Wood pole management

PAL RRP BUS 4.02, CP RRP BUS 4.02

Revised proposal 2021–2026

CitiPower and Powercor

December 2020

Contents

1 Overview

We apply the same asset management approach for our Powercor and CitiPower networks, and in this context, many of the drivers of our forecast interventions are relevant to both networks. This was recognised by both the AER and its consultant, EMCa—for example, the AER stated that it is appropriate that CitiPower should seek to improve its asset management practices to reflect Energy Safe Victoria's (ESV) recommendations to Powercor.[1]

However, given the magnitude of our program for Powercor, it is the focus of this business case. Where relevant, the differences between our forecasts for both networks are highlighted (and our CitiPower forecast is discussed in detail in chapter four of our revised proposal).

1.1 Powercor wood pole intervention overview

In our original proposal, we forecast our wood pole replacement and reinforcement requirements in three distinct categories—compliance-driven interventions due to measured condition, compliance-driven interventions due to observable defects, and an incremental risk-based program. This forecast reflected changes to our asset management practices, following a comprehensive review by Energy Safe Victoria (ESV). These changes will drive an increase in pole intervention volumes relative to our investment in the 2016–2020 regulatory period.

Stakeholders, including the AER, broadly accepted the need for an increase in our pole intervention volumes. For example, the AER recognised ESV's review and subsequent recommendations, and appreciated the significance of these recommendations in managing safety risk.[2] Notwithstanding this, further information was requested to support our forecast in full, including cost-benefit analysis demonstrating the expected risk reduction from our pole program, and updating our forecasts to reflect the outcomes from recent field trials. We also heard concerns that our current underspend relative to our regulatory allowance will result in customers paying twice for our pole and powerline safety program.

In the absence of further information, the AER developed a substitute forecast based on our 2013 expenditure, plus an allowance to address what it considered a 'backlog' of poles not replaced during the period 2014–2018. The AER also applied a capital expenditure sharing scheme (CESS) reduction.

Since submitting our original proposal, we have worked with our stakeholders to refine our forecast:

- our pole management improvement plan has been accepted by ESV. This plan outlines how we will respond to ESV's recommendations, and we will be committing to these policies through our Electricity Safety Management Scheme (ESMS), and our Bushfire Mitigation Plan (BMP)[3]
- we completed a field trial of over 4,100 wood poles to better inform the assumptions used in our compliance driven interventions (that were based on our enhanced pole calculator). This trial was originally due to be completed in late November 2020, but we accelerated the timing in response to stakeholder feedback. The trial resulted in a downward adjustment to the loading we assumed was required at the top of our poles (i.e. relative to the assumptions in our original proposal, our poles will remain serviceable with less sound wood)
- we included an annual decay rate (of one millimetre of 'sound' wood per annum) to recognise that the underlying condition of our wood poles will degrade over time. In our original proposal, we assumed the condition of our poles was static (i.e. there would be no decay between inspection cycles). The assumption

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1 AER, *Draft decision, CitiPower distribution determination 2021 to 2026, Attachment 5, Capital expenditure*, September 2020, p. 5-26.

2 AER, *Draft decision, Powercor distribution determination 2021 to 2026, Attachment 5, Capital expenditure*, September 2020, p. 5-24.

3 As outlined in appendix A, our ESMS and BMP are obligations under the Electricity Safety Act.

in our original proposal was deliberately under-stated, as it was intended to counter-balance our expectation that the pole loading was likely over-stated (i.e. it was an interim approach pending the completion of our pole trial)

- we reviewed the basis of our compliance-driven interventions that were due to visual defects, and have now removed our previous criteria associated with replacements due to large visible cracks. Given other changes in our asset management practices, the deterioration associated with these observed defects may be captured in our 'measurable' condition assessments (i.e. through our enhanced pole calculator)
- we engaged EA Technology to develop a cost-benefit model to ensure our risk-driven interventions were economic, and had this model peer reviewed by CutlerMerz. Similar to our pole trial, this modelling was initially expected to be completed in early-2021, but was brought forward to address stakeholder concerns. Our revised proposal only includes risk-driven interventions where the avoided risk associated with the intervention is greater than the cost of that intervention. We also applied our risk modelling to our compliance driven forecasts as a top-down check, but for the reasons outlined in this business case, consider that compliance-driven interventions are required irrespective of this risk-assessment.

The revisions to our enhanced pole calculator have resulted in higher interventions for this component of our forecast than our original proposal. This increase, however, is offset by a larger reduction in forecast visual defects and risk-driven interventions. In total, we are proposing less expenditure than in our original proposal.

In addition to the refinements summarised above, this business case addendum and our attached models outline our response to the draft determination. This includes the following:

- for the purposes of this revised proposal, we accept the dollar value of the AER's CESS adjustment. The asset management practices that were applied during the current period served us and customers well for some time but in hindsight, led to unsustainable volumes. As a principle we do not believe the CESS should be applied where changes are made to align asset management with best practice. We appreciate, however, the concerns raised by our stakeholders and in this context have decided not to contest the CESS adjustment
- we do not accept the AER's substitute estimate. The AER's application of 2013 as a 'base year' reflects pole asset management practices that are no longer being applied, and would not allow us to meet the recommendations set out by ESV—it implies volumes that are lower than our 2020 interventions, and would not allow us to meet our compliance obligations under the Electricity Safety Act
- the AER's characterisation of our pole replacement forecast as addressing a 'backlog' issue misrepresents the driver of forecast interventions (which are condition-based, consistent with our pole replacement and reinforcement policies). That is, failure rates are not a robust predictor of future intervention volumes, but rather, are better considered an indicator of whether asset management practices have been fit for purpose.

A comparison of our revised pole intervention volume forecast is set out in table 1.1, and the corresponding expenditure forecasts are shown in table 1.2.

Table 1.1 Total wood pole intervention volumes: 2021–2026 regulatory period

Forecasting component	Original proposal	Draft determination	Revised proposal
Compliance-driven interventions: pole calculator	15,983	N/A	20,117
Compliance-driven interventions: non-pole calculator	8,231	N/A	3,479
Risk-driven interventions	15,556	N/A	4,756
Total	**39,770**	**16,969**	**28,352**

Source: Powercor
Notes: Interventions include both replacement and reinforcement (i.e. staking). Forecast volumes excludes fault-driven, as these have been considered separately.

Table 1.2 Total wood pole intervention expenditure: 2021–2026 regulatory period ($ million, 2021)

Forecasting component	Original proposal	Draft determination	Revised proposal
Compliance-driven interventions: pole calculator	121.1	N/A	148.5
Compliance-driven interventions: non-pole calculator	62.6	N/A	34.9
Risk-driven interventions	50.1	N/A	6.5
Total	**233.8**	**104.2**	**190.0**

Source: Powercor
Notes: Forecast expenditure excludes fault-driven, as these have been considered separately.

1.2 CitiPower wood pole intervention overview

Similar to our forecast for Powercor, the changes to our asset management practices will drive an increase in pole intervention volumes for CitiPower relative to our investment in the 2016–2020 regulatory period. Stakeholders, including the AER, considered we did not provide sufficient evidence to demonstrate this increase was prudent and efficient.

We have since refined our wood pole intervention forecast and are now proposing less expenditure than in our original proposal—rather than a $49 million uplift, our revised proposal represents an $8 million increase to our corresponding investment over the 2016–2020 regulatory period.

The reduction for our revised proposal is based on updates to our compliance-driven forecast due to additional information from our field trial, changes to our visual inspection criteria, and the removal of all risk-driven interventions. This forecast differs to Powercor in the following areas:

- we have not proposed any risk-driven interventions
- we have assumed a zero decay rate in our poles (rather than 1mm per annum for Powercor).

These differences are consistent with the lower risk of wood pole failures resulting in a pole falling over. This reflects both the shorter spans in our CitiPower network, and the greater number of additional cable or conductor on these poles which may keep the pole upright until our crews arrive.

Our forecast reinforcement rate is also lower (both relative to Powercor and our observed history). This is due to most poles identified for intervention by our enhanced pole calculator for 2021–2026 being already staked, and the removal of all risk-driven interventions from our forecast (which were primarily reinforcements).

A summary of our revised pole intervention volume forecast is set out in table 1.3, and the corresponding expenditure forecasts are shown in table 1.4.

Table 1.3 Total wood pole intervention volumes: 2021–2026 regulatory period

Forecasting component	Original proposal	Draft determination	Revised proposal
Compliance-driven interventions: pole calculator	1,553	N/A	486
Compliance-driven interventions: non-pole calculator	524	N/A	361
Risk-driven interventions	2,816	N/A	-
Total	**4,893**	**N/A**	**847**

Source: CitiPower
Notes: The AER did not specify volumes in its draft determination; rather, its forecast was undertaken at a total expenditure level. Our forecast interventions include both replacement and reinforcement (i.e. staking), but excludes fault-driven, as these have been considered separately.

