EMCa
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SAPN Revenue Proposal 2020-25

Review of aspects of SA Power Network's capital expenditure

Report to

Australian Energy Regulator

from

Energy Market Consulting associates

FINAL

September 2019

This report has been prepared to assist the Australian Energy Regulator (AER) with its determination of the appropriate revenues to be applied to the prescribed distribution services of SAPN from 1st July 2020 to 30th June 2025. The AER's determination is conducted in accordance with its responsibilities under the National Electricity Rules (NER). This report covers a particular and limited scope as defined by the AER and should not be read as a comprehensive assessment of proposed expenditure that has been conducted making use of all available assessment methods.

This report relies on information provided to EMCa by SAPN. EMCa disclaims liability for any errors or omissions, for the validity of information provided to EMCa by other parties, for the use of any information in this report by any party other than the AER and for the use of this report for any purpose other than the intended purpose.

In particular, this report is not intended to be used to support business cases or business investment decisions nor is this report intended to be read as an interpretation of the application of the NER or other legal instruments. EMCa's opinions in this report include considerations of materiality to the requirements of the AER and opinions stated or inferred in this report should be read in relation to this over-arching purpose.

Except where specifically noted, this report was prepared based on information provided by AER staff prior to 29 June 2019 and any information provided subsequent to this time may not have been taken into account.

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About EMCa

Energy Market Consulting associates (EMCa) is a niche firm, established in 2002 and specialising in the policy, strategy, implementation and operation of energy markets and related network management, access and regulatory arrangements. EMCa combines senior energy economic and regulatory management consulting experience with the experience of senior managers with engineering/technical backgrounds in the electricity and gas sectors.

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Executive Summary

Overarching findings

1. AER has asked us to review and advise on aspects of the forecast expenditure allowances that SAPN has proposed in its Regulatory Proposal for the period 2020 to 2025, comprising:
   - Its proposed Information Technology and Operational Technology capex (and which we refer to as Information and Communications Technology, or ICT);
   - Its proposed recategorization of a portion of cable and conductor repairs to opex, and the resultant opex step change that it has proposed;
   - Aspects of its proposed augex, comprising two specific sub-transmission augex projects and its proposed expenditure on LV Quality of Supply remediation;
   - Its proposed connections capex; and
   - Aspects of its proposed repex, comprising its proposed expenditure on pole and pole-top replacements.

2. These aspects of SAPN's proposed expenditure total $963.9m, comprising $897.7m of capex (out of a total of $1,741.1m[1] net capex that SAPN has proposed), plus $66.3m for the proposed opex step change for cables and conductors.

3. We consider that SAPN's proposals for each of these items overstate reasonable forecasts of its prudent and efficient requirements. We base our conclusions on findings that include evidence of: (i) a systemic bias to over-forecasting using the methods that it has used for the current Regulatory Proposal; (ii) a systemic bias to conservative risk assessment; (iii) insufficient account for the realities of delivering complex and interdependent programs; (iv) insufficient or contradictory information to support proposed increases; and (v) insufficient evidence of performance or defect-based needs that are claimed as driving the increased expenditure that it proposes.

[1] See table 1

4. We concur with SAPN's proposal to recategorize a portion of its proposed cable and conductor repairs to opex, comprising minor and defect-driven repairs, though we consider that SAPN has overstated the opex step change allowance that it requires for this recategorization.

Findings on proposed ICT capex

5. The relatively high level of SAPN's proposed ICT expenditure in the current RCP and in the first two years of the next RCP is driven by significant projects including its Assets and Work Program for which the claimed main benefit is repex deferral, and by significant systems refresh with an SAP upgrade as the foundation project.

6. While there is evidence that SAPN moderated its proposed ICT forecast from a still-higher value initially considered, we consider that it has not adequately tested the deliverability of its proposed program. At the commencement of the next RCP, SAPN will have a number of large projects in flight, and its plan involves back-to-back timing of subsequent projects and phases. With some current-period projects already delayed, we consider that SAPN has a systemic bias to under-estimate the time required for efficient project delivery and that some of what it has proposed for the next RCP will inevitably be deferred.

7. SAPN has not adequately justified its proposed recurrent project expenditure or its proposed level of non-recurrent project expenditure. From our review of two of its largest proposed projects, for instance, we consider that SAPN has not adequately considered the option of deferring its proposed upgrade to SAP S/4, and that the tangible benefits it has proposed for its Assets and Work Program are not sufficient to justify its proposed expenditure. SAPN has also proposed a worker safety fatigue management project which similarly lacks compelling justification of the need for an IT solution, by comparison (for example) with procedural alternatives, and provided insufficient evidence to justify its proposed ADMS/OMS upgrade.

8. The cost of a project to ring-fence a non-regulated business activity, should not be borne by SAPN's regulated customers.

Findings on proposed cable and conductor repairs expenditure

9. We find that SAPN's proposed re-categorisation of cable and conductor minor repairs from repex to opex is reasonable. The proposed delineation between minor repairs to address operational and maintenance issues as opex - and refurbishment projects to extend asset life as repex - is appropriate and consistent with the approach taken by other DNSPs.

10. We find that SAPN's rationale (i.e., opex step change) is appropriate for proposing the expenditure re-categorisation since cable and conductor repair expenditure was not present in SAPN's base-year opex. However, we find that SAPN's proposed 2020/21 step increase of $14.2m - followed by $13.5m for each subsequent year - is over-stated and does not represent a prudent and efficient level of expenditure.

11. Specifically, we observe that SAPN has used the combined actual and estimated expenditure from the current RCP as the basis for its forecast expenditure. This incorporates estimated total expenditure for 2019/20 that appears abnormally high

and is unlikely to reflect an underlying, stable level of recurrent expenditure requirements and a 2017/18 assessment of the opex/capex apportionment that is higher than indicated by later data (i.e. for 2018/19). We consider that this has resulted in SAPN over-estimating the required opex step change associated with this re-categorisation. We consider that a reasonable adjustment would be to reduce SAPN's proposed opex step change allowance by approximately 25% and we describe the basis on which we have arrived at this adjustment in section 5.

Findings on aspects of proposed augex

12. For the three projects that we reviewed, we consider that SAPN's forecast augex of $69.8m does not reflect a reasonable, prudent and efficient level of expenditure, and is overstated.

Low voltage and quality of supply remediation

13. We find that SAPN's current reactive approach to remediate issues as they arise is reasonable. However, SAPN's use of a historical expenditure trend methodology to determine forecast expenditure is not sufficiently justified due to SAPN's use of an extremely limited number of data points, to extrapolate a supposed trend increase. Further information that SAPN provided to us following our request, does not support a forecast increase.

14. If the AER approves SAPN's proposed LV Monitoring Strategy (and which was not within our scope to review), then a reduction should be applied to reflect SAPN's identified benefits.

Sub-transmission

15. We find that the proposed new 66kV line from Myponga substation to Square Water Hole substation is not sufficiently justified. The proposed new line would only reduce interruptions under certain contingency events and with reasonable input parameters and sensitivity studies, the market benefit from the proposed investment is unlikely to be positive.

16. Similarly, we find that the proposed New Athol Park – Woodville 66kV line is not sufficiently justified. We consider that SAPN has not properly assessed lower-cost alternatives, such as real-time dynamic line rating. Such monitoring may reveal that modelled overloads are less likely to occur, leading to prudent deferral of the proposed investment.

Findings on proposed connections capex

17. SAPN has proposed an increase in net connections capex in the next RCP, with the increase based on its forecast of continued higher requirement for major project (non-residential) connections than in the current RCP.

18. Confidence in SAPN's connections forecasts is undermined by the material unexplained and inconsistent data that SAPN has provided. While SAPN claims in its Regulatory Proposal that its major project forecast is based on an analysis of specific known connection prospects, we find on investigation that it is essentially a modelled forecast. Information provided to support the modelled forecast from its

consultant does not reconcile in aggregate with SAPN's Regulatory Proposal forecast, without application of an unexplained adjustment and is also categorised differently. SAPN did not reconcile between these, nor did it explain how the economic parameters presented in its consultants' report generated its connections forecast.

19. From the lack of explanation that SAPN was able to provide, it would appear that SAPN does not have access to the forecasting model used to generate its forecast. SAPN was also unable to confirm that its management had reviewed or challenged its forecast.

20. Absent suitable sound and reconcilable information as to how SAPN had arrived at its forecast, we sought external information. While there is currently a higher level of connections activity in South Australia, information we obtained does not support connections requirements continuing at this level for the duration of the next RCP. More recent information suggests that non-residential construction (on which connections are based) is likely to decline from current levels, and ADMD per connection will continue to fall, resulting in lower connection costs.

21. On this basis, we consider that SAPN has not justified its proposed increase in connections expenditure.

Findings on aspects of proposed repex

22. Based on the models and information provided by SAPN, we find that SAPN's proposed repex forecast for poles and pole-top structures in the next RCP does not represent a reasonable, prudent and efficient level of expenditure. We consider that SAPN's expenditure forecast is overstated for the following reasons:

- Service level outcomes - the network performance and service level outcomes related to pole and pole-top structure assets appear relatively stable and do not reflect declining network performance. In our view, these trends do not provide compelling justification for an increase in the level of expenditure above that incurred in the current RCP;
- Defect history - the higher number of identified and completed defects (including backlogs) for poles and pole-top structures in the current RCP is not correlated with increased network risk. Further, we observe conservative risk and consequence values in SAPN's condition-based risk management (CBRM) model that contribute to an overestimation bias. We consider that bottom-up adjustments, to remove the additional pole renewal program for line clearance defects, will reduce the need for forecast repex across both asset categories; and
- SAPN's strategy - the work scheduling and prioritisation methods applied by SAPN are likely to achieve a lower level of repex for poles and pole-top structures than SAPN has proposed. While SAPN has claimed repex deferral benefits from its proposed Assets and Work IT investment, we expected but did not find evidence that SAPN has accounted for such deferral benefits in its forecast.

1 Introduction

1.1 Purpose and scope of requested work

1.1.1 Purpose

23. The purpose of this report is to provide the Australian Energy Regulator (AER) with our findings from a review of defined elements of SAPN's proposed capital expenditure (capex) forecast for the 2020-25 Regulatory Control Period (next RCP).

24. The assessment contained in this report is intended to assist the AER in its own analysis of the capex forecast as an input to its Draft Decision on SAPN's revenue requirements.

1.1.2 Scope

25. The scope of this review of SAPN's Regulatory Proposal (RP) covers:

    (i) Information and Communication Technology (ICT) capex, comprising Information Technology capex (IT) and Operational Technology (OT) capex;

    (ii) SAPN's cable and conductor expenditure, including:

        a. a proposed change to the accounting treatment of certain cable and conductor minor repairs from repex to opex; and

        b. whether the forecast expenditure (opex or capex) is prudent and efficient;

    (iii) Aspects of augmentation capex (augex), including:

        a. Low voltage (LV) and distribution transformers quality of supply (QoS); and

        b. Sub-transmission;

    (iv) Connections capex; and

    (v) Aspects of replacement capex (repex), including:

        a. Poles; and

        b. Pole-top structures.

1.1.3 Our approach

26. In undertaking our review, we:

- completed a desktop review of the information provided to us by the AER, which included SAPN's Regulatory Proposal and associated supporting documents;
- prepared requests for specific additional information to be provided by SAPN, and reviewed SAPN's responses to these requests;
- undertook onsite review meetings over two days with SAPN[2] to assist our understanding of the methodology and assumptions applied by SAPN as the basis for its forecast expenditure requirements;
- undertook an assessment of SAPN's expenditure forecast, which included our review of: (i) SAPN's expenditure governance, management and forecasting framework; (ii) SAPN's top-down portfolio challenge process; and (iii) SAPN's application of its expenditure justification and forecasting approach to a sample of projects and programs.

27. We have documented our findings and associated evidence in this report.

28. We also provided feedback to AER staff on our preliminary findings in a teleconference on 11 June 2019, while drafting this report and presented our findings to the AER Board on 19 July 2019.

29. The specific and limited nature of our review does not extend to advising on all options and alternatives that may be reasonably considered by SAPN, nor does it consider all aspects of their proposed capex forecast.[3] We have included additional observations in some areas based on our professional judgement that may assist the AER with its own assessment.

1.2 Structure of this report

30. Our main findings are summarised in the Executive Summary at the beginning of this report.

31. In this Section 1, we describe the purpose and scope of requested work, the approach we have applied in undertaking our review, and how this report has been structured to present our findings.

32. In Section 2, we present a contextual overview of SAPN's total capex program, including consideration of historical expenditure trends and capex forecasting performance.

33. In Section 3, we describe: (i) the governance and management framework that SAPN uses to plan and approve its capex projects and programs; (ii) SAPN's expenditure forecasting methodologies; and (iii) our observations of any systemic issues related to SAPN's application of this approach to forecast the elements of capital expenditure that we have been asked to review.

[2] The onsite review meetings took place on 13 May 2019 and 14 May 2019.

[3] For example, our review does not include unit costs or supporting models, although we have included some observations where relevant.

34. In the subsequent 5 sections, we present the evidence-based assessment that supports our findings for each in-scope aspect of SAPN's proposed capex, as follows:

    (i) Section 4 – IT and OT capex;

    (ii) Section 5 - Cable and conductor minor repairs;

    (iii) Section 6 – Aspects of augex;

    (iv) Section 7 - Connections capex; and

    (v) Section 8 – Aspects of repex.

