
- The proposed preferred option and any other credible options in respect of the identified need do not have any material market benefits (with the exception of market benefits arising from changes in involuntary load shedding).

If an additional credible option that could deliver a material market benefit is identified during the consultation period, a Project Assessment Draft Report (PADR) will be produced that updates the NPV assessment presented in this PSCR.

Submissions and next steps

We welcome written submissions on materials contained in this PSCR. Submissions are due on 7 October 2026.[6]

Submissions should be emailed to our Regulation team via regulatory.consultation@transgrid.com.au.[7] In the subject field, please reference 'Sydney East Reactor PSCR'.

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.

We intend to produce a Project Assessment Conclusions Report (PACR) that addresses all submissions received and presents our draft analysis and conclusion on the preferred option for this RIT-T. Subject to submissions to this PSCR, we anticipate publication of a PACR by December 2026.

[5] Varied from $46m to $54m based on the AER Final Determination: Cost threshold review, November 2024.
[6] Consultation period is for 12 weeks. Additional days have been added to cover public holidays.
[7] We are bound by the *Privacy Act 1988 (Cth)*. In making submissions in response to this consultation process, we 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. See Privacy Notice within the Disclaimer for more details.

Contents

1. Introduction

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options for mitigating risks caused by the deteriorating condition of Sydney East No.1 132 kV reactor. This will ensure that the Greater Sydney network meets the voltage limits stipulated in Transgrid's Connection Agreement with Ausgrid, as well as Power Frequency Voltage standard in Schedule S5.1a.4 of the National Electricity Rules (NER). This Project Specification Consultation Report (PSCR) represents the first step in the application of the RIT-T.

We are required to maintain compliance with our Connection Agreement with Ausgrid as well as NER Schedule 5.1a.4 and NER Power Frequency Voltage standard. Consequently, we consider this is a 'reliability corrective action' RIT-T. A reliability corrective action differs from a 'market benefits'-driven RIT-T in that the preferred option is permitted to have negative net economic benefits on account of it being required to meet an externally imposed obligation.

The connection voltage specified in the Ausgrid connection arrangement has been determined having regard to Transgrid's voltage control capabilities and Ausgrid's ability to maintain voltages within prescribed regulatory limits at customer exit points. Any change to the agreed connection voltage, without replacement of the ageing shunt reactor or other shared network voltage support, would compromise voltage control and risk voltages outside acceptable limits at customer connection points, with potential damage to customer equipment.

In addition to enabling us to meet obligations stipulated in our Connection Agreement with Ausgrid and the compliance obligations outlined above, the investment will also assist us to manage and mitigate safety risks that would otherwise arise from a failure of Sydney East No.1 reactor.

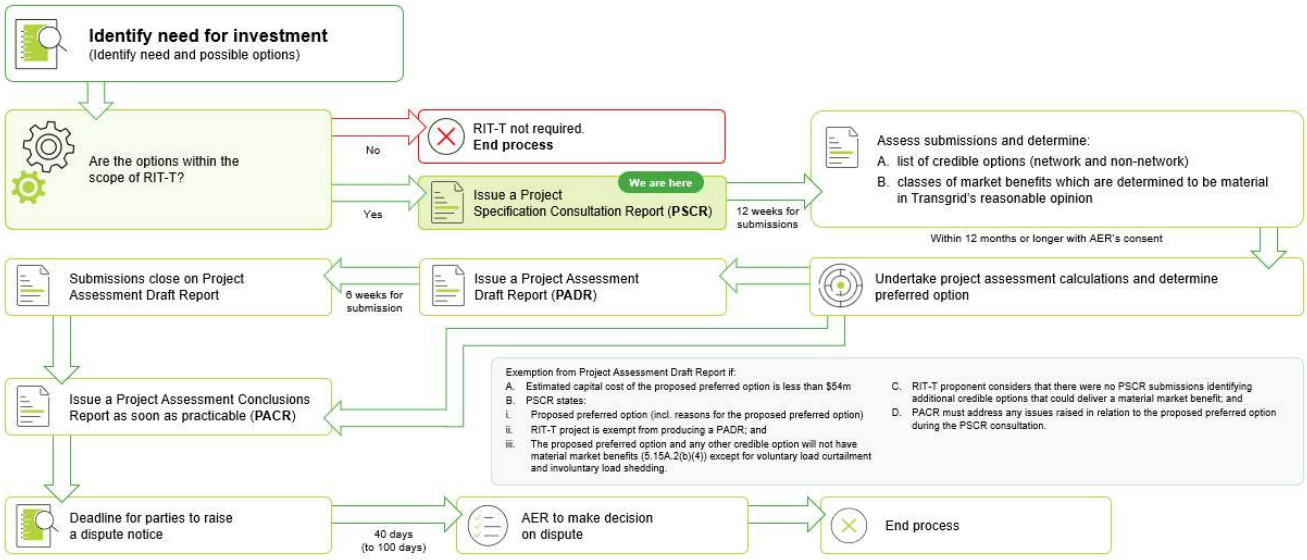
1.1. Purpose of this report

The purpose of this PSCR[8] is to:

- Set out the reasons why Transgrid proposes the action to be taken (the 'identified need');
- Present the options that Transgrid is considering to address the identified need;
- Outline the technical characteristics that non-network options would need to provide (although we note that non-network options are unlikely to be able to contribute to meeting the identified need for this RIT-T);
- Identify the preferred option under the RIT-T assessment and;
- Allow interested parties to make submissions and provide input to the RIT-T assessment.

[8] See Appendix A for the NER requirements.

Figure 1-1: This PSCR is the first stage of the RIT-T process[9]



1.2. Exemption from producing a Project Assessment Draft Report

At this stage the publication of a Project Assessment Draft Report (PADR) is not required for this RIT-T as the conditions in clause 5.16.4(z2) of the NER have been met. Specifically, a PADR is not required because:

- The estimated capital cost of the preferred option is less than $54 million[10];
- We have identified in this PSCR our proposed preferred option, together with the reasons for the preferred option; and
- The proposed preferred option and any other credible options in respect of the identified need do not have any material market benefits (with the exception of market benefits arising from changes in involuntary load shedding).

If an additional credible option that could deliver a material market benefit is identified during the consultation period, a Project Assessment Draft Report (PADR) will be produced that updates the NPV assessment presented in this PSCR.

1.3. Submissions and next steps

We welcome written submissions on materials contained in this PSCR. Submissions are due on 7 October 2026.

[9] Australian Energy Market Commission. "*Replacement expenditure planning arrangements, Rule determination*". Sydney: AEMC, 18 July 2017.

[10] Varied from $43m to $54m based on the AER Final Determination: Cost threshold review, November 2024.

Submissions should be emailed to our Regulation team via regulatory.consultation@transgrid.com.au.[11] In the subject field, please reference 'Sydney East reactor PSCR'.

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 in relation to the proposed preferred option raised during the consultation period. Subject to additional credible options being identified, we anticipate publication of a PACR by December 2026.

[11] We are bound by the *Privacy Act 1988 (Cth)*. In making submissions in response to this consultation process, we 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. See Privacy Notice within the Disclaimer for more details.