Table 1.4 Total wood pole intervention expenditure: 2021–2026 regulatory period ($ million, 2021)

Forecasting component	Original proposal	Draft determination	Revised proposal
Compliance-driven interventions: pole calculator	40.2	N/A	8.6
Compliance-driven interventions: non-pole calculator	13.5	N/A	8.8
Risk-driven interventions	5.1	N/A	-
Total	**58.9**	**11.1**	**17.4**

Source: CitiPower
Notes: Forecast excludes fault-driven expenditure, as these have been considered separately.

2 Background

2.1 Our original proposal

In our original proposal, our pole management program encompassed compliance driven interventions (i.e. interventions based on either measured or observed condition, consistent with our new asset management policies), and risk-driven interventions (i.e. interventions that are planned by assessing the risk and consequence of failure).

Our compliance-driven interventions were based on simulated outcomes from our enhanced pole calculator, and a forecast of observed historical defects (including changes to our asset management practices to replace poles with large visible cracks).

Our risk-driven interventions were based on high-level assumptions associated with the location of poles, particularly with respect to their assumed bushfire consequences. For example, we targeted poles that were forecast to be approaching a service classification of 'unserviceable', and located in areas where rapid earth fault current limiter (REFCL) technology is required.

The context of our original proposal included multiple reviews of our wood pole asset management practices by ESV, as well as our own internal reliability centred maintenance (RCM) review:

- following a high wind event in March 2018 that caused a fault on our electrical network, and a fire in the Terang area (known as the Garvoc fire), ESV conducted a technical investigation and concluded that:
  - the most likely source of ignition for the Garvoc Fire was the failure of a wood pole on our distribution network and the subsequent contact of the high voltage conductor with the ground and vegetation
  - a competent inspection and sound test of the pole in November 2017 would have identified the material degradation present when the pole failed
- a further review by ESV into our wood pole management practices determined that our wood pole management practices would not deliver sustainable outcomes for the future
- concurrent with ESV’s review, we engaged ARMS Reliability to undertake an independent assessment of our RCM practices. This review highlighted the following:
  - the historical trend in pole failures was increasing, whereas the number of poles classified as 'unserviceable’ was declining sharply
  - a higher than expected number of poles were transitioning directly from serviceable to unserviceable between inspection cycles
- these trends were also inconsistent with an ageing wood pole population, and suggested a clear need to address our existing practices
- we also recognised that the introduction of Woodscan and the use of diameter tape (rather than callipers) to assess the condition of our wood poles—while important measures to accurately assess the integrity of our assets—had reduced intervention volumes during the 2016–2020 regulatory period.

In response to these reviews, and the feedback and concerns from our customers and communities, we made the following enhancements to our asset management practices in March 2019:

- we increased the frequency of our inspection and testing process from 30 months to 12 months for all wood poles classified as 'added control serviceable’
- we increased the pole residual strength safety factor from 1.25 to 1.40 for all poles
- we introduced an additional visual assessment criterion to address defects such as large cracks or checks in the pole.

The increased inspection frequency for added control serviceable poles meant we were more likely to identify unserviceable poles before they fail (i.e. prior to the next inspection). The more conservative safety factor threshold for unserviceable poles meant an additional 5mm of 'good' or 'sound' wood is required, and provided greater assurance that the residual strength of our poles is sufficient.

For the reasons outlined later in this document, including concerns raised by the ESV, we have since removed the additional visual assessment criterion.

2.2 AER's draft determination

In its draft determination, the AER recognised ESV's review and subsequent recommendations. The AER's consultant, EMCa, also recognised that we had established a reasonable basis for increasing the volume of wood pole treatments above historical levels.

The draft determination, however, did not accept our proposed capital expenditure forecast for wood pole replacements and reinforcements. The AER's reasons largely centred around the fact we did not provide quantified cost-benefit analysis, and therefore it was not apparent what level of risk we are trying to mitigate, or what volumes were required to achieve this risk reduction.

In addition, the AER outlined the following concerns:

- it was not clear how our forecast would address the increasing failure rate and risk of lower durability poles, noting these were key drivers of changes to our asset management practices
- it was not apparent how our asset management improvements (e.g. improved monitoring, training, auditing) were factored in to our forecast interventions
- our enhanced pole calculator forecast was based on 'simulations', and relied on untested parameters and assumptions
- we did not explain how we set the serviceability threshold in our enhanced pole calculator
- we did not explain why our forecast visual inspection-based volumes were significantly higher than current levels
- our forecast included risk-driven interventions, notwithstanding these poles were assessed by our enhanced pole calculator as being serviceable
- we did not sufficiently demonstrate how we sought to moderate the expenditure forecast, including any top-down review.

2.3 Our pole management improvement plan

After conducting its technical review in 2019, ESV concluded that our wood pole management practices would not deliver sustainable outcomes for the future. Its findings resulted in 13 key recommendations, as set out below.

Figure 2.1 ESV recommendations: technical review of Powercor's wood pole asset management practices

1. Powercor is to develop a wood pole management improvement plan incorporating all recommendations and initiatives, and submit it to ESV. The plan is to include clear and measurable milestones that can be monitored through evaluation and reporting. When the plan is accepted by ESV, the plan commitments must be incorporated into an updated BMP for ESV to monitor and enforce compliance.
2. ESV is to, in consultation with Powercor, establish a regulatory reporting protocol for monitoring Powercor's progress against its wood pole management improvement plan (as referenced in the updated BMP). Powercor will report progress to ESV quarterly until all recommendations have been delivered.
3. Powercor is to update its wood pole management documentation to incorporate its revised wood pole objectives, strategies, performance measures, forecast, plans and improvement initiatives (and to otherwise address ESV's findings regarding the shortcomings of its Asset Class Strategy document).
4. Powercor is to revise its Asset Inspection and Training Manual (or equivalent) to clearly articulate the 'sound test' procedures and practices to provide a rigorous basis for inspector training, application in the field, and auditing.
5. Powercor is to revise its inspection auditing process and performance reporting to improve the quality and consistency of inspections.
6. Powercor is to provide evidence to ESV that the asset inspector training and competency modules and assessment undertaken by the asset inspection service provider comply with National Certificate II accreditation and with Powercor's asset inspection standards.
7. Powercor is to complete the development and implementation of its Serviceability Index (SI)-based serviceability assessment methodology, to lead to a more accurate representation of the likelihood of pole failure over time.
8. Powercor is to proactively explore (if feasible with broader industry), the development of non-destructive wood pole inspection technology to improve the accuracy of pole condition assessments.
9. Powercor is to complete the development of its pole risk-based asset management intervention methodology to improve the management of pole risk. If implemented appropriately, this approach will enable Powercor to prioritise the poles for intervention in higher risk areas by considering the consequence of failure to the community.
10. Powercor is to improve its asset performance monitoring by developing pole asset performance metrics and health reporting dashboards, with appropriate targets to monitor and review performance levels.
11. ESV, in consultation with MECs, is to revise the reporting guidelines to include performance indicators relating to wood pole management in the quarterly and annual performance reporting. This will include the establishment of leading and lagging indicators and clarification for the classification of assisted and unassisted pole failures, allowing ESV to monitor wood pole performance. This should build on and extend existing safety performance reporting by ESV.
12. Powercor is to finalise its proposed forecasting methodology, its forecast pole replacements/reinforcements and include the forecast pole interventions in its BMP.
13. ESV is to monitor quarterly wood pole performance and delivery of Powercor's forecast intervention volumes (up to and including 2025/26). The approved volumes are to be included in the updated BMP, with ESV using its powers to hold Powercor to account for delivery.

Source: ESV

We accepted all of ESV's findings, and our plan to implement its recommendations has been accepted by ESV. This plan builds on the asset management amendments implemented in March 2019, and includes changes to support the assessment of the condition of our poles, and changes to ensure sustainable safety outcomes are achieved.

Consistent with the findings of ESV, the implementation of our pole management improvement program, based on a more comprehensive risk assessment and better inspection practices, will deliver sustainable safety outcomes to the community.

3 Stakeholder engagement

Our proposed pole management program seeks to meet our safety obligations, as well as community expectations of a sustainable asset management program over the longer-term. In particular, our communities will benefit from our revised pole management practices in the following ways:

- maintaining safety—our poles program meets community expectations of enhancing safety around our poles through both visual and measured condition
- sustainability—as poles age and their condition worsens over time, our program ensures a more sustainable and stable level of interventions is achieved, so as to avoid the risk of future bill shocks
- reducing bushfire risk—our program reduces risk, including that associated with bushfires, in areas where it is economic to do so.

As this program represents a large percentage of our total forecast replacement investment, as well as being an increase on our historical level of investment, we recognised the value in discussing our proposed investment with our stakeholders. Following our regulatory proposal, we met with key stakeholders, including Energy Safe Victoria, the Victorian Government, Energy Consumers Australia, and the Consumer Challenge Panel. We also presented directly to the AER Board.

Since the draft determination, we continued this engagement, including the following:

- we commissioned external experts, Forethought, to facilitate a workshop to discuss how best to manage and replace poles and wires in the 2021–2026 regulatory period. This workshop included representatives from energy regulators, government, industry bodies, peak bodies and charities
- we presented our wood pole asset management practices and proposed response to the draft determination to our newly established Customer Advisory Panel (with the Consumer Challenge Panel also invited).

A summary of what we have heard from our stakeholders, and how we have responded is provided in table 3.1. Further detail on our response is provided in section 4.