1.3 Other

1.3.1 Information sources

35. We have examined relevant documents from SAPN's RP, information supplied at the on-site meetings with SAPN personnel, and further documents provided by SAPN in response to our information requests. These documents are referenced directly where they are relevant to our findings.

36. Our assessment is based on our review of the information supplied, our observations from the onsite meetings, and our professional judgement. In our consideration of SAPN's responses to EMCa's information requests, and at the request of the AER, we have included additional advice to support our assessment.

37. Where available, we sourced expenditure data for analysis from SAPN's Reset Regulatory Information Notice (RIN) submitted to AER on 31 January 2019. Any other data relied upon for analysis is referenced in our report.

1.3.2 Rounding of numbers and real conversion

38. Numerical totals in tables may not present as being equivalent to the sum of the individual numbers due to the effects of rounding. Also, some numbers in this report may differ from those shown in SAPN's regulatory submission or other documents due to rounding.

39. Consistent with SAPN's Regulatory Proposal, and most (but not all) of the supporting information that SAPN provided, this report refers to costs in real June 2020 dollars unless denoted otherwise.

2 Background

2.1 Introduction

40. In this section, we provide background and context to support our assessments which follow. We first provide an overview of SAPN's total proposed capex for the next RCP. Second, we include observations of SAPN's actual and forecast capex for the current RCP. Finally, we summarise the relevant National Electricity Rules (NER) capital expenditure criteria and capital expenditure objectives that guide our assessment.

2.2 Overview of proposed capex

41. In this section, we provide an overview of SAPN's total capex, by expenditure category, for each year of the next RCP and the current RCP.

2.2.1 Overview of total capex

42. SAPN has forecast total net capex[4] for the next RCP of $1,741.1m. This represents a $63.8m increase when compared with total actual and estimated net capex for the current RCP of $1,677.3m. The table below shows SAPN's proposed capex, by expenditure category, for each year of the next RCP.

[4] i.e. net of customer contributions

Table 1: SAPN's proposed total capex by asset category for next RCP[5]

$m, real June 2020	Forecast					TOTAL
	2020/21	2021/22	2022/23	2023/24	2024/25	Next RCP
Replacement expenditure	122.8	129.3	131.2	128.6	125.3	**637.2**
Connections	109.4	111.1	112.3	111.9	108.2	**553.0**
Augmentation Expenditure	80.8	79.0	69.9	70.6	71.7	**372.0**
Non-network	113.7	120.2	91.5	92.2	87.3	**504.8**
Capitalised network overheads	12.5	12.7	12.4	12.4	12.3	**62.4**
Capitalised corporate overheads	-7.5	-7.6	-7.7	-7.8	-7.8	**-38.3**
Total gross capex	**431.6**	**444.8**	**409.7**	**408.0**	**397.0**	**2,091.1**
Less capital contributions	*70.6*	*70.3*	*70.8*	*70.6*	*67.8*	***350.1***
Total net capex	**361.0**	**374.6**	**338.9**	**337.3**	**329.2**	**1,741.1**

Source: SAPN Reset RIN

43. The following table shows SAPN's actual and estimated capex by expenditure category for each year of the current RCP.

Table 2: SAPN's Actual/Estimated total capex by asset category for current RCP[6]

$m, Real June 2020	Actual			Estimate		TOTAL
Category	2015/16	2016/17	2017/18	2018/19	2019/20	2015-20
Replacement expenditure	80.7	88.5	135.1	147.1	148.9	**600.4**
Connections	59.9	61.9	71.9	102.8	93.8	**390.3**
Augmentation Expenditure	55.7	63.9	90.9	96.2	93.3	**400.0**
Non-network	82.4	91.7	114.0	106.3	114.5	**508.8**
Capitalised network overheads	8.2	11.3	7.0	14.4	14.2	**55.1**
Capitalised corporate overheads	-14.3	-10.0	-7.2	-10.6	-10.6	**-52.7**
Balancing items	-0.3	-2.4	-9.4	0.0	0.0	**-12.0**
Total gross capex	**272.5**	**304.9**	**402.2**	**456.2**	**454.0**	**1,889.8**
Less capital contributions	*32.8*	*29.5*	*30.8*	*62.4*	*57.0*	***212.5***
Total net capex	**239.7**	**275.4**	**371.4**	**393.8**	**397.0**	**1,677.3**

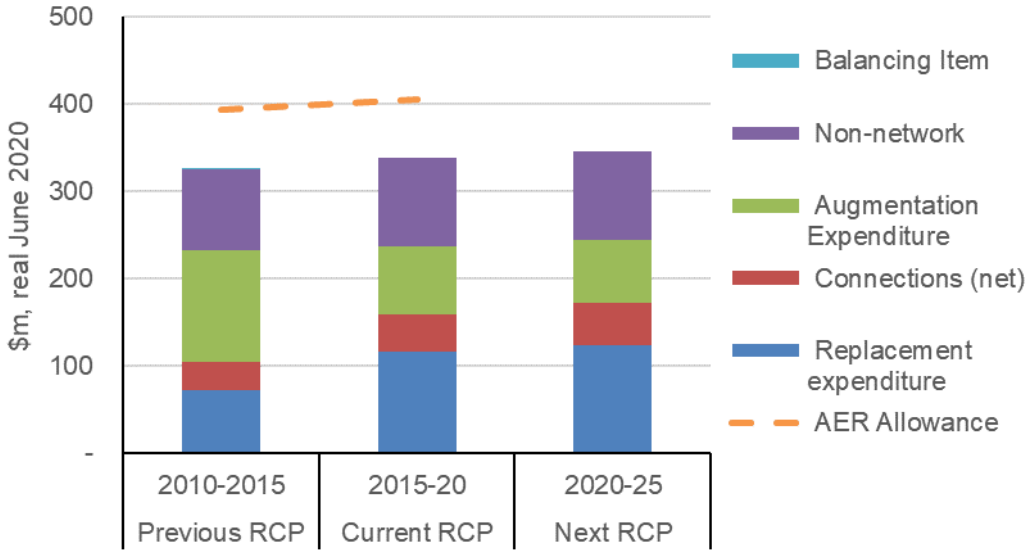
Source: SAPN - RIN 3 - Workbook 3 - CA - recast historical - January 2019 converted to real $2020

44. The figure below shows SAPN's annualised net capex and expenditure category composition for each of the 2010-15 RCP (previous RCP), 2015-20 RCP (current RCP), and 2020-25 RCP (next RCP). The AER's capex allowance is also shown for the previous and current RCP.

[5] The total net capex of $1,741.1m is reconciled with RP Att. 5 Table 5-8. However, in Table 5-8 the corporate and network overhead categories are not separately identified. This implies that these overhead costs have already been allocated into individual categories; as a result, each category in Table 5-8 is higher than the corresponding category in the RIN table. We understand that this figure also includes disposals.

[6] This table is from the RIN provided by SAPN. 2015/16 to 2017/18 is shown in nominal terms, whereas 2018/19 and 2019/20 is provided in real June 2020 dollars. We converted the nominal figure to real June 2020 using the CPI information provided by SAPN in the RIN file. As shown in the table above, the historical RIN data includes overheads, and so is consistent with the next RP data shown in Table 1. However, the total net capex here does not reconcile with SAPN RP document Att. 5, Table 5-4, which shows a total of $1,728.2m. No asset category detail was provided in Attachment 5, hence the need to use RIN data to show categorisation.

Figure 1: SAPN's annualised net capex for the previous, current, and next RCP by capex category, and AER capex allowance



Source: SAPN Reset RIN, AER Final Decision on SAPN 2010/11-2014/15 Table 6 pg. xxi and AER Final decision on SAPN 2015/16-2019/20 Att. 6, Table 6.1 page 6-8.

45. The figure above shows that SAPN has significantly underspent the AER's capex allowance for both the current and previous RCP's. It also shows a gradual upward trend in total net annualised capex.

46. SAPN's justification for historical underspend in the expenditure categories we have reviewed is discussed in subsequent sections. However, the significant underspend relative to the AER capex allowance over a 10-year period indicates a systemic bias to over-forecast capex requirements.

2.2.2 Expenditure in scope

47. The following table summarises the main elements of SAPN's expenditure forecast that we were asked to review. Comparison with table 1 indicates the relativity of the reviewed expenditure against SAPN's total proposed capex, and capex by expenditure category.

48. The three augex projects that we reviewed were presented to us only through SAPN's business case information and totalled $85.8m as presented in $2017 terms. However, it is not clear to us from the information provided how much of this is included in SAPN's total proposed augex for the period 2020 to 2025.

Table 3: Aspects of SAPN's proposed expenditure that we were asked to review (excluding the three reviewed augex projects)

Expenditure Review Category - excluding Augex projects	$m, real June 2020
ICT capex	
IT Recurent	149.1
IT non-recurrent	135.5
OT	22.2
sub-total	***306.8***
Cable and Conductor Repair	
Capex	22.0
Opex	66.3
sub-total	***88.3***
Customer net connection capex	
sub-total	***213.2***
Aspects of repex	
Poles	169.6
Pole-top structures	116.3
sub-total	***285.9***
Total excluding Augex projects	**894.2**

Source: EMCa analysis from SAPN Regulatory Proposal and RIN data

2.3 NER Capex Objectives and Criteria

49. The AER must make its decision on SAPN's revenue allowance consistent with NER requirements – specifically, the 'capital expenditure criteria' and the 'capital expenditure objective' as stated in the figures below.[7]

50. The AER must accept SAPN's capex proposal if it is satisfied that the total forecast capital expenditure is prudent, efficient and reasonable, pursuant to the NER capex objectives and criteria.

51. The purpose of our review is to provide the AER with information and advice, consistent with these requirements, to assist its determination regarding SAPN's proposed capex for the next RCP.

[7] NER 6.5.7(c).

Figure 2: NER capital expenditure criteria

> *(c) The AER must:*
>
> *(1) subject to subparagraph (c)(2), accept the forecast of required capital expenditure of a Distribution Network Service Provider that is included in a building block proposal if the AER is satisfied that the total of the forecast capital expenditure for the regulatory control period reasonably reflects each of the following (the capital expenditure criteria):*
>
> *(i) the efficient costs of achieving the capital expenditure objectives;*
>
> *(ii) the costs that a prudent operator would require to achieve the capital expenditure objectives; and*
>
> *(iii) a realistic expectation of the demand forecast and cost inputs required to achieve the capital expenditure objectives.*

Source: NER 6.5.7(c).

52. The capital expenditure objectives referred to in the capital expenditure criteria are set out in the figure below.[8]

Figure 3: NER capital expenditure objectives

> *(a) A building block proposal must include the total forecast capital expenditure for the relevant regulatory control period which the Distribution Network Service Provider considers is required in order to achieve each of the following (the capital expenditure objectives):*
>
> *(1) meet or manage the expected demand for standard control services over that period;*
>
> *(2) comply with all applicable regulatory obligations or requirements associated with the provision of standard control services;*
>
> *(3) to the extent that there is no applicable regulatory obligation or requirement in relation to:*
>
> *(i) the quality, reliability or security of supply of standard control services; or*
>
> *(ii) the reliability or security of the distribution system through the supply of standard control services,*
>
> *to the relevant extent:*
>
> *(iii) maintain the quality, reliability and security of supply of standard control services; and*
>
> *(iv) maintain the reliability and security of the distribution system through the supply of standard control services; and*
>
> *(4) maintain the safety of the distribution system through the supply of standard control services.*

Source: NER 6.5.7(a).

[8] NER 6.5.7(a).

3 SAPN's governance and management framework, and forecasting processes

3.1 Introduction

3.1.1 Context for this section

53. In this section, we provide an overview of SAPN's top-down expenditure governance and management framework and observations regarding the features relevant to our assessment of specific aspects of SAPN's forecast expenditure.

54. We also describe and assess the methods and processes by which SAPN has developed its bottom-up capital expenditure forecasts for: (i) repex; (ii) augex; (iii) connections capex; and (iv) network and non-network ICT capex.

55. Further, the extent to which SAPN's forecast meets NER requirements is dependent, in part, on how its governance and management framework and forecasting processes have been applied to forecast expenditure. Our assessment of this is provided in sections 4 to 8.

3.1.2 What has been asked of us

56. The AER has not specifically requested EMCa's advice on SAPN's governance and management framework and forecasting processes. However, we have evaluated SAPN's expenditure governance framework and expenditure forecasting methodologies because they guide the development and refinement of SAPN's network and non-network expenditure forecasts that are within our scope.

57. The scope of our review includes reviewing SAPN's governance and management framework and forecasting processes, together with all other information provided

by SAPN, in coming to our view of whether the resultant forecast of capital expenditure is prudent, efficient and reasonable.