2. The identified need

2.1. Background to the identified need

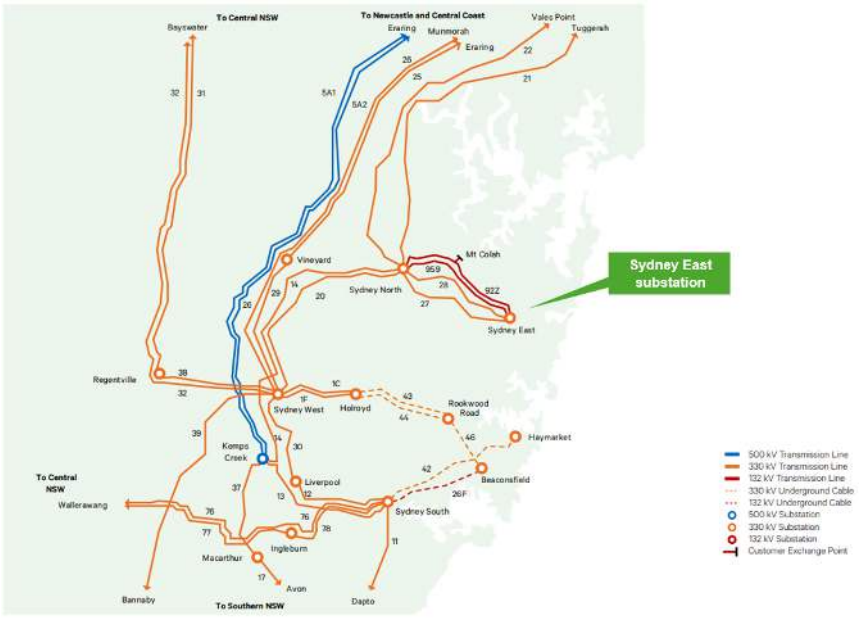
Voltage is the electric potential between two points that gives rise to the flow of electricity. Network service providers undertake voltage control to ensure that voltage is kept within technical limits, thereby safeguarding the security and reliability of the power system. Voltage is controlled by managing the production and absorption of reactive power (residual power flowing forwards and backwards between connection points, which is juxtaposed by active power which services a load).[12]

Sydney East substation was commissioned in 1976 and forms part of our network serving the Greater Sydney area. It is supplied by two 330 kV feeders (Line 27 and 28) and two 132 kV feeders (Line 92Z and 959) from Sydney North substation. It supplies ten customer 132 kV lines operated by Ausgrid and two Ausgrid 132 kV transformer tie lines. These 132 kV feeders run between Sydney East substation and Ausgrid substations in the surrounding area, including Kur-ring-gai, Linfield, Warringah, and Willoughby. Sydney East substation is comprised of three 330/132 kV transformers, two 330kV capacitors, one 132 kV reactor and two 132 kV capacitor banks.

The No.1 132 kV reactor was first commissioned in 1986 and has reached the end of its serviceable life. The reactor is showing signs of deterioration due to several condition issues, which if not remediated, increase the probability of failure

The location of Sydney East substation and transmission supply arrangements for the Inner Sydney Metropolitan area is provided in Figure 2-1 below.

Figure 2-1: Location of Sydney East substation



Sydney East 330/132 kV substation plays a critical role in supplying the areas north of Sydney Harbour including North Sydney, Ryde, Macquarie Park, Chatswood and the suburbs along the Northern Beaches.

[12] AEMO, 2023 Power System Stability Guidelines, October 2023

The Sydney East BSP is forecast to supply a maximum demand of 771 MW during Summer of 2030/2031. The substation services an estimated population of 580,930 people and over 81,315 businesses across Northern Beaches[13], Mosman[14], North Sydney[15], Willoughby[16] and Ku-ring-gai[17] local government areas.

The proposed investment, specifically replacing the No.1 132 kV reactor at Sydney East substation, is intended to ensure continued compliance with our Connection Agreement with Ausgrid as set out in Schedule 5.1a and Power Frequency voltage standards in Schedule S5.1a.4 of the NER. The investment will also assist us to manage and mitigate safety risks that would otherwise arise from failure of this ageing Sydney East reactor no.1. [18]

2.2. Description of the identified need

The identified need for this RIT-T is to maintain voltage levels in the Sydney Inner Metropolitan area by managing the risk of excess voltage levels due to declining minimum demand. Without investment to address this need, there is an increasing likelihood of imminent non-compliance with Transgrid's Connection Agreement with Ausgrid, and later, with NER Power Frequency Voltage standard.

The following is Transgrid's obligations with respect to management of voltages as stipulated in the current Connection Agreement Data Book with Ausgrid:

Table 2-1: Connection Agreement Data Book agreed specifications for Sydney East BSP[19]

Nominal Voltage (kV)	Target Operating Voltage Range	
	Volt (kV)	Load (MVA)
132	132.2	250
	135.5	800

If the reactor is not replaced when it fails, agreed voltage set-points will need to be re-negotiated in the Connection Agreement. However, raising the voltage set-points at the connection point means that Ausgrid's end customers will receive high voltages outside of Australian Standards requirements. Ausgrid's ability to lower voltages at its customer exit points will be severely compromised and will result in customers receiving unacceptably high voltages outside of Australian Standard requirements for extended periods during times of low load. Transgrid must meet the requirements in the Connection Agreement with Ausgrid and is required to maintain compliance with NER Schedule 5.1.4 and NER Power Frequency Voltage standard. Consequently, this is a 'reliability corrective action' RIT-T.

Joint planning conducted by Transgrid and Ausgrid supports the continued requirement of a reactor at Sydney East. Outcomes from the joint planning indicate that reactive power is always being exported from

[13] Australian Bureau of Statistics. "Region summary: Northern Beaches". Economy and industry. Accessed 15 March 2026.
[14] Australian Bureau of Statistics." Region summary: Mosman". Economy and industry. Accessed 15 March 2026.
[15] Australian Bureau of Statistics, "Region summary: North Sydney LGA", Economy and industry. Accessed 15 March 2026.
[16] Australian Bureau of Statistics. "Region summary: Willoughby", Economy and industry. Accessed 15 March 2026.
[17] Australian Bureau of Statistics, "Region summary: Ku-ring-gai", Economy and industry. Accessed 15 March 2026.
[18] Transgrid manages and mitigates safety risk to ensure they are below risk tolerance levels or 'As Low As Reasonably Practicable' ('ALARP'), in accordance with Transgrid's obligations under the New South Wales Electricity Supply (Safety and Network Management) Regulation 2014 and Transgrid's Electricity Network Safety Management System (ENSMS). In particular, risks for Transgrid and its consumers are mitigated unless it is possible to demonstrate that the cost involved in further reducing the risk would be grossly disproportionate to the benefit gained.
[19] Target Operating Voltage Range as specified in the Transgrid-Ausgrid Sydney East BSP Connection Agreement Data Book

the distribution network to the transmission network as indicated by the Sydney East BSP MW Profile and Sydney East BSP MVAr Profile in Figure 2-2 below.

In 2025, the reactor was utilised for approximately 70% of the year. This occurs while the active power is mostly being exported from the BSP to the Ausgrid network and reactive power flowing in the opposite direction.