Table 3.1 Our response to stakeholder feedback

What we've heard	How we've responded
We should consider reinvesting some or all of the CESS benefit towards our pole and powerline safety program, with customers perceiving that they may be 'paying twice'.	We have increased our pole replacement volumes in 2019 and 2020 (i.e. in the current regulatory period), and will continue to intervene on an increasing number of poles going forward. For the purposes of this revised proposal, we also accept the dollar value of the AER's CESS adjustment. The asset management practices that were applied during the current period served us and customers well for some time but in hindsight, led to unsustainable volumes. As a principle we do not believe the CESS should be applied where changes are made to align asset management with best practice. We appreciate, however, the concerns raised by our stakeholders and in this context have decided not to contest the CESS adjustment.
We are concerned the decision to increase pole replacements have not taken into account the reduced bushfire risks that REFCLs have created. We seek assurance that the risk assessment has taken this improvement into account.	REFCLs will reduce the likelihood of a fire start from our assets for a specific failure mode (i.e. a single phase-to-ground failure). At this stage, however, we do not have data that allows us to quantify the reduction in fire starts due to single phase-to-ground failures that would be avoided. In any event, poles in REFCL areas that are justified on a risk-reduction basis comprise less than 1 per cent of our total wood pole forecast. Further, in a peer review of our modelling assumptions and approach, CutlerMerz considered our bushfire risk assumptions are conservative (i.e. understating the bushfire risk).
The Victorian Government and ESV supported our increased pole replacement program. The CCP also stated, from a consumer perspective, that they fully support Powercor revising its pole and powerline maintenance strategies and improving the 'on the ground' safety assessment of poles.	Notwithstanding the support from the Victorian Government, ESV and the CCP, we have continued to refine our asset management practices and forecast methods.
There is a perception that we are 'stuck' between two regulators—the safety regulator and the economic regulator. More should be done to demonstrate where we are in that conversation, and who will be the ultimate decision maker.	We consider ESV, as the technical regulator, is best placed to make judgement on the prudency of our proposed serviceability threshold. In this context, we will be submitting a revised BMP to ESV in December 2020 that explicitly refers to this threshold. The acceptance of our BMP will make the application of this threshold a binding compliance obligation. Subject to the acceptance of our revised BMP, we consider it is then the AER's role to assess whether our forecast for the 2021–2026 regulatory reasonably reflects the efficient costs consistent with this threshold.
Given the complexity of our risk-driven forecast method, stakeholders such as Energy Consumers Australia, suggested we have our modelling peer reviewed.	We engaged EA Technology to develop a wood pole risk model alongside the refresh of our condition based risk management (CBRM) modelling. CutlerMerz were also engaged to peer review the risk model and assumptions.

Source: Powercor

4 Revised forecast

Consistent with our original proposal, our revised forecast includes wood pole replacement and reinforcement requirements in three distinct categories:

- compliance-driven interventions due to measured condition
- compliance-driven interventions due to observable defects
- risk-driven interventions.

Our compliance-driven interventions are focused on those poles forecast to be classified as unserviceable during the 2021–2026 regulatory period.[4] The classification of a pole as unserviceable only occurs following a field inspection, and may be driven by 'measured' condition (e.g. based on our serviceability index), or 'observed' condition (e.g. the visible presence of termites or fungal fruiting bodies that undermine the structural integrity of the pole). If a pole is assessed during our inspection process as unserviceable, we are obligated to intervene through replacement or reinforcement.

Our risk-driven interventions recognise that it may be economic from a risk reduction perspective to replace poles in higher risk locations earlier than in lower risk locations. These poles will still be in a deteriorated condition (i.e. they are classified as 'added control serviceable', previously known as 'limited life'), but greater regard will now be had to the consequence of failure. For our revised proposal, our risk-driven forecast is supported by a condition-based risk model developed by EA Technology, and peer reviewed by CutlerMerz.

A summary of how these forecast interventions have been determined is shown in figure 4.1. This diagram demonstrates how our condition data and enhanced pole calculator are combined, with further detail provided within this section. Compliance-driven interventions due to observable defects are forecast separately, as due to their random nature (i.e. we cannot predict the specific pole or when termite damage will occur), these are based on observed, historical volumes.

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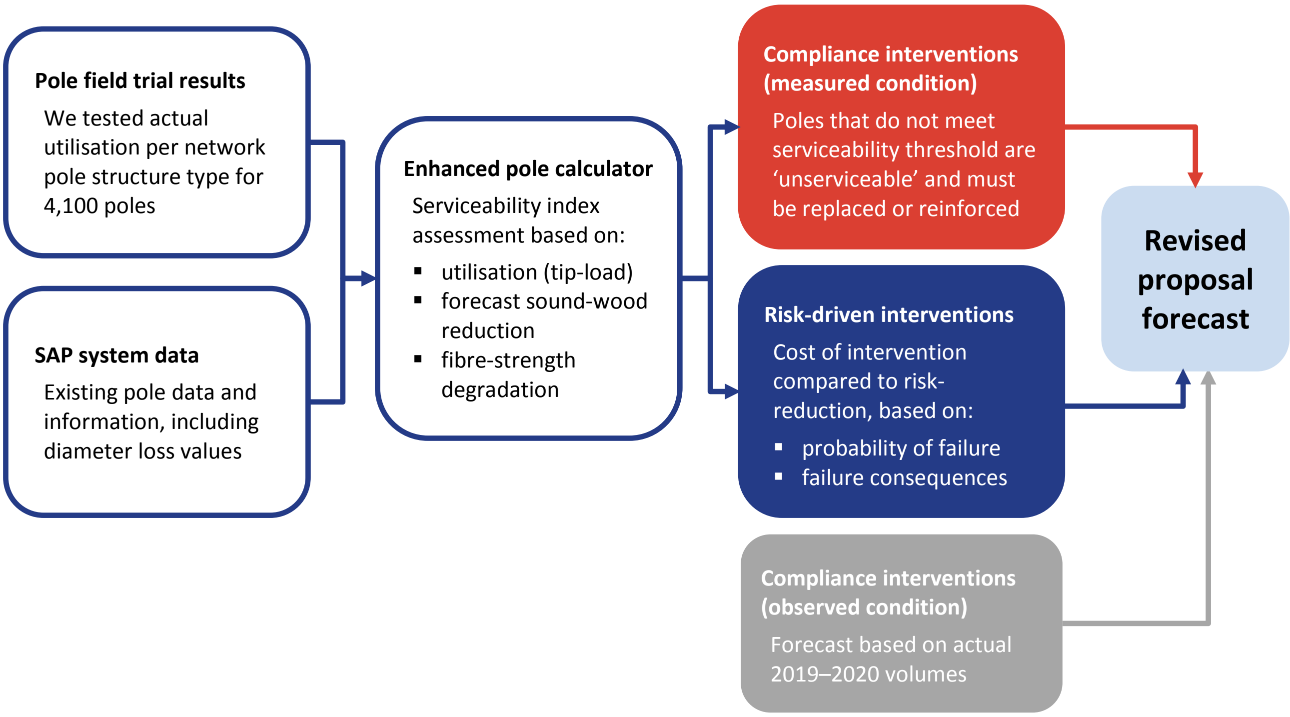
4 This differs from our original proposal, whereby we also included in our compliance-driven forecast some poles in bushfire construction areas (i.e. our highest bushfire risk locations) that were classified as added control serviceable. These poles are now only included in our forecast if an intervention is economic under our risk modelling.

Figure 4.1 Development of our revised proposal forecast



Source: Powercor

Both our compliance-driven and risk-driven forecast methods have been improved as part of our revised proposal. Overall, this had led to lower forecast intervention volumes (and therefore expenditure) for wood poles in the 2021–2026 regulatory period.

For Powercor, a summary of our revised volumes and expenditure for each component of our forecast is shown in table 4.1 and table 4.2. These forecasts are also provided in our wood pole summary model (PAL RRP MOD 4.15).

Table 4.1 Powercor: revised wood pole intervention volumes, 2021–2026 regulatory period

Forecasting component	Replacement	Reinforcement	Total
Compliance-driven interventions: measured condition	14,000	6,117	20,117
Compliance-driven interventions: observable defects	3,479	-	3,479
Risk-driven interventions	35	4,721	4,756
Total	**17,514**	**10,838**	**28,352**

Source: Powercor

Table 4.2 Powercor: revised wood pole intervention expenditure, 2021–2026 regulatory period ($ million, 2021)

Forecasting component	Replacement	Reinforcement	Total
Compliance-driven interventions: measured condition	140.5	8.0	148.5
Compliance-driven interventions: observable defects	34.9	-	34.9
Risk-driven interventions	0.4	6.2	6.5
Total	**175.8**	**14.2**	**190.0**

Source: Powercor

For CitiPower, our revised volumes and expenditure for each component of our forecast is shown in table 4.3 and table 4.4. Similar to Powercor, these forecasts are also provided in our wood pole summary model (CP RRP MOD 4.21).

