SA Power Networks

Supporting document 5.31

Assets & Work Program Business Case Addendum

2020-25 Revised Regulatory Proposal

10 December 2019

SA Power Networks

Assets and Work Program Business Case: Addendum Dec 2019

Contents

1. About this document

1.1 Context and related documents

This document is an addendum to the Assets and Work (**A&W**) program business case[1] (the '**original business case**') submitted to the Australian Energy Regulator (**AER**) as a supporting document to our Regulatory Proposal in January 2019[2] (the '**Original Proposal**') and should be read in conjunction with the original business case for context and background. Both documents are intended as supporting documents to our Revised Regulatory Proposal (the '**Revised Proposal**') and are related to several other supporting documents as illustrated in Figure 1. More detailed information in relation to aspects of the original business case is contained in our responses to the relevant AER Information Requests[3].

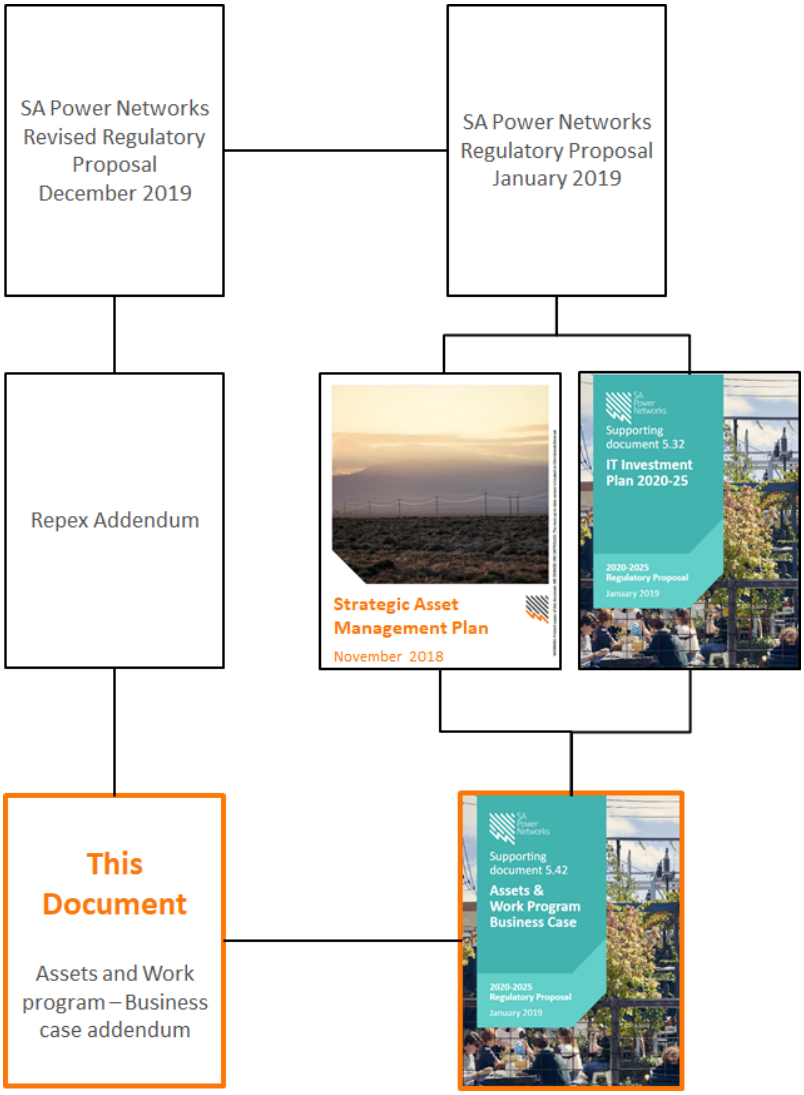


Figure 1: Related documents

[1] SA Power Networks: *Supporting document 5.42 Assets & Work Program Business Case, 2020-25 Regulatory Proposal,* January 2019

[2] SA Power Networks: Determination *2020-25 Regulatory Proposal,* January 2019, https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/sa-power-networks-determination-2020-25/proposal

[3] SA Power Networks, responses to the AER Information Requests: AER SAPN IR 003, AER SAPN IR 008, AER SAPN IR 011C, AER SAPN IR 038 and AER SAPN IR 039.

This Addendum aligns with the AER's assessment framework for ICT expenditures[4]. The expenditure considered in this Addendum belongs to the 'Non-Recurrent information and communications technology (**ICT**)' expenditure category, the ' New or expanded ICT capability, functions and services' sub-category for the purposes of acquiring new or expanded capabilities functions or services, according to the AER's framework for ICT expenditures as set out in its guidance note. As such, the recommended option in this Addendum is shown to have benefits that exceed costs (positive net present value (**NPV**)), consistent with the assessment approach set out by the AER[5].

1.2 Glossary

Term / Abbreviation	Definition
ADMS	Advanced Distribution Management System
A&W	Assets and Work
AER	Australian Energy Regulator
AIO	Asset Investment Optimisation
Augex	Augmentation expenditure
AUD	Automated Utility Design
Bundling	In the context of this document, bundling refers to combining tasks to reduce the cost of preparation, travel and post-task activities associated with asset replacement or refurbishment work
Capex	Capital expenditure
CBRM	Condition Based Risk Management
CU	Compatible unit Compatible unit is an engineering template used to define labour, materials, services, and resources that are required to perform a work order, such as replacing a pole, in a standardised way. CUs are used as the basis for estimating the costs and resource requirements that are associated with work orders. They are also used for assessing actual performance against standards.
DNSP	Distribution network service provider
EAM	Enterprise Asset Management
ERP	Enterprise Resource Planning
ESCoSA	Essential Services Commission of South Australia
Feeder	an electrical circuit
GEF	Geographical Enablement Framework
GIS	Geographic Information System
IT	Information Technology
NEL	National Electricity Law
NEM	National Electricity Market
NER	National Electricity Rules
NPV	Net present value
Opex	Operating expenditure

[4] AER: *Non-network ICT capex assessment approach*, November 2019

[5] AER: *Non-network ICT capex assessment approach*, November 2019, p.12

Original business case	The Assets and Work (**A&W**) program business case[6]
Original Proposal	The SA Power Networks Regulatory Proposal for the 2020-25 regulatory control period submitted to the AER on 31 January 2019[7]
RAB	Regulatory Asset Base
RCP	Regulatory Control Period
RIN	regulatory information notice
POF	Probability of failure
ROI	Return on Investment In the context of this document, ROI is the ratio of the risk cost associated with an asset failure to the cost of replacement or refurbishment of that asset.
PPM	Portfolio Planning Management
Repex	Replacement expenditure Repex comprises network capital expenditure required for: • Asset Replacement: the replacement of existing parts of the network with modern equivalent assets; and • Asset Refurbishment: expenditure to extend the engineering life expectancy of an asset (but not increase its functionality) by replacing or repairing parts of an asset rather than the whole.
Revised business case	The combination of the original business case and the 'Assets and Work Program Business Case: Addendum Dec 2019' (this document)
Revised Proposal	The SA Power Networks Revised Regulatory Proposal for the 2020-25 regulatory control period submitted to the AER on 10 December 2019
SA Electricity Act	Electricity Act 1996 (SA)
SAMP	Strategic Asset Management Plan
SDO	Service Delivery Optimisation
SME	Subject matter expert
WACC	Weighted average cost of capital
WSE	Work Selection Effectiveness WSE is a measure of the effectiveness with which potential asset replacement or refurbishment work is selected and executed on the basis of estimated risk and cost.

[6] SA Power Networks: *Supporting document 5.42 Assets & Work Program Business Case, 2020-25 Regulatory Proposal,* January 2019

[7] SA Power Networks: Determination *2020-25 Regulatory Proposal,* January 2019, https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/sa-power-networks-determination-2020-25/proposal

2. Executive summary

SA Power Networks faces significant challenges in maintaining the service performance and safety of our ageing distribution system while keeping prices down for our customers. With more of our network assets approaching the end of their economic life in the next decade, we must find ways to prudently manage increased requirements for asset replacement and refurbishment through efficiency improvements and better asset management practices.

Our Strategic Asset Management Plan (**SAMP**) recognises these challenges and outlines our response strategies, which include gaining efficiencies through investing in our systems and work delivery processes[8]. Our Assets and Work (**A&W**) program supports the SAMP through a roadmap to efficiency improvements that encompass changes to our processes, data, people and systems. The roadmap, originally referred to as an Enterprise Asset Management Blueprint, was developed in 2014 in consultation with the global asset management specialist firm, Vesta[9] and in alignment with an international standard in asset management, ISO 55000:2014. As evidenced by Gartner[10] independent industry research, experience of similar organisations around the world confirms that implementing the proposed roadmap significantly improves efficiency and effectiveness of asset management processes[11].

The first stage of the A&W program was approved by the AER in its 2015-20 Determination[12] and will have delivered significant benefits including the efficient deferral of over $205 million of repex over the 10-year period from 2015 to 2025. Based on a thorough analysis and stakeholder consultation, this Addendum recommends continuing the program into the next, 2020-25, regulatory control period (**RCP**). The program enables an efficient deferral of repex on an ongoing basis and a range of other efficiency benefits thus allowing us to moderate the upward expenditure trend while maintaining the safety and reliability of our network.

This addendum responds to the AER feedback in its Draft Decision[13] on the A&W Program Business Case submitted with our Regulatory Proposal in January 2019 (the '**original business case**'). The issues raised by the AER were related to the economic value of the A&W program benefits and the alignment between the A&W Business Case and network asset replacement expenditure (**repex**) forecast.

In response to the AER feedback we revised the business case to address the issues raised and provided additional clarification where required. The revised cost-benefit analysis gives a positive net benefit in NPV terms of $24.4 million (Dec $2017)[14] and will allow us to achieve a deferral of repex in the 2020-25 RCP of $49.3 million and repex savings of $0.2 million. The program is also expected to deliver efficiency benefits

[8] SA Power Networks, *Strategic Asset Management Plan – Manual No. 15*, November 2018, pp. 68-71

[9] Vesta (https://vestapartners.com/about-vesta/) is a global professional services firm specialising in asset management.

[10] Gartner Inc. is the world's leading independent research and advisory company. We consulted with Gartner during the development of this Addendum to ensure alignment with good industry practices and to validate our estimated benefits using Gartner insights into relevant experience of our peers around the world.

[11] Refer, for example, Gartner, *Cost Cutting in Utilities Can Come from Better Asset Management*, April 2008

[12] The AER accepted the EAM business case in its final determination and commented that "This project provides the single largest source of cost reduction and cost avoidance benefits of SA Power Networks' proposed non-recurrent IT projects. Total project benefits exceed project costs over the ten year period from 2015–25."

[13] AER: *DRAFT DECISION SA Power Networks Distribution Determination 2020 to 2025, Attachment 5: Capital expenditure*, October 2019, pp. 5-69 – 5-70

[14] Unless otherwise specified, all costs in this document are in December 2017 dollars.

across the business estimated at $3.4 million over the 2020-25 RCP and ongoing benefits into future periods.

The amended and the original cost-benefit status of the A&W program business case is as follows (Table 1):

Table 1: Amended cost-benefit analysis over the 15-year period from 2020 to 2035 and the original cost-benefit analysis over the 10-year period from 2020 to 2030, $million (Dec $2017)

Option	Costs		Benefits				NPV [15]
	Total capex	Total new opex	Total deferred repex	Discounted benefits from deferred repex[16]	Repex reduction due to bundling	Other efficiency benefits	
Option 0 (Base Case) – Do Nothing	-	-	-	-	-	-	-
Option 1 - Revised proposal (15-year NPV)	38.7	18.8	184.4	42.2	4.7	48.3	24.4
Option 1 - Original proposal (10-year NPV)	80.0	13.0	95.0	not calculated	not quantified	32.8	28.2

The sensitivity analysis conducted against our key assumptions confirmed that the NPV remained positive under a wide range of plausible future scenarios.

Total capital expenditure (**capex**) proposed is $38.7 million over the 2020-25 RCP, and there is an associated increase in the Information Technology (**IT**) operating expenditure (**opex**) of $5.2 million over the period, which is offset by opex benefits expected from this and other proposed IT investments[17]. The summary of the program costs and benefits by RCP is provided in Table 2.

[15] Net present value (**NPV**) of the proposal based on discount rate of 2.63%. The NPV for the revised proposal is taken over 15-year cash flow period from 1 July 2020 to 30 June 2035, excludes the total deferred repex, but includes the corresponding discounted benefits. The NPV for the original proposal was taken over 10-year cash flow period from 1 July 2020 to 30 June 2030 and included the total deferred repex.

[16] Represents the total repex savings associated with the proposed option over the 15-year cash flow period, obtained by subtracting the present value of the amount we need to spend on deferred asset replacement/refurbishment after the Repex Deferral Period of 10 years from the present value of the total deferred repex.

[17] We have not proposed any associated step change on that basis that we will use expected opex benefits resulting from our proposed IT investments (in this and other business cases) to offset the extent of expenditure shortfall that we will face in the 2020-25 RCP in implementing the identified needs across our whole IT proposal. Refer to the IT Investment Plan for further details. This approach was articulated to the AER in response to several AER Information Requests, and was not challenged in the AER's Draft Decision for the 2020-25 RCP.

Table 2: Option 1 Cost and benefit summary by RCP, $million (Dec $2017)

Option 1 Summary by RCP	2020-25	2025-30	2030-35	Total 2020-35
COSTS				
Capex	38.7	-	-	38.7
Opex	5.2	6.8	6.8	18.8
Total costs	**43.9**	**6.8**	**6.8**	**57.5**
BENEFITS				
Repex benefits				
Estimated repex deferral[18]	49.3	60.4	74.6	184.4
Discounted benefits from deferred repex	11.3	13.8	17.1	42.2
Repex reductions due to bundling	0.2	2.3	2.3	4.7
Sub-total repex benefits	**13.1**	**15.6**	**19.2**	**47.8**
Other efficiency benefits (cost avoidance and cost reductions other than repex)				
Capex	1.1	5.4	5.5	12.0
Opex	2.3	16.6	17.4	36.3
Sub-total - other efficiency benefits	**3.4**	**22.0**	**22.9**	**48.3**
Total cost avoidance and cost reduction benefits	**14.9**	**38.1**	**42.2**	**95.2**

Note: Totals may not exactly match the sums of individual costs due to rounding.

The program achieves repex benefits through interlinked initiatives that:

- improve our ability to more accurately estimate the probability and consequence of asset failures and the cost to replace or refurbish these assets;
- improve our ability to undertake work based on the estimate of cost and benefit to reduce the volume of assets replaced to achieve the same service outcomes;
- reduce the unit cost of undertaking replacements through optimised service delivery by combining tasks to reduce the cost of preparation, travel and post-task costs (commonly referred to as 'bundling'); and
- reduce the cost of undertaking asset replacements and refurbishments through standardisation, via compatible units[19], across the asset management lifecycle, from estimation and design to planning and execution.

In addition, the program achieves a range of other efficiency benefits through automation of manual tasks and integration between disparate asset and work management systems, including:

- avoided costs of manually collecting asset information and condition data;
- avoided costs of manually entering and updating asset information in multiple systems;
- avoided cost of manually analysing asset age and condition data;
- improved resource utilisation;

[18] The full repex amounts that can be deferred in each RCP. The deferral amount for the 2020-25 RCP appears in Repex Addendum and IT Investment Plan. For the purposes of the NPV analysis, these benefits are discounted to reflect the eventual cost of deferred repex – the corresponding discounted benefits are listed in the line below.

[19] Compatible units (**CU**s) are engineering templates that are used to define labour, materials, services, and resources that are required to perform a work order, such as replacing a pole, in a standardised way. CUs are used as the basis for estimating the costs and resource requirements that are associated with work orders. They are also used for assessing actual performance against standards.

- reduced inventory holding costs;
- avoided manual data processing costs for regulatory reporting and submission preparation through improved capture of actual work data linked to our asset register and regulatory accounts;
- reduced time to find and collate documentation necessary to schedule and perform planned and unplanned work; and
- efficiency savings through standardisation and automation of design and estimation of work.

The projects that make up the program are co-dependent and form a single long-term program aimed at minimising the level of repex spend required to maintain our ageing asset base. For this Addendum, we focus only on the investments required in 2020-25 RCP to achieve this long-term goal and include only the benefits arising from the 2020-25 investment. The opportunity for further investment in the A&W program beyond 2025 will be evaluated in the lead-up to the 2025-30 RCP on the basis of experience gained in the 2020-25 RCP and any technological, environmental or organisational changes at the time. This approach allows us to focus on those investments that are the most certain to deliver the most value at this time and continually improve plans for future stages in collaboration with stakeholders based on value delivered to date.