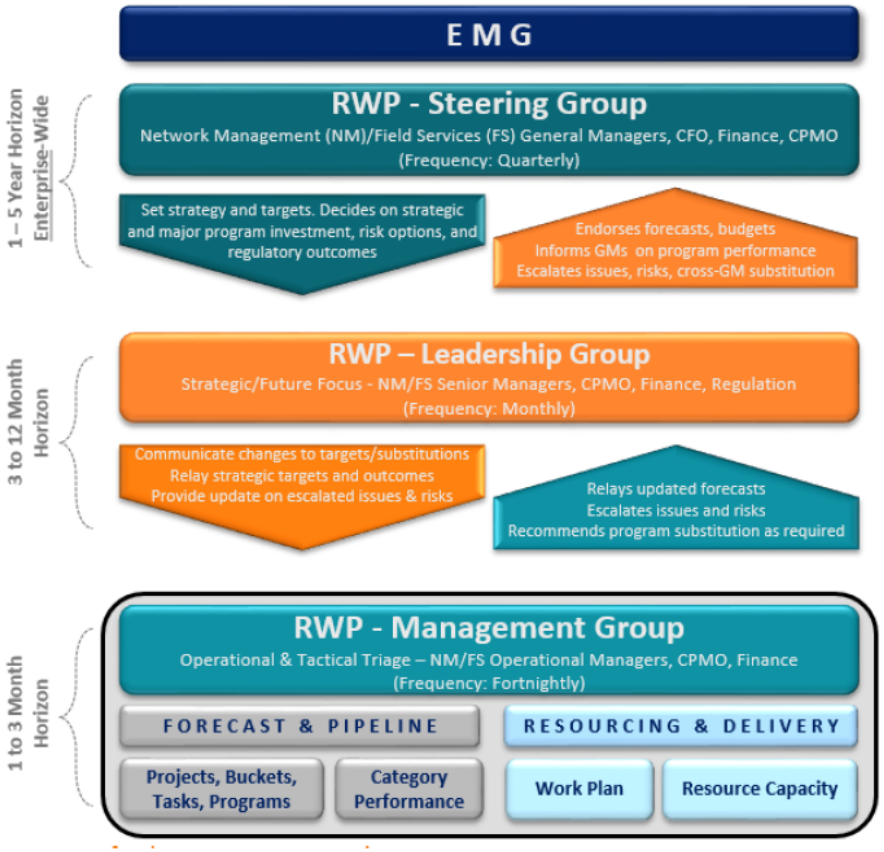
3.2 SAPN's capex governance and management framework

3.2.1 Investment governance framework

58. The figure below shows SAPN's Regulated Works Program governance framework in which a hierarchy of responsibilities is evident from the Executive Management Group (EMG) to the Steering Group, Leadership Group and Management Group.

59. The EMG establishes strategies and targets and reviews and, ultimately, endorses the departmental budgets. The budget is submitted to the Board for approval.

Figure 4: SAPN's Regulated Works Program governance framework



Source: SAPN. Attachment 5.2. Expenditure Governance Procedures. January 2019. Page 7

3.2.2 Strategic planning

60. SAPN advised that a '*key component of the strategic planning process is the development of the Strategic Plan for which the Board requires an approved 5-year financial plan, to ensure progress is made towards maximising overall shareholder value and achieving long-term goals*.' The strategies and targets provide a framework for departments to undertake business planning, including the establishment of work programs and related capital and operating budgets.

61. SAPN's strategic objectives are to keep prices down, maintain safety and reliability, and transition to the new energy future.[9] Its capex objectives are to:[10]

- meet or manage the expected demand for its services;
- comply with applicable regulatory obligations;
- maintain the reliability and security of supply of standard control services to customers; and
- maintain safety.

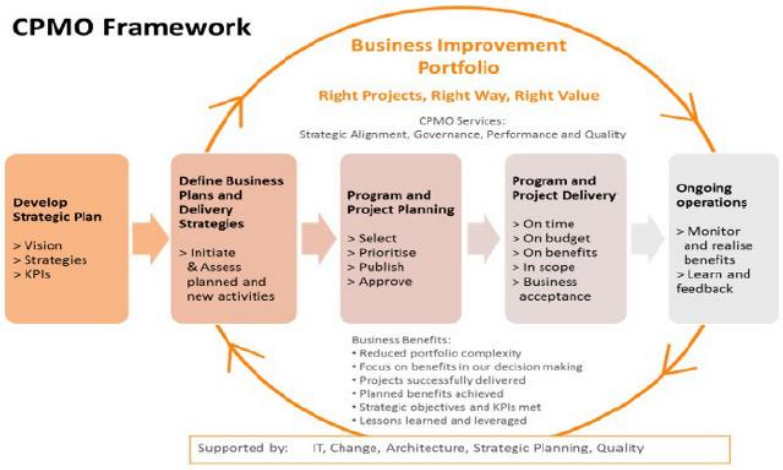
62. SAPN's develops a Financial Plan which comprises:

- the Annual Budget (first year of the internal 5-year plan) which includes detailed estimates of capital and operating expenditures that will be used for performance measurement; and
- the remaining four years of the 5-year plan, incorporating SAPN's long term strategies and expenditure forecast.

63. SAPN has introduced a Corporate Portfolio Management Office (CPMO) to manage the portfolio of capital projects and programs (i.e., network and non-network).

64. SAPN's portfolio management framework is shown in the figure below. One of the CPMO's roles is to manage benefits realisation. SAPN has developed a Benefits Management Framework, which includes benefits reporting.

Figure 5: CPMO framework



Source: SAPN. Attachment 5.2. Expenditure Governance Procedures. January 2019. Page 6.

3.2.3 SAPN's risk framework

65. SAPN's risk matrix is illustrated in the figure below, which shows five graduated levels of risk, ranging from 'Negligible' to 'Extreme'. SAPN's risk assessment is based on qualitative assessment of likelihood and consequence.

[9] SAPN. RP Overview. Page 11.

[10] SAPN. Attachment 5.9. Repex Overview. Page 25-26.

Figure 6: SAPN level of risk matrix

Risk Matrix		Consequence				
Likelihood		Minimal 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Almost Certain	5	Medium 6	High 7	High 8	Extreme 9	Extreme 10
Likely	4	Low 5	Medium 6	High 7	High 8	Extreme 9
Possible	3	Low 4	Low 5	Medium 6	High 7	High 8
Unlikely	2	Negligible 3	Low 4	Low 5	Medium 6	High 7
Rare	1	Negligible 2	Negligible 3	Low 4	Low 5	Medium 6

Source: SAPN. Attchment 5.2. Expenditure Governance Procedures. January 2019. Page 11.

3.2.4 Capital planning process

66. SAPN advised at our onsite meeting that the AER Regulatory Determination is used to 'inform' SAPN's capital planning. In a response to an Information Request it confirmed that *'…Departmental Managers consider AER approved expenditure forecasts as the initial basis in the preparation of departmental budgets within the 5 year Regulatory Control Period (RCP).'*[11]

67. SAPN further advised that the forecast for years beyond the current RCP are a high level roll forward of the approved budget for 2019: '*[t]hey are indicative budget estimates only, and do not reflect a forecast of the opex and capex that will be required to meet the expenditure criteria in the National Electricity Rules. Full opex and capex forecasts can only be prepared and inserted into the Annual Budgeting and longer term planning process once the AER Determination outcome is known*.'[12]

68. In another document, SAPN advised that it developed its capex plan for the next RCP by:[13]

- '*aggregating a number of generally bottom-up asset management and/or expenditure plans across a range of expenditure categories'*; and
- applying a *'...top down assessment at a portfolio level to ensure a holistic and strategic consideration of our forecast capex program…we will take into consideration network performance and risk*.'

69. SAPN advised that its initial bottom-up forecast for its 2020-25 RP was $2,023.7m and was challenged within the business. The final forecast was $1,741.1m, following stakeholder consultation. This represents a reduction of $282.6m through the iterative review process.[14]

70. For its bottom-up capital planning, SAPN refers to four project expenditure categories when developing its capital plan:[15]

[11] SAPN's response to information request AER IR039-EMCa follow-up-20190531. Page 1.

[12] SAPN's response to information request AER IR039-EMCa follow-up-20190531. Page 1.

[13] SAPN. Expenditure Forecasting Methodology 2020-25. January 2019 – Version 1.0. Page 23.

[14] SAPN's response to information request AER IR039-EMCa follow-up-20190531. Page 5.

[15] SAPN. Attachment 5.2. Expenditure Governance Procedures. January 2019. Page 9-10.

- Mandatory projects – required by legislation or regulations and carryover projects;
- Priority projects – address extreme or high risks, although '*projects with multiple medium ratings across several risk domains might be treated as Priority, depending on the circumstances';*
- Discretionary projects – for which the risk rating is moderate or lower; and
- Ranking near the Budget cut-off - Projects will be included in the budget, in order of their ranking, up to the level of the allowed budget totals.

71. SAPN describes the features of its risk assessment and ranking methodology for capital projects as follows:

- competing proposals to achieve a given objective are assessed based on financial evaluation, where the least cost proposal (on an NPV basis) will generally be the favoured project; and
- the only exception is where a lower cost option has a higher risk - in this case, a complete risk assessment must be prepared in order for the cost versus risk implications to be properly assessed.

3.2.5 Network risk

Network risk assessment

72. For network risks, likelihood and consequence scores are automatically assigned based on responses to a series of questions posed to responsible Network Management personnel across three categories: safety; environment; and reliability. Scores are assigned for each category, with the final risk score being the highest value of the three categories *'unless the assessor provides appropriate justification'* and *'System administrators can override the assigned likelihood value'* depending on whether the defect history or condition warrants a higher value.

73. Typically, only network projects with an overall risk ranking of Medium or higher are considered in the budget process.[16] Discretionary projects are ranked primarily according to their 'risk rating bands' and included in the budget in order of their risk ranking '*up to the level of the allowed budget totals.'*

Value and Visibility

74. Value and Visibility (V&V) is SAPN's operational tool applied to line assets and substation assets to assess the level of risk present in the network arising from identified defects and other required works for small and medium repeatable jobs (for which a detailed cost benefit analysis is not warranted). Key elements of the V&V tool include:

- 'work value' is the sum of the reduction in risk and benefits from undertaking the activity;
- 'visibility' is about making work visible to everyone, enabling bundling of less urgent work to augment the primary task ('anchor jobs'); and

[16] SAPN. Attachment 5.2. Expenditure Governance Procedures. January 2019. Page 12.

- required maintenance or renewal/replacement work is prioritised based on the greatest return on investment (e.g., priority is given to low cost, high value work).

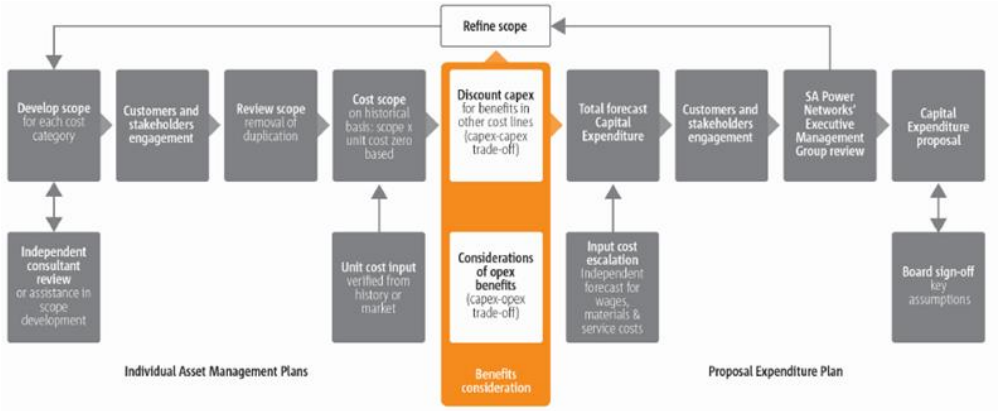
3.3 SAPN's capex forecasting processes

75. As discussed in section 3.2, SAPN applied a top-down assessment to its initial bottom-up forecast of candidate projects and programs across its various expenditure categories. SAPN's bottom-up forecast is developed using the processes described below for relevant expenditure components.

76. The figure below represents the processes utilised by SAPN to develop its network capex forecast for repex, augex, OT and connection and customer driven works.

77. Non-network categories have their own individual processes – of these, only the IT capex development process is relevant to our scope of work. We discuss IT expenditure plan development process in section 4.

Figure 7: SAPN's network capex development and forecasting process



Source: SAPN. Expenditure Forecasting Methodology 2020-25 Price Reset. January 2029. Page 23.

3.3.1 Repex

78. In one source,[17] SAPN advises that its forecast repex will be determined by two methods:

- historical failure rates - for unplanned asset replacement; and
- probability of failure and the consequence of failure – for planned asset replacement.

79. In another source,[18] SAPN advised that it has applied four forecasting methods to derive its proposed repex for the 2020-25 RCP: (i) CBRM; (ii) AER Repex model; (iii) Historical expenditure; and (iv) Historical expenditure trend. Based on the description in this source, it appears that none of SAPN's repex forecast is based directly on the AER's Repex model, although it has modelled some categories of expenditure for comparison. Furthermore, SAPN refers to application of two additional forecasting methodologies: (v) 'Targeted'; and (vi) 'SME knowledge'.

[17] SAPN. Expenditure Forecasting Methodology 2020-25 Price Reset. January 2019. Page 29.

[18] SAPN. Attachment 5.9. Repex Overview. January 2019. Page 41.

80. SAPN states that it utilises asset information, engineering knowledge, historical performance and practical experience to quantify the condition of the asset and risk it poses. '*[It] commenced transitioning its CBRM models to a new integrated platform that vastly improves its quality of data and modelling ability…using a platform software package called Asset Management Planning Suite...'*[19]

81. The CBRM model calculates deterioration rates for each asset based on the asset's condition and age to forecast the growth in risk for each asset over time. SAPN has adopted the strategy of aiming to '*maintain a determined overall asset population risk level every year'.*

Historical expenditure forecasting method

82. The forecast repex is based on the actual and estimated remaining repex for particular asset classes over the 2015-20 RCP. SAPN applied this methodology to all powerline classes except poles.