Table 4.3 CitiPower: revised wood pole intervention volumes, 2021–2026 regulatory period

Forecasting component	Replacement	Reinforcement	Total
Compliance-driven interventions: measured condition	342	144	486
Compliance-driven interventions: observable defects	361	-	361
Risk-driven interventions	-	-	-
Total	**703**	**144**	**847**

Source: CitiPower

Table 4.4 CitiPower: revised wood pole intervention expenditure, 2021–2026 regulatory period ($ million, 2021)

Forecasting component	Replacement	Reinforcement	Total
Compliance-driven interventions: measured condition	8.3	0.3	8.6
Compliance-driven interventions: observable defects	8.8	-	8.8
Risk-driven interventions	-	-	-
Total	**17.1**	**0.3**	**17.4**

Source: CitiPower

4.1 Compliance-driven interventions: measured condition

Our compliance-driven interventions that are based on 'measured' condition are forecast using our enhanced pole calculator. These interventions represent those wood poles that are not expected to meet our serviceability threshold in the 2021–2026 regulatory period, and comprise the majority of our total expenditure forecast.

Since our original proposal, several key assumptions reflected in our enhanced pole calculator have been refined. These include our assumed tip-load and pole decay rates. As a result of these refinements, our enhanced pole calculator now better targets interventions toward lower durability poles.

4.1.1 Our serviceability threshold is appropriate

The serviceability of all our wood poles are forecast using our enhanced pole calculator. This calculator is used by pole inspectors in the field to enter pole inspection data on site. The algorithm in the calculator uses the input data to compute a serviceability classification—in effect, whether there is enough remaining 'sound' or 'good' wood in the pole.

As part of the asset management changes made in March 2019, we revised our serviceability criteria by increasing the minimum safety factor for a pole to be classified as 'added control serviceable'.[5] Increasing the minimum safety factor means a pole is more likely to be classified as 'unserviceable' and therefore be replaced or reinforced through the ongoing maintenance of our network.

ESV supported the development of our serviceability threshold in its review of our wood pole management practices. In particular, recommendation seven requires us to 'complete the development and implementation of our serviceability-index based serviceability assessment methodology, to lead to a more accurate representation of the likelihood of pole failure over time'.

We consider ESV, as the technical regulator, is best placed to make judgement on the prudency of our proposed serviceability threshold. In this context, we will be submitting a revised BMP to ESV in December 2020 that explicitly refers to this threshold.[6] The acceptance of our BMP will make the application of this threshold a binding compliance obligation.

Subject to the acceptance of our revised BMP, we recognise it is then the AER's role to assess whether our forecast for the 2021–2026 regulatory reasonably reflects the efficient costs consistent with this threshold.

4.1.2 Our tip-load assumptions have been revised

The forecast serviceability of our wood poles, as assessed through our enhanced pole calculator, are sensitive to the assumption of how heavily loaded a pole is relative to its residual capacity. For example, a pole that has heavier equipment installed on it, or has spans with greater distances between adjacent poles, will be subject to greater stress or load (all else equal). This loading is reflected at the ‘tip’ of the pole.

At the time our original proposal was developed, we did not have actual ‘tip-load’ data for any of our poles. As a proxy, therefore, we assumed a loading based on the location of the pole—for poles in the highest risk locations (i.e. bushfire construction areas), we assumed that poles were loaded to their maximum. This assumption was progressively scaled back for lower risk locations (i.e. in low bushfire risk areas, we assumed poles were loaded to 80 per cent of their rated maximum).

As part of our pole management improvement program, which sets out how we will respond to the recommendations in ESV's review of our wood pole asset management practices, we identified the need to undertake a trial of wood poles in our network to better inform our tip-load assumptions to meet AS/NZS 7000 requirements.

Our pole trial was initially due to be completed in late November 2020. In response to feedback from our stakeholders, we brought forward the timing of this trial to be completed in October 2020. In total, this trial assessed over 4,100 wood poles across our network. Individual poles were selected randomly, but stratified to ensure a representative sample of durability classes and structure types.

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5 The details of the asset management changes made in March 2019 are included in appendix B.

6 Our revised BMP will be lodged following final endorsement of our revised policies by our Strategic Asset Management Committee (SAMC). Consistent with our pole management improvement program, our SAMC will finalise our revised policies in early December 2020.

The outcomes of our wood pole trial were used to re-calibrate our enhanced pole calculator for our revised proposal. That is, rather than relying on broad assumptions based on the location of a pole (as per our original proposal), we determined the average tip-load per structure type.[7] From the structure type, we could calculate an average utilisation factor (i.e. the extent to which a pole is loaded to its capacity). The average observed utilisation per structure was used to extrapolate pole tip-loads across the entire pole population.

By way of example, in our original proposal, intermediate structure types (which are our most common wood pole structure type) were assumed to be between 80–100 per cent utilised. For our revised proposal, and based on our field trial, intermediate structure types are now assumed to be 54 per cent utilised.

The revisions to our tip-load assumptions worked to lower our forecast of wood pole interventions relative to our original proposal.

4.1.3 Our pole decay assumptions have been revised

In addition to our tip-load assumptions, our enhanced pole calculator forecast is sensitive to the assumed decay rate of wood poles. In recognition of the conservatism that was built into our tip-load assumption, our original proposal included an annual decay rate equal to zero (i.e. we forecast that the sound wood of a pole would remain constant over the five-year period).

Given the conservatism regarding our tip-load assumption has been removed, our revised proposal forecast now reflects an annual decay rate of one millimetre. For the following reasons, we consider this assumption will under-state the actual level of deterioration:

- all wood poles degrade over time, and the assumption of zero degradation over time is most certainly incorrect
- historically, observed decay rates on our network have averaged around two millimetres per annum (although we recognise changes to our diameter measurement procedures are evident in this data)[8]
- for our United Energy network, observed decay rates have been comprehensively reviewed and calibrated, and range around three millimetres per annum across all durability classes
- in preliminary discussions with ESV, they raised concerns that our assumed decay rates were lower than observed in other Victorian networks.

All else equal, the revisions to our decay rates increased our forecast of wood pole interventions relative to our original proposal.

For clarity, the assumed decay rate is separate to fibre-strength degradation (which refers to the strength of the underlying wood fibres, rather than the physical measurement of the diameter of a wood pole).[9] Both factors are relevant, in combination, to the underlying structural integrity of a wood pole. In January 2021, we will complete more destructive tests on a selection of wood poles we have removed from service to further validate our enhanced pole calculator serviceability index. This will include further testing our fibre-degradation

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7 Pole structure refers to the type of construction (e.g. a simple intermediate structure, versus more complex or strained structures).

8 We previously measure pole diameter using callipers, but now use diameter tape. Further guidance is now provided to ensure greater consistency in the selection of the measurement site.

9 In response to an AER information request (PAL IR010), we provided ENA research that supports our fibre-strength degradation assumption. We also noted that ESV stated this research provides a reasonable basis for enhancements to our pole calculator algorithms to incorporate strength degradation more explicitly.

assumptions (although given the depth of similar analysis undertaken by ENA, and our recent destructive testing as part of our RCM review, we do not envisage any material departure from previous results).

4.1.4 We have tested the reasonableness of our enhanced pole calculator output

As part of our original proposal, we demonstrated that the underlying increase in pole failures reflected, in part, our ageing pole population. This was most evident in our lower durability poles, whereby failure rates for class three poles have been observed to increase sharply from the age of around 45 years.

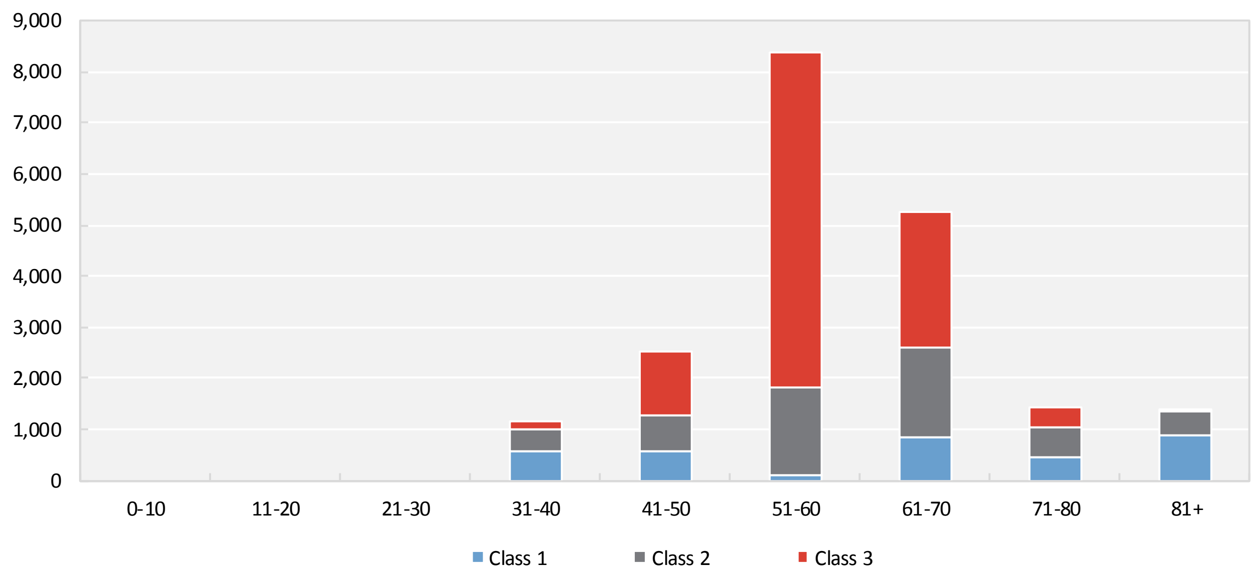
Our analysis also showed that a continuation of our current asset management practices would lead to an increase in the average age of our wood pole population from 43 years to 51 years by 2030. Although age is not a true reflection of condition, it can be used as a proxy and the average age of observed wood poles failures on our network is 51 years. At this age and beyond, ESV noted that loss of fibre strength in the residual wood becomes a governing factor for the end-of-life reliability of the pole.