As part of our comprehensive review of the original business case, we made the following key amendments to address matters raised in the AER's Draft Decision:

Table 3: Summary of the AER feedback on the original business case and the key amendments we made to address it

AER Draft Decision considerations	Our response	Section of this document
• NPV analysis excluded the eventual cost of deferred repex	• We have now included the eventual cost of deferred repex in the NPV analysis	Section 4.6
	• Further modelling has now confirmed our assumption expressed in our response to the AER Information Request 011[20] that the average deferral period is approximately 10 years	Section 4.9.1 Appendix D
• NPV is negative unless average deferral length exceeds 39 years	• We identified that in the original business case the baseline repex cost in the 2025-30 RCP included benefits from the second stage of the A&W program proposed for the 2020-25 RCP, leading to underestimation of the repex deferral benefits relative to the 'Do Nothing' scenario	Appendix I
	• We have now also quantified A&W program benefits resulting from bundling of work	Section 4.9.2 Appendix E
• Insufficient NPV analysis period to adequately assess costs and benefits	• We have increased the NPV analysis period from 10 to 15 years as there were material benefits expected as a result of the A&W investment that were not captured in the previous analysis	Section 4.6.1

[20] SA Power Networks, response to the AER Information Request AER SAPN IR 011C–Capex Non-Network ICT, p.7

• No evidence of A&W deferral benefits in the repex forecast	• We have more explicitly articulated the link to repex[21], and reconciled the repex forecast in the A&W business case with the 2020-25 repex forecast in the Repex Addendum[22]	Section 4.6.1
• Forecast improvement in work selection effectiveness (**WSE**) solely based on subject matter expert (**SME**) judgement	• We have explained the estimation of present levels of WSE and future WSE improvements from the available assets and work data	Section 4.9.1 Appendix C

[21] The A&W program impacts the effectiveness of a subset of repex—the modelling of this program excludes other repex which is included in the total repex forecast, including: Zone Substation asset replacement, unplanned asset replacement and specific projects/programs

[22] SA Power Networks Revised Regulatory Proposal: *Supporting Document 5.4 - Repex Addendum*, December 2019

3. Background

3.1 Assets and Work program

The Assets and Work (**A&W**) program was initiated in 2014 in response to the need to improve efficiency and effectiveness of our network asset maintenance and replacement processes. A roadmap to achieve these improvements through process change and Information Technology (**IT**) investment was developed in consultation with the global asset management specialist firm, Vesta[23]. We worked with Vesta to develop an Enterprise Asset Management (**EAM**) blueprint later known as the A&W program - a long-term program of interlinked initiatives reliant on investment in our processes, data, people and systems to curtail the upward trend in replacement expenditure (**repex**) while maintaining reliability and safety of our electricity network.

The first stage of the program was approved by the AER in its 2015-20 Determination[24] and will have delivered significant benefits including the efficient deferral of over $205 million of repex over the 10-year period from 2015 to 2025.

3.2 Our original business case

Our original A&W Program Business Case[25] (the '**original business case**') submitted with our Regulatory Proposal in January 2019[26] (the '**Original Proposal**') proposed to continue the A&W program, building on the foundations developed during the 2015-20 RCP.

The proposed program comprised five inter-related workstreams with the total cost of $80.3m capex and $13.0m opex over the 2020-2030 period, of which $40.8m capital expenditure (**capex**) and $5.5m operating expenditure (**opex**) were proposed for the next, 2020-25, regulatory control period (**RCP**).

In addition to the 'Do Nothing' option, the original business case considered three options to deliver the full scope of the EAM blueprint over three different implementation periods. The recommended option, Option 1, delivered the full scope over the next two RCPs to minimise project delivery risks, while Options 2 and 3 had more compressed timeframes.

The original business case quantified two categories of benefits expected from the A&W program:

1. repex deferral, estimated at $95m over the next two RCPs; and
2. other benefits, estimated at $32.8m over the next two RCPs.

The repex deferral benefits were estimated based on the expected improvement in our ability to identify, select, allocate and perform the asset replacement or refurbishment work that delivers the greatest reduction of network risk per dollar spent. In the quantitative model supporting the benefit estimates, this

[23] Vesta (https://vestapartners.com/about-vesta/) is a global professional services firm specialising in asset management.

[24] The AER accepted the EAM business case in its final determination and commented that "This project provides the single largest source of cost reduction and cost avoidance benefits of SA Power Networks' proposed non-recurrent IT projects. Total project benefits exceed project costs over the ten year period from 2015–25."

[25] SA Power Networks: *Supporting document 5.42 Assets & Work Program Business Case, 2020-25 Regulatory Proposal,* January 2019

[26] SA Power Networks: Determination *2020-25 Regulatory Proposal,* January 2019, https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/sa-power-networks-determination-2020-25/proposal

improvement was represented by a parameter called work selection effectiveness (**WSE**) [27], with the initial values of WSE derived from our actual WSE measured in 2017. While the original business case mentioned other sources of repex benefits such as bundling of work located in close proximity to each other, it did not quantify them.

The 'other benefits' identified in the original business case were associated with improved process efficiency across the organisation (eg reduced data entry time, reduced data processing time, reduced inventory costs).

Table 4 provides the breakdown of the A&W program benefits quantified in the original business case:

Table 4: Repex deferral benefits identified in the original A&W business case ($million Dec $2017)

Benefit type	2020-25 RCP	2025-30 RCP	Total
Repex deferral	65.0	30.0	95.0
Other benefits (cost reduction and cost avoidance)	4.2	28.6	32.8

Both types of benefits were included in the net present value (**NPV**) analysis, which yielded a strongly positive NPV of $28.2m for the recommended option over the 10-year period from 2020 to 2030. However, the NPV analysis did not account for the need to eventually undertake the deferred work. While the original business case recognised that shortcoming, we did not have sufficient information at the time to undertake more detailed analysis.

3.3 AER draft decision

In its Draft Decision, the AER did not approve our proposed expenditures for the original business case in its allowed expenditures for the 2020-25 RCP, citing concerns with our modelling and inadequacies in our explanations of the costs and benefits including how these benefits were incorporated into our overall Original Proposal (in particular, our repex forecast). Table 5 summarises the AER's considerations and how this addendum has responded.

Table 5: Summary of the AER comments on the original A&W business case submitted with our Proposal in January 2019

AER draft decision	Our revised approach
NPV analysis excluded the eventual cost of deferred repex: *"SA Power Networks' business case recognised that its calculations may over-state the benefits of this investment, by assuming deferred repex amounts are never incurred (i.e. deferred in perpetuity)."*[28]	• We have now included the eventual cost of deferred repex in the NPV analysis. • We have now included assumptions as to reasonable periods of repex deferral (an average of 10 years), and tested our results using sensitivity analysis on these assumptions. • We have now more explicitly outlined the benefit categories as we expect network repex benefits are not solely related to repex deferral.

[27] Work Selection Effectiveness is defined as a percentage of annual replacement expenditure allocated to fixing defects based on the ratio of the risk cost of the defect to the cost to fix that defect (via replacement or refurbishment of the corresponding asset).

[28] AER: *DRAFT DECISION SA Power Networks Distribution Determination 2020 to 2025, Attachment 5: Capital expenditure*, October 2019, p. 5-69

AER draft decision	Our revised approach
NPV is negative unless average deferral length exceeds 39 years: *"Our analysis identified that excluding the eventual cost of deferred repex, when considering only a ten year period introduces significant bias. We find that average deferral length would need to exceed 39 years for this program to be NPV positive, once the period of analysis is extended."*	• We revised our NPV analysis to more accurately capture benefits we reasonably expect to result from the recommended option, including by: – quantifying benefits that were only qualitatively described in our original business case—these pertain to bundling; and – extending our cost benefit analysis period from 10 to 15 years, as our 10-year timeframe failed to incorporate all benefits expected from the recommended option. The 15-year timeframe is also more closely aligned to the anticipated life of the investment. • Our recommended option is of net benefit over a 15-year NPV period (using an average repex deferral period of 10 years), and is of net benefit under several tests of the sensitivity of our assumptions.
Insufficient NPV analysis period to adequately assess costs and benefits: *"SA Power Networks also stated that "deferring these works will best stagger the effects on consumer prices". However, ICT assets have shorter depreciation asset life than repex, so the program may increase prices in the short-term. Regardless, we must consider the long-term interests of consumers, which requires NPV analysis covering a long enough period to capture relevant costs and benefits."*	• We agree that a suitable analysis period is required to demonstrate that our recommended option is in the long-term interests of customers. • Our recommended option minimises long term costs to customers by minimising the costs of maintaining service performance and safety (via efficient repex referral and bundling) and other process efficiencies. • In consultation with stakeholders, it was made clear that the A&W investment would slightly increase short-term costs, but result in long-term benefits. Stakeholders remained supportive despite this short-term impact as described in Section 3.4.1.
No evidence of A&W deferral benefits in the repex forecast: *SA Power Networks stated that its repex forecast "will need to be increased by $65 million ($2017) if the A&W Program for the 2020–25 RCP is not allowed by the AER." However, we and EMCa have not found evidence of this $65 million deferral in SA Power Networks' repex forecast."*[29]	• Our Repex Addendum[30] has now more explicitly identified the expected benefits of the recommended Option 1 for the A&W program that were factored into our forecast repex proposal (Option 1 in the Repex Addendum). • This A&W Addendum has also more explicitly outlined the interactions with repex. In summary: – The 'Option 0 (Base Case) - Do Nothing option (no further IT investment)' for A&W corresponds to the 'Option 1 - base-case repex forecast' in the Repex Addendum. That is, no further investment in the A&W

[29] AER: *DRAFT DECISION SA Power Networks Distribution Determination 2020 to 2025, Attachment 5: Capital expenditure*, October 2019, pp. 5-69 - 5-70

[30] SA Power Networks Revised Regulatory Proposal: *Supporting Document 5.4 - Repex Addendum*, December 2019

AER draft decision	Our revised approach
	program in the 2020-25 RCP will mean our repex in the 2020-25 RCP will need to be increased in order to maintain service performance and safety. – The recommended option, 'Option 1: continue A&W in 2020-25' corresponds to 'Option 2: Revised Proposal repex' in the Repex Addendum. That is, investment in A&W in the 2020-25 RCP will enable us to spend less on asset replacements / refurbishments in the 2020-25 RCP (and in future regulatory periods) relative to the repex base case, in order to maintain service performance and safety.
Forecast improvement in work selection effectiveness solely based on subject matter expert (SME) judgement and no comparison provided with historical increase in WSE: *"SA Power Networks has also not demonstrated the adequacy of its method to estimate repex deferrals. Its forecasts depend on an assumed 25 percent increase in a metric called 'Work Selection Effectiveness' (WSE), which was only determined "based on SME [subject matter expert] judgement and experience". SA Power Networks did not provide a comparison with historical increases in WSE."* [31]	• We have provided more detailed explanations of the reasonable basis upon which we arrived at forecast improvements in WSE arising from the recommended option. This includes explaining current barriers to improving WSE and how the A&W program proposes to overcome those barriers.
Estimated improvements in WSE are not consistent with our statement that CBRM repex forecasts assume perfect allocation of work. *"Further, SA Power Networks states that its CBRM repex forecasts assume perfect allocation of work. This does not appear to allow for an increase in WSE due to the program."*[32]	• Our WSE improvement model only includes a subset of repex for those asset classes that benefit from WSE improvement (refer Appendix H for further detail). Repex forecast expenditure used as an input into the WSE improvement model for those asset classes is not modelled using CBRM and therefore does not assume 'perfect allocation of work'

3.4 What our stakeholders have said

We have undertaken a comprehensive stakeholder engagement program for our 2020-2025 Regulatory Proposal involving over 5,000 participants across more than 100 workshops and other activities since the program commenced in February 2017. Submissions provided to the AER by stakeholders accepted that prudent investments in IT can deliver benefits to customers as evidenced by SA Power Networks' historic

[31] AER: *DRAFT DECISION SA Power Networks Distribution Determination 2020 to 2025, Attachment 5: Capital expenditure*, October 2019, pp. 5-69 - 5-70

[32] AER: *DRAFT DECISION SA Power Networks Distribution Determination 2020 to 2025, Attachment 5: Capital expenditure*, October 2019, pp. 5-69 - 5-70

performance, but also encouraged the AER to verify incorporation of benefits expected from IT investment. Table 6 summarises the stakeholder views and how this addendum has responded.

Table 6: Representative stakeholder comments

Stakeholder views	SA Power Networks response
SA Power Networks' use of IT investments for efficient asset management: *"the secret of SA Power Networks' success has been best practice asset management which has kept assets in service longer than their technical life…this has been enabled by well implemented IT changes which allow for data analysis."*[33]	• We welcome this acknowledgement. SA Power Networks' long-term performance as one of the most efficient distribution network service providers (**DNSPs**) compared to our peers has been the result of continuing to seek innovative ways of improving our practices in order to mitigate costs to customers. • Our A&W program seeks to continue our drive to further improve efficiency in our network asset management and is shown in this Addendum to derive significant long-term benefits for our customers.
The need to see benefits of IT investments incorporated into operating and capital expenditure forecasts: *"Identify the (ICT) costs as part of the capital works but include a strong and identifiable 'downward step' in operating costs and capital requirements that flow from the ICT investment."*[34]	• We have further explained all the benefits we expect to result from our recommended option and how these have been incorporated into our broader revised regulatory proposal (the '**Revised Proposal'**) – principally by means of a lower repex forecast than would otherwise be required to maintain service performance and safety[35]. • The 'downward step' that stakeholders seek has now been more clearly illustrated in our Revised Proposal.

3.4.1 Our further consultation with customers and stakeholders

We engaged further with our customers and stakeholders on this topic since the AER Draft Decision, including by hosting a workshop on 25 October 2019 with our Customer Consultative Panel, Reference Group members, the AER's Consumer Challenge Panel 14 (CCP14), jurisdictional government and AER representatives.

In this workshop, we actively engaged with our customers and stakeholders by seeking their preferences with respect to the trade-offs for customers within our considered options for the A&W program. We outlined three possible scenarios that we could take in our Revised Proposal to the AER.

1. **Scenario 1: SA Power Networks accepts the AER Draft Decision**—ie lower forecast repex than in our Original Proposal, and no further A&W investment. We outlined our reasons for why the AER's Draft Decision allows insufficient expenditure for us to maintain service performance and safety.
2. **Scenario 2: SA Power Networks to propose higher repex and no further A&W investment**—corresponding to the 'Option 1: base-case repex forecast' in the Repex Addendum and the 'Option 0 (Base Case) - Do Nothing (no further investment)' for the A&W program. This was shown to have a slightly lower short-term price impact on customers, but higher long-term costs than Scenario 3.
3. **Scenario 3: SA Power Networks to propose lower repex and continue the A&W program**—corresponding to the 'Option 2: Revised Proposal Repex' in the Repex Addendum and 'Option 1 –

[33] Dynamic Analysis Pty Ltd, *Technical regulatory advice to Energy Consumers Australia*, 15 May 2019, p.16.

[34] CCP14, *Advice to the AER on the SA Power Networks 2020-25 Regulatory Proposal*, 16 May 2019, p.47.

[35] This Addendum and the IT Investment Plan also set out how we have accounted for other expected benefits.

Continue the A&W program' for the A&W program. This was shown to have a slightly higher short-term price impact on customers, but lower long-term costs than Scenario 2. This is because A&W investments have shorter asset lives than network assets, meaning the costs of these investments are recovered over a shorter period of time.

There was general consensus and support from customers and stakeholders for Scenario 3 which forms the basis of our Revised Proposal. Customers and stakeholders told us that:

- SA Power Networks should in the 2020-25 RCP continue investment in improving the efficiency of network management and asset replacement/refurbishment work. It would be unacceptable to stakeholders for SA Power Networks to not look at the things that the A&W program seeks to do in light of the significant looming uplift that will be required in repex.[36]
- Stakeholders preferred Scenario 3, in appreciation of the need to minimise inter-generational equity issues, and avoiding 'kicking the can down the road'.[37]
- While suggesting Scenario 3 should be presented to the AER in SA Power Networks' Revised Proposal, our customers and stakeholders encouraged the AER to fully assess the modelling that SA Power Networks has undertaken as this was beyond their areas of expertise.[38]

[36] Verbal comment during the workshop, 25 October 2019.

[37] The issue of inter-generational effects arising from lower than required replacement expenditure is discussed in a report prepared for SA Power Networks by Frontier Economics, 'The long-run implications of regulatory repex allowances', provided as supporting document 5.9 to our Revised Proposal.

[38] For example, a stakeholder comment in our evaluation form stated: "*this is a reasonable option, provide your reasons and what I'd hope is that the AER continue to apply the same rigour to your proposal and consider feedback provided in stakeholder submissions*."

4. Revised proposal

4.1 Revisions to our original business case

This Addendum makes several key amendments to the original business case in order to address the AER's Draft Decision and customer and stakeholder feedback. Key changes are outlined in Table 7.