Historical expenditure trend forecasting method

83. Repex for the next RCP is based on the projected trend from actual and remaining repex in the current RCP. SAPN forecasts repex for the 2020-25 RCP for telecommunications and safety related work using a combination of the 'historical expenditure trend' and 'targeted' forecasting methodologies. Neither of these asset classes is within EMCa's scope of work.

Poles and Pole-top structures

84. Our assessment of forecast repex for Poles and Pole-top structures in section 8 provides more detailed information on SAPN's application of its forecasting methodologies to these asset categories. In summary:

- for Poles - SAPN has determined its 2020-25 RCP repex forecast using the CBRM methodology. It has also considered the results of applying the AER Repex model, historical trend, and historical expenditure methodologies;[20] and
- for Pole-top structures - SAPN has applied the historical expenditure and historical expenditure trend methodologies, selecting the result of the former as the basis for its 2020-25 RCP repex forecast.[21]

3.3.2 Demand driven capex

85. The purpose of demand driven capex is to meet or manage the expected demand for standard control services (SCS) over the RCP. There are two categories of demand-driven capex: (i) capacity expenditure; and (ii) customer connections expenditure.

86. Key inputs that underpin SAPN's demand-driven capex forecasts include:

- spatial peak demand growth; and

[19] SAPN. Attachment 5.9. Repex Overview. January 2019. Page 41.

[20] SAPN. Attachment 5.9. Repex Overview. January 2019. Pages 51.

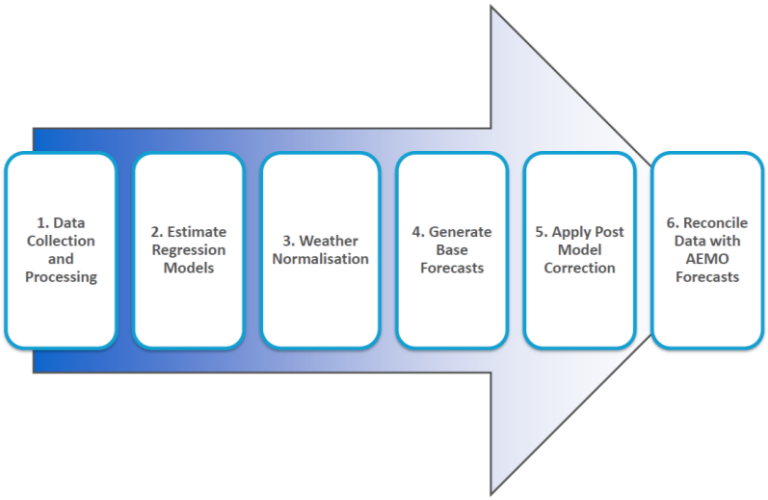
[21] SAPN. Attachment 5.9. Repex Overview. January 2019. Pages 60.

- network planning criteria – which define the level of redundancy required at SAPN's connection points, zone substations and sub-transmission lines to meet reliability and security of supply standards. This also includes the Electricity Distribution Code (EDC) and Electricity Transmission Code (ETC) standards.

3.3.3 Demand forecast

87. SAPN has been using its 'Maximum Demand Forecasting Tool' (developed for it by ACIL Allen) since 2014 to generate P10 and P50 forecasts. This tool calibrates the forecasts based on underlying demand growth. The figure below illustrates SAPN's demand forecasting process.

Figure 8: SAPN's demand forecasting process – overview



Source: SAPN. On-site meeting Power Point Presentation. May 2019. Slide 129.

3.3.4 Capacity capex

88. Capacity capex is associated with upgrades to the capacity of the distribution network in response to spatial demand growth and comprises:

- low voltage capacity - low voltage network constraints are forecast based on measured demand from short term load and voltage recorders;
- feeder, sub-transmission, and substation related works – to address one or more of the following: (i) changes to the ETC; (ii) changes caused by or required by ElectraNet at transmission connection points; (iii) network constraints; and/or (iv) supply to a new customer region.

89. SAPN also considers non-network solutions, by testing whether they:

- '*might resolve all of the identified network constraints;*
- *are technically viable (e.g., sufficient load reduction can be achieved to remove or delay the identified need);*
- *are economically viable (i.e., the combination of costs and benefits exceed those of alternative solutions); and*
- *are achievable within the required timeframe to resolve the identified need.*'[22]

[22] SAPN. Expenditure Forecast Methodology 2020-25 Price Reset. January 2019. Page 27.

3.3.5 Customer connections capex

90. Customer connection capex is associated with additions, upgrades or alterations to the distribution system resulting from the requirements and requests of specific customers. SAPN engaged BIS Oxford Economics (BISOE) to develop its customer connections capex forecast for the next RCP. BISOE's forecasting methodology was based on a combination of historical data and economic projections to assess forecast connections in three categories:[23]

- **Minor customer connections** – the expenditure model is based on new dwellings, alterations and additions, BISOE's forecast of South Australia's population growth, and SAPN's historical expenditure;
- **Medium customer connections** – the expenditure model is based on BISOE's forecasts of the real value of non-residential building commencements for projects less than $20m and `other dwelling' commencements in South Australia; and
- **Major customer connections** – BISOE identified major residential building commencements, non-residential building commencements above $20m, and selected categories of engineering construction work. Load and cost per kVA estimates from comparable projects were used to derive the forecast expenditure after applying probabilities of proceeding. This project-specific forecast was than considered as a 'floor' to BISOE's modelled forecast for this category.

3.3.6 Cost estimation

91. SAPN derives project costs using a standard estimating tool and standard construction components. *Unit costs are reviewed and updated periodically, based on historic project information, current activity, material and service rates, and/or quotes received from suppliers or service providers.*[24]

92. SAPN's expenditure governance report does not identify its approach to deriving cost estimates for volumetric programs of work, however from other sources, such as business cases themselves we note that SAPN relies largely upon historical costs, with input from subject matter estimates in some cases.

3.4 Our observations on SAPN's governance and management framework, and forecasting processes

93. In this sub-section, we provide our observations regarding SAPN's governance and management framework and forecasting processes. In subsequent sections of the report, we consider how SAPN's framework and processes have been applied specific to the expenditure categories that we were asked to review.

[23] BISOE. Attachment 5.12. Gross Customer Connections Expenditure Forecasts to 2025/26. November 2018. Pages 14-16.

[24] SAPN. Attachment 5.2. Expenditure Governance Procedures. January 2019. Page 13.

94. Our observations regarding SAPN's separate IT governance and management framework are provided in section 4 as part of our review of SAPN's proposed IT and OT capex.

3.4.1 Our observations on SAPN's governance and management framework

95. The elements of SAPN's governance and management framework are generally consistent with industry practice, and so we have focused our assessment on SAPN's application of those elements in developing its forecast requirements. The establishment of the CPMO to manage delivery of all capital projects across SAPN (i.e., network and non-network projects) is consistent with industry practice.

96. As discussed in sections 4 to 8, we have concerns with the practical application of SAPN's governance and management elements and its forecasting processes to actual projects and programs, based on the evidence provided (or lack thereof) from our assessment of the aspects of repex and augex that are within our scope.

3.4.2 Our observations on SAPN's expenditure forecasting

97. At a portfolio level we observe that SAPN's expenditure forecasting approach applied prior to and during the current RCP has resulted in:

- an expenditure forecast for its initial 2015-20 RP that was subsequently reduced significantly in the revised 2015-20 RP; and
- a significant underspend of the AER's capex allowance for both the current and previous RCP's.

98. This follows the same pattern in the previous RCP. The significant underspend relative to the AER capex allowance over a 10-year period indicates a systemic bias to over-forecast capex requirements. We have not observed significant changes to SAPN's expenditure forecasting methodologies for the development of its 2020-25 RP, but we do observe a number of claims regarding improvements to input data/information.

99. Our assessment of SAPN's expenditure relates only to certain aspects of SAPN's expenditure and in the sections 4-8 below, we consider SAPN's application of its expenditure forecasting methodologies to the relevant capex categories. As discussed in our review of the proposed IT portfolio we consider SAPN's top-down challenge process has not provided compelling evidence that it has adequately accounted for:

- the impact of likely delays in delivering its IT projects and programs in the current RCP to dependent projects in the next RCP; and
- the complexity of individual IT projects and programs in the next RCP and the complex interdependencies between projects and programs.

4 Proposed ICT capex

4.1 Introduction

4.1.1 Context for this section

100. In this section, we provide our assessment of SAPN's IT and OT capex forecasts, which we collectively refer to as ICT capex. We first summarise SAPN's proposed IT and OT expenditure. We then summarise SAPN's governance and management framework and forecasting methods specific to IT.[25] Finally, we provide our assessment of SAPN's IT and OT forecast expenditure for the next RCP.

101. We note that SAPN's forecast ICT capex is provided in $2020 whereas SAPN's Business Case information is provided in $2017. While the aggregate in $2017 does not reconcile to SAPN's proposed expenditure in $2020, this does not materially affect our assessment or findings on the programs themselves.

4.1.2 What has been asked of us

102. The AER has requested EMCa's advice on whether SAPN's Information and Communication Technology (ICT) expenditure, including all network and non-network-related ICT expenditure, is likely to be prudent and efficient. SAPN describes its non-network-related ICT as 'Information Technology' (IT) and its network-related ICT as 'Operational Technology' (OT).

103. The AER has also requested that we provide our reasons for accepting or not accepting SAPN's forecast of network and non-network ICT expenditure.

[25] SAPN applies its network-related governance and management framework and forecasting methodologies to OT expenditure

4.2 Summary of proposed expenditure

4.2.1 Introduction

104. The scope of the non-network technologies considered as IT by SAPN include capabilities associated with maintaining the existing corporate and enterprise IT systems, IT networks and developing new capability consistent with SAPN's Digital Strategy to meet service levels and improve services to reduce costs. Where relevant, we have also considered the regulatory treatment of IT services provided to SA Power Networks' unregulated affiliated entity (Enerven).

105. The network OT program supports continuous day to day operation and monitoring of the distribution and telecommunications network.

4.2.2 Overview

Information Technology

106. SAPN has proposed total IT capex of $284.6m for the next RCP compared to its actual/estimated expenditure in the current RCP of $311.5m, as shown in the tables below.[26] The recurrent/non-recurrent classifications are defined by SAPN.

Table 4: Forecast total IT capex by asset category for next RCP

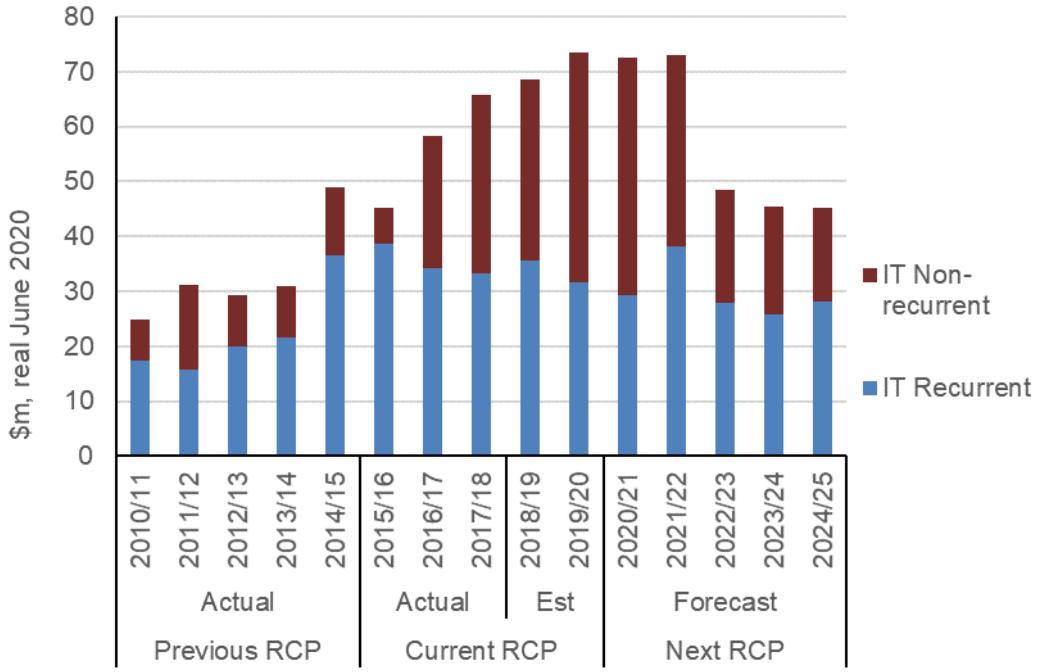
$m, real June 2020	Forecast					Total
	2020/21	2021/22	2022/23	2023/24	2024/25	Next RCP
IT Recurrent						
IT Applications Refresh	16.1	16.8	14.6	13.4	15.7	76.5
Client Device Refresh	4.7	6.0	5.6	4.6	4.6	25.5
Cyber Security	2.2	2.4	2.5	2.7	2.8	12.7
IT Infrastructure Refresh	5.5	12.3	4.6	4.5	4.2	31.1
IT Management, Risk and Governance	0.6	0.7	0.7	0.6	0.7	3.4
IT Recurrent Total	**29.2**	**38.2**	**27.9**	**25.7**	**28.0**	**149.1**
IT Non-recurrent						
CRM & Billing Completion	20.9	6.5	0.0	0.0	0.0	27.4
Network Protection Settings System Replacement	0.0	0.0	2.8	0.3	0.0	3.1
SAP Upgrade	5.0	3.9	11.6	4.6	1.8	26.9
Five Minute Settlement Rule	5.1	3.2	0.0	0.0	0.0	8.3
Ring-fencing Compliance: IT Solution	2.7	1.4	0.0	0.0	0.0	4.0
Assets and Work Program	7.1	10.3	0.0	13.1	14.3	44.9
GIS Consolidation	2.5	6.8	4.7	1.0	0.1	15.0
Worker safety: Fatigue Risk Management	0.0	2.6	1.4	0.8	1.0	5.8
IT Non-recurrent Total	**43.3**	**34.7**	**20.5**	**19.8**	**17.2**	**135.5**
Grand Total	**72.5**	**72.9**	**48.5**	**45.5**	**45.2**	**284.6**

Source: SAPN's response to information request AER IR 008.