Therefore, if our pole population was to continue to age without any additional risk mitigation measures, it is reasonable to expect an increase in the rate of pole failures. Such an outcome cannot be regarded as acceptable, given our obligation to minimise safety risk as far as practicable.

As part of the top-down review process for our enhanced pole calculator, we assessed the characteristics of our revised pole interventions forecast. In particular, we reviewed our results to ensure the focus of our wood pole intervention was on aged, lower durability poles.

As shown in figure 4.2, our forecast compliance-driven interventions over the 2021–2026 regulatory period based on 'measured' condition are predominantly older, lower durability poles. This outcome supports the robustness of our pole calculator.

Figure 4.2 Compliance-driven, measured condition: wood pole interventions (volumes) by durability class and age



Source: Powercor
Notes: Class three and four poles are combined above, as the volume of unserviceable class four poles is small (i.e. 135).

As part of the top-down challenge of our forecast, we also removed a small subset of poles younger than 30 years that were forecast to require intervention (i.e. they are not included in our revised proposal). We may need to address some of these poles, particularly where the driver is the design rating relative to capacity (now that our asset management practices capture such factors), but will determine any prudent and efficient intervention solution during the 2021–2026 regulatory period.

4.2 Compliance-driven interventions: observable defects

Our enhanced pole calculator does not capture all relevant information regarding the residual strength of a pole. Other information, such as visual observations, quite reasonably play an important role in assessing the serviceability of a pole—for example, our pre-existing (and ongoing) asset management practice is to visually inspect poles to detect the presence of above-ground rot/decay, fungal fruiting, termite activity, and lightning/fire damage. As noted in ESV's review, this approach is consistent with general Victorian industry practice.

4.2.1 Our forecast of observable defects is now based on historical volumes

In our original proposal, our forecast of observable defects reflected the percentage of poles expected to transition to an unserviceable classification due to factors other than condition, as based on our 2019 RCM review.

We have listened to feedback from our stakeholders, including the AER, and our revised forecast is now based on historical volumes over the period 2019–2020 (extrapolated to reflect a five-year period). We have relied on this averaging period given the recent improvements to our inspection and maintenance practices, consistent with ESV's conclusions.

A summary of our revised forecast for compliance-driven interventions that are based on observed condition is shown in table 4.5. This represents a material reduction on our original proposal. As discussed below, we have also amended our forecast to remove the replacement criteria due to large visible cracks or voids.

Table 4.5 Wood pole interventions based on observable defects (volumes)

Defect type	2019	2020	2021–2026
Termites (where unable to measure condition)	45	24	173
Fungal fruiting, inspection holes, environmental (fire, lightning)	167	247	1,034
Leaning (where unable to straighten)	249	167	1,040
Double-staked poles (where unable to measure condition)	226	267	1,232
Total	**687**	**705**	**3,479**

Source: Powercor

4.2.2 We have removed the replacement criteria due to large visible cracks

In March 2019, we introduced an additional visual inspection criterion for poles that have been condition assessed at the ground line but are displaying visual traits that impact the integrity of the pole and are outside the measured condition assessment. These additional visual traits included the following:

- see-through split greater than 10mm in width
- deterioration of pole cross-section greater than 25 per cent
- 100mm or greater void or loss of wood (knot hole or damage) including staked poles with no timber above ground level.

These visual traits were concerning our customers, leading to the 'dodgy poles' campaign. This campaign encouraged people to photograph power poles they perceived as unsafe, and demonstrated the significant concern expressed by our communities (most notably in the south west).

We consider the inclusion of this additional criteria reflected a prudent response at the time to concerns with our asset management practices. For the following reasons, however, we have now removed the impact of these additional visual replacement criterion from our revised proposal forecast:

- in its review, ESV concluded there was no technical basis to continue with this approach
- the refinements to our asset management practices, including those in our enhanced pole calculator and improvements in our inspection practices and auditing processes, may identify some of these poles for intervention
- our stakeholders have expressed concerns regarding affordability.

4.3 Risk-driven interventions

Recommendation nine of ESV's technical review requires us to complete the development of our risk-based asset management intervention methodology to improve the management of pole risk. If implemented appropriately, ESV considered this approach will enable us to prioritise the poles for intervention in higher risk areas by considering the consequence of failure to the community.[10]

As part our original proposal, we forecast risk-driven interventions as the balance of poles assessed as added control serviceable (with a serviceability index less than 0.70) in REFCL areas, minus those forecast to become unserviceable due to factors other than condition. Consistent with our pole management improvement program, the completion of our risk-based asset management modelling was scheduled for the end of January 2021.

Many stakeholders, including the AER, suggested we bring forward the development of this model for our revised proposal. Accordingly, we engaged EA Technology to integrate calibrated risk-modelling with the refresh of our condition-based risk management (CBRM) modelling for wood poles.

Similarly, it was suggested by Energy Consumers Australia, and supported by our Customer Advisory Panel, that we have this modelling peer reviewed by an external party. As discussed below, we engaged CutlerMerz to undertake this review.

4.3.1 EA Technology developed our risk-model

The risk modelling developed by EA Technology uses a health index model to determine the condition of a pole, and then considers five consequence categories to determine the annualised risk cost per pole. The risk reduction for a given pole is then compared to the cost of an intervention.

This modelling comprises three separate models, and we discuss each of these below.

Probability of failure (health index) model (PAL RRP MOD 4.16)

A key element of our CBRM model for poles is the forecast health index (i.e. a condition metric) for our entire wood pole population. This health index is used to inform the probability of failure.

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10 Our response to recommendation nine is due to be approved by our SAMC in early December 2020. Our revised proposal is based on and consistent with the policies and practices presented to our SAMC.

The health index summary from this model is shown in figure 4.3. Without intervention, we will have an additional 7,500 poles by 2026 with health indices greater than 7.0 (typically consistent with an asset at end-of-life).

Figure 4.3 Health index: wood poles (volumes)

Source: PAL RRP MOD 4.16

Figure 4.3 also shows that a substantial volume of poles—over 120,000—will be approaching end-of-life (i.e. health indices between 5–6). This is consistent with the findings of our reliability centred maintenance review, as outlined in our regulatory proposal and in response to AER information requests, which suggests we can expect to see an eight-fold increase in required condition-based replacements across the next 20 years.

Consequence model (PAL RRP MOD 4.17)

Our risk modelling evaluates the consequence of failure across five separate categories—network performance, safety, bushfire, financial and environmental—and relies on the probability of failure for a given pole based on the health index model.

The consequences reflect three separate failure modes, as shown in table 4.6.

Table 4.6 Failure modes

Failure mode	Description	Consequence
Minor	Conditional failure: pole failed inspection and requires intervention	If not reinforced, there is a chance of major failure by the end of 2026 (e.g. for network performance, this is equal to 1 per cent)
Significant	Conditional failure: pole failed inspection and requires replacement	If not replaced, there is a chance of major failure by the end of 2026 (e.g. for network performance, this is equal to 5 per cent)
Major	Conditional failure: pole failed in-service	Realised level of risk as per consequence model

Source: Powercor

An excerpt of our consequence assumptions, as per our CBRM consequence model, are included in appendix C.

Network performance

Network performance risk refers to the reliability impacts of a pole failure. The method for converting network performance risk to a monetary value is based on the value of customer reliability (VCR) and expected unserved energy:

- a network-wide VCR is used, based on the AER's latest VCR report, as we are not able to identify the mix of industrial, commercial, agricultural and residential customers for a given pole
- expected unserved energy for any given pole failure is based on the average duration of an outage, the number of customers impacted, and average demand per customer at the relevant zone substation (i.e. calculated from the peak demand at the zone substation, converted to average demand per customer using the zone substation load factor and the number of customers)
- the assumed average duration (60 minutes) is likely to understate the true consequence, as it only represents network switching times, rather than the additional time off supply for customers as the pole is replaced.

Our network performance consequence modelling also recognises that minor or significant failures will not cause an unplanned outage, but may require some customers to be without power during scheduled reactive maintenance. Major failures, however, will cause an unplanned outage and reactive maintenance and network switching to restore supply.

Safety

Safety consequences are defined in terms of the amount of money we would spend to prevent an injury. The severity categories are divided into minor injuries, major injuries and fatalities. Each injury type is then assigned a base value (or value to prevent the injury). The base value is then multiplied by a disproportion factor which represents the severity of the injury type and the exposure of the public and workers to the safety risk.