Table 7: Revisions to our original Assets & Work business case described in this Addendum

Topic	SA Power Networks' revised proposal	Section(s) of this document
Options considered to address identified need	We reduced the options in consideration from three to one (relative to a base case option).	4.5
	This addendum no longer considers options 2 and 3 from our original business case on the basis that: • these options had more compressed implementation timeframes and would have created deliverability pressures; and • the AER and its consultant, EMCa had raised concerns regarding ICT deliverability.	4.10
	Option 1 from our original business case has been revised. This addendum and the cost benefit analysis therein, focusses only on the investments that our original Option 1 proposed for the 2020-25 RCP, with further refinements to reduce costs. The recommended option is now for IT expenditure over a 5 year rather than 10 year investment horizon. This is on the basis that: • we consider it more prudent to evaluate the need for further IT investment in Assets and Work in the 2025-30 RCP in our subsequent Regulatory Proposal; and • we will aim to later consider the need on the basis of experience that we gain in implementing the recommended option in the 2020-25 RCP and on the basis of prevailing technology, environment and organisational conditions at this later time, and further stakeholder engagement.	4.5.2
Modelling	We now include explained assumptions as to a reasonably expected period of time for which repex will be deferred, estimated to be 10 years consistent with our previous estimates on the basis that: • this Addendum corrects the analysis in our original business case which incorrectly did not account for the eventual cost of having to undertake asset replacement/ refurbishment work that has been deferred.	4.9.1 Appendix D
	We have now extended the NPV analysis period from 10 to 15 years. This is on the basis that: • as noted by the AER, a 10-year analysis period is too short to examine long term effects on customers; • it is consistent with the anticipated lifetime of the investment; and • we identified that the original 10 year analysis period failed to acknowledge significant benefits that are expected from the recommended option.	4.6.1 Appendix A

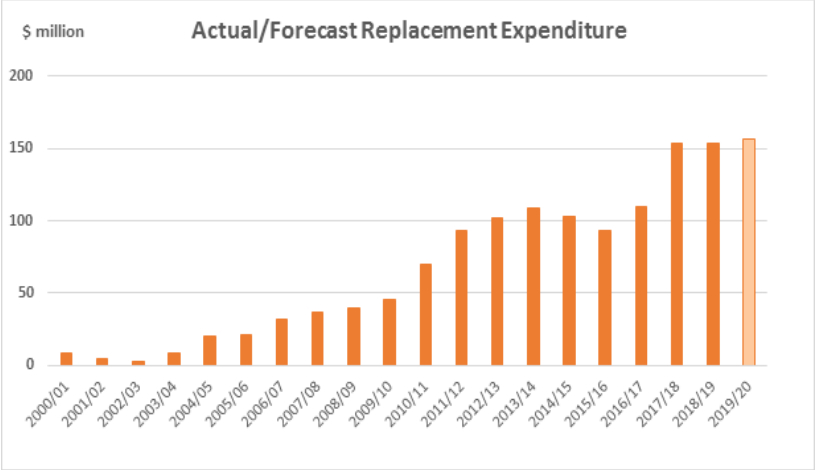
Costs	We have refined the scope and costing of activities for Option 1, resulting in lowered proposed costs for the 2020-25 RCP relative to our original business case: • capex has been reduced from $40.8 million to $38.7 million • opex has been reduced from $5.5 million to $5.2 million This was on the basis of focusing on the investments that maximise value to our customers.	4.5.2 4.8.1 4.8.2
Benefits	We have refined our quantitative estimation of expected benefits, including by: • Better explaining the categories of benefits that we expect to result from the recommended option (Option 1). This is noting that our original business case inadequately explained expected benefits. • For deferral benefits: – Refining and better explaining the basis upon which we have estimated the improvements in Work Selection Effectiveness that will result in repex deferral. This is noting that the AER considered these explanations to be inadequately substantiated. – Correcting an error we identified in our original business case. In the baseline repex cost for the 2025-30 RCP we had included benefits from the proposed 2020-25 A&W program which resulted in an underestimation of the repex deferral benefit in the 2025-30 RCP. Refer to Appendix I for further information. • For bundling benefits: quantifying additional benefits which we had expected but had only described qualitatively in our original business case. • For other efficiency benefits: – Providing further detail to that provided in the original business case; we note that these were not challenged in the AER's Draft Decision but are still outlined in this Addendum. – Engaging Gartner to validate our estimated benefits using its research insights into relevant experience of our peers around the world. • Sensitivity analysis: testing our expected net benefits to show that the recommended option is of net benefit even when we test for plausible changes in our key assumptions.	4.9 4.9.4 Appendix A 4.9.1 Appendix C Appendix I 4.9.2, Appendix E 4.9.3 4.6.2
Program delivery	We explain how we have adequately planned to be able to deliver the recommended option, as a program and as a program alongside our other IT programs and projects across our whole IT portfolio.	4.10

4.2 The identified need

SA Power Networks has consistently been one of the most efficient DNSPs in the National Electricity Market (**NEM**) over a long period of time. We have managed our network prudently and have had the lowest Regulatory Asset Base (**RAB**) growth of any DNSP.

However, the principal challenge we face is considering now how to manage the replacement of what has become the oldest network asset fleet in the NEM in the most efficient way possible. This challenge is made particularly acute given the age profile of our network assets:

- a very significant proportion of our network was built within a very short period of time, between 50 and 70 years ago.[39] The 'lumpiness' of that investment creates a large bow-wave of assets that will need to be replaced as they reach the end of their useful lives;
- as our asset population ages, the condition of our physical assets, poles and wires, will deteriorate and they will ultimately fail. In light of this deterioration, an increasing amount of repex will be required to maintain the service performance and safety of our distribution system;
- our actual spend has shown that over the last two decades we have had to increase our repex spend levels in order to maintain service performance and safety as our average asset age has increased from 25 years old to 45 years old; and
- we expect to continue to need to increase our repex spend levels, unless we can find ways of mitigating the extent of this required increase by either improving our ability to target risk on our network or reducing the costs of undertaking work on our network.



The identified need for this Addendum is to minimise the long-term costs to customers of maintaining the performance and safety of our distribution system and distribution network services to our customers as our assets age,[40] by improving our ability to:

- identify and execute the network asset replacement work that has the greatest impact on maintaining service performance and safety for customers;
- optimise the way we combine / bundle and schedule network asset refurbishment and replacement work in the field to minimise costs; and
- achieve other administrative efficiencies in our network asset management and work management practices.

With respect to the regulatory framework, this 'Assets and Work Program Business Case Addendum' is more directly concerned with:

- achieving the expenditure criteria (ie the capex criteria and the opex criteria) in the NER , by investing prudently in ICT processes and systems in order to maintain efficiency of, and realise productivity in our network asset management, to minimise long-term cost outcomes to customers[41]—which investment is also consistent with the National Electricity Objective;[42] and
- having regard to the expenditure factors (ie the capex factors and the opex factors) in the NER, including examining expenditure to address the concerns of electricity consumers as identified by

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39 The relatively old and lumpy nature of SA Power Networks' network asset age profile, and what this means for future required replacement expenditure is the subject of a report prepared for us by Frontier Economics, provided as 'Supporting Document 5.9: Frontier Economics—the long-run implications of repex allowances', to our revised proposal.

40 Our proposed repex for the 2020-25 RCP seeks to maintain service performance and safety in order to comply with clauses 6.5.6 and 6.5.7 of the National Electricity Rules—this is further detailed in our Supporting Document 5.4 - Repex Addendum document.

41 Clauses 6.5.6(c) and 6.5.7(c) of the NER.

42 Section 7 of the National Electricity Law (NEL)

SA Power Networks in the course of our engagement with consumers[43]—our customers have made it clear that they prefer that we continue to invest to drive further efficiency improvements in network asset management and mitigate inter-generational equity issues.

Our repex forecast for the 2020-25 RCP, which we have outlined in our Repex Addendum, is directly concerned with achieving the NER expenditure objectives (the capex objectives and opex objectives)[44] and the identified need of maintaining reliability and security of supply of network services and safety—both of the repex forecast options in the Repex Addendum propose to achieve this identified need but via higher or lower levels of repex spend. In support of the Repex Addendum, we note the following:

- The NER expenditure objectives entitle us to recover forecast expenditure for the 2020-25 RCP in order to maintain service performance and safety, and achieve compliance with our applicable regulatory obligations and requirements. Our applicable regulatory obligations and requirements includes our obligation to comply with the conditions of the licence we hold for our distribution network issued under the *Electricity Act 1996* (SA) (**SA Electricity Act**).[45]
- Our distribution licence conditions require us to maintain service performance and safety. For example:
  - We are required, as a condition of our distribution licence, to comply with applicable regulatory instruments (including any safety or technical requirements under the SA Electricity Act),[46] and to prepare, maintain and comply with a safety, reliability, maintenance and technical management plan.[47]
  - We are therefore required to comply with the SA Electricity Act and the regulations made under that Act[48] in relation to the design, installation, operation and maintenance of our infrastructure in a safe manner. The SA Electricity Act also requires us to inspect and clear vegetation from around power lines at regular intervals in accordance with prescribed requirements.
  - We are further required, as a condition of our distribution licence, to meet service standard levels contained in the South Australian Electricity Distribution Code. These include service standard framework targets for reliability of supply, customer service and Guaranteed Service Levels. The Essential Services Commission of South Australia (**ESCoSA**) is the jurisdictional body that establishes these standards.

4.3 Current capability/state

4.3.1 Achievements of the A&W Stage 1

[43] Clauses 6.5.6(e)5A and 6.5.7 (e)5A of the NER.

[44] Clauses 6.5.6(a) and 6.5.7(a) of the NER.

[45] 'Regulatory obligation or requirement' for the purposes of the NER is defined in the National Electricity Law (**NEL**) and includes an obligation or requirement under the NEL, which in turn includes an obligation or requirement under an act or instrument of South Australia (other than an act or instrument excluded by the definition), that materially affects the provision, by a regulated network service provider, of electricity network services that are the subject of a distribution determination. Under section 25(1) of the SA Electricity Act, we must not contravene a condition of our distribution licence.

[46] Under clause 7.1 of our distribution licence, SA Power Networks is required to comply with all 'applicable regulatory instruments', which is defined as meaning any 'local regulatory instrument' or any 'national regulatory instrument'. 'Local regulatory instrument' includes, amongst other things, the South Australian Electricity Act and the South Australian Electricity Distribution Code (which falls within the definition of 'industry code').

[47] Clause 8.1 of our distribution licence.

[48] Clause 7.1 of our distribution licence.

As outlined in the IT Investment Plan[49], the A&W program outcomes to date have improved our understanding of our assets, risks and work and directly contributed to:

- efficient deferral of $63 million in asset replacement expenditure in the 2015–20 RCP with an additional $142 million in efficient asset repex deferral and $20 million in other benefits to be realised in the 2020–25 RCP, equating to significant savings for our customers;
- commencing transition of asset management from high level management of 1,500 feeders and basing maintenance decisions on history, to identifying and managing more than two million individual assets and using current condition data to manage assets based on risk and value;
- improved focus on what our customers value, 'doing the right work';
- increased accuracy and timeliness of information given to customers; and
- improving the way we select work to maintain our network assets.

More detail on the A&W program achievements over the 2015-20 RCP (the '**A&W Stage 1**') can be found in the original business case[50]. This section provides additional information on specific aspects of the A&W Stage 1 relevant to scoping and benefit estimation of the proposed A&W program for the 2020-25 RCP (the '**A&W Stage 2**').

The A&W Stage 1 has implemented an asset hierarchy within our corporate IT systems for priority asset classes[51] and integrated defect information with this asset hierarchy. Prior to the A&W Stage 1 defects were recorded at an electrical circuit (**'feeder'**) level, whereas now more detailed defect and asset condition information can be recorded against specific assets, allowing for an estimation of an asset failure risk. This change is explained below.

Prior to the implementation of the A&W Stage 1 (Figure 2): Assets were not recorded in our corporate systems, which meant that we only had approximate estimates of asset age, count and geographic location, and no ability to assign defects to assets. Defects were recorded at a feeder level, with a free text description indicating defect location. Each defect was assigned one of three priority levels indicating a time period during which it should be fixed, with no facility to record further information necessary to estimate risk consequences of not fixing it. Asset replacements / refurbishments were driven by defect priority levels (indicative of probability of failure) with no regard to risk consequences or broader economic considerations such benefit to cost ratio.

[49] SA Power Networks: Supporting document 5.32 IT Investment Plan 2020-25, January 2019, pp. 65-66

[50] SA Power Networks: *Supporting document 5.42 Assets & Work Program Business Case, 2020-25 Regulatory Proposal,* January 2019, pp. 11-14

[51] Priority asset classes include poles, conductor, cable, distribution transformers, ground level switchgear and overhead switchgear, but exclude other asset classes such as pole top structures.

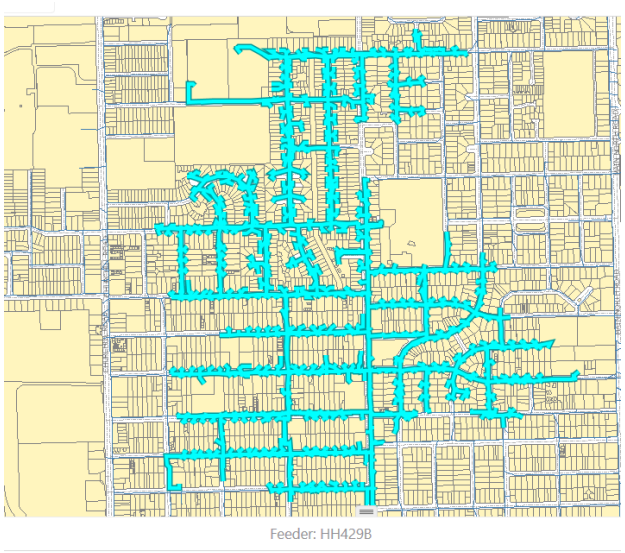

Figure 2: Defects recorded at feeder level

Figure 3: Defect/condition recorded against specific assets

Current state (Figure 3): Asset information including age, geolocation and condition is now recorded in our corporate system, SAP. This is currently implemented for priority asset classes only; the A&W Stage 2 aims to extend it to more asset classes. Defect information is recorded against specific assets, and includes an estimated cost to fix the defect (Replacement/Refurbishment Cost, also referred to as 'cost') as well as an estimated Risk Cost[52], also referred to as 'risk'. Risk Cost is estimated using an integrated valuing algorithm that considers multiple consequences of failure, with estimates of consequence costs informed by the number of customers impacted, public density, critical customers impacted, ground level vegetation/bushfire region and the presence of water courses.

Each asset for which a defect has been raised has a Risk Cost associated with failure, which is a function of the probability of failure (**POF**) and consequence(s) associated with the failure, eg bushfire, network performance, environment.

The Risk Cost associated with an asset failure can be described as:

$$Risk\ Cost = POF \times \sum_{x=1}^{y} [(Likelihood\ of\ Consequence \times Consequence\ Cost)_x]$$

With estimates of Risk Cost and Replacement/Refurbishment Cost attributed to each potential replacement task, we can now attempt to reduce replacement volumes while achieving the same safety and reliability outcomes by prioritising replacements with the highest ROI[53]. Asset replacements or refurbishments can now be informed by both probability and consequences of failure.

However, prioritisation based on the ROI is presently predominantly a manual task and only a small percentage of planned work is presently executed based on the ROI. Although in the 2015-20 RCP we commenced the implementation of capabilities and systems that will eventually allow us to optimise asset replacement/refurbishment work, including the implementation of the asset investment optimisation

[52] Risk Cost is not yet calibrated in our systems to represent a monetised value of risk in dollar terms due to current data and system limitations

[53] In the context of this document, ROI is the ratio of the Risk Cost associated with an asset failure to the Replacement/Refurbishment Cost of that asset

software, Riva, and an upgrade to our scheduling system, Click, there are significant barriers that prevent us from utilising these new capabilities to the full extent. These barriers are explained in the next section.

4.3.2 Gaps that are to be addressed to meet the identified need

The A&W Stage 1 enabled us to achieve significant benefits by laying the foundation for moving from asset replacement/ refurbishments based on defect priority levels to replacement/ refurbishments based on risk and cost (Figure 4).

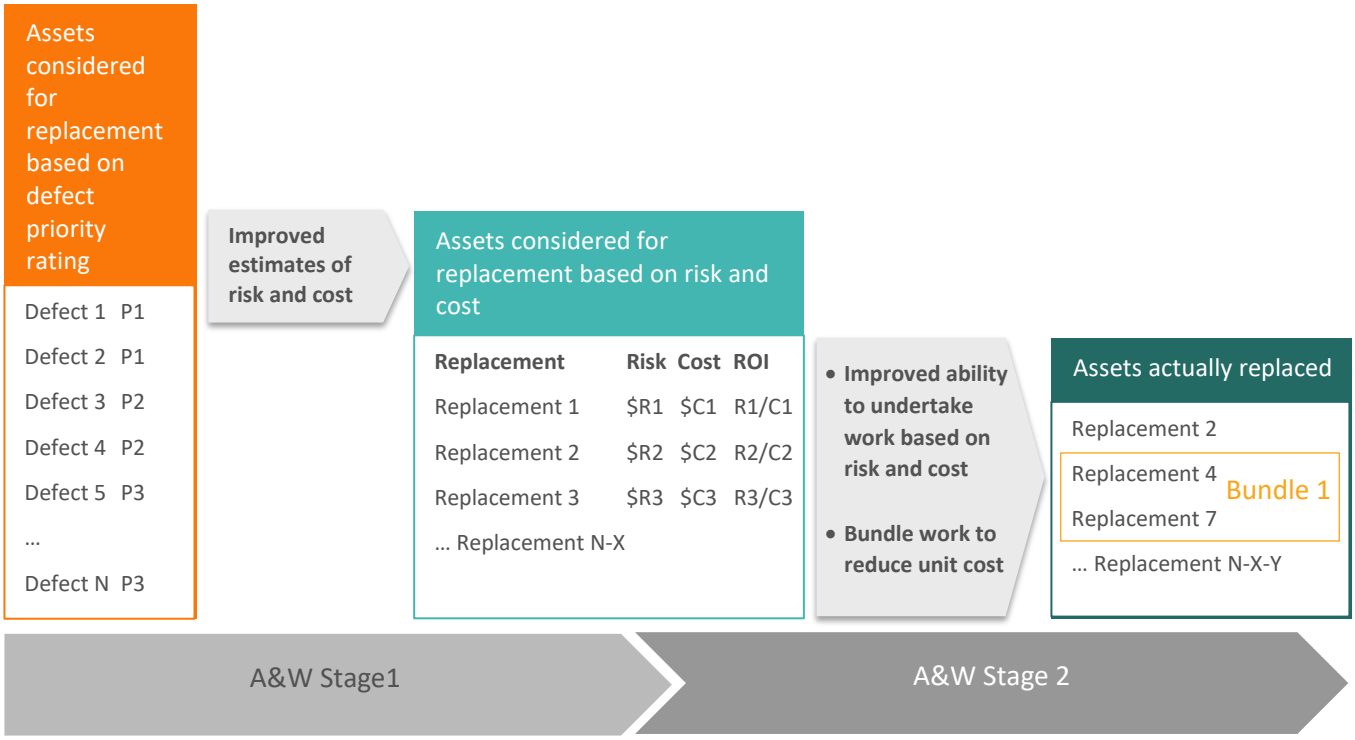

Figure 4: Work flow and A&W improvements

Our current systems and processes, however, provide limited ability to achieve further benefits. Current gaps include:

- limited integration between key systems, including SAP (which holds key asset information), Click, Riva and Advanced Distribution Management System (**ADMS**). For example, network switching information is stored separately from asset information; this limits our ability to optimise planned maintenance schedule and bundle jobs because switching information is critical in order to know which parts of the network can be isolated for work in a given day (due to physical limitations on the network), and to bundle work into an outage window;
- limited ability of our current disparate GIS platforms to provide accurate location information to our EAM system to support asset condition analysis and scheduling optimisation[54];
- lack of capability and systems to support end-to-end management of field work portfolio, from planning and estimation to resource allocation, job execution, and operational and management reporting;
- inaccurate Risk Cost estimates due to insufficient or inaccurate risk and cost data. Our systems are not set up to enable collection and management of additional data, for example:
  - risk and cost information can currently be recorded only for priority asset classes;
  - failures are still recorded at a feeder level and cannot be linked to the corresponding assets, which limits our ability to improve POF estimates;

[54] The associated need for modern consolidated GIS platform is addressed in the GIS Consolidation business case accepted by the AER in its Draft Decision

- inaccurate and inefficient Replacement/Refurbishment Cost estimates. International asset management standards recommend using compatible units (**CU**s) to estimate labour, materials, services, and resources that are required to perform a work order. Our systems are not set up for CUs leading to higher error margins in Replacement/Refurbishment Cost estimates and potentially higher repex due to more laborious estimation processes than when CUs are used.