107. The figure below shows SAPN's actual, estimated, and forecast IT capex, by category, for the previous, current and next RCPs.

[26] SAPN define its recurrent and non-recurrent expenditure items in its IT Investment Plan 2020-25. Table 8.1. Page 37.

Figure 9: Forecast total IT capex by asset category – previous, current and next RCP



Source: SAPN Reset RIN and SAPN's response to information request AER IR008

108. The figure above shows that, in the previous and current RCP, total annual IT capex was relatively flat in the 4 year period to 2013/14 and then steadily increasing in the 6 year period between 2014/15 and 2019/20. In the next RCP, SAPN forecasts total annual IT capex to remain elevated until 2021/22, followed by a step-change decrease starting in 2022/23.

Operational technology

109. SAPN's proposed OT capex program for the next RCP is $22.2m, which compares with $30.2m for the current RCP (2015-20) and $12.5m for the previous RCP (2010-15).[27] for the next RCP, as shown in the table and figure below.

110. SAPN advised that the proposed network OT program for the next RCP is a continuation of existing programs, noting that in the current RCP it has:[28]

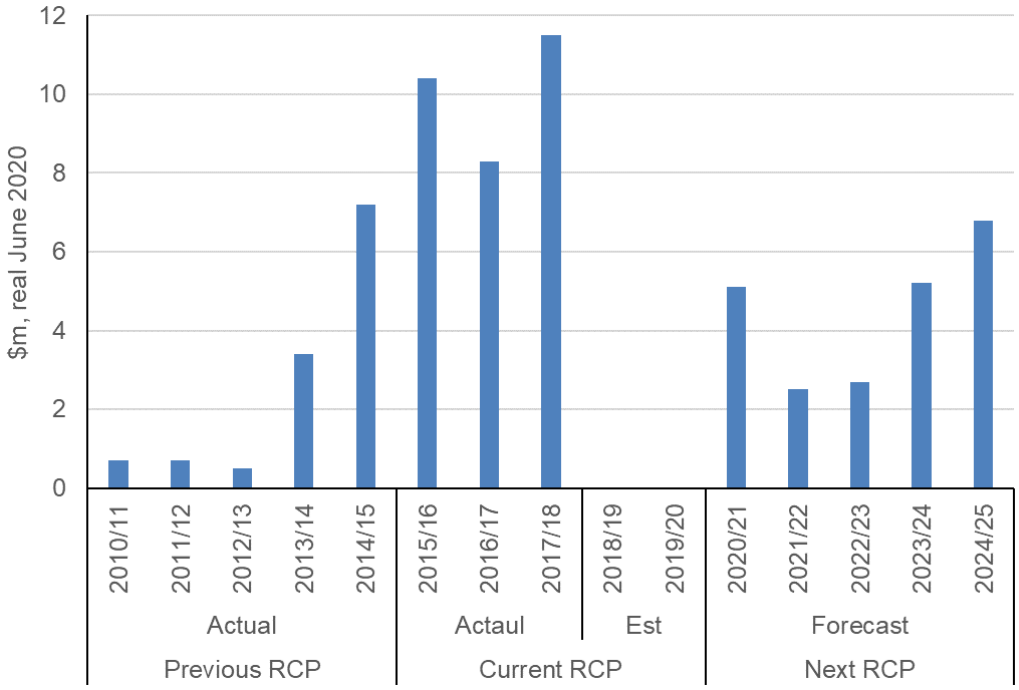
- completed implementation of its advanced distribution management system (ADMS);
- commenced integration of its outage management system (OMS) into the ADMS;
- upgraded its telecommunications network control (TNC); and
- transferred its field and emergency switching communications to the Government Radio Network.

111. From the figure below, it appears that this work was completed in 2017/18, as there is no subsequent actual or estimated expenditure for the balance of the current RCP. We observe that the cost over the current RCP is $30.2m, which is significantly more than the $22.2m proposed for the next RCP.

[27] SAPN. Attachment 5- Capital expenditure. Table 5-43 and Table 5-44

[28] SAPN. Attachment 5 - Capital expenditure. Page 103

Figure 10: Total OT capex for the previous, current and next RCP



Sources: SAPN. Attachment 5 – Capital expenditure, Table 5-56

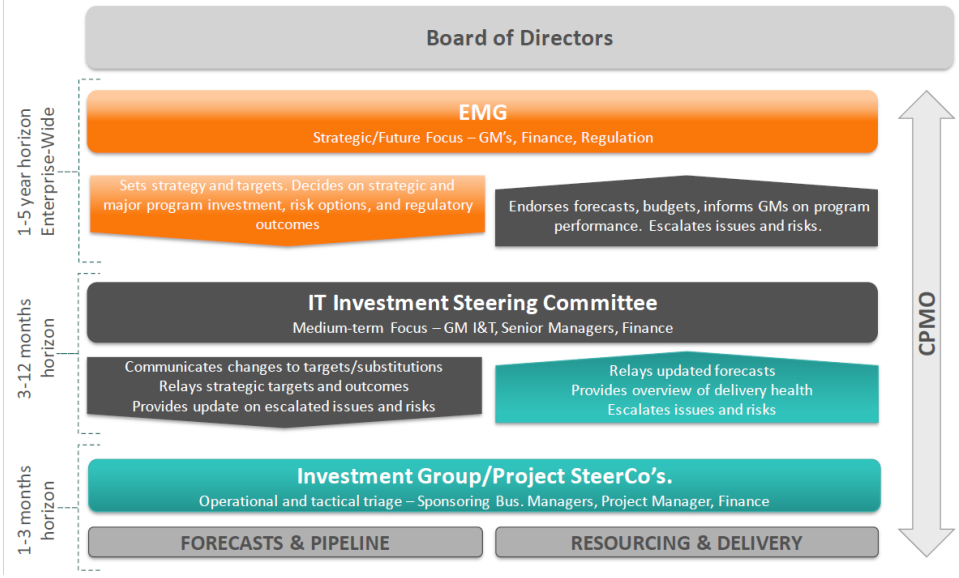
4.3 SAPN's IT governance and management framework, and forecasting processes

4.3.1 IT governance and management framework

112. The figure below shows SAPN's IT governance framework, which is similar to its network governance framework reviewed in section 3. There is a hierarchy of responsibility from the Executive Management Group (EMG) to the IT Steering Committee, and Investment Group / Project Steering Committees.

113. As with network expenditure, the project and program portfolio is overseen by the CPMO using the same portfolio management framework as described in section 3.

Figure 11: SAPN's IT governance framework



Source: SAPN. EMCa presentation master deck – Day 2 Stream 2 IT – Confidential – May 2019.

SAPN's IT expenditure drivers

114. SAPN's hierarchy of IT documents underpinning its forecast include its Digital Strategy 2018 – 2025, its IT Investment Plan 2020-2025, Business cases and its Cost model. SAPN's bottom-up forecast is designed to respond to three key challenges (referred to by SAPN as '*Strategic Drivers*'):[29]

- rapidly changing energy market and customer preferences;
- SAPN's ageing network infrastructure and changing workforce; and
- core IT needs to continue to evolve cost-efficiently.

SAPN's IT investment objectives

115. SAPN's IT investment objectives are to:[30]

- maintain compliance with existing and meet new regulatory obligations;
- maintain current levels of service and manage IT technology risk; and
- manage business and distribution costs through efficient use of data and digital technology.

SAPN's IT strategy

116. SAPN's Digital Strategy 2018-2025 outlines a strategic response to these key challenges based on six themes:[31]

- unleashing intelligence – such as by extending analytics capability;
- richer data and greater visibility;
- creating an open, integrated platform;

[29] SAPN. Attachment 5.32. IT Investment Plan 2020-25. January 2019. Page 10.

[30] SAPN. Attachment 5.32. IT Investment Plan 2020-25. January 2019. Page 12.

[31] SAPN. Attachment 5.32. IT Investment Plan 2020-25. January 2019. Page 49.

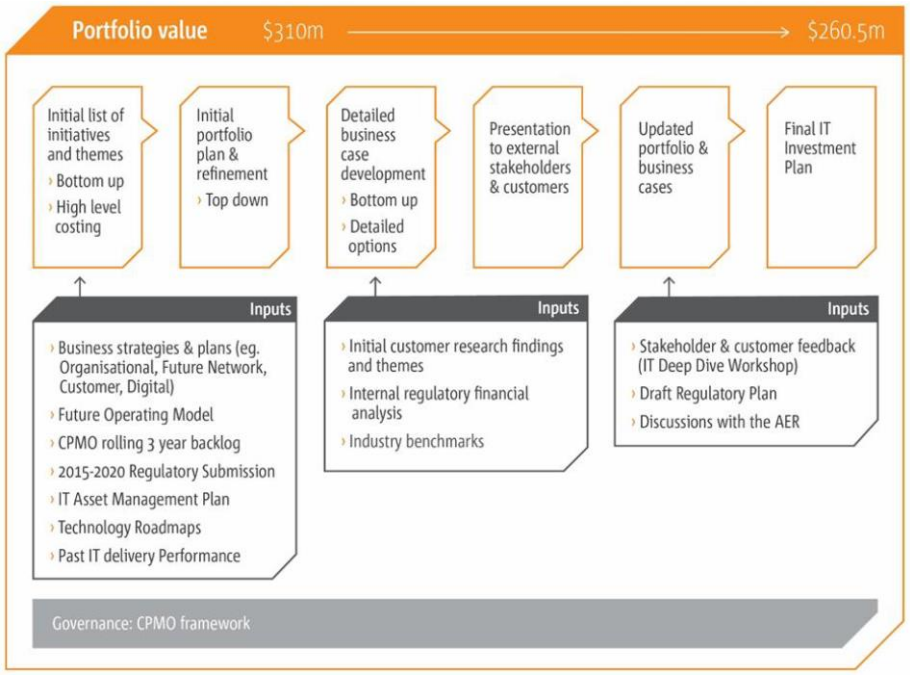
- equipping SAPN people for the digital world;
- reshaping the IT operating model; and
- evolving core IT – including transition to the Cloud.

SAPN's portfolio development process

117. SAPN's IT investment plan development process, shown in the figure below, illustrates that its initial bottom-up forecast was based on high level cost forecasts from various inputs. This forecast was progressively refined through internal reviews, business case development, stakeholder & customer feedback (from an IT Deep Dive Workshop), and discussions with the AER. The detail underpinning its internal reviews is provided in response to an Information Request.[32]

118. SAPN reduced its initial IT portfolio forecast of $310m ($2017) by $49.5m through this review process, to $260.5m ($2017)[33] for the next RCP.

Figure 12: SAPN IT investment plan development process



Source: SAPN. EMCa presentation master deck – Day 2 Stream 2 IT – Confidential – May 2019.

119. The prioritisation methods applied in SAPN's initial top-down refinement of the portfolio are described by SAPN in the table below.

[32] SAPN-IR039-EMCa follow up-20190531-Confidential. Pages 27-30

[33] This is equivalent to the IT forecast for the next RCP of $284.6m ($2020)

Table 5: Portfolio prioritisation methodologies

IT investment objective	Expenditure type	Prioritisation method
Maintain compliance	Regulatory or legal	Mandatory
Maintain current levels of service	≤ 5years	IT AMP and risk assessment
	≥ 5 years	Business case must consider deferral option
Manage business & network costs	New business or customer need	Alignment to the NER, customer input & strategic fit

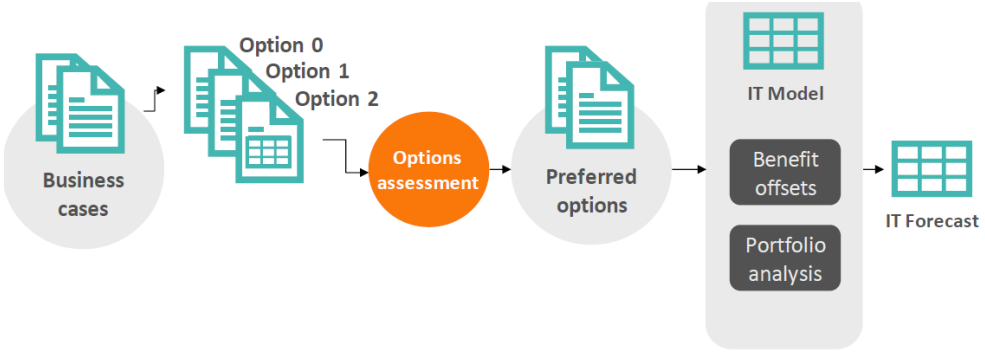
Source: SAPN. EMCa presentation master deck – Day 2 Stream 2 IT – Confidential – May 2019.