Our disproportionate factors are likely conservative, noting that they are less than those referenced by the AER in its asset replacement practice note.[11]

Bushfire

Any asset failure has a chance to create a fire start, and once started, the fire may be contained or suppressed. If suppressed, the consequences are relatively minor and consist of minor property damage and the cost of fire crews and authorities to respond to the emergency. If the fire is not able to be suppressed, the consequences can be catastrophic.

We estimate the likelihood a fire will be suppressed based on the following:

- prevailing conditions at the time (i.e. fire danger categories, up to a 'code red' day)
- location of the asset (i.e. low bushfire risk areas, up to bushfire construction areas).

The consequence of a bushfire has been estimated in two components—property damage and public safety. Our estimate of property damage is based on the cost of recent bushfires in the south-west of Victoria, whereas public safety consequences are consistent with the values set out in the Regulatory Impact Statement associated with the Victorian Bushfire Royal Commission (following the Black Saturday bushfires). A disproportionate factor has only been applied to the public safety costs, and this is a conservative approach (noting that the Electricity

11 AER, *Industry practice application note, Asset replacement planning*, January 2019, p. 80.

Safety Act in Victoria explicitly refers to our requirement to minimise as far as practicable the hazards and risks of damage to the property of any person arising from our supply network).[12]

Lastly, we use consequence weightings consistent with the f-factor methodology, weighted by the number of days each year that a fire danger category is experienced.

Financial and environmental

The financial impact of a pole failure is the average cost to replace the asset for each failure mode, whereas the environmental impacts include the loss of oil, gas, fire, waste and disturbance. The cost of risk associated with these consequence categories is immaterial relative to network performance, safety and bushfire.

Wood pole interventions: cost-benefit model (PAL RRP MOD 4.18)

Our wood pole intervention models assess whether the reduction in risk due to an intervention is greater than the annual financing cost of the intervention, whereby:

- the risk-reduction is calculated as the risk for a given pole at the end of 2026 (drawing on our probability of failure and consequence modelling), minus the risk associated with a new pole
- the annual financing cost is calculated as the return on and return of capital that could be avoided if the intervention was deferred by one year
- the time over which the financing costs are calculated is 10 years for a pole reinforcement (consistent with standard expectations for pole life extensions), and 51 years for pole replacements (consistent with the average age of observed wood poles failures on our network, and the standard asset life of a pole)
- the cost of an intervention (i.e. replacement or reinforcement) is based on observed costs for our network.

Our risk-driven modelling supports reinforcements on a small subset of our added-control serviceable poles. These poles are already in deteriorated condition (i.e. they are classified as 'added control serviceable', previously known as 'limited life'), but it is shown to be economic to intervene earlier on these poles based on the risk reduction benefits.

We also applied our risk modelling to our compliance-driven forecasts as a top-down check—this modelling supports over 6,500 our compliance-driven interventions due to measured condition (i.e. pole calculator).[13] By their nature, however, all compliance-driven interventions are required irrespective of this risk-assessment.

4.3.2 CutlerMerz peer reviewed our risk-model

The risk models developed for our wood pole population contain large volume of input data, and are computationally intensive. These models also include several assumptions that require some level of engineering judgement (e.g. the consequence of a bushfire).

In order to provide stakeholders with a level of comfort regarding the reasonableness of these assumptions, and to ensure ourselves of the veracity of the modelling, we engaged CutlerMerz to undertake an independent peer review.

12 See section 98 of the Electricity Safety Act 1998.

13 Risk-modelling cannot be applied to our compliance-driven volumes due to observable defects (i.e. non-pole calculator), as these occur randomly. As we cannot predict the specific poles that will be impacted by observable defects, our forecast is based on historical performance.

CutlerMerz found that our risk quantification model is appropriate given the forecasting requirement—for example, they stated the following:

- the framework used is consistent with contemporary asset management and risk management practices
- the models were independently developed and follow a standard methodology that aligns with the risk monetisation justification approach proposed by the AER in its industry practice application note for asset replacement planning
- we did not identify any material concerns with the approach being applied that would lead us to believe that investment decisions that rely on the outputs of the model would be unreasonably biased.

CutlerMerz also concluded the following regarding our risk consequence assumptions:

- network performance risk—there is no observable bias towards under or over estimating risk based on the parameters being used
- safety risk—whilst the value of a statistical life being used is appropriate, the valuation of lower consequence injuries tend to be underestimated. Furthermore, the weighted average of the disproportionality factors being applied are low compared to the AER's guidance. Whilst the likelihood of an incident is higher than expected, the weighting of incidents is heavily skewed to low consequence injuries and therefore in aggregate, the value of safety risk is likely to be a low estimate of the risk
- bushfire risk—the values used within the model tend to be conservative and may result in an underestimate in the value of the bushfire risk
- financial and environmental risk—the capital expenditure and environment risks are minor contributors to the total quantified risk and are not unreasonable.

We have included CutlerMerz's report with our revised proposal.[14]

[14] CutlerMerz, *CitiPower / Powercor poles replacement model, Peer review*, November 2020.

5 Response to AER draft determination

Our revised forecast represents a reduced volume (and therefore expenditure) for wood pole interventions than included in our original proposal. Our revised forecast, however, is higher than the substitute estimate set out in the draft determination.

In this section, we summarise our response to the specific concerns raised by the AER, noting many of these have been addressed through the refinements to our forecast.

We also outline the reasons why the AER's substitute estimate is unreasonable, and will not provide us an opportunity to recover the prudent and efficient costs associated with our wood pole management program.

5.1 Our response to the AER's criticisms of our original proposal

In developing our revised proposal forecast, we had regard to the observations made by the AER in its draft determination. In many instances we consider the AER's concerns were valid, and these have been addressed by the changes identified in section 4.

Accordingly, a summary of how we have responded to the draft determination is set out in table 5.1.

Table 5.1 Summary of our response to the AER's draft determination

What the AER said	How we've responded
It was not clear how our forecast addresses increasing failure rates and risks of lower durability poles, noting these were key drivers of our asset management changes.	Our enhanced pole calculator now better targets aged, lower durability poles (noting these poles comprise the majority of our pole failures). Consistent with the analysis in section 4.1.4, over 55 per cent of our forecast wood pole interventions are durability class three, and over 80 per cent are for wood poles older than 50 years.
It was not apparent how our asset management improvements (e.g. improved monitoring, training, auditing) were factored in to our forecast interventions.	Changes to our asset management practices were required to support the assessment of pole condition, and to ensure sustainable safety outcomes. The improvements noted by the AER (e.g. improved monitoring, training and auditing), should ensure we have a better understanding of pole condition. These changes, however, will not avoid the need to intervene on an increasing volume of poles in the 2021–2026 regulatory and beyond. Rather, these interventions are primarily driven by underlying condition.
Our enhanced pole calculator forecast was based on 'simulations', untested parameters and assumptions.	We have now completed a field trial of over 4,100 wood poles to better inform the assumptions used in our compliance driven interventions (that were based on our enhanced pole calculator).
We did not explain how we set the serviceability threshold in our enhanced pole calculator.	Our serviceability threshold was developed based on the fibre strength reduction with age and the pole load (tip-load) to AS/NZS7000 based on pole top structure configuration. We consider ESV, as the technical regulator, is best placed to make judgement on the prudency of our proposed serviceability threshold. In this context, we will be submitting a revised BMP to ESV in December 2020 that explicitly refers to this threshold. The acceptance of our BMP will make the application of this threshold a binding compliance obligation.
We did not explain why our forecast visual inspection-based volumes were significantly higher than current levels.	We revised our forecast for compliance-driven pole interventions driven by observed defects to be based on historical volumes. We also removed the impact of our additional visual replacement criterion that accounted for large crack or voids (noting these poles are now more likely to be identified for intervention based on measured condition).

Our forecast included risk-driven interventions, notwithstanding these poles were assessed by our enhanced pole calculator as being serviceable.	The nature of risk-driven interventions is that some poles that are significantly deteriorated may be replaced or reinforced slightly earlier than if we waited until they were classified unserviceable. This recognises the higher consequence of failure in some locations. All our risk-driven pole interventions have now been demonstrated as economic (as outlined in section 4.3), and are from poles that are already in a deteriorated condition (i.e. they are classified as added control serviceable, previously 'limited life').
We did not sufficiently demonstrate how we sought to moderate the expenditure forecast, including any top-down review.	Our forecasts include many assumptions that are conservative, and as such, are more likely to understate the 'true' volume of interventions we will undertake in the 2021–2026 regulatory period. This includes: • our low decay rate assumption • the lower disproportionate factors used in valuing safety consequences • our unit rates assume a like-for-like replacement, whereas due to recent bushfire activity, our suppliers have indicated the potential for lower wood pole availability (which would necessitate more expensive alternatives, such as concrete) • any poles younger than 30 years old have been removed and will be managed within our regulatory allowance. Further, and contrary to the AER's comments, our original proposal was subject to a top-down review. For example, as shown in our original business and presented to the AER Board, our forecast compared favourably to age-based and service-level alternatives. Our top-down considerations also note the substantial volume of poles—over 120,000—that will be approaching end-of-life in subsequent regulatory periods, such that any investments in the 2021–2026 regulatory period will reasonably be undertaken on a 'no regrets' basis. This is consistent with the findings of our reliability centred maintenance review, as outlined in our regulatory proposal and in response to AER information requests, which suggests we can expect to see an eight-fold increase in required condition-based replacements in the next 20 years. It is also consistent with the sustainability focus of ESV's review.