This results in:

- significant challenges in work planning and execution based on risk and cost due to other conflicting priorities and lack of system integration;
- ineffective work bundling due to numerous limitations and constraints including lack of switching information, resource constraints and unplanned work; and
- suboptimal asset replacement decisions due to large error margins in our risk and cost estimates.

These three issues are discussed in more detail below.

Significant challenges in work planning and execution based on risk and cost

While we have improved our estimates of risk and cost during the A&W Stage 1, *planning, scheduling and executing* work based on risk and cost (ie optimising our replacement expenditure to maintain service performance and safety) remains a manual process. Our analysis of the effectiveness with which asset replacement or refurbishment work is currently selected and executed on the basis of estimated risk and cost, measured by WSE, confirmed that there is significant room for improvement. This improvement, however, cannot be achieved with our existing processes and systems due to lack of integration between systems, insufficient information to inform our scheduling, and underlying process complexities.

Given the complexity of planning and scheduling thousands of tasks from a constantly growing pool of over 150,000 defects across the state, we are limited in our ability to manually select work based on risk and cost. Figure 5 illustrates the increasing number of tasks we are scheduling. Further complicating this process is the fact that manual scheduling also attracts costs, such as the scheduler's time, and creates downstream impacts such as switching bookings, customer communications, and travel time optimisation.

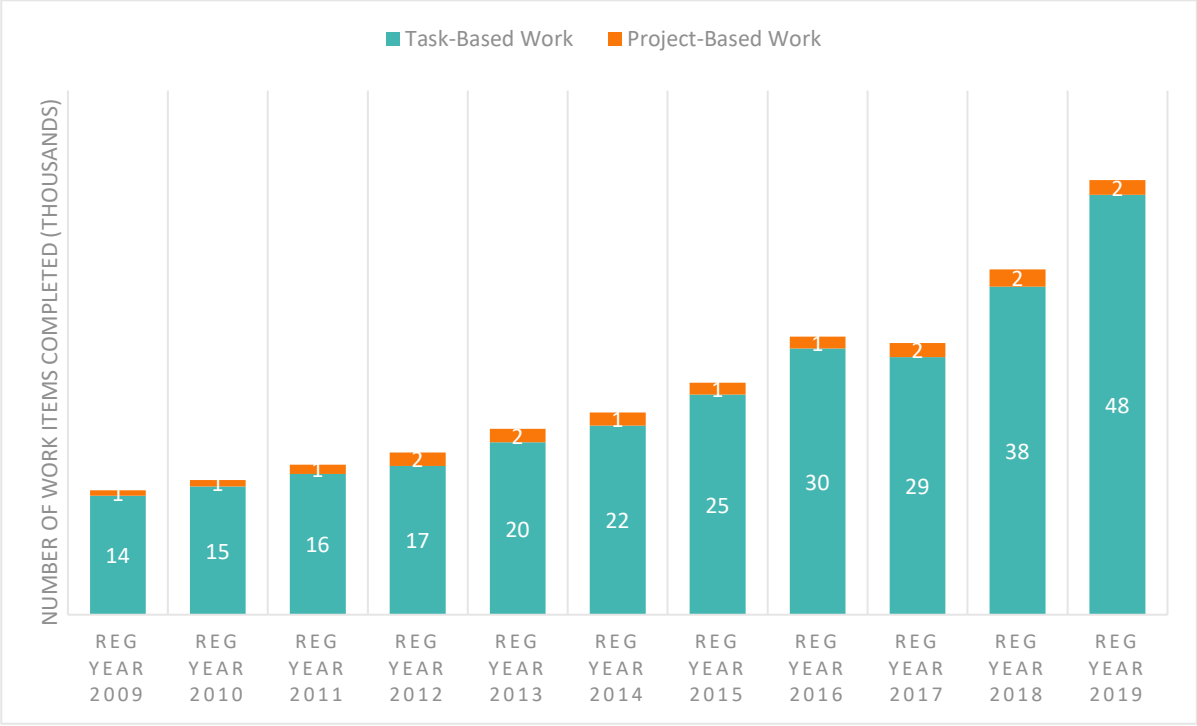

Figure 5 Number of planned tasks completed annually

Improvement to the optimisation of our work selection based on risk and cost, modelled by WSE, will be made in A&W Stage 2. This benefit will result in a reduction in replacement or refurbishment *volumes*[55] against our base case and is quantified in this business case.

Ineffective work bundling

Our current planning and work scheduling systems and processes are not integrated with some key IT systems, such as our switching scheduling system, inventory management system and resource management system. This results in limited ability to bundle asset work, due to insufficient information for scheduling optimisation software to be able to identify work orders that can be executed together to reduce travel time, planning and switching costs, and improve resource utilisation. Implementation of bundling improvements will result in a reduction of *unit costs* of asset replacement or refurbishment work, which is also quantified in this business case.

Suboptimal asset replacement decisions

The optimal timing of an asset replacement relates to the Risk Cost and Replacement/Refurbishment Cost. There is a degree of uncertainty in the Risk Cost and Replacement/Refurbishment Cost associated with each asset. This uncertainty leads to some assets being replaced earlier or later than optimal, potentially leading to under-utilisation of useful asset life or Risk Costs exceeding replacement costs.

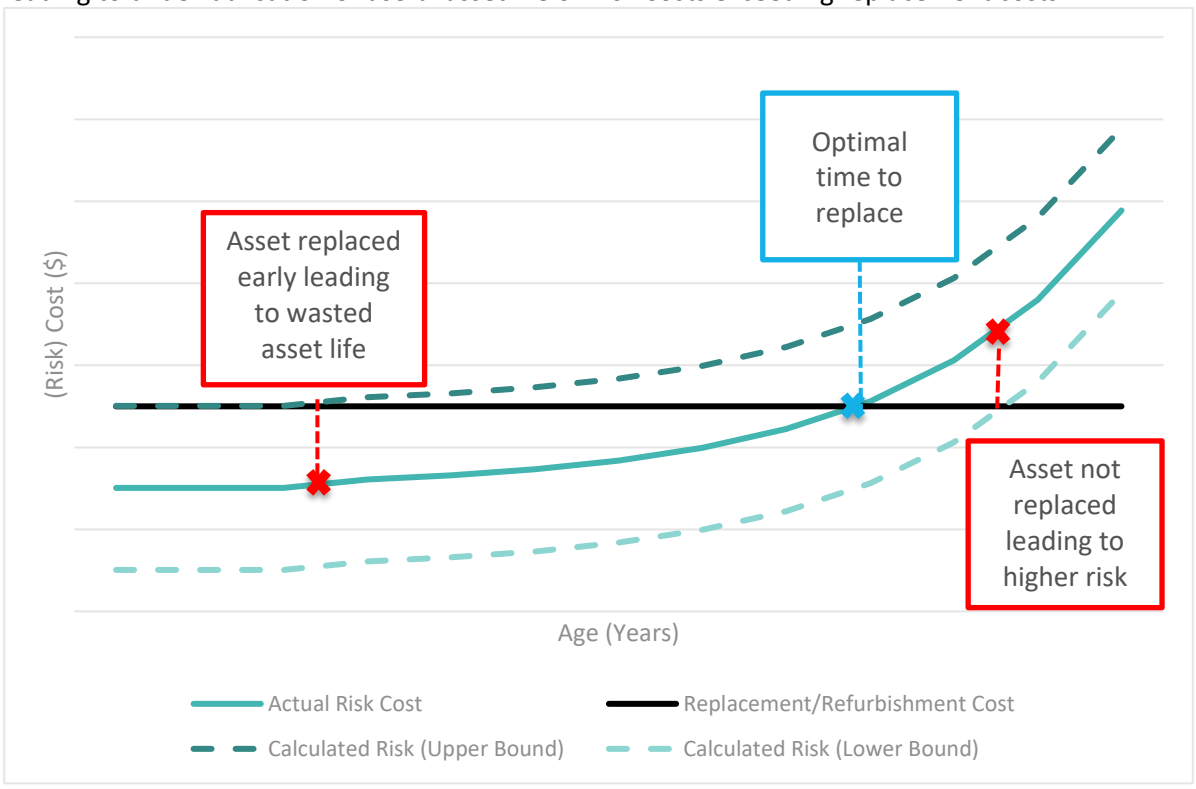

Figure 6 Risk Cost vs Age - adapted from AER Asset Replacement Guideline

At the asset population level this uncertainty leads to higher expenditure to maintain the current risk profile than would be achieved with better information, with assets being replaced too early, assets remaining in service with excessively high risk of failure, and some asset failures eventuating that could have been economically avoided.

[55] The benefit is about efficiently managing the volume of work by delaying work until it is economically optimal to do it.

As our asset data, analytics and cost estimating improve, the error margin around the risk/cost of individual assets is reduced leading to a reduction in the actual cost to maintain service performance and safety at the asset population level. The complexity of this analysis is compounded by the fact that replacement cost is a function of scheduling (costs can be reduced by bundling).

While A&W Stage 1 has improved our ability to target risk by estimating the cost of consequence, there is opportunity to further improve our estimate of probability of failure and to make use of data sources other than inspection data to estimate risk. For instance, as discussed in Section 4.3.2, asset failure information (as distinct from condition information) is still recorded at an electrical circuit level in our IT systems and is not linked to specific assets. Investing in our systems to link failure information to specific assets and utilising past failure information to estimate probability of future failures will further improve our risk estimation accuracy.

4.4 How the A&W program Stage 2 closes the identified gaps and addresses the identified need

Our Strategic Asset Management Plan (**SAMP**) recognises the challenges described in Section 4.2 - The identified need and outlines our response strategies, which include gaining efficiencies through investing in our systems and work delivery processes[56]. The A&W program, developed in alignment with the international standard in asset management ISO 55000:2014, supports the SAMP and delivers on the identified need through a roadmap to efficiency improvements that encompass changes to our processes, data, people and systems. During the development of this Addendum, we engaged an independent industry research company Gartner[57] to assist us in validating the proposed A&W Stage 2 program. Gartner confirmed that our approach is aligned with good industry practices and that experience of many similar organisations around the world implementing similar programs has demonstrated marked improvements in the efficiency and effectiveness of their asset management processes and financial outcomes without compromised network performance[58].

The A&W program comprises five interlinked workstreams that deliver IT system and process improvement across the entire asset management lifecycle. The five workstreams (described in detail in the original business case) are summarised below.

- **Asset Data Optimisation.** As described in Section 4.3, not all our asset classes are presently recorded in SAP and while defect information is now linked to assets, failure information is still recorded at a feeder level. As part of this workstream, asset data structures in our corporate systems will be optimised to enable recording and management of additional asset-related information for a wider range of our assets. This will allow us to:
  - better understand asset condition through multiple sources of asset data (inspection, drone, field); and
  - better understand probability of failure through field failure data capture.

  This will also establish a foundation for extending the data capture on asset failures to customers via functionality similar to our Street Light Out application.

[56] SA Power Networks, *Strategic Asset Management Plan – Manual No. 15*, November 2018, pp. 68-71

[57] Gartner Inc. is the world's leading independent research and advisory company. We consulted with Gartner during the development of this Addendum to ensure alignment with good industry practices and to validate our estimated benefits using Gartner insights into relevant experience of our peers around the world.

[58] Verbal communication by Gartner's Senior Director – Energy and Utilities.

- **Asset Investment Optimisation.** Using the improved asset information delivered by the Asset Data Optimisation workstream, and more accurate estimates of the cost of work achieved through the Work Lifecycle Standardisation workstream, Asset Investment Optimisation will further develop our analytical systems and algorithms piloted in the 2015-20 RCP to better model Risk Cost and Replacement/ Refurbishment Cost. This will reduce error margins in our risk and cost estimates and improve prioritisation of work to ensure assets are considered for replacement at an economically optimum time.

- **Work Lifecycle Standardisation.** This workstream will introduce compatible units (CUs) to standardise design, planning and estimation of asset replacement and refurbishment work. CUs are engineering templates that are used to define labour, materials, services, and resources that are required to perform a work order, such as replacing a pole, in a standardised way. CUs are used as the basis for estimating the costs and resource requirements that are associated with work orders and for assessing actual performance against standards. Using CUs and improved integration between design and estimation processes will:
  - reduce the overall cost of work orders due to reduced planning and estimation effort; and
  - improve accuracy of the Cost of Replacement/ Refurbishment estimates.

- **Service Delivery Optimisation.** As discussed in Section 4.3.2, identifying the highest value work at the planning stage is not sufficient to ensure the highest value work is actually executed due to insufficient integration between our asset management and scheduling systems, complex relationship between work types, switching requirements, voltage restrictions and resource availability. The latter also prevents effective bundling of work. Service Delivery Optimisation will integrate and enhance our systems to ensure all relevant information is available to inform scheduling. This, in turn, will ensure the highest value work (identified at the planning stage) is undertaken, and the work is bundled when appropriate to reduce travel, switching and other associated costs.

- **Portfolio Planning Management.** This workstream will improve capital budgeting, forecasting and tracking of capital spend against plan. It will also integrate and extend our capital portfolio planning systems and processes to put the resources where the highest value work will be. With our resources dispersed across 28 depots and allocated to multiple job types including customer projects and unplanned / emergency work, optimising resource allocation to deliver on optimised schedule is a complex task not currently supported by our systems and processes.

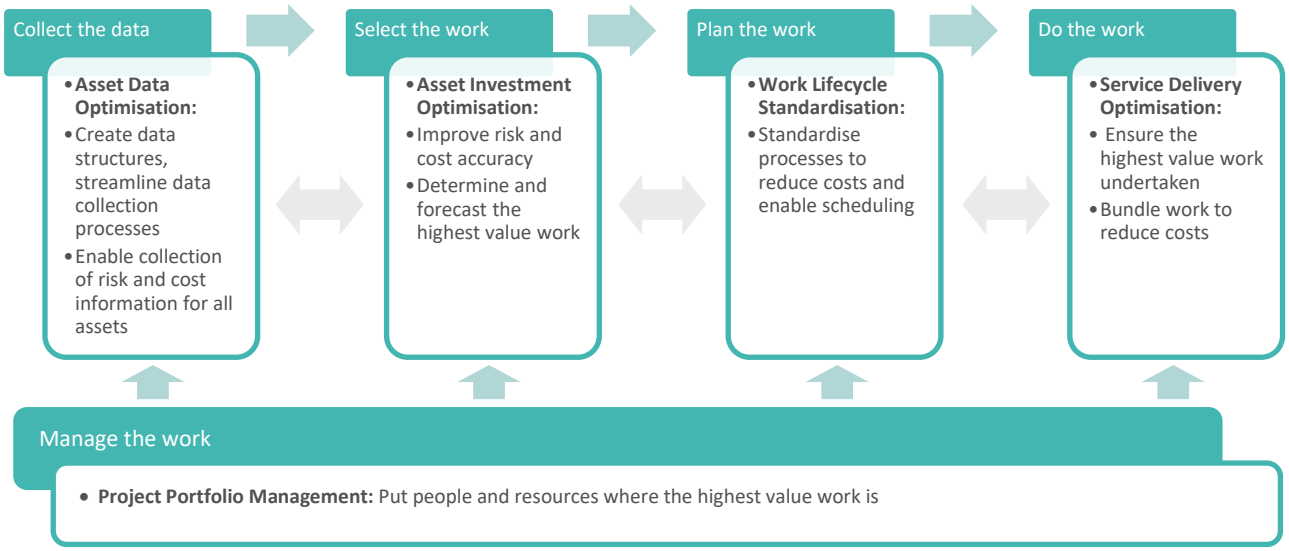

Figure 7: A&W program outcomes

Through implementing these system and process improvements the A&W program will address the identified need of minimising the costs of repex required to maintain reliability, safety and performance of the network by:

1. **Reducing the *volume* of replacements and refurbishments.** As illustrated in Figure 4, the program achieves reduced volumes through:
    a. **improving our estimate of risk and cost at an asset level** to better understand the cost/benefit of a specific replacement investment, due to:
        i. an improvement in asset data accuracy and analytics to improve our estimate of probability of asset failure, and likelihood and cost of consequences; and
        ii. an improvement in asset replacement/refurbishment cost estimate; and
    b. **improving our ability to plan and schedule work based on the estimate of cost/benefit** to reduce the volume of replacement required to maintain reliability and safety, due to:
        i. an improvement in our effectiveness to select the work which has the highest benefit to cost ratio, or ROI, constrained by resource location; and
        ii. an improvement in our resource allocation (ie allocation of field resources to regions where the work of highest value is likely to arise, such as by temporarily accommodating employees from other regions) by forecasting work geographically across our entire portfolio; and

2. **Reducing the *unit cost* of replacements and refurbishments.** The program achieves reduction in repex unit costs through:
    a. **reducing the cost of undertaking work through service delivery optimisation** via improved ability to bundle work where this results in lower cost because of the reduction in travel and the number of instances of switching off the network and improved preparation steps; and
    b. **reducing the cost of undertaking work through standardisation** across work lifecycle via CUs and integration.