Figure 2-2: MW and MVAr Annual profiles at Sydney East BSP

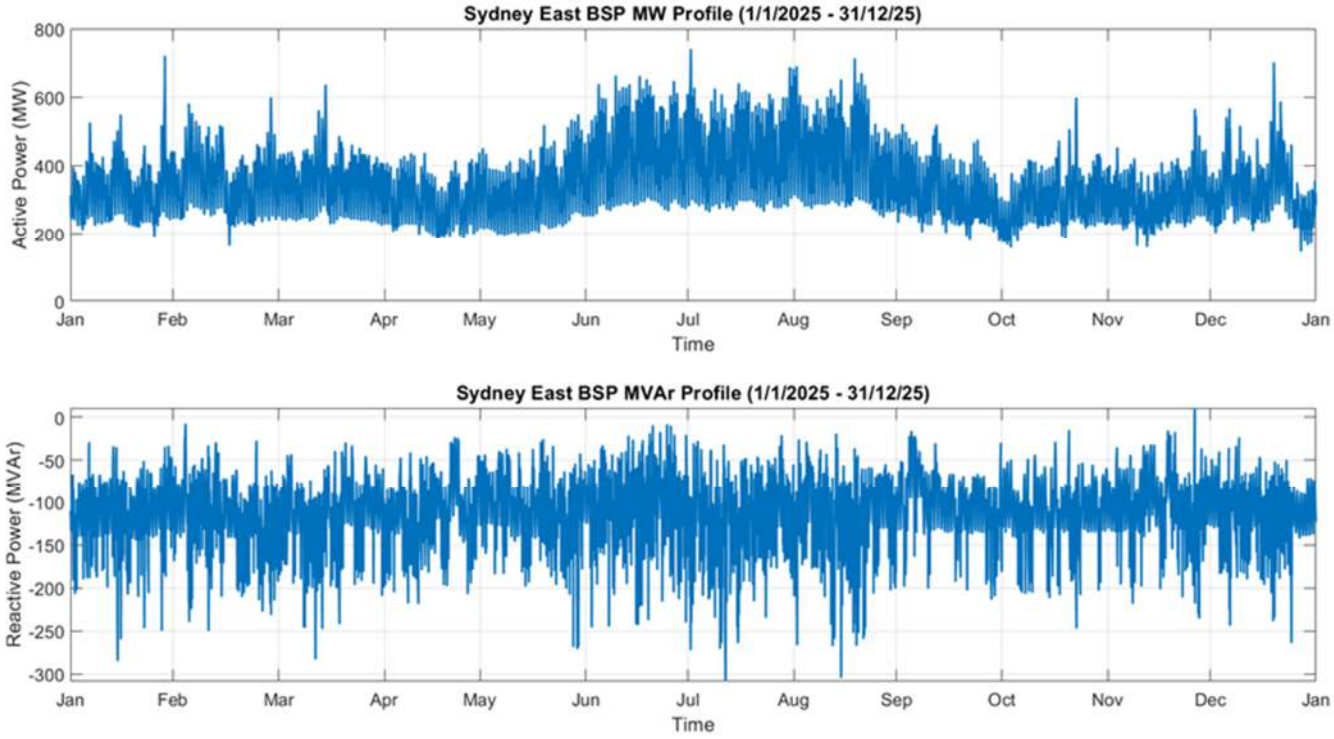
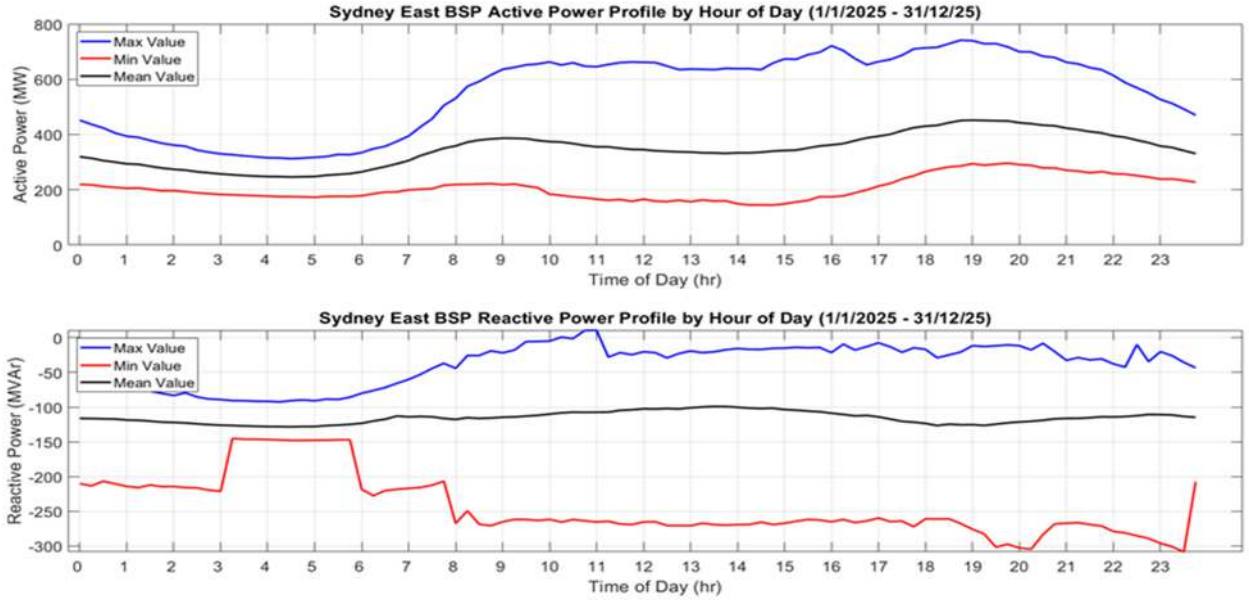
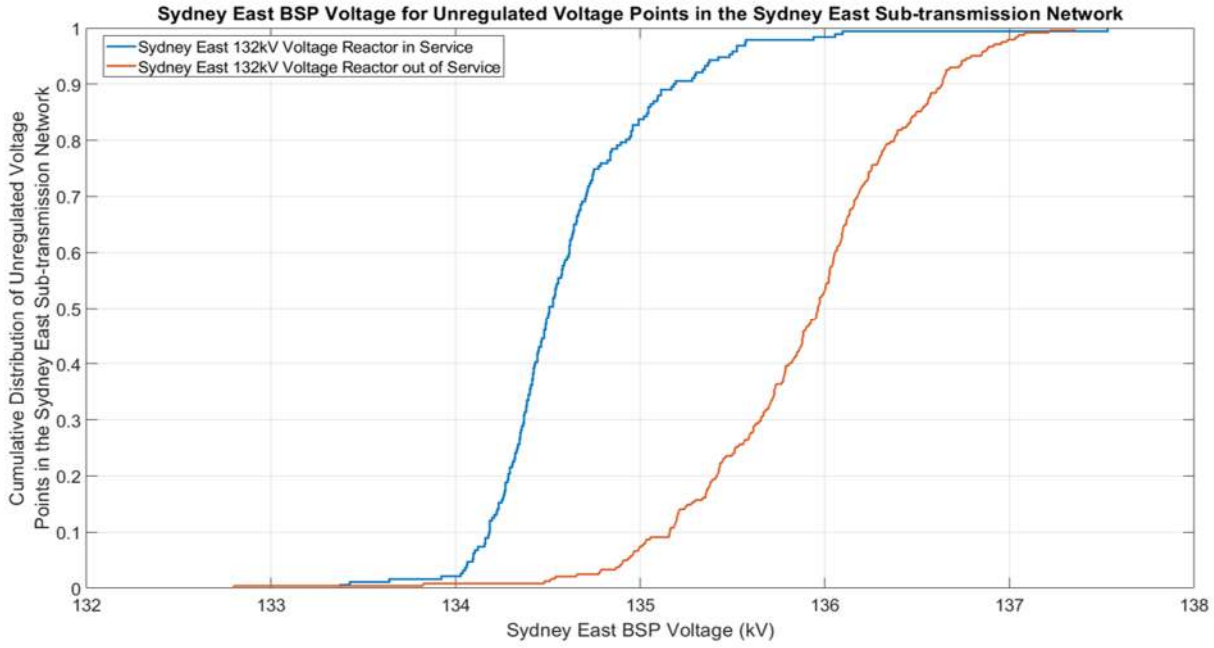


Figure 2-3: Sydney East BSP Daily MW and MVAr Profile



Our joint planning with Ausgrid shows that voltage control is significantly improved by the reactor (Figure 2-4 below). Based on 2025 data, unregulated voltages in the sub-transmission network start at around 134 kV with the reactor in service and increase to around 137 kV without it.

Figure 2-4: Cumulative distribution of unregulated voltage points in the Sydney East sub transmission network with and without the reactor in service