Source: Powercor

5.2 Our response to the AER's substitute estimate

The AER did not accept the forecast included in our original proposal, and instead, applied a substitute estimate equal to our 2013 intervention volumes (multiplied by five to provide a total regulatory period forecast), plus what it described as a 'back-log' of poles that were not completed in 2014–2018 (when compared with 2013 volumes). The AER then applied the average staking rates over the period 2010–2018 to determine the split between pole reinforcements and replacements.

For the reasons below, and discussed in further detail, the AER's substitute estimate will not provide us an opportunity to recover the prudent and efficient costs associated with our wood pole management program:

- the AER's substitute estimate is based on pole asset management practices that ESV stated will not deliver sustainable safety outcomes for the future
- the AER's substitute estimate will not allow us to comply with the recommendations set out by ESV (as committed to in our pole management improvement plan, and accepted by ESV), or our revised BMP (subject to ESV approval, which is expected to be submitted to ESV in December 2020)
- the AER's application of 2013 as a 'base year', due to its relatively low and stable failure rates, misrepresents the driver of forecast interventions (which are condition-based, consistent with our pole replacement and reinforcement policies).

5.2.1 The AER's substitute estimate is based on pole asset management practices that ESV stated will not deliver sustainable safety outcomes for the future

In its technical review, following a comprehensive analysis of our existing wood pole management practices, ESV made the following three conclusions:

- the wood pole management system in place in March 2018, at the time of The Sisters fire at Garvoc, would not deliver sustainable safety outcomes for the future
- since March 2018, we have improved our wood pole management system, which has the effect of increasing the volume of wood pole replacements and reinforcements. However, these changes alone will not deliver sustainable wood pole safety outcomes
- we are progressing further improvements to its wood pole management system based on a more comprehensive risk assessment and better inspection practices that, if fully implemented, will as far as practicable, deliver sustainable safety outcomes for the community.

The premise of the AER's substitute estimate, however, is that our 2013 pole intervention volumes are representative of a prudent level. For example, in its draft determination, the AER stated the following:[15]

> *[we] consider that the base level volume is adequate for Powercor to maintain the safety and reliability of its wood poles population*

And

> *[our] substitute estimate… acknowledges the need to address a 'backlog' of poles requiring intervention due to Powercor's inadequate historical wood pole inspection practices.*

The AER's conclusion is incongruent with ESV's findings. That is, the AER's substitute estimate is based on the very asset management practices that ESV found would not lead to sustainable safety outcomes.

We are concerned that an economic regulator considers it appropriate to reach conclusions that differ from those reached by the technical regulator, particularly in light of the greater depth and transparency of ESV's review relative to the AER's. This is further evident in how the AER reached its conclusion, which was on the back of a simplistic assessment of failure rates. For the reasons set out in section 5.2.3, failure rates are not a robust indicator of forecast intervention volumes, and rather, support the fact that our previous asset management practices are no longer fit for purpose for our network.

5.2.2 The AER's substitute estimate will not allow us to comply with our pole management improvement plan (as accepted by ESV), or our revised BMP (subject to ESV approval)

As outlined previously, we accepted all the findings in ESV's technical review, and our plan to implement its recommendations—our pole management improvement program—has been accepted by ESV. Relevantly, this program includes the following:

- we are to complete the development and implementation of our serviceability index-based assessment methodology, to lead to a more accurate representation of the likelihood of pole failure over time
- we are to complete the development of our pole risk-based asset management intervention methodology to improve the management of pole risk. If implemented appropriately, this approach will enable Powercor to

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15 AER, *Draft decision, Powercor distribution determination 2021 to 2026, Attachment 5, Capital expenditure*, September 2020, p. 5-31.

prioritise the poles for intervention in higher risk areas by considering the consequence of failure to the community.

Our pole interventions forecast for the 2021–2026 regulatory period has been developed based on our revised serviceability threshold, and our pole risk model. The AER's substitute estimate has been developed using a completely different and more simplistic approach, and falls well short of the allowance required to implement the changes required by ESV (in regards to both volumes and expenditure).

ESV also required us to incorporate our pole management improvement plan into an updated BMP for it to monitor and enforce compliance.

We consider ESV, as the technical regulator, is best placed to make judgement on the prudency of our proposed serviceability threshold. We will be submitting a revised BMP to ESV in December 2020 that explicitly refers to this threshold. The acceptance of our BMP will make the application of this threshold a binding compliance obligation.

Subject to the acceptance of our revised BMP by ESV, the AER's substitute estimate will not provide a reasonable opportunity for us to recover the efficient costs consistent with this threshold—the AER's substitute expenditure allowance is almost half of that included in our revised proposal.

5.2.3 Failure rates are not a robust predictor of forecast interventions

The AER observed that over the period 2010–2015, failure rates were relatively low and stable compared with the period from 2016–2018. At the same time, intervention volumes were generally higher than in 2016–2018. The AER concluded that this indicates these volumes represent a sustainable intervention level at which we can adequately manage wood pole failure rates.

We replace poles, however, based primarily on condition. Accordingly, condition-driven interventions comprise over 96 per cent of our revised capital expenditure forecast for wood poles.

For the following reasons, therefore, we consider current failure rates are not a robust predictor of future intervention volumes:

- rather than being a leading indicator of intervention volumes, failure rates are better considered a lagging indicator of whether inspection and management practices are adequate. For example, robust inspection practices and governance over the application of these methods can drive low failure rates, but if the underlying condition of the relevant asset population is poor and/or deteriorating, high and increasing intervention volumes will still be required
- where failure rates are low relative to the total asset population—such as for wood poles—caution should be taken when drawing conclusions on fluctuations in these failure rates. For example, the draft determination shows our wood pole failure rates relative to intervention volumes since 2010. It is clear from this chart that failure rates have moved independently from intervention volumes. This likely reflects a range of factors, including inspection standards, asset condition, and environmental factors.

A Compliance obligations

The *Electricity Safety Act 1998 (Vic)* (Safety Act), and regulations made under the Safety Act include requirements that affect our pole maintenance practices. This includes the requirement to submit and comply with an ESV approved Electricity Safety Management Scheme (ESMS) and Bushfire Mitigation Plan (BMP).

This legislative framework, whereby we must submit an ESMS and BMP for acceptance by ESV, differs from other jurisdictions (where legislative requirements may be more prescriptive). This does not imply, however, that our obligations are less robust, less binding, or can be changed without oversight by ESV.

A.1 Electricity Safety Management Scheme

Section 98 of the Safety Act provides that a major electricity company (defined to include distribution companies, such as CitiPower and Powercor) must design, construct, operate, maintain and decommission its supply network to minimise as far as practicable:

- the hazards and risks to the safety of any person arising from the supply network; and
- the hazards and risks of damage to the property of any person arising from the supply network; and
- the bushfire danger arising from the supply network.

In order to provide ESV, as the technical regulator, with oversight of our practices, the Safety Act provides that we must submit an ESMS to ESV. Our ESMS must (among other things), specify the safety management system being followed to comply with section 98 of the Safety Act.

ESV considers the ESMS, and must undertake one of the following:

- accept the ESMS if it is satisfied that the ESMS is appropriate for the supply network to which it applies and complies with the Safety Act and the regulations relating to the ESMS
- provisionally accept the ESMS if it is satisfied it will provide for the safe operation of the supply network
- if it does not accept or provisionally accept the ESMS, notify us in writing of the non-acceptance and give the us an opportunity to modify and re-submit the ESMS
- if ESV does not accept a re-submitted ESMS, it may determine the ESMS that is to apply.

We must comply with our accepted ESMS, and ESV may at any time request us to submit a revised ESMS.

A.2 Bushfire Mitigation Plan

We are also required under the Safety Act to prepare and submit to ESV, for acceptance, a plan to mitigate bushfire risks. ESV considers our BMP, and must undertake one of the following:

- accept a BMP if it is satisfied that the BMP is appropriate for the supply network to which it relates
- provisionally accept a BMP if it is satisfied that the BMP will minimise the bushfire danger arising from the supply network to which the BMP applies
- if it does not accept or provisionally accept a BMP, notify us that the BMP was not accepted or provisionally accepted, and give us an opportunity to modify and re-submit the BMP
- may determine the BMP that is to apply in relation to the supply network in circumstances where we failed to submit a BMP, or ESV has decided not to accept a submitted BMP.

During the specified bushfire risk period, we must not commence to commission, or operate, a supply network unless a BMP that applies to our supply network has been accepted or provisionally accepted.

We must comply with an accepted BMP.

B Asset management practices

Our wood pole management policies are developed to ensure we meet the following objectives:

- achieve a sustainable pole lifecycle management program
- maintain acceptable performance levels
- address the right poles at the right time
- meet community and stakeholder expectations.