In addition, implementing each of these initiatives will deliver efficiencies across the organisation through automation of manual tasks and integration between our asset and work management systems resulting in reduction in manual labour required to undertake work in the field (mobility) or office, such as reducing manual scheduling or use of paper forms and checklists.

4.5 Options considered

The original business case included three options with the same scope but different implementation schedules, with Option 1 having the longest implementation timeframe spanning two RCPs. While Option 1 had the lowest NPV compared to the other two options, it was selected as the recommended option due to the lowest project delivery risk. As the deliverability considerations remain valid, this Addendum does not consider the accelerated implementation timeframes set out in Options 2 and 3 of the original business case, but focusses on further refinement of Option 1, comparing it with the base case (Option 0) of not continuing the A&W program beyond 2020.

4.5.1 Option 0 (Base Case): Do Nothing – Do not continue the A&W program past 2020

If we do not continue the A&W program into the 2020-25 RCP, there will be no further improvements to the asset management capabilities compared to those implemented in the current, 2015-20, RCP.

The A&W program provides repex benefits through reduced replacement/refurbishment volumes and reduced unit costs (refer A&W Stage 2 Benefits in Figure 8). Without further improvement in our asset management capabilities we forecast planned replacement/refurbishment volumes to follow the observed upward trajectory. Our base case for A&W Stage 2 is based on a projected (10-year) repex trajectory (refer Forecast repex without A&W Stage 2 (Base Case) in Figure 8), taking into account improvements already achieved by the A&W Stage 1. Further detail on the base case repex forecast is provided in the Repex Addendum and Appendix H.

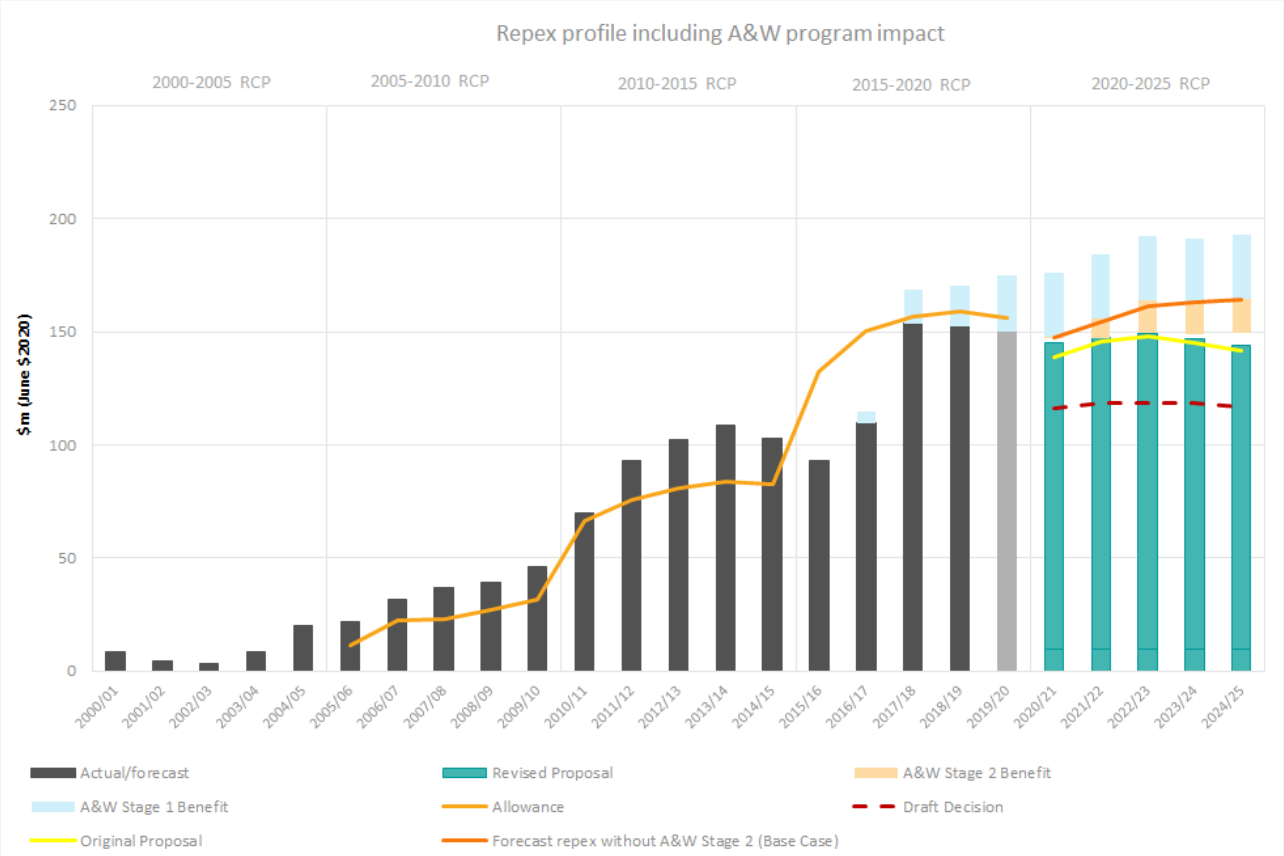

Figure 8 Repex forecasts

4.5.2 Option 1 – Continue the A&W program

Following the AER Draft Determination, we conducted a full review of the original Option 1 of A&W program aiming to maximise its value for money in the 2020-25 RCP and confirm alignment of the proposed projects to the delivery of the 'identified need' and the expected benefits. The revised roadmap for Option 1 is presented in Figure 9.

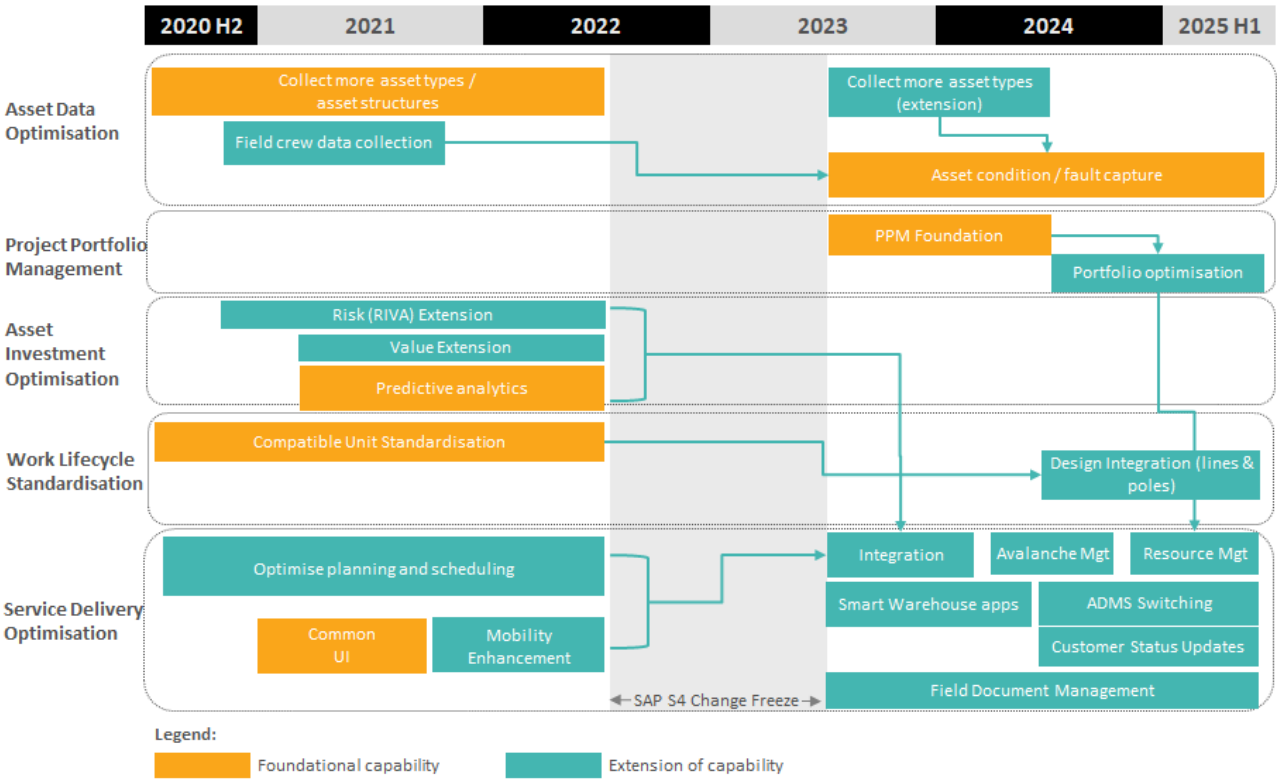

Figure 9: Option 1 projects roadmap. The projects shown in orange colour deliver foundational capabilities that must be in place before the subsequent projects in each stream can be implemented

The full scope of the A&W program including detailed descriptions of business and IT capabilities delivered by the proposed projects is provided in the original A&W business case[59]. As discussed in Section 4.1 of this Addendum, our revised approach focuses only on investments required in the 2020-25 RCP and the subsequent 15-year NPV resulting from this investment[60]. Appendix F compares the original and revised scope. Detailed descriptions of the projects proposed for the 2020-25 RCP are provided in Appendix B.

4.5.3 Option considered but not costed: Using manual processes

For completeness, we considered the option of using manual processes for service delivery optimisation and improving WSE instead of continuing the A&W program. If the information on Risk Cost and Repair/Refurbishment Cost is available, it may seem a feasible approach to use human operators to manually select the highest ROI tasks, because with modern desktop tools one can easily sort and prioritise hundreds of thousands of records.

In practice, however, this approach is not feasible. To prepare optimised plans and daily assignments for work crews one needs more information than simply Risk Cost and Repair or Refurbishment Cost. Each task

[59] Section 3 and Appendices E to I.

[60] This does not negate the need for the implementation of further initiatives beyond 2025, initially identified in our EAM Roadmap. However, as explained earlier in this addendum, any further initiatives will be considered closer to the 2025-30 RCP in light of experiences we gain over 2020-25, views we obtain from our ongoing stakeholder engagement, and prevailing technology options at the time.

requires information related to the nature of repair/refurbishment and estimated effort, required crew skills, tools, other resources (eg, expendables, third party contractors), combined with switching information.

The above information comes from different source systems. At present connecting them, even manually, is problematic because of different data architecture and the absence of common unique identifiers. Thus, a very significant manual effort would be required to just create a dataset suitable for optimised planning. As an example, creating an optimised schedule for one depot in our analysis to support bundling assumptions presented in Appendix E required five days of effort for two specialist resources. This dataset would have to be combined with real-time data on the notified emergency asset repairs, which would create further challenges.

Given the complexity of data matching and manipulation required, it is unlikely that a team of analysts would be capable of managing this work at the acceptable level of accuracy and data integrity. Further, while manual processing can potentially be used for service delivery optimisation based on available data, the gap analysis in section 4.3.2 identified a number of gaps that can only be closed by a proper system solution, eg, our inability to record risk and cost information for non-priority assets, inability to link failures to the underlying assets, non-use of compatible units (CUs) for replacement/refurbishment effort estimation, etc.

On the basis of the above the option to strengthen human resources instead of IT investment was considered not feasible; no further analysis or costing was performed.

4.6 Options assessment

4.6.1 Cost benefit analysis

Option 1 has a positive net benefit in NPV terms, of $24.4 million over the 15-year period from 1 July 2020 to 30 June 2035 (Table 8).

Table 8: Costs and benefits of Option 1 relative to Option 0 (Base Case) over the 15-year period from 1 July 2020 to 30 June 2035, $million (Dec $2017)

Option	Total capex[61]	Total new opex[62]	2020-25 RCP capex[63]	Total deferred repex[64]	Discounted benefits from deferred repex[65]	Repex reduction due to bundling[66]	Other efficiency benefits[67]	NPV[68]
Option 0 (Base Case) – Do Nothing	-	-	-	-	-	-	-	-
Option 1 - Continue the A&W program	38.7	18.8	38.7	184.4	42.2	4.7	48.3	24.4

Assumptions:

- Repex Deferral Period: 10 years
- Pre-tax real WACC: 2.63%
- Percentage reduction in repex unit costs due to bundling (eg travel, switching): 5%
- Percentage WSE increase from 2020 to 2025: 9.5%

The sensitivity analysis conducted with respect to the above assumptions is provided in the following section (Section 4.6.2). Detailed cost-benefit analysis is attached in Appendix A.

The impact of the options considered in this business case on the 2020-25 repex forecast is provided in the Repex Addendum and summarised in Table 9. The impact of the A&W program on the 2020-25 repex

[61] Represents the total capex associated with the proposed option over the 15-year cash flow period from 1 July 2020 to 30 June 2035.

[62] Represents the total opex increase associated with the proposed option above the current level of IT opex, over the 15-year cash flow period from 1 July 2020 to 30 June 2035.

[63] Represents the total capex required within the 2020-2025 RCP.

[64] Represents the total deferred repex associated with the proposed option over the 15-year cash flow period from 1 July 2020 to 30 June 2035.

[65] Represents the total repex savings associated with the proposed option over the 15-year cash flow period from 1 July 2020 to 30 June 2035, obtained by subtracting the present value of the amount we need to spend on deferred asset replacement/refurbishment after the Repex Deferral Period from the present value of the total deferred repex.

[66] Represents the total reduction in repex expected from reduction in unit costs due to bundling of work in close geographical proximity over the 15-year cash flow period from 1 July 2020 to 30 June 2035.

[67] Represents the total capital and operating benefits other than repex over 15-year cash flow period from 1 July 2020 to 30 June 2035 expected across the organisation as a result of implementing the proposed option.

[68] Net present value (NPV) of the proposal over 15-year cash flow period from 1 July 2020 to 30 June 2035, based on discount rate of 2.63%.

forecast was included as a benefit in the above options assessment, as part of the repex deferral and repex reduction benefits attributed to the 2020-25 RCP.

Table 9: Impact A&W program on forecast repex, $million, Dec $2017

Repex forecast for the asset classes that benefit from WSE improvement	Forecast repex relevant to A&W[69] required to maintain current risk and performance levels during the 2020-25 RCP
Option 0 (Base Case): Do not continue the A&W program past 2020	423.8
Option 1: Continue the A&W program	374.3
Impact of the A&W program on repex forecast	**(49.5)[70]**

4.6.2 Sensitivity analysis

To test the proposal against a range of assumptions with respect to benefit expected from the investment, a sensitivity analysis was conducted with respect to the scenarios listed in Appendix G. The modelling described in Sections 4.9 and 4.9.1 further supports the assumptions made in these scenarios.

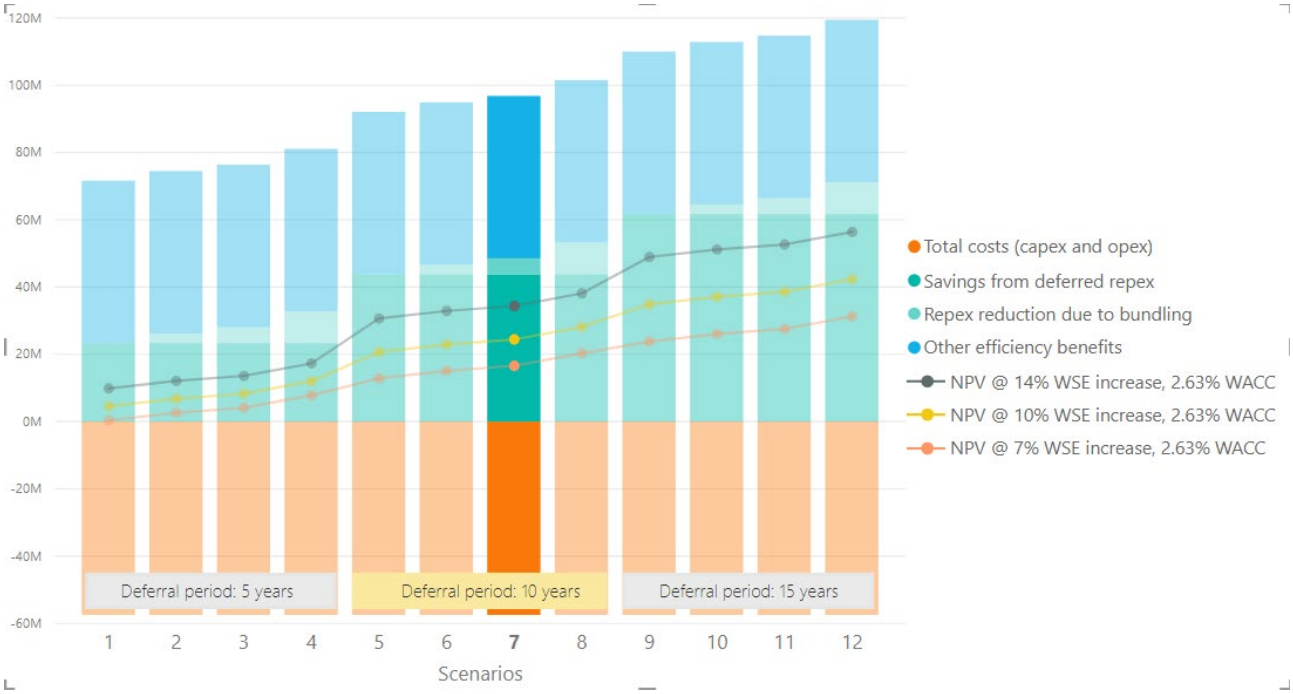

Figure 10: Costs, benefits and NPV calculated for the scenarios detailed in Appendix G. The scenario used in the options assessment (Scenario 7) is highlighted.