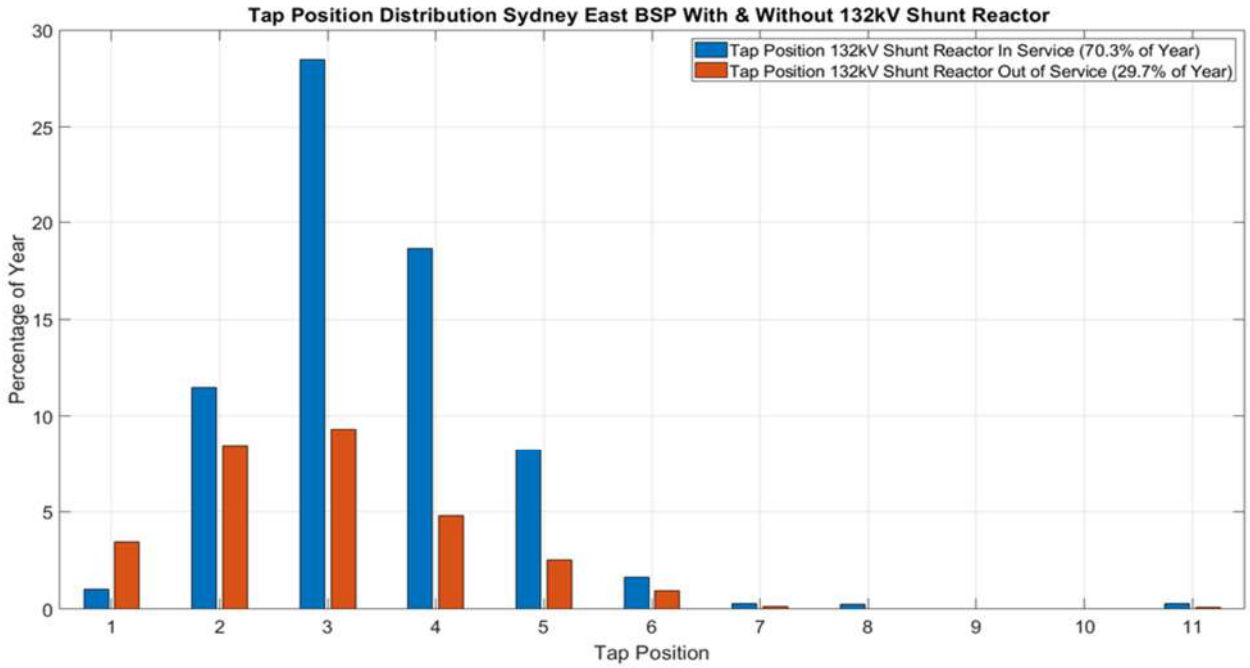


With the reactor in service, voltages exceed 135.5 kV less than 2% of the time. Without the reactor, this increases to over 80% of the time.

This issue is expected to worsen in future years, indicating that voltage compliance limits will be breached much earlier if the reactor is not replaced.

Figure 2-5 below shows the increase in proportion of time that the Sydney East transformers operate at their minimum tap setting (tap 1), limiting their ability to further reduce voltages at the 132 kV bus. With the reactor out of service, the transformers were at their minimum tap for approximately 4% of the year in 2025. This is expected to increase as minimum demand continues to decline.

Figure 2-5: Sydney East BSP Tap position distribution with and without 132 kV Shunt Reactor



Furthermore, several Ausgrid zone substations in the network supplied by Sydney East spend a high proportion of time on Tap 1, some more than 90% of the year. With increasing distribution network voltages due to the capacitive nature of the load and increased rooftop PV, voltage set points are continually being lowered. Eventually, this will no longer be effective when distribution voltages at customer sites exceed 253V at certain times and fall below 216V at other times[20]. Without a reactor at Sydney East BSP, voltage management is expected to become unmanageable for some substation transformers during low demand periods.

2.3. Assumptions underpinning the identified need

2.3.1. Reliability corrective action

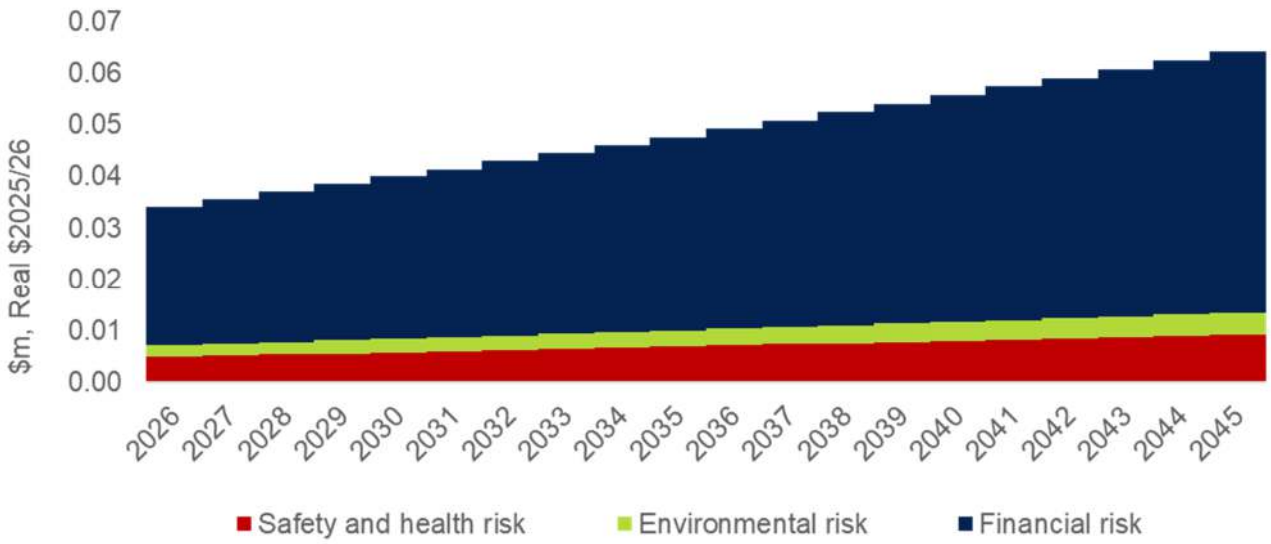
The studies undertaken by Ausgrid suggest that the current reactive capacity in this area of the grid, without the Sydney East reactor in service, would limit the ability to manage voltages in some areas of the downstream network. This will become progressively worse in subsequent years if the reactor is not replaced. Transgrid stipulates voltage limits in the Connection Agreement with due consideration of its network and Ausgrid uses these limits to manage voltage compliance risks in the downstream network all the way to connected customers.

[20] Australian Standards 60038

2.3.2. Risk costs

We adopt a risk cost framework to quantify and evaluate the risks and consequences of increased failure rates. Appendix B provides an overview of our Risk Assessment Methodology.

Figure 2-6: Estimated risk costs



2.3.3. Asset health and the probability of failure

Our asset health modelling aligns with Chapter 5.2 of the AER's Asset Replacement Planning guideline[21]. Condition information for each asset is assessed to generate an Asset Health Index and assets identified as being in relatively poor condition, are candidates for a replacement or refurbishment intervention.

Asset Health is used to estimate the remaining life of an asset and forecast the associated probability of failure (PoF) of the asset now and into the future. The future health of an asset (health forecasting) is a function of its current health and any factors causing accelerated (or decelerated) degradation or 'age shifting' of one or more of its components. Such moderating factors can represent the cumulative effects arising from continual or discrete exposure to unusual events, external stresses, overloads and faults.

Asset condition information is the primary source of information on the current health of the reactor and its components. Condition information obtained through routine maintenance of the reactor, such as condition rating of each component, and asset information, such as natural age, oil sampling results, test results and physical condition, form the basis for deriving current health.

The PoF is the likelihood that an asset will fail during a given period resulting in a particular adverse event. The probability of each failure mode is calculated using reliability engineering techniques that take into account conditional age (chronological age moderated by asset health), failure and defect history, and industry benchmarking studies. We screen out failures that are not related to end-of-life when quantifying risk for replacement projects because such risks are not addressed by these works.

[21] AER, Industry practice application note – Asset replacement planning, January 2019

2.3.4. Deteriorating Condition of No. 1 132 kV at Sydney East substation

The No.1 132 kV reactor at Sydney East substation was first commissioned in 1986 and it has now reached the end of its serviceable life. The health index considers natural age, dissolved gas analysis (DGA), oil quality (OQ), Bushing DDF, defects, load and corrosive oil. The condition issues related to Sydney East Reactor no.1, its potential impact and consequences are outlined in Table 2-2.

Table 2-2: Condition issues at Sydney East Reactor, their potential impact and its consequences

Issue	Potential Impact	Consequence
Oil Impregnated Paper (OIP) Bushings	The 132 kV OIP bushings were installed in 1986 and are equipped with porcelain insulators and a condenser-based core. Their advanced age makes them susceptible to failures from over voltages, and thermal stresses and humidity ingress.	Increases the probability of reactor failure which will risk Transgrid's compliance with NER Power Frequency Voltage standard and associated network performance requirements in Schedule s5.1a.4 and increase safety and environmental risks.
Thermal heating <300°C	Dissolved Gas Analysis (DGA) shows high levels of methane (CH4) and ethane (C2H6) in the main tank of the reactor. This typically indicates thermal fault in the paper or oil at low temperatures below 300 °C.	
Paper Insulation Moisture	The reactor insulation system is based on special papers impregnated with insulating oil. The papers provide insulation and support the structure of the reactor winding. Moisture acts to increase the rate of degradation of the paper insulating system and the paper may become brittle. At high levels, it may compromise the insulation. This may progress to the point where a mechanical shock caused by a fault can result in electrical failure.	
Corrosion resulting in loss of oil due to leaks	Corrosion resulting in leaks or leaking gaskets can cause loss of oil within the reactor resulting in a catastrophic failure. Moisture and oxygen can also enter the reactor resulting in accelerated ageing of the insulation resulting in failure.	