120. SAPN advised that: '*Several business cases and initiatives from within business cases were deferred to the 2025–30 RCP as a result of the dependency and prioritisation analysis.*'[34]

4.3.2 IT forecasting process

121. SAPN advised that the IT expenditure forecasting methodology is aligned to its Networks Forecasting Methodology and the AER IT Expenditure Assessment Guidelines. SAPN has provided 13 business cases in support of its proposed 2020-25 RCP investment. The process is illustrated in the figure below.

Figure 13: IT expenditure forecasting methodology



Source: SAPN. EMCa presentation master deck – Day 2 Stream 2 IT – Confidential – May 2019.

Non-recurrent IT capital expenditure

122. SAPN's forecasting methodology for non-recurrent IT capex includes bottom-up and top-down costing approach that is based on: (i) vendor and supplier quotes; (ii) experience of other distributors and entities; (iii) historical experience of making similar changes in the organisation; and (iv) a project breakdown of resources by year and capital/operational category.[35]

123. The business cases provided typically consider at least three options: 0 - BAU or undertake minimal investment to keep the system operational; 1 - Develop an in-house version or enhance the current version(s) of the system; or 2 - Replacement and/or consolidation. SAPN usually, but not always, selects the project with the highest NPV of the options considered. However, as discussed in subsequent sections, the NPV is typically negative.

[34] SAPN. Attachment 5.32. IT Investment Plan 2020-25. Page 51.

[35] SAPN. Attachment 5.32. IT Investment Plan 2020-25. Page 54.

Recurrent IT capital expenditure

124. SAPN's forecasting methodology for recurrent IT capex is derived from a bottom-up approach. Costs are based predominantly on historical expenditure and current vendor support agreements, with more detailed analysis undertaken where capital to operating cost shifts are expected (such as when migrating IT infrastructure to the cloud).[36]

4.3.3 Observations on SAPN's IT governance and management process

SAPN's objectives and strategy are similar to those of other DNSPs

125. SAPN's objectives are aligned with the NER capex criteria and its 'Network Digital Strategy' is designed to provide the foundation for the delivery of its 'Future Network Strategy'. As with other DNSPs, SAPN is seeking to respond to 'technology disruption' in the electricity sector (i.e., PV penetration, battery energy storage systems, electric vehicles, Virtual Power Plants, risks to the stability and security of supply, and new energy products).

126. At a strategic level, we consider that responding to these emerging issues and seeking to reduce costs through enhanced capability and deployment of IT is appropriate for SAPN. This does not in itself justify any or all such projects and programs, however it does provide context for our assessment of these elements in SAPN's proposal.

SAPN's justification for discretionary projects is not compelling

127. SAPN has developed business cases for each project within its non-recurrent capex expenditure category. Typically, three options are considered, which is acceptable given the majority of the proposed projects are in the early phases of the project lifecycle. SAPN relies upon aggregate benefit streams to justify proposed discretionary expenditure, rather than the net present value of the individual projects (which are usually negative and collectively negative). SAPN itself notes that its approach to determining individual project benefits is biased to overstate them and we have seen no evidence of the claimed 'collective' repex deferral benefits in its repex forecast.

SAPN's expenditure governance and management framework is appropriate

128. The elements of SAPN's IT governance and management framework are generally consistent with industry practice and we have focused our assessment (which we describe in subsequent sections) on its application of those framework elements in preparing its forecast expenditure requirements.

SAPN's portfolio deliverability assessment appears to be conservative

129. Whilst we note the steps taken by SAPN to assess the risk of deliverability, we consider that there remains material delivery risk at a project level and, because of

[36] SAPN. Attachment 5.32. IT Investment Plan 2020-25. Page 54.

the project interdependencies, at a portfolio level. We discuss our views further in section 4.4., below.

SAPN's cost estimation methodologies are appropriate

130. SAPN applies a number of cost estimation forecasting methodologies to develop its forecasts for recurrent and non-recurrent expenditure. SAPN's cost estimation methodologies are appropriate and the level of accuracy is acceptable given most of the projects are in the early phases of the project development lifecycle.

4.4 Assessment of proposed IT portfolio program

4.4.1 Introduction

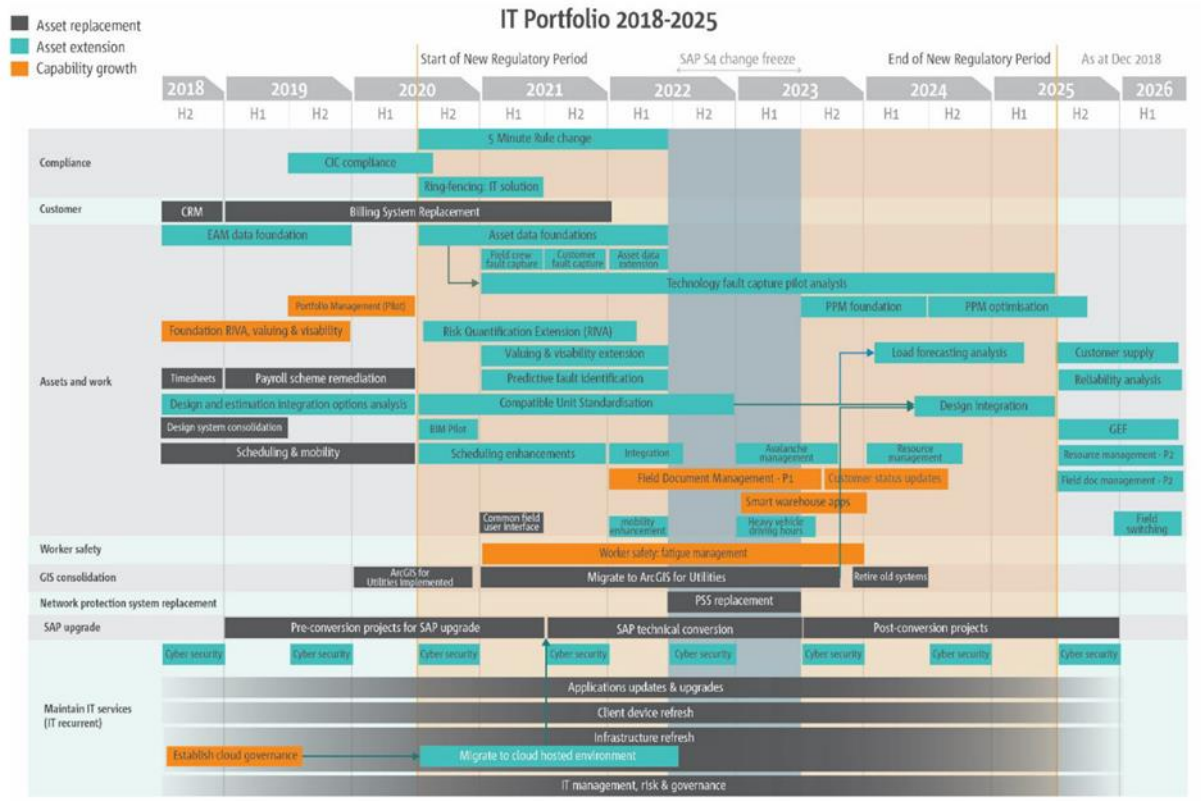
131. In this section, we focus on the risks to efficient delivery of SAPN's proposed $284.6m portfolio of IT capex projects for the next RCP, noting that:

- Proposed non-recurrent expenditure is $135.5m and proposed recurrent expenditure is $149.1m (the justification for which we assess in a subsequent section); and
- SAPN is planning to deliver a further $22.2m of OT capex projects, which is $10.0m less than in the current RCP.

4.4.2 SAPN's IT portfolio

132. The figure below shows SAPN's IT capital project portfolio for the 2020-25 RCP. Projects in the portfolio have been identified as: (i) asset replacement; (ii) asset extension; or (iii) capability growth based on the RIN Category Analysis ICT capex expenditure classifications. It is evident from this figure that SAPN is seeking to deliver a large and complex portfolio of projects.

Figure 14: SAPN's IT Portfolio 2018 - 2025



Source: SAPN – 5.32 IT Investment Plan 2020-25 – January 2019, Figure 4.3

4.4.3 Our assessment

SAPN's initial IT forecast was significantly higher than the revised 2015-20 RCP forecast

133. SAPN's initial RP 2015-20 IT forecast was $367.3m ($2017). Following the AER's Draft Determination, which significantly reduced the IT allowance on the grounds of delivery risk, SAPN reduced its proposed expenditure to $311.2m ($2017) in its Revised RP which is approximately 15% less than its initial forecast.[37] This indicates an optimistic bias to its initial expenditure forecasting.

134. We asked SAPN to comment on what changes it had made to its expenditure forecasting methodology in developing its IT capex forecast for the next RCP. SAPN advised that:[38]

- for its 2015-20 IT Proposal, it used 'a rigorous and standardised forecasting methodology including standard costing templates and estimation methods, and linking our estimates strongly to evidence and customer benefits';
- as part of its 2015-20 IT Proposal development it contracted KPMG to provide an independent review, and that KPMG concluded that the forecasting methodology '…followed better industry practices in developing expenditure forecasts'; and
- its method has not changed significantly for this current Proposal.

[37] SAPN-IR039-EMCa follow-up-20190531-Confidential. Page 21

[38] SAPN-IR039 EMCa Follow-up 20190531 Confidential. Page 24

135. On this basis we conclude that SAPN has not significantly changed its expenditure forecasting methodology in preparing the IT capex forecast for the next RCP.

136. Unless SAPN provides evidence to the contrary, we expect that this bias to overestimation to have been maintained in developing its forecast for the current RCP.

Some IT projects in the current RCP are behind schedule

137. In the last year of the current RCP, the IT Plan designates 20 concurrent projects with an aggregate expenditure of $74m in 2019/20, with 12 of these projects scheduled to be delivered to production.[39] [40]

138. At our onsite meeting in May 2019, SAPN advised that - of the 12 projects scheduled for delivery at the end of the current RCP - a number were behind schedule. Of particular concern to SAPN was the 'Customer Systems' program of work.[41] SAPN advised that it was not seeking extra capex in the next RCP for any work it requires to complete the in-flight projects.

139. We subsequently asked SAPN to confirm its 2015-20 IT portfolio status. SAPN provided an extract from its IT Investment Steering Committee – Portfolio Monthly Performance report (20 May 2019), which shows:[42]

- 57 in-flight projects - nine (16%) of which are rated as red or amber in the dashboard, although only three of these appear to have schedule issues;
- the extract does not indicate project performance or portfolio performance against the baseline, noting that there are several references in the extract provided about re-baselining; and
- the performance report does not indicate that 'Customer Systems' projects are behind schedule and therefore does not align with the information provided verbally at our on-site meeting.

140. Based on our discussions with SAPN, and our assessment of the complexity of the projects in progress and/or due to be completed, we consider that there is a high likelihood that delivery of some projects will extend past the end of the current RCP. Based on our experience, we consider that these projects carry an expected 15% risk of delay. Accordingly, we estimate that approximately $10m of project activity will 'roll-out' into the next RCP, with consequent implications for dependent projects that SAPN plans for this next period.

Projects within the next RCP are complex adding to delivery risk

141. A primary benefit of the proposed IT upgrade and replacement work proposed by SAPN in the current and next RCP is reduced IT system and environment complexity. However, the IT projects themselves are complex, high risk and large capital investments. We discuss three examples below.

[39] SAPN's response to information request AER IR011B-ICT-20190405-Confidential. Page 2

[40] SAPN. Attachment 5.32. IT Investment Plan 2020-25 – January 2019, Figure 4.3.

[41] SAPN. IT Review Meeting. Adelaide. 14th May 2019.

[42] SAPN's response to information request AER IR039-Q51-CPMO-Monthly-Report 20190531-Confdential.

- **Example 1:** The proposed upgrade of SAP is probably the most complex of these project investments. SAPN has chosen to stage the work over the current and next two RCPs and to include an applications 'freeze' to assist with delivery of the core conversion project to SAP S/4. We note that SAPN engaged SAP and Capgemini to help with its planning process and has integrated lessons learned from SAP S/4 upgrade reference sites in its planning.[43] SAPN rates the delivery risk for this project as Medium.
- **Example 2:** SAPN does not explicitly rate the delivery risk of its proposed $14m GIS consolidation project, but it does identify risk mitigation tactics. We consider that it is a relatively complex project, given that it requires, among other things:[44]
  - translation from two separate systems (Hexagon's G/Technology and ESRI's ArcGIS), which have customised interfaces with other major business systems, into a single platform; and
  - implementation of required changes to ensure the consistency and accuracy of asset information for network operations and asset management decision making.
- **Example 3:** The Asset and Works program involves five integrated initiatives, each of which brings their own complexities. We note that SAPN rates the delivery risk as 'negligible'.

142. Despite SAPN's confidence in managing delivery risks, we consider the technical complexity of these projects, including the need to manage interfaces with other business enterprise systems (e.g., through the transition from one system to another) adds to project delivery and business continuity risk.