As can be seen from Figure 10, the analysis indicates that NPV remains positive under all scenarios for the 15-years NPV analysis period.

[69] A&W impacts the effectiveness of a subset of repex, relevant to for high volume asset classes, —the modelling of this program excludes other repex which is included in the total repex forecast, including: Zone Substation asset replacement, unplanned asset replacement and specific projects/programs.

[70] $49.5 million includes $49.3 million of repex deferral and $0.2 million of repex savings due to bundling. Corresponds to $52.7 million (June $2020), which is reflected in Supporting Document 5.4 - Repex Addendum as benefits from the A&W program.

We have also tested scenarios with a higher WACC, 2.74%, which resulted in further improvement in NPVs for all other combination of parameters.

4.6.3 Options comparison

Options comparison is provided in Table 10.

Table 10: Options comparison

Option	NPV	Customer implications
Option 0 (Base Case) – Do Nothing	-	• Maintains customer risk at current levels • Not getting the best value from repex spend • Fails to increase efficiency for this and future periods • Higher long-term cost
Option 1 - Continue the A&W program	$24.4	• Lower long-term cost • Ensures every dollar of repex counts • Retains momentum in our drive to improve efficiency, building on 2015-20 A&W program

4.7 Recommended option

Our objective is to minimise the long-term costs to customers of maintaining the performance and safety of our distribution network services to our customers as our assets age.

Option 1 is recommended because it:

- provides a better long-term economic outcome than Option 0 (Base Case);
- lays a foundation to optimise asset maintenance intervals in future periods;
- delivers sustainable customer savings in future periods;
- maximises value for money spent on repex; and
- retains momentum in our drive to improve efficiency, building on the achievements of the 2015-20 A&W program.

4.8 Estimated costs

4.8.1 Capex

The estimated capex to implement Option 1 is $38.7 million (Dec $2017) over the 2020-25 RCP. This is a reduction of $2.1 million compared to the original business case. The cost breakdown by program streams is provided in Table 11. Detailed cost models are provided in Appendix A.

Table 11: Capex, $'000s, Dec $2017

Expenditure type Program streams	2020/21	2021/22	2022/23[71]	2023/24	2024/25	Total
Capex						
Asset Data Optimisation	2,990	1,823	-	2,836	2,362	**10,011**
Project Portfolio Management	-	-	-	4,267	1,094	**5,360**
Asset Investment Optimisation	555	5,081	-	-	-	**5,636**
Service Delivery Optimisation	1,426	753	-	3,794	5,416	**11,390**
Work Lifecycle Standardisation	1,721	1,888	-	-	2,690	**6,299**
Total Capex	**6,693**	**9,545**	**-**	**10,897**	**11,562**	**38,697**

Note: Totals may not exactly match the sums of individual costs due to rounding.

4.8.2 Opex

The estimated opex for licenses and support costs associated with new technology to be implemented as part of the A&W program is $5.2 million (Dec $2017) over the 2020-25 RCP. This is a reduction of $0.3 million compared to the original business case[72]. The breakdown of the new opex by program streams provided in Table 12. Detailed cost models are provided in Appendix A.[73]

Table 12: New opex, $'000s, Dec $2017

Expenditure type Program streams	2020/21	2021/22	2022/23	2023/24	2024/25	Total
Opex						
Asset Data Optimisation	-	827	847	827	827	**3,328**
Project Portfolio Management	-	-	10	20	20	**50**
Asset Investment Optimisation	53	107	107	107	107	**480**
Service Delivery Optimisation	-	-	57	113	113	**283**
Work Lifecycle Standardisation	-	145	290	290	290	**1,015**
Total New Opex	**53**	**1,079**	**1,310**	**1,357**	**1,357**	**5,156**

Note: Totals may not exactly match the sums of individual costs due to rounding.

4.8.3 Cost estimation methodology

Costs were estimated following our standard costing approach for IT projects described in the IT Investment Plan[74], which included bottom up and top down costing based on:

- vendor and supplier quotes for new software and additional licences;
- experience of other distributors and entities implementing EAM improvements;

[71] There is no capex investment in A&W program planned for 2022/23 due to the SAP Upgrade change freeze planned for this year.

[72] Due to the removal of Customer Data Collection and Network Load Forecasting initiatives from the 2020-25 portfolio.

[73] We have not proposed any associated opex step change on that basis that we will use expected opex benefits resulting from our proposed IT investments (in this and other business cases) to offset the extent of expenditure shortfall that we will face in the 2020-25 RCP in implementing the identified needs across our whole IT proposal. Refer to the IT Investment Plan for further details. This approach was articulated to the AER in response to several AER Information Requests, and was not challenged in the AER's Draft Decision for the 2020-25 RCP.

[74] SA Power Networks: Original Proposal Supporting document 5.32 IT Investment Plan 2020-25, Appendix C3, pp.51-56

- a project breakdown of resources by year and capital/operational category completed by our internal subject matter experts and verified externally by Vesta and SAP; and
- the learnings from the implementations during the first stage of the A&W program.

4.9 Estimated benefits

As shown in Table 13, Option 1 delivers an estimated $96.1 million (Dec $2017) of cost avoidance and cost reduction benefits which yield a net benefit in NPV terms of $24.4 million over the 15-year period from 1 July 2020 to 30 June 2035.

The estimated costs and benefits of Option 1 over the 15-year period from 1 July 2020 until 30 June 2035 are shown in Table 13.

Table 13: Option 1 Cost and benefit summary by RCP, $million (Dec $2017)

Option 1 Summary by RCP	2020-25	2025-30	2030-35	Total 2020-35	Notes	Section Ref
COSTS						
Capex	38.7	-	-	**38.7**	(1)	4.8.1
Opex	5.2	6.8	6.8	**18.8**	(2)	4.8.2
Total costs	43.9	6.8	6.8	**57.5**		
BENEFITS						
Repex benefits						
Estimated repex deferral	49.3	60.4	74.6	**184.4**	(3)	App. A
Repex savings from repex deferral	11.3	13.8	17.1	**42.2**	(4)	App. A
Repex reductions due to bundling	0.2	2.3	2.3	**4.7**	(5)	App. E
Sub-total repex benefits	13.1	15.6	19.2	**47.8**		
Other benefits (cost avoidance and cost reductions other than repex)						
Capex	1.1	5.4	5.5	**12.0**	(6)	App. A
Opex	2.3	16.6	17.4	**36.3**	(7)	App. A
Sub-total - other benefits	3.4	22.0	22.9	**48.3**		
Total benefits	**14.9**	**38.1**	**42.2**	**95.2**		

Note: Totals may not exactly match the sums of individual costs due to rounding.

Notes:

(1) Total implementation costs over the 2020-25 RCP. The cost breakdown is provided in Section 4.8.1 of this document.
(2) New opex arising from the implementation. The cost breakdown is provided in Section 4.8.2 of this document.
(3) The total amount of deferred repex due to improved WSE.
(4) The modelling to derive repex savings from repex deferral amounts and assumed repex deferral periods is provided in Appendix A.
(5) The estimates and justification for these benefits are provided in Appendix E.
(6) The bottom-up estimates and justification for these benefits are provided in the cost models (Appendix A).

(7) The bottom-up estimates and justification for these benefits are provided in the cost models (Appendix A).

The detailed assumptions and analysis performed to confirm these assumptions are summarised in Table 14 and explained in the following sections.

Table 14: Benefits summary by type, assumptions made and modelling performed to justify the assumptions

Benefit type	Benefit source	Assumptions	Analysis / modelling performed to justify assumptions
Repex deferral	Ongoing reductions in repex required to maintain network risk levels due to improvements in work selection effectiveness	The rectification of known defects with lower ROI can be deferred by 5 to 15 years depending on the asset class and defect priority rating. For modelling purposes, we assumed an average of 10 years for all asset classes.	• Justification for deferral periods for different asset classes and priority ratings (Refer Appendix D). • Justification for max % improvement in WSE (refer Appendix C).
Repex reduction due to bundling	Estimated reduction in travel time (plus any other costs, e.g. switching) due to bundling	5% of the annual travel budget for planned work estimated at $9 million p/a.	• Comparison of actual data with simulated data run through Click optimiser (Refer Appendix E).
Other efficiency benefits	Avoiding increased costs of manual data entry, data updates & calculations Improved inventory management Improved drafting efficiency	Various, included in the bottom-up cost-benefit models	• Estimates from internal SMEs (refer detailed cost models in Appendix A). • Verified by Gartner asset management specialist based on industry research.[75]
Non-quantified benefits	Better ongoing ability to select / identify work according to its service cost vs option cost.	N/A	Not quantified.

4.9.1 Repex deferral

The chart in Figure 8 shows the total repex profile including historical expenditure and our repex forecast submission. We used the long-term trend for high volume asset classes[76] (which incorporates the impact of A&W Stage 1) to estimate repex deferral benefits from the A&W Stage 2.

The benefit of A&W in terms of deferred repex delivers much of the difference between the A&W 'do nothing' scenario (10-year trend) and our repex forecast submission (which assumed a 5-year average).

[75] Refer, for example, Gartner, *Cost Cutting in Utilities Can Come from Better Asset Management*, April 2008

[76] The asset classes that are relevant to high volume work scheduling. Only those asset classes benefit from WSE improvements and have been included in the WSE improvement model.

Improving our ability to undertake work based on the estimate of cost/benefit (WSE)

While significant repex reductions have been achieved through A&W in the current RCP, it has become evident that further improvements in scheduling and planning of asset replacement/refurbishments to achieve an optimum risk reduction per dollar invested cannot be achieved with our existing processes and systems due to the shortcomings explained in Section 4.3.2. We seek to address these shortcomings as part of the A&W program for the 2020 – 25 RCP.

Through the A&W program, we will improve our WSE reducing the volume of asset refurbishments / replacements that would otherwise be required. This will be achieved by automating the planning and scheduling of work and integrating our scheduling systems with other systems to enable optimisation on a risk/cost basis.

WSE improvement model

The benefit of this reduced volume of work has been modelled using the WSE improvement model described in Appendix C.

Deferral period

Our current inspection regime for most of our assets (outside of Zone Substations) is a 5- or 10-year cycle dependent on the corrosion zone of the asset (the corrosion zone being related to the degradation rate of most of our assets).

For the purposes of our NPV analysis, we have assumed that repex tasks will be deferred on average by two 5-year inspection cycles. At a subsequent inspection the condition data associated with the asset will be updated. If the asset has degraded further (which is likely) the new condition data will lead to a higher risk value which may lead to the work being undertaken.

As a reference, our subject matter experts expect the deferral periods to be in line with the Table 17 provided in Appendix D. We have used these values to conduct a sensitivity analysis on the deferral period and found the A&W program to have an even higher NPV using these values.

4.9.2 Repex reduction due to bundling

In addition to improving our WSE, the A&W program will enable a reduction in the unit cost of undertaking repex work. Whilst augmentation expenditure (**augex**) and customer connection work are typically time-dependent (ie they must be undertaken at a particular point in time), our approach to repex allows flexibility in the scheduling of replacing defective assets[77].

The flexibility of repex work allows multiple repex tasks located in close proximity to each other to potentially be scheduled to be undertaken together – the tasks are 'bundled'. Further, a repex task may be scheduled to be undertaken along with a (time-critical) augex or customer connection task. By undertaking multiple tasks on the same segment of the network, the unit cost of the repex task is reduced through a reduction in travel time, electrical switching, customer notification and traffic management.

[77] Augex often relates to a network constraint such as a capacity shortfall which is time dependent. Similarly, the timing of customer connection work is typically determined by customer need and scheduled on a specific date. The timing of replacement expenditure is less fixed and is therefore more readily bundled.

This effect is illustrated in Figure 11 below:

Figure 11: Effect of bundling

While bundling of work can be achieved to some extent through manual processes, the complexity of scheduling thousands of tasks across the state and across multiple depot workgroups, and the interrelation between scheduling and the benefit/cost ratio means that there is potential for improved bundling through automation. The modelling undertaken to support bundling benefit estimates is described in Appendix E.

4.9.3 Other efficiency benefits

Other efficiency benefits associated with the proposed program were estimated by our internal subject matter experts and verified by Vesta based on their experience implementing EAM improvements in similar organisations with comparable initial EAM maturity levels. During the development of the original business case, we re-evaluated these benefits based on the benefits achieved by the first stage of the A&W program.

For this Addendum, only the benefits directly associated with the projects proposed for the 2020-25 RCP were retained. In our discussions with Gartner as part of the development of this Addendum, Gartner confirmed the validity of our assumptions behind these benefits and that that our approach to benefit identification and realisation is in line with industry best practices.[78] The summary of these benefits is provided in Table 15. Detailed estimates are provided in the cost models included in Appendix A.

Table 15: Summary of estimated efficiency benefits

A&W program stream	Benefits description
Asset Data Optimisation	• Avoided costs of manually collecting asset information and condition data • Automating of asset condition data processing • Avoided costs of manually entering and updating asset information in multiple systems
Portfolio Planning Management	• Improved inventory management

[78] Based on verbal communication and written report by Gartner's Senior Director – Energy and Utilities, Lloyd Jones.

	• Planning efficiency due to visibility of capital projects • Regulatory submission preparation efficiency
Asset Investment Optimisation	• Avoided cost of manually analysing asset age and condition data • Avoided costs of manual data updates
Service Delivery Optimisation	• Improved resource utilisation • Avoided manual data processing costs for regulatory reporting and submission preparation through improved capture of actual work data linked to our asset register and regulatory accounts • Reduced time to find and collate all documentation necessary to perform planned and unplanned work • Automated or improved the 'job ready' activities such as authority for traffic management and switching
Work Lifecycle Standardisation	• Drafting efficiency savings • Estimation automation • GIS data entry savings

4.9.4 Non-quantified benefits

In addition to those benefits outlined above, there are three additional groups of benefits that are expected to lead to a tangible reduction in repex but have not been quantified through modelling.

Improved estimates of likelihood, consequence and cost

To date the A&W program has largely been aimed at improving our ability to estimate consequence, with little improvement in our ability to estimate probability. The use of consequence data to improve risk targeting in the current RCP is estimated to defer $63m of repex in the 2015-20 RCP and $142m in 2020-25 RCP. This reduction has been achieved through a step change in our ability to estimate the likelihood of consequence and consequence of an asset failure and using this estimate to inform work scheduling.

The A&W program in 2020-25 will be aimed at improving our ability to estimate probability of failure, in part by linking asset failure data to specific assets. However, given that the improvement in accuracy from the data proposed for 2020-25 as part of the A&W program is unknown, we are unable to estimate the reduction in investment achievable through gathering and using the data. Improving our understanding of risk and better targeting investment may result in a further repex deferral, however this deferral has not been quantified.

Improved WSE through long term resource forecasting

Service Delivery Optimisation is expected to improve WSE at a *work depot* level, however WSE can be further improved at a *whole of network* level by moving labour resources between depots.

The maximum WSE achievable with optimisation remains constrained by the availability of resources at a given work depot. Field resources are allocated to a specific work centre (ie field employees work at a specific geographical work depot to efficiently respond to unplanned outages). The optimum plan at a whole of network level (ie 100% WSE) would require employees from one depot to undertake work at

another potentially located 1000km from home. The cost of travel would almost certainly negate the improvement in WSE by allocating employees to tasks at alternate work centres.

To further improve our WSE, the A&W program aims to reduce the resource constraint by providing a portfolio forecast view of all work types geographically. By forecasting risk and resource demand for all work types (including opex, augex and customer connection) resources can be re-allocated to the appropriate work centre to achieve an improvement in WSE. This is enabled through the Portfolio Planning stream.

This improvement is reliant not only on our ability to forecast work (including resource hours required) and risk, it is also dependent on our ability to re-locate field staff. A 100% WSE would rely on field staff constantly moving (without cost) between work centres which is not achievable. The improvement in WSE through staff movement between work centres is expected to improve our WSE and thus defer repex by a tangible amount, however this amount has not been quantified.

Preserving optionality

Improving our ability to more precisely understand the Risk Cost associated with our network assets will not only allow us to efficiency defer repex / refurbishment works, but also increase the chance that we can optimise or avoid future repex work further. For example:

- there may be some future opportunities to decommission some small network assets (likely to be small) owning to more efficient solutions becoming available, such as the provision of Standalone Power Systems to customers;
- some assets may be replaced as part of augex or Customer Connection work. For example, an existing pole in poor condition may be replaced with a larger pole to support a pole-top distribution transformer installation for an augex or Customer Connection project. Had the pole been replaced like-for-like as a repex investment, the pole would subsequently be replaced with a larger pole for the augex/Customer Connection. This cost is avoided by deferring the pole replacement; and
- the longer a replacement task is deferred, the more likely it is that an opportunity to bundle the task with other work will arise. This bundling allows the task to be undertaken at a reduced cost, ie the deferral benefit becomes a cost reduction benefit.

4.10 Consideration of deliverability

SA Power Networks has been able to successfully deliver programs of similar sizes in the past, with a mix of consultants, vendors and internal staff. We have used our standard IT Portfolio and IT Delivery methodology and capital expenditure governance processes to estimate and manage the project effort and availability of resources across projects. We have also incorporated learnings from the A&W Stage 1 into this proposal.