2.3.5. Risk assessment framework

The major risks quantified for this RIT-T includes financial, safety and environmental risks and are explained in more detail in Sections 2.3.5.1 to 2.3.5.3.

2.3.5.1 Financial Risk

This refers to the financial consequence of an asset failure. The likelihood of a consequence considers any compliance and regulatory factors which are not covered by the other categories. The monetary value accounts for the associated cost with disruption to business operations, third party liabilities, and the cost of replacement or repair of the asset, including any temporary measures.

Financial risk makes up approximately 79 per cent of the total estimated risk cost.

2.3.5.2 Safety risk

This refers to the safety consequence to staff, contractors and/or members of the public of an asset failure. The likelihood of a consequence considers the frequency of workers on-site, duration of maintenance and capital work on-site, and the probability and area of effect of an explosive asset failure. The monetary value considers the cost associated with fatality or injury compensation, loss of productivity, litigation fees, fines and any other related costs.

We manage and mitigate safety risk to ensure they are below risk tolerance levels or 'As Low As Reasonably Practicable' ('ALARP'), in accordance with our obligations under the New South Wales Electricity Supply (Safety and Network Management) Regulation 2014 and our Electricity Network Safety Management System (ENSMS). Consistent with our ALARP obligations, we apply a disproportionality factor of 'six' to the public safety component and 'three' to the worker safety component of safety risk.

Safety risk makes up approximately 14 per cent of the total estimated risk cost.

2.3.5.3 Environmental risk

This refers to the environmental consequence (including bushfire risk) to the surrounding community, ecology, flora and fauna of an asset failure. The likelihood of a consequence considers the location of the site and sensitivity of surrounding areas, the volume and type of contaminant, the effectiveness of control mechanisms, and the likelihood and impact of bushfire. The monetary value considers the cost associated with damage to the environment including compensation, clean-up costs, litigation fees, fines and any other related costs.

Environmental risk makes up approximately 7 per cent of the total estimated risk cost.

3. Potential credible option

We consider there is only one credible option in this RIT-T assessment that would meet the identified need from a technical, commercial, and project delivery perspective.[22]

Table 3-1 summarises the credible option we currently consider can meet the identified need.

Table 3-1: Summary of the credible options ($2025/26)

Option	Description	Estimated capex +/- 25%	Operating costs ($ per year)
Option 1	Replacement of Sydney East No.1 reactor	$8.82m	$606[23]

3.1. Base case

Consistent with the RIT-T requirements, the assessment undertaken in this PSCR 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:

> *"The base case is where the RIT-T proponent does not implement a credible option to meet the identified need, but rather continues its 'BAU activities'. 'BAU activities' are ongoing, economically prudent activities that occur in absence of a credible option being implemented"*[24]

As the reactor is required to maintain voltage levels, the base case is to continue to operate the reactor under increasing risk of failure and other associated risks. Under the base case, i.e. not facilitating network developments to address the need and taking into account failure risks, overvoltage issues occurring in the Inner Sydney Metropolitan area are highly likely and will be worsening because of decreasing minimum demand. Recent operational experience suggests that the reduction in minimum demand is worse than expected in the forecasts and can happen during most weekends in the shoulder period. This option is not acceptable since there is an increasing risk of non-compliance with the Connection Agreement voltage control requirements.

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

3.2. Option 1 – Replacement of Sydney East No.1 reactor

Option 1 involves replacement of the No.1 reactor at Sydney East substation with a new 132 kV 110MVAr shunt reactor. The option will address the identified need by installing a new reactor with a very low probability of failure, associated risks and lower operating costs.

[22] As per clause 5.15.2(a) of the NER.
[23] Incremental operating costs relative to base case
[24] AER, *Regulatory Investment Test for Transmission Application Guidelines,* November 2024, p.21.

This option involves:

- Installation of a new 110MVAr shunt reactor.
- Installation of new bund, single firewall, LV supply and protection systems (secondary systems).

The existing No.1 reactor will be decommissioned and the compound demolished prior to the installation of a new compound and new No.1 reactor. The scope of works is expected to be carried out between 2026/27 and 2028/29 with commissioning occurring in 2030/31. All works will be completed in accordance with the relevant standards with minimal modification to the wider transmission assets. We estimate that it will take 73 months from this RIT-T commencement to complete Option 1 with commissioning possible in 2030/31.

The estimated capital expenditure associated with this option is $8.82 million, which is comprised of:

- $2.14 million in labour costs;
- $4.25 million materials costs; and
- $2.43 million in expenses (which includes expenses in relation to contractors, design consultants etc).

The table below shows the expected expenditure profile of this option.

Table 3-2: Annual breakdown of Option 1's expected capital cost ($m, $2025/26)

	Stage 1 *(current regulatory period)*	Stage 2 *(future regulatory period)*	Total
Labour	0.18	1.96	2.14
Expenses	0.21	2.22	2.43
Material	0.36	3.89	4.25
Total	0.75	8.07	8.82

This program will be delivered in the following two stages:

- **Stage One:** Planning, design, development and completion of RIT-T are expected to be undertaken between 2026/2027 and 2027/2028.
- **Stage Two:** Procurement, project delivery, construction and commissioning will occur from 2028/2029 and 2030/2031. Project completion is assumed by 2030/2031.

Routine operating and maintenance cost increases approximately $606 per annum.

Options considered but not progressed

We considered three other options that were not progressed as they were not considered technically or economically feasible. These options are outlined in the table below.

Table 3-3: Options considered but not progressed

Option	Reason for not progressing
Refurbishment of the Reactor	Refurbishment is expected to improve condition issues associated with the bushings, insulating oil quality, and gasket leaks. It cannot address or improve the

Option	Reason for not progressing
	quality of the paper insulation, eliminate gas generation, ageing in the core or improve winding clamping pressure. Refurbishment will not meet the need of addressing all the identified condition issues and will only marginally extend the asset life.
Increased maintenance or inspections	The condition issues have already been identified and cannot be rectified through increased maintenance or inspections and therefore is not technically feasible to address the need.
Elimination of all associated risk	Continuing to operate the existing reactor entails increasing safety, environmental and operating cost risks. Eliminating all associated risks can only be achieved by retiring the assets, which is not technically feasible due to the requirement to maintain NER compliance and Ausgrid Connection Agreement requirements.
Non-network solutions	There are no known non-network solutions in the area that would provide the functionality required under this need. Non-network options are not able to mitigate the increasing risks of failure of ageing assets.

3.3. No material inter-network impact is expected

We have considered whether Option 1 is expected to have material inter-regional impact.[25] A 'material inter-network impact' is defined in the NER as:

> "*A material impact on another Transmission Network Service Provider's network, which impact may include (without limitation): (a) the imposition of power transfer constraints within another Transmission Network Service Provider's network; or (b) an adverse impact on the quality of supply in another Transmission Network Service Provider's network.*"

AEMO's suggested screening test to indicate that a transmission augmentation has no material inter-network impact is that it satisfies the following:[26]

- A decrease in power transfer capability between transmission networks or in another TNSP's network of no more than the minimum of 3% of the maximum transfer capability and 50 MW;
- An increase in power transfer capability between transmission networks or in another TNSP's network of no more than the minimum of 3% of the maximum transfer capability and 50 MW;
- An increase in fault level by less than 10 MVA at any substation in another TNSP's network; and
- The investment does not involve either a series capacitor or modification in the vicinity of an existing series capacitor.

We note that Option 1 satisfies these conditions. By reference to AEMO's screening criteria, there are no material inter-network impacts associated with the credible option considered.