Our wood pole asset management practices are designed to ensure we meet these objectives, and include leading and lagging indicators. For example, leading indicators include our serviceability index, whereas lagging indicators include asset failure rates, and health and safety incidents.

Our practices for the maintenance of poles are documented in the following key documents:

- Network Asset Class Strategies, Poles and Towers, which provides a consolidated description of the asset management strategies that we employ with respect to poles
- Network Asset Maintenance Policy for Inspection of Poles, which describes the inspection frequency and scope (i.e. tasks to be undertaken during the inspection), depending on pole condition
- Asset Inspection Manual, which details the work practises for inspectors, and activities that need to be completed during the inspection of our assets.

The above documents are called upon in our accepted ESMS and BMP. For example, our ESMS clearly states that we will maintain our assets in accordance with these documented asset maintenance policies. Similarly, our BMP expressly refers to the inspections being undertaken in accordance with the Maintenance Policy for Inspection of Poles and Asset Inspection Manual.

As our BMPs have been accepted by ESV, we have an obligation under the Safety Act to comply with the BMPs, and thus an obligation to comply with the Maintenance Policy for Inspection of Poles and Asset Inspection Manual.

B.1 Wood pole inspection practices

In maintaining our wood pole populations, we undertake a routine inspection of poles at defined intervals. These inspections are a preventative maintenance strategy developed from RCM methodologies and are an integral component of our network asset maintenance plan.

Inspection frequency is based on the pole classification and whether it is located in an high bushfire risk area (HBRA). These inspections involve either:

- a full inspection, covering the entire pole above and below ground level (generally including pole-top and ground-line inspection zones)
- on alternative cycles, an above ground inspection, which includes the section of pole above ground level including the pole top.

The limited inspection (above ground inspection) includes the following:

- assessment of the condition of the pole from ground level up to two metres, including a sound 'hammer' test to identify any pole cavities requiring further investigation
- identifying the presence of wood destroying insects (e.g. termites) or fungal fruiting.

Since March 2019, we have also included a visual inspection of the condition of the pole and pole-top assets to identify large checks or cracks in the pole. For the reasons discussed earlier in this document, we will cease interventions due to visible checks and cracking (noting that our other asset management changes may account for these defects).

Our full inspection (above ground and below ground inspection) includes the following:

- limited inspection (as described above)
- excavation and assessment of a wood pole's condition from ground line to a minimum of 300 millimetres below ground and to inspect for termite infestation
- determining the residual strength of the pole by drilling the pole with a 12 millimetre auger bit below ground, and in some cases, using WoodScan technology above ground to ascertain the amount of sound timber remaining
- internally treating hardwood poles with preservative where drilled.

B.2 Wood pole interventions

As outlined above, the condition of wood poles is determined via asset inspection and condition monitoring in accordance with the Maintenance Policy for Inspection of Poles and the Asset Inspection Manual. Based on the inspection, the pole is classified as either:

- serviceable—these poles are assessed as being serviceable
- added control serviceable—these poles are assessed as having sufficiently deteriorated to warrant an increased inspection frequency
- unserviceable (priority one)—these poles are assessed as having deteriorated to a point which requires priority replacement
- unserviceable (priority two)—these poles are assessed as having deteriorated to a point which requires reinforcement (also referred to as nailing or staking) or replacement.

The classification of a pole in the field is undertaken using our 'pole calculator'. Our pole calculator is a program in our asset inspection mobility software that sits within a portable computer which pole inspectors use to enter the pole inspection data. The software algorithms convert the input data into the serviceability classifications based on the residual strength of the pole (compared to either the working stress design capacity of the pole, or the original strength of the pole determined with WoodScan technology).[16]

Where a need for remedial maintenance work is identified through our inspection program, that work is undertaken in accordance with the policies expressly referred to in our BMP.[17]

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16 WoodScan is generally only used if a pole is classified as unserviceable (priority two) and unsuitable to stake through drilling of the pole.

17 Specifically, Policy No. 05 - C001.D - 392 - Management of Unserviceable Poles; and Policy No. 05 - C001.D - 398 - Permanent Reinforcing of Wood Poles.

C CBRM extracts

The following figures are used as part of our CBRM consequence model to determine the overall risk per pole. They are reproduced here for ease of reference.

Figure C.1 Network performance

Network Performance Consequence Values

Subtransmission Load Factor	65%
Additional Outage Risk Factor	5%
Default Load at Additional Risk (MVA)	18
VCR Distribution Load Factor	42%
Default kVA per Customer	1
Default Customers on Feeder	1200
LV Customers per Outage	100

NP Risk - VOLL Modifiers			
Failure Mode >	Minor	Significant	Major
Factor	0.01	0.05	1

NP Risk Basis	VCR

NP Risk - VCR (Value of Customer Reliability) - Subtransmission and Distribution							
	CitiPower			PowerCor			
	CBD	Urban	Default	Urban	Rural Short	Rural Long	Default
Cost of Interruption ($/MWh)	$39,886	$39,886	$39,886	$41,691	$41,691	$41,691	$41,691
Duration of Outage	30	30	30	60	60	60	60

Source: PAL RRP MOD 4.17

Figure C.2 Safety

Safety Consequence Values

Settings	Base Value	Disproportion F	Reference Value
Val. Consequence - Minor	$135,700	1	$135,700
Val. Consequence - Serious	$722,511	2	$1,445,022
Val. Consequence - Fatality	$4,814,917	3	$14,444,751

Failure Mode >	Minor	Significant	Major
Avg. Consequence - Minor	0.000372709	0.002648194	0.017654629
Avg. Consequence - Serious	0.000157134	0.001116479	0.007443192
Avg. Consequence - Fatality	8.94501E-07	6.35567E-06	4.23711E-05
Avg. Cost of Fault	$291	$2,065	$13,763

Source: PAL RRP MOD 4.17

Figure C.3 Bushfire

Bushfire Consequence Values

	Value	Disproportion
Bushfire Property Damage Consequences	$27,500,000	1
Bushfire Public Safety Consequences	$7,482,014	3

Bushfire Average Consequences - Suppressed	$18,160
Bushfire Average Consequences - Not Suppressed	$49,946,043
REFCL Reduction Factor	0.00%

Chance to Cause a Fire Start			
Bushfire Category	Minor	Significant	Major
LBRA	0.003%	0.013%	0.250%
HBRA	0.050%	0.250%	5.000%
REFCL(HBRA)	0.050%	0.250%	5.000%
BCA	0.050%	0.250%	5.000%
REFCL(LBRA)	0.003%	0.013%	0.250%

Fire Supression Chance and Consequence Weighting			
Bushfire Category	Suppressed	Weight	Total Weight
LBRA	99.00%	0.2	0.070207
HBRA	94.28%	1	0.351034
REFCL (HBRA)	94.28%	4.6	1.614754
BCA	94.28%	19.8	6.950464
REFCL (LBRA)	99.00%	0.2	0.070207

Fire Danger Weighting				Suppression Chance				
Category	Weight	Days Per Year	Yearly Weightir	LBRA	HBRA	REFCL (HBRA)	BCA	REFCL (LBRA)
No Forecast	0.1	171.15	0.0468583	99.00%	98.00%	98.00%	98.00%	99.00%
Low-Moderate	0.2	68	0.0372348	99.00%	97.00%	97.00%	97.00%	99.00%
High	0.5	82	0.1122519	99.00%	95.00%	95.00%	95.00%	99.00%
Very High	1	35	0.0958248	99.00%	90.00%	90.00%	90.00%	99.00%
Severe	2	7	0.0383299	99.00%	15.00%	15.00%	15.00%	99.00%
Extreme	3.5	2	0.0191650	99.00%	10.00%	10.00%	10.00%	99.00%
Code Red	5	0.1	0.0013689	97.00%	5.00%	5.00%	5.00%	97.00%

Source: PAL RRP MOD 4.17

Figure C.4 Financial

Financial Consequence Values			

Settings	Value
Capex:Opex ratio	1

OPEX Average Cost of Failure			
Failure Mode >	Minor	Significant	Major
Avg. Cost of Fault	$0	$0	$0

CAPEX Average Cost of Failure			
Failure Mode >	Minor	Significant	Major
Avg cost of fault	$0	$0	$10,012
Adjusted cost	$0	$0	$10,012

Source: PAL RRP MOD 4.17

Figure C.5 Environmental

Environmental Consequence Values			

Settings	Value
Val. Consequence Loss Oil / litre	$100
Val. Consequence Loss SF6/Kg	$598
Val. Consequence Fire	$10,000
Val. Consequence Waste / tonne	$100
Val. Consequence Disturbance	$400

Average Qty SF6 per TX (kg)	0.8
SF6 GWP	23900
Price of carbon (per tonne)	$25

Failure Mode >	Minor	Significant	Major
Avg. Consequence Loss Oil	0	0	0
Avg. Consequences Loss SF6 kgs	0	0	0
Avg. Consequence Fire	0	0	0
Avg. Consequence Waste	0.01	0.01	0.01
Avg. Consequence Disturbance	0	0	1
Avg. Cost of Fault	$1	$1	$401

Source: PAL RRP MOD 4.17