The original business case included three options that differed in the duration of the program, with Option 1 having the longest implementation timeframe spanning two RCPs. While Option 1 had the lowest NPV compared to the other two options, the original business case recommended it as the recommended option due to the lowest project delivery risk. In assessing the delivery risk, we considered A&W program in the context of the overall IT portfolio and evaluated each of the dependencies between A&W program and other proposed programs including SAP upgrade and GIS consolidation. In our revised approach we did not consider Options 2 and 3 for deliverability reasons and further refined the program scope of Option 1 for the 2020-25 RCP to ensure it can be delivered in conjunction with the rest of the IT portfolio.

Our review of Option 1 resulted in a slightly reduced scope[79] compared to the original business case (Appendix F). We reviewed revised resourcing requirements and dependencies with our internal SMEs and confirmed that our revised proposal is deliverable both on its own and when considered in the context of the overall revised IT portfolio. Specifically, we:

- ensured that there are no planned A&W program activities in 2022/23 to take into account the impact of the SAP Upgrade on field services and asset management business areas;
- ensured all dependencies with the GIS consolidation program were taken into account; and
- kept larger and more complex A&W projects in the later in the period when there are less replacement and upgrade activities being undertaken.

[79] These activities were moved into 2025-2030 period and not removed from our EAM Roadmap

APPENDICES

A. Financial models

1. NPV analysis, including cost deferral model and sensitivity analysis

2. Cost and benefit models:
    a. AIO Option 1 Measured Implementation
    b. Asset Data Optimisation Option 1 Measured Implementation
    c. PPM Option 1 Measured Implementation
    d. SDO Option 1 Measured Implementation
    e. WLS Option 1 Measured Implementation

3. WSE models

4. Bundling models

B. Option 1 - IT capability and technology solutions

Table 16: Option 1 scope: IT capability and technology solutions proposed to be delivered during the 2020-25 RCP

Project ID / Name	IT capability	Technology solution outline
Asset Data Optimisation		
25-004_1_1 Collect more asset types / asset structures	Asset data management	• Extension of the work initiated in the A&W Foundation to define the data standards for additional assets • Build an asset model aligned with RIN requirements (Category Analysis and Economic Benchmarking) • Extending collection capability to capture information attributes that assist in RIN compliance • Activities to check the validity of the existing asset data against defined data standards and perform data remediation
25-004_1_4 Asset condition / fault capture	Technology asset condition / fault capture	Pilot for: • Establish a platform (Business Intelligence platform) to handle the data and algorithms to analyse data • Workflow/ process for manual verification, to formalise and automate processes where onsite presence can be replaced by office validation activities • Architecture and design of a data store to capture unstructured data (eg, photos/ LiDAR) and associated metadata • Integration to replicate the metadata to locate the unstructured data from GIS, asset management and asset operational systems
25-004_1_2 Field crew data collection	Field crew collect asset condition data	• Extend applications that capture asset data to field crew mobile devices • Improving work bundling methods to inform Field workers if there are asset collection needs in their schedule • Architecture and design of a data store to capture additional asset data including unstructured data on mobile devices
Asset Investment Optimisation		
25-004_3_1 Risk (RIVA) Extension	RIVA risk quantification	• Extract newly captured asset condition information from our asset data system • Automate maintenance risk value calculations for assets based on condition records and using standard valuing algorithms

Project ID / Name	IT capability	Technology solution outline
		• Automate work generation and valuing of work in the work recording system based on the risk value calculations • Dynamically re-prioritise backlog work when the risk quantification model is adjusted in line with refinement of asset replacement strategies
25-004_3_2 Value Extension	Integrated Value and Visibility program	• Integrate RIVA with predictive analytics and related external data to expand insights into assets and the distribution network • Extend work types to Substation Design, Reliability Improvements and Lights Out
25-004_3_3 Predictive analytics	Business Intelligence Analytics	• Enhance and integrate RIVA with predictive analytics to develop a model to forecast faults
Portfolio Planning Management		
PPM Foundation	Foundational capital investment visibility	• Implement and configure a PPM system with four portfolios: – Capex – Opex – Discrete Capex/ Opex – Customer Projects • Update Business Intelligence tools to combine project Budgeting from the enterprise budgeting system with Actuals from Work Management/ Project systems
Portfolio optimisation	Extended capital investment visibility and planning capability	• Further integrate PPM with Estimating (ProEst/ RealEst) and Asset Condition (RIVA) applications • Extend system functionality to improve non-financial asset data for RIN compliance • Extend system capital planning functionality to provide demand and expenditure forecasts for assets based on age, condition and risk
Work Lifecycle Standardisation		
25-004_5_1 Compatible Unit Standardisation	Integrate: • Planning systems • Estimating systems (ProEst and RealEst) • Drawing systems (IDMS Vault drawing storage) • Design Systems (Autodesk CAD design platform)	• Extend the use of Compatible Units across multiple systems, including planning, estimation and design
25-004_5_2 Design Integration (lines & poles)	Automated data transfer between processes (lines/poles)	• Automated Utility Design (**AUD**) (or equivalent solution) for poles

Project ID / Name	IT capability	Technology solution outline
Service Delivery Optimisation		
25-004_4_1 Optimise planning and scheduling	• Scheduling Enhancements • Scheduling Integration • Avalanche Management • Resource Management • ADMS Switching	• Update systems to enable real-time staff rostering and management during normal and avalanche situations • Integrate Work, Planning, Design and Estimation systems using compatible units • Update systems to enable Field Staff to pull work based on vehicle location • Update planning/ scheduling systems to maximise work value by real-time work bundling • Integrate major project planning systems with Scheduling and ERP systems • Provide system functionality for leaders to view worker certifications and licenses prior to allocating work
25-004_4_2 Fully work-enable mobile workforce	• Common Field User Interface • Mobility Enhancements	• Develop a common user interface to be used by all Field Staff • Make all job-related information available electronically in the field • Develop a messaging application to enable communication between depot and crew using a standard mobile platform • Provide ability to view spatial data in the field • Enable real-time status of a job and ability to close out in the field • Enable documentation to be available and viewed in the field, including the ability to update drawings • Develop and implement a 'Smart Warehouse' application
25-004_4_3 Customer Communication throughout the Work Management lifecycle	Provide progress updates to customers on work status	• Provide system functionality to: – update real-time work status in the field. – view customer information and assets in the field; and – update customer information in the field • Develop an app for customers to view work status
25-004_4_4 Field Documentation Management	Job readiness improvements and access to job and asset data in the field	• Develop and implement 'electronic job folders' using a standard platform and integration to information repositories • Integrate electronic job folders with the Customer Relationship Management system to support the customer view of work and related documentation • Broader integration with Engineering and Asset Information to support full Enterprise Content Management

C. WSE modelling

The WSE improvement model calculates the reduction in planned repex investment in high volume asset classes (also referred to as 'task based repex') required to maintain risk under differing WSE values (Figure 12). The model uses as an input the planned portion of the repex forecast for high volume asset classes that is required under the 'Option 0 (Base Case): Do Nothing' of this Addendum to maintain service performance and safety over the 2020-25 RCP assuming that WSE does not improve past 2020.

Our baseline WSE is derived from historical data from 2017 and 2018 using the actual work that was undertaken from the pool of available defects.

Future WSE for Option 1 in 2025 has been estimated via a two-step analysis.

Firstly, using the pool of available defect work as at the start of November 2019, and labour resources available for each work centre for November and December 2019, we constructed a theoretically optimal resource allocation plan for each work centre that maximises risk/cost, or ROI, for the two months. This step did not consider physical constraints that prevent an optimum work centre plan to be developed. This allowed us to derive a maximum WSE given the work and labour available. We note that this WSE is far from 100%, as our labour, materials, and vehicles are geographically dispersed across work centres and cannot be quickly and frequently re-allocated. Longer term resource re-allocation is expected to be enabled by the Portfolio Planning stream within the A&W program Option 1 but this has not been modelled.

Secondly, we sampled a single work centre plan to manually review each task, flagging physical constraints such as requiring switching, design, desktop review, or other issues such as requiring a specialist work group (eg Glove-and-Barrier work), or work needing to be done at night or on weekends (to minimise disturbance to customers). Using this analysis we constructed a realistic optimum plan for a single work centre for the two month period and compared this plan with the actual work plan to determine a difference between a realistic optimum and actual plan

Finally, we used this manually produced achievable work centre WSE and the ratio determined in step 1 to determine a reasonable estimate of the WSE achievable at a whole of network level when physical constraints are considered.

Integration of the switching management system, labour planning system, and defect management system, as well as improving data capture on work delivery operational constraints, are part of the Service Delivery Optimisation and the Work Lifecycle Standardisation streams within the A&W program Option 1 respectively. These streams will enable us to achieve this future state WSE target.

Note that even subsequent to all A&W program improvements, we do not expect a WSE of 100% to be feasible. Ensuring safe physical access to assets, total switching capacity of the network, total design resource capacity, customer interruption concerns, among other things, would still place limits on when work can be feasibly delivered, which do not necessarily align with achieving the maximum theoretical risk/cost.

We further note that the future WSE achieved through the A&W program was estimated via a manual, sampled method, as an automated, whole-of-population analysis is not currently possible. However, we believe this to be a reasonable estimate of what will be achieved through automation and integration. In fact, an integrated automated schedule may in reality exceed the WSE of this manually produced optimum plan.

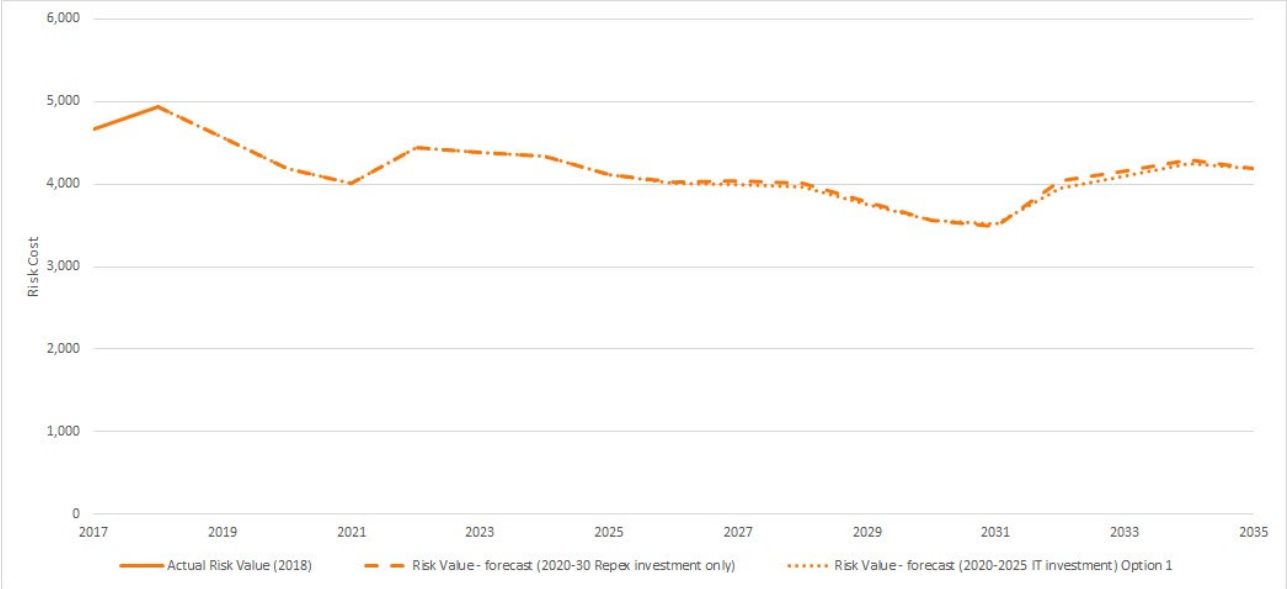

Figure 12: Option 1 Risk Cost is kept at the same level Option 0 Risk Cost due to improved WSE

The low risk/high cost work not undertaken in the current period in the WSE model is not avoided but is simply deferred into the future. The work may be bundled (at reduced cost) with other work or undertaken when the asset condition has sufficiently degraded to the point where the risk/cost ratio results in scheduling.

D. Deferral Period Estimates

The deferral periods below were estimated by our subject matter experts based on the available asset condition/defects information and are aligned with our minimum inspection cycles of 5 and 10 years. We note that condition /defects information has only been linked to priority assets[80] for a short period of time (through A&W Stage 1 – refer Section 4.3.1) and failure information remains to be linked to specific assets (proposed in A&W Stage 2 – refer Section 4.4). We do not have a sufficient data set to make quantified estimates of deferral periods have therefore relied on reasonable assumptions for the analysis. Our NPV analysis uses an average deferral period of 10 years for all assets.

Table 17 Estimated deferral periods

Asset class	Asset-Severity	Deferral Period		
		5 years	10 years	15 years
Poles	Pole-P1	✓		
	Pole-P2		✓	
	Pole-P3			✓
Pole Top Structures	Pole Top Structure-P1	✓		
	Pole Top Structure-P2	✓		
	Pole Top Structure-P3		✓	
Service Lines	Service Line-P1	✓		
	Service Line-P2	✓		
	Service Line-P3		✓	
Switchgear	Switchgear-P1	✓		
	Switchgear-P2		✓	
	Switchgear-P3		✓	
	Recloser-P1	✓		
	Recloser-P2		✓	
	Recloser-P3		✓	
Conductors	Conductor-P1	✓		
	Conductor-P2		✓	
	Conductor-P3			✓
Transformers	Pole Top Transformer-P1	✓		
	Pole Top Transformer-P2		✓	
	Pole Top Transformer-P3			✓
	Padmount Transformer-P1	✓		
	Padmount Transformer-P2		✓	
	Padmount Transformer-P3			✓

[80] Priority asset classes include poles, conductor, cable, distribution transformers, ground level switchgear and overhead switchgear but do not include pole top structures.

E. Bundling modelling

An estimate for the reduction in repex that can be achieved through optimised scheduling has been derived by comparing a sample actual execution log of planned defect remediation work with an optimised plan.

The actual work log included defect remediation work performed in the period from 1 April to 30 September 2019 by crews operating out of Mount Barker depot. The actual work log included job identifier, location latitude and longitude, start and end date/time, and repair crew name.

The dataset was manually loaded into our scheduling software, Click. The software optimisation parameters were set to remove existing constraints (which are currently in place due to system limitations, eg lack of switching information) seeking to minimise the total distance travelled by the crews to perform all the jobs.

The modelling results showed that the optimisation has led to a 34% reduction in total travel distance, from 8,700 km actual to 5,700 km optimised.

The model used some simplifying assumptions:

- distances were calculated along a straight line both for the actual and the improved state due to current system limitations
- job lengths used for scheduling were based on actual repair start and end times
- no emergency repairs that must be done on the day in addition to the planned work were considered.

More detailed assumptions were as follows:

- All crews had the capacity (availability) to perform work
- Field workers have been pre-allocated to crews
- Crews had the skills / tools / capabilities to perform any type of work
- No date or time constraints were applied (no appointment start/finish/due dates/early starts)
- Job tasks had no required or preferred engineers
- Data cleansing was performed where actual recorded duration was:
  - 1 minute: update to 15 minutes
  - Greater than 7.5 hours: update to 7 hours
  - Set duration to 1 hour where no record found
- No time and resource dependencies specified between tasks

In reality, crews would travel on the roads, jobs length estimates would never be fully accurate and emergency repairs would have to be added the planned jobs for a given day. However, a very significant (34%) travel reduction achieved in the model indicates that there is a large margin for optimisation.

The bundling benefit estimate used in the business case relates to travel costs. Travel costs include fuel costs, vehicle amortisation, and crew wages accruing during travel periods. All of these are proportional to the distance travelled.

The business case uses a 5% travel cost reduction assumption, which appears conservative in view of the 34% travel distance decrease achieved in the model.

F. Revised and original scope for the recommended option

Figure 13 shows the revised and original A&W roadmap for the recommended option. For this Addendum, we focus only on the investments required in 2020-25 RCP to achieve this long-term goal and include only the benefits arising from the 2020-25 investment. The opportunity for further investment in the A&W program beyond 2025 will be evaluated in the lead-up to the 2025-30 RCP on the basis of experience gained in the 2020-25 RCP and any technological, environmental or organisational changes at the time. This approach allows us to focus on those investments that are the most certain to deliver the most value at this time and continually improve plans for future stages in collaboration with stakeholders based on value delivered to date.