3.4. Community engagement

Transgrid is not proposing to undertake specific community engagement (in addition to the publication of the RIT-T consultation reports) in relation to this project. The proposed project relates to infrastructure

[25] As per clause 5.16.4(b)(6)(ii) of the NER.
[26] Inter-Regional Planning Committee. *"Final Determination: Criteria for Assessing Material Inter-Network Impact of Transmission Augmentations."* Melbourne: Australian Energy Market Operator, 2004. Appendix 2 and 3. Accessed 14 May 2020. https://www.aemo.com.au/-/media/Files/PDF/170-0035-pdf

within an existing substation, and as such there will be no additional impact on communities located close to the current transmission infrastructure, apart from construction activities. Transgrid will ensure that all construction works associated with the project are conducted in a manner that causes the least disruption to communities and notes that the construction activities will be subject to a separate environmental approval.

As a result, Transgrid does not consider that there is a need for additional community engagement as part of this RIT-T process. We will still engage with community as part of our project's construction works notifications and welcome any submissions from community members to this PSCR.

4. Materiality of market benefits

This Section outlines the categories of market benefits prescribed in the NER and whether they are considered material for this RIT-T.[27]

4.1. Wholesale electricity market benefits are not material

The AER has recognised that if the credible options will not have an impact on the wholesale electricity market, then several classes of market benefits will not be material in the RIT-T assessment and so do not need to be estimated.

We determine that the credible option in this RIT-T will not affect 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 pool price)
- Changes in costs for parties other than Transgrid
- Changes in ancillary services costs
- Changes in greenhouse gas emissions specific to the wholesale electricity market
- Competition benefits

4.2. No other classes of market benefits are material

In addition to the classes of market benefits listed above, NER clause 5.15A.2(b)(4) requires us to consider the following classes of market benefits, set out in Table 4-1 below, arising from each credible option. We consider that none of the classes of market benefits listed are material for this RIT-T assessment for the reasons set out.

Table 4-1: Reasons non-wholesale electricity market benefits categories are considered not material

Market benefits	Reason
Differences in the timing of unrelated network expenditure	The credible options considered are unlikely to affect decisions to undertake unrelated expenditure in the network. Consequently, material market benefits will neither be gained nor lost due to changes in the timing of expenditure from any of the options considered.
Option value	We note the AER's view that option value is likely to arise where there is uncertainty regarding future outcomes, the information that is available is likely to change in the future, and the credible options considered by the TNSP are sufficiently flexible to respond to that change. We also note the AER's view that appropriate identification of credible options and reasonable scenarios captures any option value, thereby meeting the NER requirement to consider option value as a class of market benefit under the RIT-T. We do not consider there to be any option value with the options considered in this RIT-T. Additionally, a significant modelling assessment would be required to

[27] As per NER clause 5.15A.2(b)(4) See Appendix A for requirements applicable to this document.

	estimate the option value benefits, but it would be disproportionate to potential additional benefits for this RIT-T. Therefore, we have not estimated additional option value benefit.
Changes in network losses	We do not expect any material difference in transmission losses between options.
Changes in Australian greenhouse gas emissions	Option 1 is not expected to result in a material change in Australia's greenhouse gas emissions.

5. Overview of the assessment approach

This section outlines the approach that we are proposing to apply in assessing the net benefits associated with Option 1 against the base case.

5.1. Assessment period and discount rate

A 20-year assessment period from 2025/26 to 2044/45 has been adopted for this RIT-T analysis. This period accounts for the size, complexity and expected asset life of each option.

Where the capital components have asset lives extending beyond the end of the assessment period, the NPV modelling includes a residual value to capture the remaining functional asset life. This ensures that the capital cost of the long-lived assets over the assessment period is appropriately captured, and that costs and benefits are assessed over a consistent period, irrespective of option type, technology or serviceable asset life. The terminal values have been calculated based on the undepreciated value of capital costs at the end of the analysis period and expected operating and maintenance cost for the remaining asset life. As a conservative assumption, we have effectively assumed that there are no additional cost and benefits after the analysis period.

A real, pre-tax discount rate of 7.00 per cent has been adopted as the central assumption for the NPV analysis, consistent with AEMO's latest Input Assumptions and Scenarios Report (IASR).[28]

5.2. Approach to estimating option costs

We have estimated capital costs based on the defined scope of works, supported by historical project experience, current market data and the MTWO estimating database. MTWO includes rates and cost information developed from period order agreements, supplier pricing, labour productivity data, recent tenders, contract rates and completed project outcomes.

The MTWO estimating database is reviewed quarterly to reflect updated outturn costs and market information. Estimates are also benchmarked against internal project outcomes and, where appropriate, independent estimates prepared by engineering or estimating consultancies.

We estimate that actual costs will be within +/- 25 per cent of the central base capital cost estimate. This range is consistent with the indicative accuracy range associated with a Class 4 estimate under AACE International Recommended Practice 18R-97, which identifies typical Class 4 accuracy ranges of -15 per cent to -30 per cent on the low side and +20 per cent to +50 per cent on the high side, depending on project complexity, reference information and other risks. While Transgrid has not formally classified this estimate under the AACE system, the adopted +/- 25 per cent range falls within the indicative Class 4 range and reflects the preliminary level of scope definition and estimate maturity at this stage of the RIT-T.

Contingency is treated separately from the base estimate and is developed using a proportionate, risk-based approach where project-specific risks have been identified and quantified. Portfolio-level contingency is not applied.

[28] AEMO, *2023 Inputs, Assumptions and Scenarios Report*, Final report, July 2023, p 123.

Work is planned within existing Transgrid substations. No specific allowance for additional access has been included as part of the estimate. Where civil works is anticipated, normal soil conditions have been assumed.

All cost estimates are prepared in real 2024/25 dollars based on the information and pricing history available at the time that they were estimated.[29] The cost estimates do not include or forecast any real cost escalation for materials.

As per RIT-T Guidelines[30], RIT-T proponents are expected to explicitly consider community engagement and social licence during the RIT- T process. This means that Transgrid must consider social licence principles in the identification of credible options. This may affect how we determine the most likely cost and delivery timeline for an option. Transgrid believes building relationships and trust is how we can gain and grow social licence. Through engagement with affected communities, we identify prudent and efficient investment opportunities that can build and gain community acceptance for our options.

Costs associated with social licence include those associated with engagements, community benefits, minor route adjustments and legislated additional landholders' payments, as applicable. Social licence costs can be reduced through early and continued engagement with communities and stakeholders who are reasonably expected to be affected by the project.

We will continue to engage with community to identify opportunities to address social impacts and reduce the need for compensation due to project impact. We will take into account any additional social licence considerations (including those identified through ongoing community engagement, as outlined in section 3.4) identified and accordingly update the cost and timing of the credible options in the PACR, where appropriate.

5.3. One scenario has been assessed

In light of market benefits (and avoided risk cost benefits) not being considered material for this RIT-T (as there is only one credible option), we model one reasonable scenario as part of this PSCR assessment. This scenario is summarised in the table below.

Table 5-1: Scenario summary

Variable	Central scenario
Scenario weighting	100%
Discount rate	7.0%
Network capital costs	Base estimate
Operating and maintenance costs	Base estimate

This scenario implicitly assumes the expected most likely scenario for the 2025 ISP (i.e., the 'Step Change' scenario).

We have not undertaken sensitivity testing for this PSCR on account of it not being proportionate, i.e., given we only have one credible option for this reliability corrective action, sensitivity testing will not inform the identification of the preferred action.

[29] For the net economic benefit analysis, the cost estimates were escalated from real 2024/25 dollars to real 2025/26 dollars using the Reserve Bank of Australia's CPI forecast published in the February 2026 Monetary Policy Statement (June 2026 CPI).

[30] AER, Regulatory Investment Test for Transmission Application Guidelines, November 2024, p.67

6. Assessment of the credible option

This Section outlines the assessment of the credible option compared to the base case.

6.1. Estimated net economic benefits

The net economic benefits are the differences between the estimated gross benefits and the estimated costs. The table below summarises the present value of the net economic benefits of the credible option relative to the base case, under the single scenario investigated.