143. From our review of the project delivery risk statements in each business case, the recognition of these risks and the risk management strategies vary in scope, depth and quality. In the larger projects referred to above, SAPN has adopted a number of risk mitigation strategies. In other business cases, the project risk section is perfunctory.

144. We consider that SAPN has understated and/or underestimated the delivery risk of the majority of its projects within its planned portfolio.

There are complex interdependencies across RCP boundaries and within the next RCP which increase delivery risk

145. The incomplete IT project work from the current RCP that we expect to roll into the next RCP will reduce SAPN's capacity to commence and undertake the IT projects forecast for the next RCP. It is not clear if and/or how SAPN has taken account of the interdependencies of project completion delays and utilisation of project delivery resources - as between the current RCP and next RCP - in its risk assessment of portfolio deliverability.

146. The figure below shows the complex interdependencies for the GIS and Assets & Work programs. We consider that neither this Figure 15, nor the preceding Figure

[43] SAPN's response to information request AER IR039-EMCa follow-up-20190531-Confidential. Pages 30-31.

[44] SAPN. Attachment 5.37. GIS Consolidation Business Case. January 2019. Page 4.

14, nor the individual business cases show evidence of any Hypercare support[45] windows between dependent projects to allow for re-work or settling in of the new technologies. In a number of dependent projects, the portfolio view shows an overlap of project-end and project-start times. This can considerably increase the risk of a total portfolio expenditure overrun.

Figure 15: [redacted]

Source: SAPN. IR038. [redacted]

147. Based on our experience, we consider that all projects in the proposed IT portfolio require a 25% - 30% time contingency added.

148. We observe that a significant number of projects are active year-on-year across the forecast period. During 2020/21, for instance, 21 large projects will be in full flight, requiring governance across a number of diverse project teams with significant interdependencies.

149. With the number of large, complex dependent projects the phasing becomes critical. The phasing adopted by SAPN is back-to-back. Based on our experience, only 10-15% of existing IT projects being delayed would negatively affect future program delivery. In our view, this likelihood dramatically increases the schedule and delivery risk profile.

150. Based on the information provided, we are not satisfied that SAPN has adequately accounted for the non-recurrent project and program complexities and

[45] Hypercare is the phase after the system/tool goes live – it is a support phase recognising that there are often bugs and fixes to resolve after go-live (particularly when data integration is a feature of the project. Provision for a hypercare window recognises that resources are required to provide the support. When the hypercare support ends, the system is assumed to be stable

interdependencies, which for the proposed IT Portfolio are considerable. As a result, we consider that it is likely that SAPN will: (i) actually incur a lower level of expenditure for the RCP (i.e., deliver less than the forecast non-recurrent capex due to delays); and/or (ii) deliver the projects less efficiently (i.e., higher cost due to risks / complexities).

4.5 Assessment of proposed recurrent IT expenditure

4.5.1 Introduction

151. In this section, we review the specific components of project expenditure underpinning SAPN's proposed recurrent IT capex for the next RCP and provide our assessment for each project component.

152. SAPN has provided its IT recurrent capex forecast expressed in $2020, however the business case documents provided to support the expenditure are expressed in $2017. SAPN has not provided a reconciliation of the values it has provided in its business cases and the RP. We therefore refer to expenditure for specific initiatives in $2017, consistent with its business case documents, however our assessments are not affected by the terms on which expenditure information is expressed.

153. We have provided a comparison of the forecast capex for the next RCP in $2020 and $2017, by initiative in the table below.

Table 6: Comparison of Total IT recurrent capex for the next RCP in $2020 and $2017

IT Recurrent capex	Total Next RCP real $2020	Business Cases real $2017
Initiative		
IT Applications Refresh	76.5	69.8
Client Device Refresh	25.5	23.2
Cyber Security	12.7	11.5
IT Infrastructure Refresh	31.1	28.5
IT Management, Risk and Governance	3.4	3.1
Total	**149.1**	**136.1**

Source: EMCa analysis.

4.5.2 SAPN's proposed components of expenditure

SAPN's forecast

154. SAPN's proposed IT recurrent capex comprises five projects, as shown in the table below. SAPN has expressed Total forecast recurrent IT capex for the next RCP is $149.1m, as shown in the table above. However, in comparing historical and forecast expenditure at the 'initiative' level, SAPN's information is expressed in $2017 and, as shown above, corresponds to 136.1m in $2017 terms. Compared to actual and estimated capex of $158.3m ($2017) for the current RCP, this represents an overall $22.2 million ($2017) or 14.0% reduction in forecast capex when compared with the current RCP.

Table 7: Total IT recurrent capex for the previous, current and next RCP

$m, real Dec 2017 Initiative	Allowance 2015-20	Actual/ Estimate 2015-20	Forecast 2020-25	Change from 2015-20
Cyber security	6.8	10.5	11.5	9.5%
Client devices refresh	20.1	26.4	23.2	-12.1%
IT applications refresh	81.6	80.0	69.8	-12.8%
IT infrastructure	36.7	38.2	28.5	-25.4%
IT management, risk and governance	5.7	3.2	3.1	-3.1%
TOTAL	**150.9**	**158.3**	**136.1**	**-14.0%**

Source: SAPN. Attachment 5.32. IT Investment Plan 2020-25, Table 6.3

155. SAPN advised that its reduction in forecast capex for the next RCP, compared to the current RCP, has been achieved by consolidating IT systems, moving capability to cloud services and continual improvement of IT services management.

Cyber security

156. In its Business Case, SAPN states that the cyber security project is designed to enable the business to meet and maintain compliance with relevant legislative requirements such as the Privacy Act and Security of Critical Infrastructure obligations from the Energy Security Board.

Client devices refresh

157. SAPN's 'client devices' project includes expenditure for desktops, laptops, mobile devices (phones, tablets) and meeting room equipment. SAPN's Business Case presents four options: (i) Option 0 Replace when unusable; (ii) Option 1 Industry standard refresh; (iii) Option 2 Business as Usual; and (iv) Option 3 Role-based refresh. SAPN has selected Option 3 Role-based refresh.

IT applications refresh

158. SAPN's IT Applications project comprises approximately 80 supported software applications. The forecast capex is for periodic application version upgrades, defect and/or compliance remediation, security patching, and minor enhancements.

IT infrastructure

159. SAPN describes the purpose of this project as being for the progressive move of hosting services from all 'on-premise' to a Hybrid Cloud environment.

IT management, risk and governance

160. We understand from SAPN's 2020-25 RP[46] that there is no Business Case for this initiative. SAPN describes the capex being for 'IT technology roadmaps to underpin cost efficient future planning.'

[46] SAPN. Attachment 5 - Capital expenditure. Figure 5.28.

4.5.3 Our assessment

Cyber security

161. We are satisfied that SAPN has both strategically and operationally addressed its obligations to mitigate Cyber Security threats. The capex forecast in security projects of in the next RCP is consistent with a DNSP of this nature and size. On this basis we consider that the forecast expenditure is reasonable.

Client devices refresh

162. We consider that SAPN's selection of the 'Role-based refresh', which allows for increased risk by extending the refresh cycles of some devices, is a prudent choice. The forecast expenditure: (i) is 12% less than estimated to be incurred in the current RCP; (ii) corresponds with the least cost option (of those considered); and (iii) appears to appropriately balance cost and risk. SAPN advised that the cost estimate is based on detailed cost models, with external estimates sought for all vendor-related costs.[47] On this basis, we consider that the forecast expenditure is likely to be prudent and efficient.

IT applications refresh

163. SAPN advised that: *'… we have used a strategy of retaining a conservative approach to maintain supportability of, and compatibility between, IT application assets. This has included a focus on consolidating to a core set of applications, removing applications no longer required and considering appropriate support options including the use of cloud services… Following this strategy has enabled us to continue to respond to continual demand for new capabilities within the existing budgets.'*[48] We consider the strategy to be reasonable.

164. SAPN considered two options for its IT applications refresh: (1) patch and upgrade all systems; or (2) utilise a risk-based approach. SAPN has selected Option 2 at a cost of $69.8m ($2017).[49] This is 13% lower than the current RCP actual/estimated capex of $81.6m ($2017).

165. Based on the information provided, we consider the capex proposed represents a prudent approach with an efficient cost.

IT infrastructure refresh

166. SAPN advised that: '*[t]raditionally we have managed our infrastructure refresh program by prudent and efficient replacement of end-of life-assets, deferring replacement where risk is manageable… but with the recent advent of new technology we have followed the industry in exploring new ways of managing IT Infrastructure needs using cloud computing such as Infrastructure as a Service (IaaS).'*[50]

[47] SAPN. Attachment 5.33. Client Devices Refresh Business Case. January 2019. Page 26.

[48] SAPN. Attachment 6.2. IT Applications Refresh Business Case - January 2019. Page 3

[49] This includes decommissioning SAPN's on-premise version of Click and moving to the cloud based version, a project that was commenced in the current RCP – there is an opex impact of this move which is not within the scope of our assessment.

[50] SAPN Attachment 6.1. IT Infrastructure Refresh Business Case - January 2019 – Confidential. Page 4

167. SAPN considered three options for its infrastructure refresh program: (1) Business as Usual; (2) Measured Move to Cloud; and (3) Aggressive move to Cloud. SAPN has selected option 2 - Measured Move to Cloud - to be completed by mid-2022 at a capital cost of $28.5m ($2017) plus a step increase in opex of $6.9m across the next RCP. The totex for the selected option is $35.3m ($2017), which is 8% less than totex for the current RCP.

168. We are satisfied that the 'measured move' to a Hybrid Cloud model and to expand SAPN IT cloud operational capability is a prudent and appropriate IT strategy for the next RCP based on the risk/benefit assessment in the business case. The proposed capital expenditure is reasonable and consistent for a project of this nature. The proposed expenditure responds to cyclical lifecycle refresh which is evident from the historical capex profile.[51] The risk profile of this project is appropriately stated and mitigated. Based on the information provided, we consider the capex to represent a prudent approach at an efficient cost.

IT management, risk and governance

169. SAPN has not provided sufficiently compelling information to support the proposed expenditure on IT management risk and governance. We assume that some operational expenditure is involved in the activities, but it is not clear why $0.6m-$0.7m ongoing capex is required on developing 'IT technology roadmaps to underpin cost efficient future planning' when the plan for the next five years has been developed.[52] On this basis we cannot consider the expenditure to be prudent or efficient.

4.6 Assessment of proposed non-recurrent IT expenditure

4.6.1 Introduction

170. In this section, we consider the Business Cases and other supporting information presented by SAPN to justify its proposed total Non-recurrent forecast capex of $135.5m. Total forecast expenditure is further divided by SAPN into three main categories aligned to network needs:

- maintain current levels of services and risk - $57.4m;
- maintain compliance - $12.3m; and
- maintain business and network costs through efficient use of data and technology - $65.7m.

171. While we refer to SAPN's RP proposed expenditure in $2020, where we have need to refer to expenditures from SAPN's business case information, this is typically expressed in $2017. We have provided a comparison of the forecast capex for the next RCP in $2020 and $2017, by project in the table below.

[51] SAPN's response to information request AER IR010-Non Network ICT recurrent capex-20190325-Public. Figure 1. Page 2

[52] SAPN's response to information request AER IR010-Non Network ICT recurrent capex-20190325-Public. Table 2. Page 2

Table 8: Comparison of Total IT Non-recurrent capex for the next RCP in $2020 and $2017

IT Non-recurrent capex	Total Next RCP real $2020	Business Cases real $2017
Maintain current levels of service and manage risk		
CRM & Billing Completion	27.4	24.6
Network Protection Settings System Replacement	3.1	2.8
SAP Upgrade	26.9	25.5
subtotal	**57.4**	**52.9**
Maintain compliance		
Five Minute Settlement Rule	8.3	7.7
Ring-fencing Compliance: IT Solution	4.0	3.8
subtotal	**12.3**	**11.5**
Maintain business and network costs		
Assets and Work Program	44.9	40.8
GIS Consolidation	15.0	13.8
Worker safety: Fatigue Risk Management	5.8	5.3
subtotal	**65.7**	**59.9**
Total IT non-recurrent	**135.5**	**124.3**

Source: EMCa analysis.

4.6.2 SAPN's proposed expenditure

SAPN ICT strategy element: Maintain current levels of services and risk

SAPN's forecast

172. SAPN has proposed non-recurrent IT capex to maintain current service levels and risk of $57.4m in the next RCP, comprising three initiative, as described below.

SAP upgrade

173. SAPN considered three approaches to address the risk posed by SAP Australia's advice that the current SAP environment would not be supported beyond 2025 and that no option for extended maintenance from SAP Australia would be available. SAPN's proposed expenditure is based on upgrading the current SAP system to SAP S/4 over three regulatory control periods.

CRM & Billing Program completion

174. SAPN initiated replacement of its legacy Customer Information and Billing System (CIS/OV) with a new Customer Relationship Management (CRM) and Billing system in the current RCP.

175. SAPN adopted the 'modular billing supplemented with cloud CRM' option at a total capex of $66.0m ($2017). The forecast expenditure in the current RCP was $49.4m ($2017) with the balance of $16.6m ($2017) to finalise the replacement in the next RCP. SAPN advised that actual and planned expenditure in the current RCP will be $40.6m ($2017) due to exogenous factors which delayed the program. SAPN's updated cost estimate to complete the project is the same as the initial budget, which has the result of rolling-over $8.8m ($2017) from the current RCP to the next RCP.