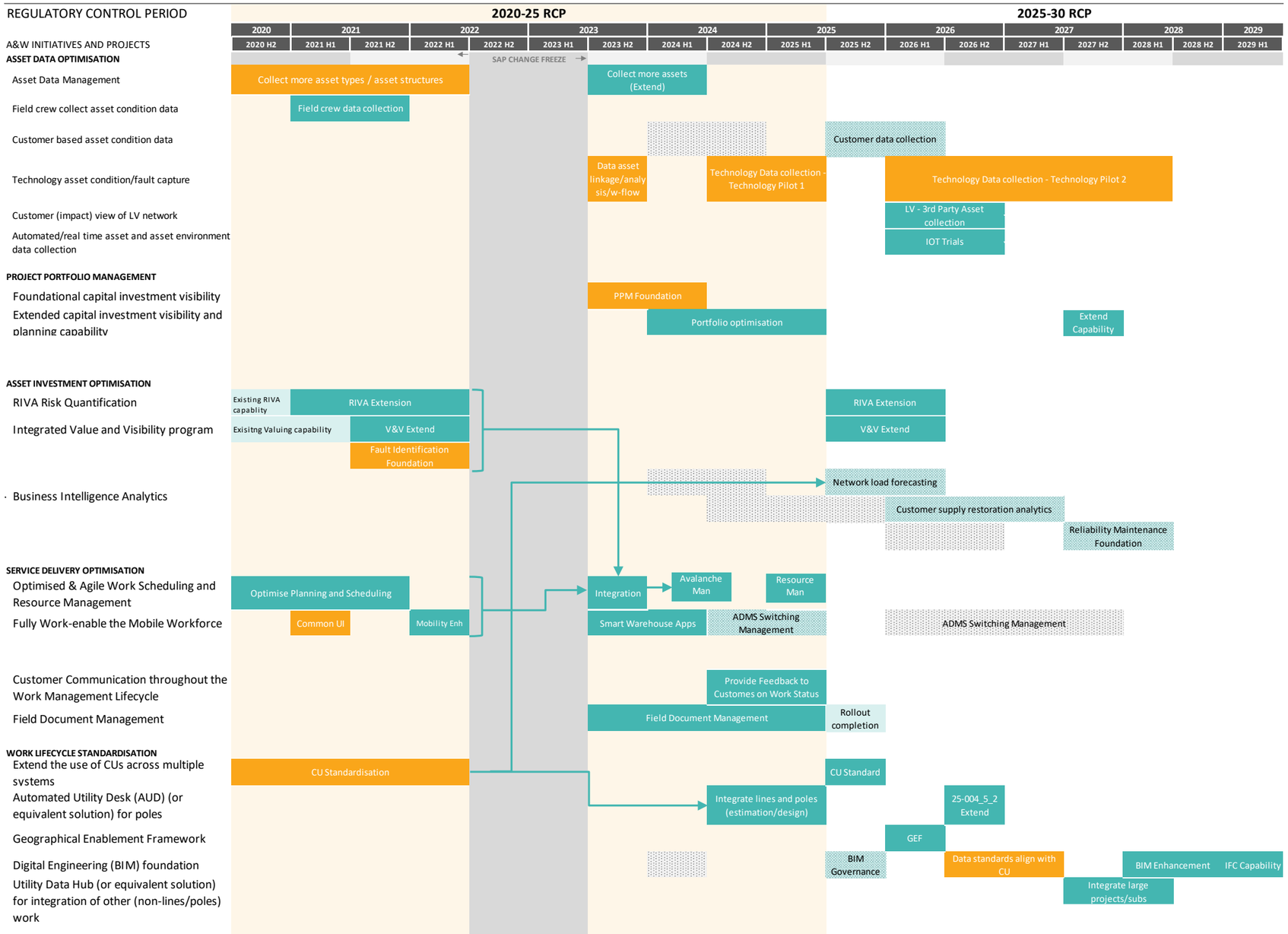

Figure 13: Revised and original roadmaps for Option 1

G. Scenarios for sensitivity analysis

Table 18: Scenarios considered in the sensitivity analysis. The shaded row indicates the base scenario considered in the options assessment

Scenario	% WSE increase by 2025	Average deferral term (years)	% of travel costs saved due to bundling
1	9.5%	5	0%
1	6.8%	5	0%
1	13.6%	5	0%
2	9.5%	5	3%
2	6.8%	5	3%
2	13.6%	5	3%
3	9.5%	5	5%
3	6.8%	5	5%
3	13.6%	5	5%
4	9.5%	5	10%
4	6.8%	5	10%
4	13.6%	5	10%
5	9.5%	10	0%
5	6.8%	10	0%
5	13.6%	10	0%
6	9.5%	10	3%
6	6.8%	10	3%
6	13.6%	10	3%
7	9.5%	10	5%
7	6.8%	10	5%
7	13.6%	10	5%
8	9.5%	10	10%
8	6.8%	10	10%
8	13.6%	10	10%
9	9.5%	15	0%
9	13.6%	15	0%
9	6.8%	15	0%
10	9.5%	15	3%
10	13.6%	15	3%
10	6.8%	15	3%
11	9.5%	15	5%
11	13.6%	15	5%
11	6.8%	15	5%
12	9.5%	15	10%
12	13.6%	15	10%
12	6.8%	15	10%

H. Repex forecast detail for A&W Option 0 (Base Case)

The base case Repex forecast was developed using a 10-year trend for planned repex for those asset classes that benefit from improved WSE and where a long-term trend was appropriate (refer Table 19).

Actual expenditure from 2010/11 to 2018/19 and forecast 2019/20 expenditure was used to develop a 10-year trend. Only expenditure related to planned pro-active replacement was included – unplanned replacement (eg emergency work to replace assets that have failed) was excluded as this work is not impacted by WSE.

Further detail on the base case repex forecast is included in the Repex Addendum.

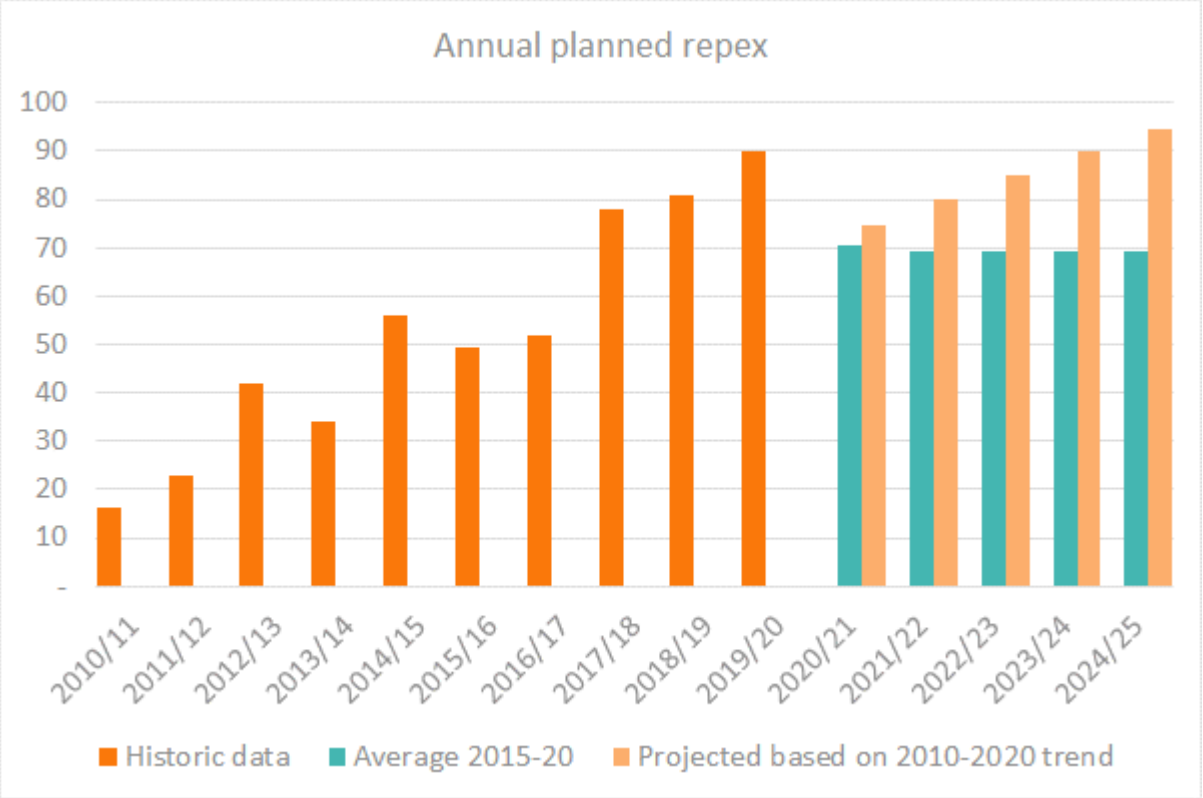

Figure 14 Projected trend vs historical expenditure for the asset classes that benefit from improved WSE (Table 19)

For the purposes of WSE modelling only those asset classes which are relevant to high volume work scheduling were included. The base case expenditure forecast for those asset classes is detailed in Table 19.

Table 19 Base case forecast for planned repex, $million Dec $2017

Asset Class	Total 2020-25 RCP
Poles	160.4
Pole Top Structures	157.9
Conductors	13.6
Service Lines	32.4
Distribution Transformers	17.5
Distribution Switchgear (Reclosers/Sectionalisers/Switching Cubicles)	29.5
Other line assets	12.6
Total	**423.8**

For the purposes of modelling benefits in this business case we have used the above repex forecast for 2020-25 RCP for the subsequent two periods. This provides a conservative estimate of repex benefits as the repex for 2025-30 and 2030-35 periods is likely to be higher than 2020-25 in the absence of improved risk targeting or productivity improvements.

Repex for asset classes that do not benefit from improved WSE such as zone substation assets (for which existing asset and work systems are advanced) is not expected to materially change and was unchanged from our repex submission for the base case.

I. Calculation of repex deferral benefits from improved WSE

Repex deferral benefits from improved WSE are calculated using the Work Selection Effectiveness Improvement Model provided in Appendix A of this Addendum. Detailed explanation of the design and operation of that model has been provided in our response to the AER Information Request IR038. The design of the model has not been changed for the resubmission; however, we identified an error in one of the input assumptions used in the original model, which led to under-estimation of the repex deferral benefit in the 2025-30 RCP. This error is explained below.

Figure 15 shows original and revised repex forecasts for the asset classes included in the WSE model. The dashed and solid lines represent the forecasts with and without the proposed A&W investment, respectively. As can be seen from Figure 15, in the original business case there was further reduction of repex in the 2025-30 RCP due to the A&W investments in the 2025-30 (A&W Stage 3), whilst in the revised business case there was no further reduction because the revised business case only considers costs and benefits from the 2020-25 RCP investment. This reduction, however, was incorrectly calculated from repex baseline that already included the effects of A&W Stage 2.

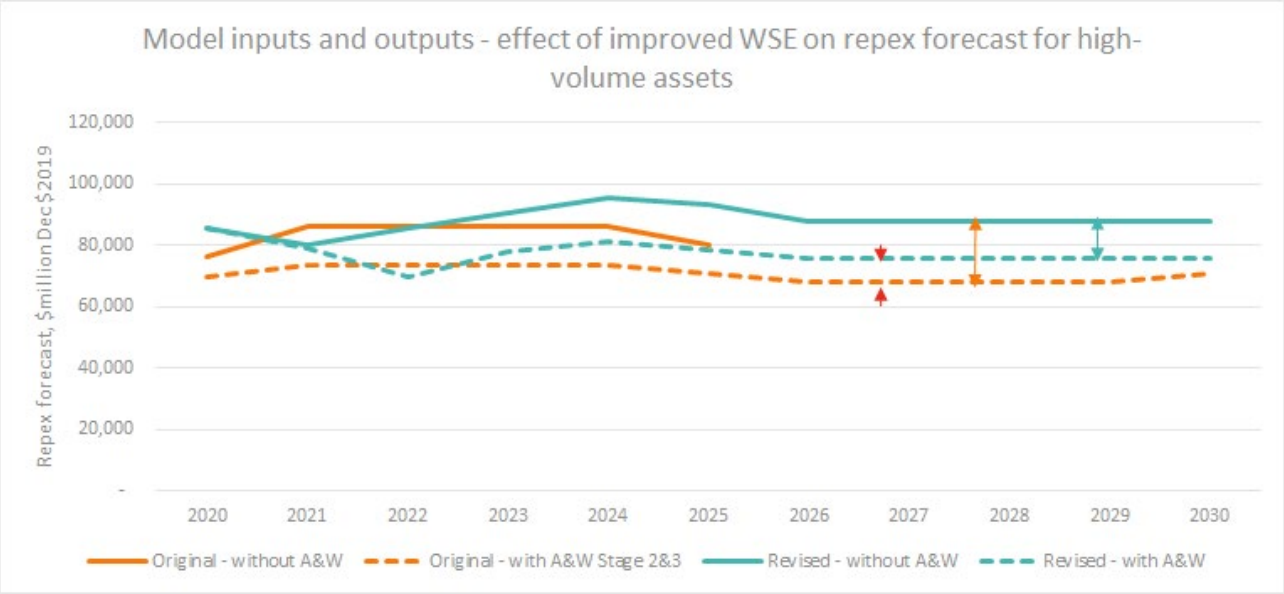

Figure 15: Repex deferral benefits summary: original business case (orange) and revised business case (teal)

Original business case

The original model used a continuation of the 2020-25 repex forecast that included the effect of A&W Stage 2 and then calculated the reduction in expenditure achievable in 2025-30 RCP through the A&W Stage 3. This benefit was approximately $30 million.

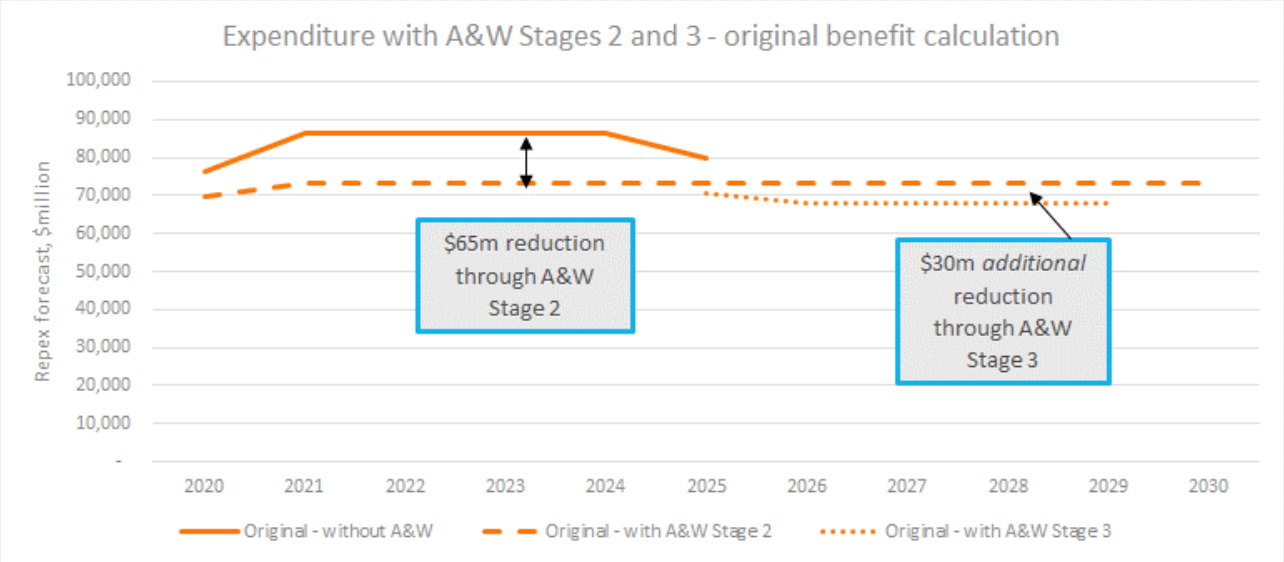

Figure 16: Repex deferral benefits in the original business case

Revised business case

The correct approach, which is being used in the revised business case, is to use a base case repex forecast (the 'Do nothing' for A&W) and then determine all benefits as a reduction against the base case. The benefit in the 2020-25 RCP is in the order of $49 million and $60 million for the 2025-30 RCP.

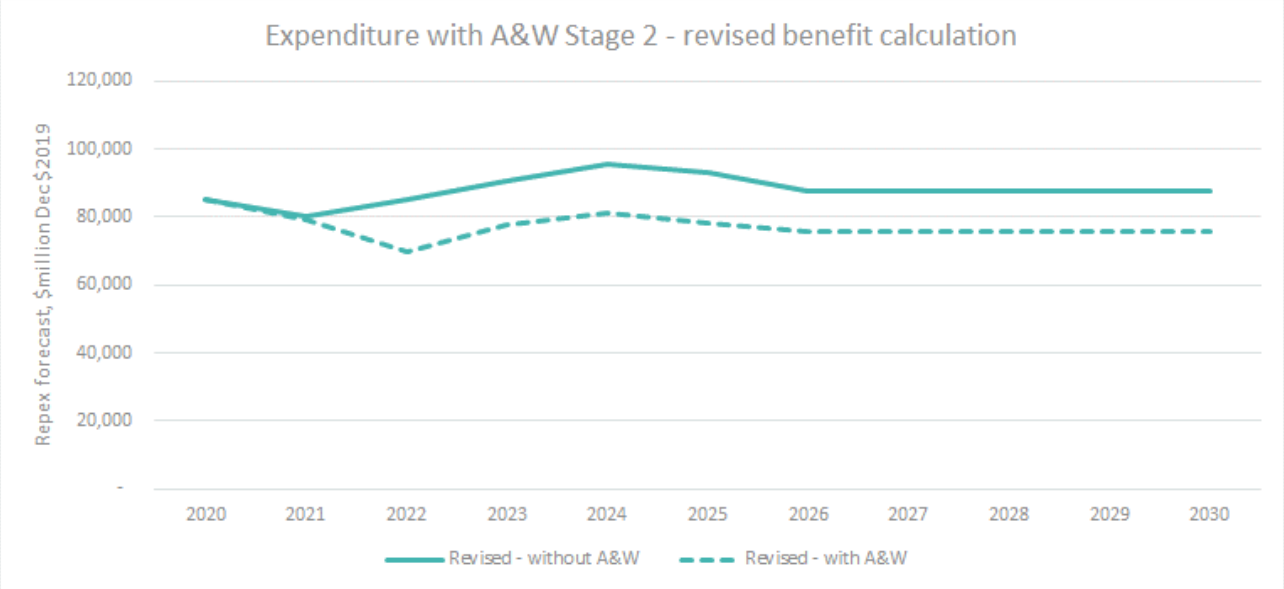

Figure 17: Repex deferral benefits in the revised business case, $million, Dec $2017