Table 6-1: PV of net economic benefits for Option 1 relative to the base case ($m, $2025/26)

Option/scenario	Central scenario
Scenario weighting	100%
Option 1	-$5.33

7. Draft conclusion and exemption from producing a PADR

This PSCR has found that Option 1 is the preferred option for this RIT-T. Option 1 involves Replacement of Sydney East No.1 reactor. The estimated capital expenditure associated with Option 1 is $8.82 million (in 2025/26 dollars).

The works will be undertaken between 2026/27 and 2030/31. Planning, design, development and procurement (including the completion of the RIT-T) will occur between 2026/27 and 2027/28 while project delivery and construction will occur in 2028/29. All works are expected to be completed by 2030/31, with final commissioning of the solution expected in 2030/31 to best meet the need of improving voltage control.

Option 1 is the preferred option in accordance with NER clause 5.15A.2(b)(12) because it is the credible option that maximises the net present value of the net economic benefit to all those who produce, consume and transport electricity in the market.

Subject to the identification of additional credible options during the consultation period, publication of a Project Assessment Draft Report (PADR) is not required for this RIT-T as we consider that the conditions in clause 5.16.4(z1) of the NER exempting RIT-T proponents from providing a PADR have been met. Specifically, a PADR is not required because:

- The estimated capital cost of the preferred option is less than $54 million[31];
- We have identified in this PSCR our proposed preferred option, together with the reasons for the preferred option; and
- The proposed preferred option and any other credible options in respect of the identified need do not have any material market benefits (with the exception of market benefits arising from changes in involuntary load shedding).

If an additional credible option that could deliver a material market benefit is identified during the consultation period, then we will produce a PADR that includes an assessment of the net economic benefit of each additional credible option.

If no additional credible options with material market benefits are identified during the consultation period, then the next step in this RIT-T will be the publication of a Project Assessment Conclusions Report (PACR) that addresses all submissions received, including any issues in relation to the proposed preferred option raised during the consultation period.[32]

[31] Varied from $43m to $54m based on the AER Final Determination: Cost threshold review, November 2024.
[32] In accordance with NER clause 5.16.4(z2).

Appendix A Compliance checklist

This appendix sets out a checklist which demonstrates the compliance of this PSCR with the requirements of the National Electricity Rules version 250.

Rules clause	Summary of requirements	Relevant section
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;	2
	(2) the assumptions used in identifying the identified need (including, in the case of proposed reliability corrective action, why the RIT-T proponent considers reliability corrective action is necessary);	2
	(3) the technical characteristics of the identified need that a non-network option would be required to deliver, such as: (i) the size of load reduction or additional supply; (ii) location; and (iii) operating profile;	NA[33]
	(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;	NA
	(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, alternative transmission options, interconnectors, generation, demand side management, market network services or other network options;	3
	(6) for each credible option identified in accordance with subparagraph (5), information about: (i) the technical characteristics of the credible option; (ii) whether the credible option is reasonably likely to have a material inter-network impact; (iii) the classes of market benefits that the RIT-T proponent considers are likely not to be material in accordance with clause 5.15A.2(b)(6), together with reasons of why the RIT-T proponent considers that these classes of market benefit are not likely to be material; (iv) the estimated construction timetable and commissioning date; and (v) to the extent practicable, the total indicative capital and operating and maintenance costs.	3 & 5
5.16.4(z1)	A RIT-T proponent is exempt from [preparing a PADR] (paragraphs (j) to (s)) if: 1. the estimated capital cost of the proposed preferred option is less than $35 million[34] (as varied in accordance with a cost threshold determination);	8

[33] As per Section 3.3, there are no known non-network solutions to provide the functionality of the equipment under this need. Non-network options are not able to mitigate the increasing risks of failure of ageing assets.

[34] Varied to $54m based on the AER Final Determination: Cost threshold review November 2024.

	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 5.15A.2(b)(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 5.15A.2(b)(4).1(c)(4) except those classes specified in clauses 5.15A.(b)(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.	

In addition, the table below outlines a separate compliance checklist demonstrating compliance with the binding guidance in the latest AER RIT-T guidelines.

Guidelines section	Summary of the requirements	Relevant section(s)
3.1	In all cases, it is essential that RIT-T proponents express the identified need as the achievement of an objective or end, and not simply the means to achieve the objective or end. This objective should be expressed as a proposal to electricity consumers and be clearly stated and defined in RIT-T reports, as opposed to being implicit.	2.2
3.2.5	A RIT-T proponent must consider social licence issues in the identification of credible options. There are many potential sources of information when considering how this should be done, which include community sentiment data, prior experience, best practices, relevant guidelines, and early engagement with consumers, stakeholders and communities.	3.4 & 5.2
3.4	Except for specific circumstances, RIT-T proponents must adopt the inputs, assumptions and scenarios from the most recent inputs, assumptions and scenarios report (IASR).	5.1
3.4.1	The RIT-T specifies that: (i) The RIT-T proponent must adopt the discount rate from the most recent inputs, assumptions and scenarios report unless it provides demonstrable reasons why a variation is necessary. If the RIT-T proponent decides to vary this parameter, this variation must be consistent with paragraph 19. (ii) The present value calculations must use a commercial discount rate appropriate for the analysis of a private enterprise investment in the electricity sector. The discount rate used must be consistent with the cash flows being discounted. Consistent with the RIT-T requirement, present value calculations in the ISP must use a commercial discount rate appropriate for the analysis of a private enterprise investment in the electricity sector. Given this consistency, it should be suitable for RIT-T proponents to apply the discount rate that AEMO has applied in the most recent ISP.	5.1

3.5	In the RIT-T, costs are the present value of a credible option's direct costs. These must include the following classes of costs: • Costs incurred in constructing or providing the credible option. • Operating and maintenance costs over the credible option's operating life. For clarity, a consequence of this is that, if the modelling period is shorter than the life of the credible option, the RIT-T proponent would incorporate the operating and maintenance costs (if any) for the remaining years of the credible option into the terminal value. • Costs of complying with relevant laws, regulations and administrative requirements. • A RIT-T proponent must exclude from its analysis, the costs (or negative benefits) of a credible option's harm to the environment or to any party that is not prohibited under the relevant laws, regulations or legal instruments, with the exception of changes in Australia's greenhouse gas emissions.	5.2 & 5.3
3.5A.2	For each credible option, a RIT-T proponent must specify, to the extent practicable and in a manner which is fit for purpose for that stage of the RIT-T: (i) all key inputs and assumptions adopted in deriving the cost estimate (ii) a breakdown of the main components of the cost estimate (iii) the methodologies and processes applied in deriving the cost estimate (e.g. market testing, unit costs from recent projects, and engineering-based cost estimates) (iv) the reasons in support of the key inputs and assumptions adopted and methodologies and processes applied (v) the level of any contingency allowance that have been included in the cost estimate, and the reasons for that level of contingency allowance	3 & 5
3.5.3	The RIT-T proponent is required to provide the basis for any social licence costs in their RIT-T reports and may choose to refer to best practice from a reputable, independent and verifiable source.	3.5 & 5.3
3.6.1	Under the RIT-T instrument, a RIT-T proponent must include all classes of market benefits unless: • it can provide reasons for why a particular class of market benefit is unlikely to materially affect the outcome of the credible options assessment, or • it expects the cost of undertaking the analysis to quantify the market benefits will be disproportionate to the scale, size and potential benefits of the credible options.	4
3.6.2	Under the RIT-T instrument, a RIT-T proponent must also consider classes of market benefits that: • the RIT-T proponent determines relevant, and • we have agreed to in writing before the RIT-T proponent publishes its consultation report.	4
3.7.1	For each credible option, a RIT-T proponent must develop two states of the world (one with the credible option in place and the other being the base case with no option in place) for each reasonable scenario. This allows the RIT-T proponent to later derive the market benefits of an option by comparing these states of the world, and then probability weighting those benefits across a range of reasonable scenarios.	5.3

3.8.1	Where no scenarios from the ISP are relevant to the RIT-T application, the RIT-T proponent must form reasonable scenarios consistently with the requirements for reasonable scenarios in the RIT-T instrument.	6.5
	Under the RIT-T instrument, the number and choice of reasonable scenarios must be appropriate to the credible options under consideration. Specifically, the choice of reasonable scenarios must reflect any variables or parameters that are likely to affect: • the ranking of the credible options, where the identified need is for reliability corrective action, inertia network services or system strength services. In these cases, only the ranking (as opposed to the sign) of credible options' net economic benefits is important; and • the ranking or sign of the net economic benefit of any credible option where the identified need is not for reliability corrective action, inertia network services or system strength services. In these cases, the preferred option must have a positive net economic benefit.	
3.9.1	The methodology for assigning probabilities to each reasonable scenario must be consistent with the methodology for choosing the reasonable scenarios themselves. Where a RIT-T proponent has no evidence or rationale for assigning a higher probability for one reasonable scenario over another, it may weight all reasonable scenarios equally. Moreover, where the RIT-T proponent uses the most recent ISP scenarios as its reasonable scenarios, it must adopt the probability weightings that AEMO used in the most recent ISP.	5.3
3.9.2	A RIT-T proponent must separately undertake a weighted averaging of the direct costs of a credible option as well as the market benefits of a credible option.	6
3.9.3	The RIT-T instrument requires RIT-T proponents to consider option value as a class of potential market benefit.	4.2
4.1	RIT-T proponents are required to describe in each RIT-T report • how they have engaged with local landowners, local council, local community members, local environmental groups or traditional owners and sought to address any relevant concerns identified through this engagement • how they plan to engage with these stakeholder groups, or • why this project does not require community engagement	3.4

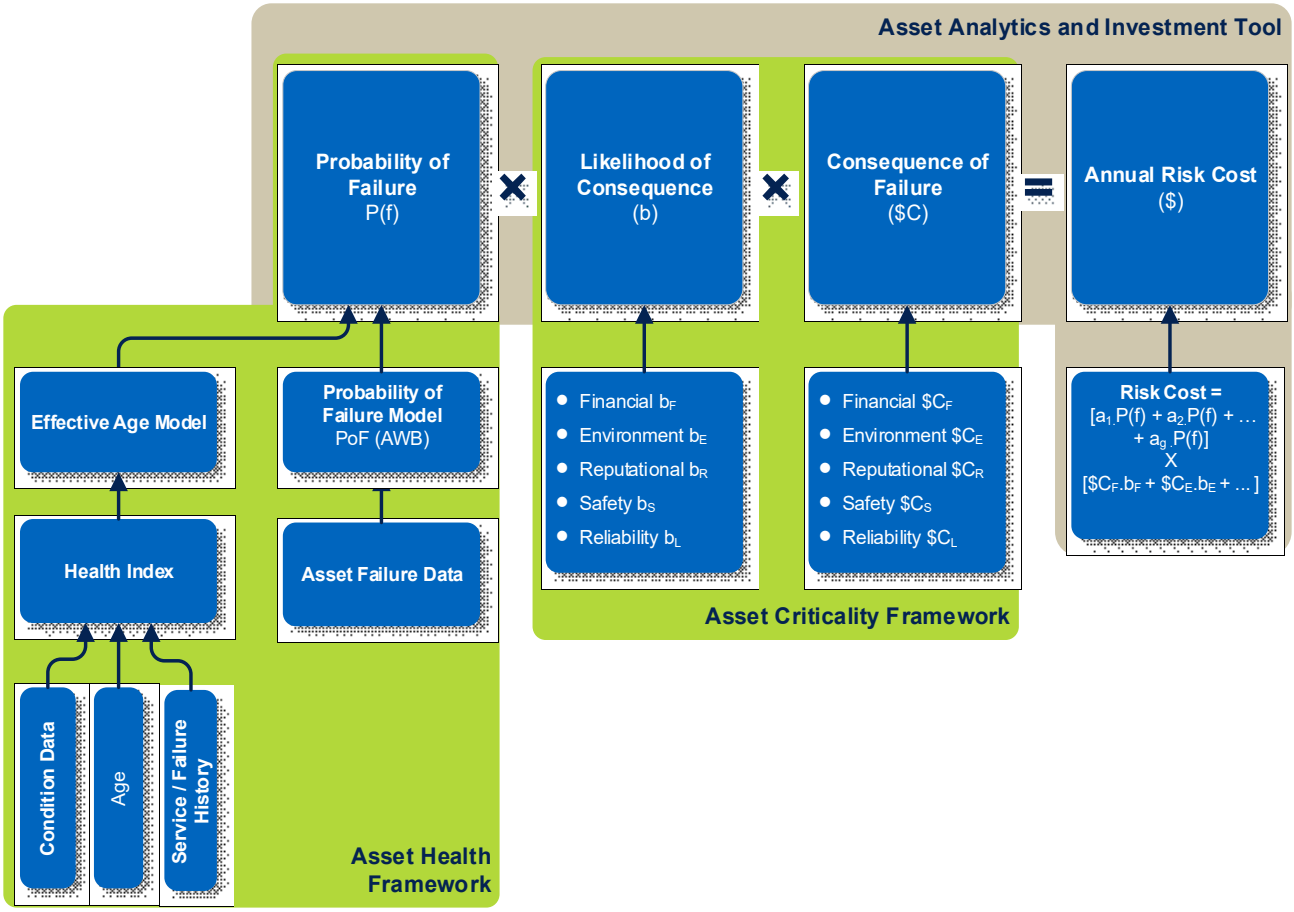
Appendix B Risk assessment framework

This appendix summarises our network risk assessment methodology that was part of the analysis in the identified need for this RIT-T. Our risk assessment methodology is aligned with the AER's Asset Replacement Planning guideline[35] and its principles.

A fundamental part of the risk assessment methodology is calculating the annual 'risk costs' or the monetised impacts of the reliability, safety, bushfire, environmental and financial risks.

The monetary value of risk (per year) for an individual asset failure resulting in an undesired outcome, is the likelihood (probability) of failure (in that year with respect to its age), as determined through modelling the failure behaviour of an asset (Asset Health), multiplied by the consequence (cost of the impact) of the undesired outcome occurring, as determined through the consequence analysis (Asset Criticality). Figure B-1 illustrates the base risk equation that we apply.

Figure B-1: Risk cost calculation



Economic justification of Repex to address an identified need is supported by risk monetised benefit streams, to allow the costs of the project or program to be assessed against the value of the avoided risks and costs. The major quantified risks we apply for Repex justifications include asset failures that materialise as:

[35] Industry practice application note - Asset replacement planning, AER July 2024

- Bushfire risk
- Safety risk
- Environmental risk
- Reliability risk, and
- Financial risk.

The risk categories relevant to this RIT-T are explained in Section 2.3.

Further details are available in our Network Asset Risk Assessment Methodology.

Appendix C Asset Health and Probability of Failure

The first step in calculating the probability of failure of an asset is determining the Asset Health and associated effective age,[36] which considers:

- An asset consists of different components, each with a particular function, criticality, underlying reliability, life expectancy and remaining life. The overall health of an asset is a compound function of all of these attributes.
- Key asset condition measures and failure data provides vital information on the current health of an asset. The 'Current effective age' is derived from asset information and condition data.
- The future health of an asset (health forecasting) is a function of its current health and any factors causing accelerated (or decelerated) degradation or 'age shifting' of one or more of its components. Such moderating factors can represent the cumulative effects arising from continual or discrete exposure to unusual internal, external stresses, overloads and faults.
- 'Future effective age' is derived by moderating 'current effective age' based on factors such as, external environment/influence, expected stress events and operating/loading condition.

The Probability of Failure (PoF) is the likelihood that an asset will fail during a given period resulting in a particular adverse event.

The outputs of the Probability of Failure (PoF) calculation are one or more probability of failure time series which provide a mapping between the effective age, discussed above, and the yearly probability of failure value for a given asset class. This analysis is performed by generating statistical failure curves, normally using Weibull analysis, to determine a PoF time series set for each asset that gives a probability of failure for each further year of asset life. This establishes how likely it is that the asset will fail over time.

The Weibull parameters which represent the probability of failure curve for key assets are summarised in the table below.

Table C-1: Weibull parameters for asset components

Asset	Weibull parameters	
	η	β
Reactor	38.84	2.95

[36] Apparent age of an asset based on its condition.