Protection settings management system

176. SAPN's Protection Settings Management System (PSS) catalogues more than 13,500 network protection devices used to manage, maintain and monitor the reliability of the distribution network. The Business Case states that '*PSS was first developed in 1997 and has had several upgrades since then – the current version is 6.2. Now over 20 years after it was first implemented, the system has exhausted its useful life, both in terms of technology obsolescence and the ability to meet the increasing network protection requirements of a modern Distribution Network Service Provider (DNSP).*'[53]

SAPN ICT strategy element: Maintain compliance

SAPN's forecast

177. SAPN's proposed non-recurrent IT capex to maintain compliance totals $12.3m for the next RCP, comprised of two projects as described below.

Five Minute Settlement Rule

178. SAPN has described the driver of the Five Minute Settlement Rule project as its response to the initiative by the Australian Energy Market Commission (AEMC) to introduce the Rule in the NEM. It requires the time interval for financial settlement in the NEM to be reduced from 30 minutes to five minutes. In turn, this requires updates to SAPN's IT systems to comply with the DNSP license provisions in the next RCP.

Ring Fencing: IT Solution

179. The Ring-fencing compliance project is to automate an existing manual arrangement which was implemented prior to 1 January 2018 to provide the required legal and accounting separation between SAPN's regulated network business and SAPN's unregulated business (Enerven). The forecast capital cost of this project is $4.0m.

SAPN ICT strategy element: Manage business and network costs through efficient use of data and technology

SAPN's forecast

180. SAPN's proposed non-recurrent IT capex to manage business and network costs through efficient use of data and technology totals $65.7m for the next RCP, comprised of three projects as described below.

Assets & Work Program

181. SAPN has developed a *'10-15 year rolling program of change to [its] processes, data, people and systems'* which commenced in the current RCP with the Enterprise Asset Management (EAM) project and RIN reporting. The completed EAM initiatives have contributed to '*the efficient deferral of approximately $63*

[53] SAPN. Protection Settings Management System Business case. Page 3.

million in repex in the current RCP and an additional estimated $142m deferral to be realised in the 2020-25 RCP…' [54]

182. SAPN proposes expenditure of $44.9m in the next RCP for its Asset and Works program to, among other things, realise a further $65m ($2017) benefit in the next RCP from deferred repex and a further $30m ($2017) benefit in the 2025-30 RCP. SAPN claims that the Asset and Works program will contribute to a total repex deferral of $270m ($2017) across the current and next RCP.

183. In addition to the repex-related benefits, SAPN's IT Investment Plan identifies a further $2.5m ($2017) cost reduction benefit and $1.7m ($2017) cost deferral benefit in the next RCP from the Assets & Work Program.[55] [56]

Worker Safety – Fatigue management

184. SAPN proposes spending $5.8m on technology solutions to maintain worker safety and public safety, maintain compliance with relevant legislation, support its Heavy Vehicle National Law exemption, and to enable realisation of Assets & Work Program benefits. SAPN has identified three options for fatigue management: (1) BAU manual processes; (2) Conservative implementation of integrated fatigue risk management system (IFRMS); and (3) Advanced IFRMS implementation.

GIS consolidation

185. The proposed project involves consolidating two disparate GIS systems onto a single platform. It requires implementation of an additional ArcGIS module, ArcGIS Utility, near real -time integration with ADMS, OMS, SAP and Riva systems, and decommissioning of the G/Technology platform. The proposed enhancements are stated by SAPN to be critical to supporting the Assets & Work Program to deliver the identified benefits.

4.6.3 Our assessment

SAP Upgrade – Options analysis is inadequate

186. In its Business Case, SAPN confined its options analysis to comparison of three upgrade options: (1) upgrade to SAP S/4; (2) move to a competitive non-SAP core platform; or (3) move to a portfolio of 'best of breed' applications. SAPN did not discuss the alternative of contracting a third-party vendor to provide support and virtual patching of its existing version of SAP. In response to an Information Request on this option, SAPN advised that it did not consider the option to be viable for SAPN for a number of reasons, including:[57]

- evidence of poor past experiences using third-party software support, including a DNSP;
- inadequate patching with respect to cyber security vulnerabilities and environment compatibility/interoperability;

[54] SAPN. Assets & Work Program Business case. Pages 3-4.

[55] SAPN. Attachment 5.32. IT Investment Plan 2020-25. January 2019. Appendix H.

[56] There is a small difference to benefits included in the two source documents from SAPN

[57] SAPN's response to information request AER IR011A – Non network ICT recurrent Capex. Page 6.

- software maintenance becomes largely 'break-fix' with little or no functionality for upgrades/enhancements to support mandatory electricity market changes, legal or compliance requirements and the execution of long-term business strategies; and
- significant future cost escalation risk.

187. We have considered SAPN's response to our request for information[58] and have made our own enquiries regarding alternative, third-party providers of support for the SAP ERP system. The salient points are:

- third party support providers can provide system patches (e.g. for bug fixes, and mandatory legal or regulatory changes) without having access to the SAP system kernel or Java components;
- operating costs can be significantly reduced compared to the normal level of opex charges from SAP Pty Ltd by contracting with third party support vendor;
- in the long term (more than five years), the third-party support model is likely to constrain business strategy and is likely to increase the cost and disruption of the future upgrade; and
- in the long term, the benefit of lower maintenance costs and/or prolonging the life of the existing version of SAP is likely to be negatively offset by the risk of reducing access to the technology and industry innovations by the software manufacturer, SAP.

188. Neither SAPN's Business Case, nor its response to our Information Request adequately considers the option of deferring the proposed upgrade to SAP S/4 until sometime beyond 2025 by using the third-party support model in the interim. We consider this to be a viable option and, in the absence of consideration by SAPN, we do not consider that the project has been adequately justified in accordance with the capex criteria.

189. Furthermore, in our experience, vendor announcements that it will no longer support a version of its software at a certain date can be deferred by the vendor.

SAP Upgrade – Delivery risk is not adequately assessed

190. The Business Case for the SAP Upgrade project states that the delivery risk for the three options are: Option 1 – High; Option 2 – Medium; Option 3 – Low (this is the preferred option). Our review shows that SAPN has not adequately addressed the risks that have plagued many historical ERP projects in the Australian energy utility industry. The most common risks that have stressed these historical projects include:

- Data Integration failure;
- Data Migration failure;
- Data Quality failure; and
- Change Management Failure.

191. Further, the SAP Upgrade project phases are placed back-to-back without any time contingency between phases. We consider this to be unrealistic. Based on our experience, time contingency is required for projects of this complexity for

[58] SAPN's response to information request AER IR011.

hypercare support. As discussed in our assessment of SAPN's proposed IT Portfolio Plan, after completing each phase of work, hypercare time contingency should be included to allow the project to fine-tune and settle by addressing any issues that emerge at the end of a project. As proposed, the SAP Upgrade project requires significant data migration and integration. We have not seen evidence that SAPN has adequately considered provisions for time contingency, which we estimate would add at least 3 months after each of the SAP project Phases for hypercare / time contingency.

192. Of further concern is that the SAP project timeline indicates that the technical migration will start prior to the move of SAP to the Cloud. It is unlikely that the SAP technical conversion can be done in the legacy environment. To pick up any Cloud dependencies, the SAP technical conversion would need to be done 100% in the new cloud environment. This would further stretch the project time frame.

193. We note SAPN's advice in response to our Information Request regarding its SAP Upgrade delivery risk analysis,[59] but our view is that the complexity of the project in the context of the overall IT Plan represents material risk of one or more of the above 'failures' materialising.

194. In summary, our assessment of the delivery risk is that all three options would carry a "High" risk rating, with the likelihood of one or more risk occurring as "Likely".

CRM & Billing Program completion

195. On the basis of the information provided, we consider that the proposed expenditure for SAPN to complete the in-flight CRM & Billing project of $27.4m in the next RCP is reasonable.

Protection settings management system

196. SAPN considers three options in its Business Case to replace this outdated system. We consider the selected option (replace with a commercial off-the-shelf system) and the timing of the work to be a reasonable assumption for expenditure forecasting purposes. Whilst the source of the cost estimate is not obvious from the Business case, a cost breakdown is provided, and the total cost estimate appears reasonable.

Five Minute Settlement Rule

197. We consider the scope of work, including the selected option (i.e., compliance through modifying existing processes and systems), and cost estimate to be reasonable.

Ring Fencing: IT Solution

198. Based on the information provided we consider that, if the project proceeds, the costs should be borne by Enerven, not by SAPN's regulated customers. We note that regulated customers have been (in our view, inappropriately) bearing the cost of the existing manual system.

[59] SAPN's response to information request AER IR039-EMCa follow up-20190531-Confidential. Pages 30-31

Assets & Work Program

199. The project is built around five inter-related initiatives, as shown in the figure below. The Worker Safety and GIS Consolidation projects are identified by SAPN as enabling initiatives to the other five initiatives. We note the link to the GIS consolidation and upgrade project., however we consider these in subsequent sub-sections below, as these are identified by SAPN as 'enabling' projects rather than 'core' projects.

Figure 16: Elements of SAPN's proposed Assets & Work Program

Source: SAPN. Assets & Work Program Business case. Page 24

Individual project NPVs indicate that the proposed program of work is not justified

200. In response to a request for information, SAPN provided NPV spreadsheets for each of the projects in the Assets & Work program. The results are summarised in the table below. The aggregate NPV for the five 'core' projects within the Assets & Work program is -$57.3m ($2017). Of these, the Service Delivery Optimisation project was the only one assessed by SAPN to have a positive NPV, by a small margin.

201. The table also shows that the total proposed capex to achieve the stated benefits is $80.3m ($2017), with $40.8m ($2017) in the next RCP (and which corresponds to the $44.9m ($2020) that SAPN has proposed).

202. In addition to the $29.7m benefits directly associated with the five core projects comprising the Asset & Works business case, SAPN claims repex deferral benefits enabled by the Asset & Works programs of $95m over the next two RCPs. Of this, SAPN has claimed that $65m will be realised in the next RCP and the balance of $30m in the subsequent 5-year period.

Table 9: Assets & Work project cost, benefits and NPV ($Dec 2017)[60]

$m, real Dec 2017	Total Capex	Next RCP	1 Jan 2020 – 31 Dec 2030	
Project	[1]	Capex [1]	NPV [1, 2]	Benefits [1]
Asset data optimisation	22.0	10.6	-21.6	4.7
Portfolio planning management	6.0	5.4	-4.9	0.6
Asset investment optimisation	22.8	11.0	-21.0	0.6
Work lifecycle standardisation	17.7	6.7	-10.0	10.0
Service delivery optimisation	11.7	7.2	0.2	13.9
Sub-total	**80.3**	**40.8**	**-57.3**	**29.7**
Repex benefit [3]				95.0
Total	**80.3**	**40.8**	**28.2**	**124.7**

Sources: [1] SAPN Business cases NPV analyses from SAPN-IR003-Asset&Work-20190222-Confidential; preferred options, noting that the benefits attributed to individual projects are 'Other benefits' (i.e. in addition to the repex deferral benefit [2] Table 6, Asset & Works Business Case; [3] Table 13, Asset & Works Business Case, repex deferral benefit

203. SAPN advised that the benefits arising from repex deferral are likely to be overstated because it has assumed in its analysis that the repex capex is not required at some point in the future.[61] It further states that '*due to the lack of accurate and complete data, updating the NPV analysis with approximate timing of expenditure would paint an incomplete picture of the long-term advantages of the proposed program.'* SAPN provided several reasons why, despite the strongly negative NPV from the individual programs, the Assets & Work program should proceed. The reasons included: (i) option value; (ii) staggering the impact on consumer prices; (iii) and the opportunity to do the planned network repex at a lower cost in the future.[62]

204. However, we consider that the prudency or otherwise of undertaking the proposed program of work, which is essentially a continuation of the program of the same name in the current RCP, is strongly dependent on the NPV analysis of the individual projects within the program. Based on the NPV analysis presented by SAPN, the projects do not satisfy the NER capex criteria.

The aggregate repex deferral benefit attributed to the Assets & Work program has not been adequately demonstrated

205. The table above shows that from 2020 -2030, SAPN claims that total benefits of $124.7m will accrue from implementing the Asset & Works program. In the next RCP, the total quantified benefits that SAPN claims would comprise $65.0m ($2017) from repex deferral and a further $4.2m ($2017) from the five core projects (i.e. total benefits of $69.2m in the next RCP).. SAPN advised that '*[t]he $65 million has been subtracted from the estimated required repex.'*[63]

206. The overall claimed positive NPV of the Asset & Works program is dependent on the contribution of the claimed $95m repex deferral benefits. We sought to understand the source of the repex deferral benefit as provided in the NPV analysis for the Asset and Works program including the temporal allocation of expected

[60] Expenditure and benefits are associated with the proposed option over the cash flow period from 1 January 2020 to 31 December 2030

[61] SAPN 5.42. Assets & Work Program Business Case. January 2019. Page 39.

[62] SAPN's response to information request AER IR011C-ICT-20190405-Confidential. Page 7.

[63] SAPN's response to information request AER IR003-Non-NetworkCapex-20190222. Pages 12, 18.

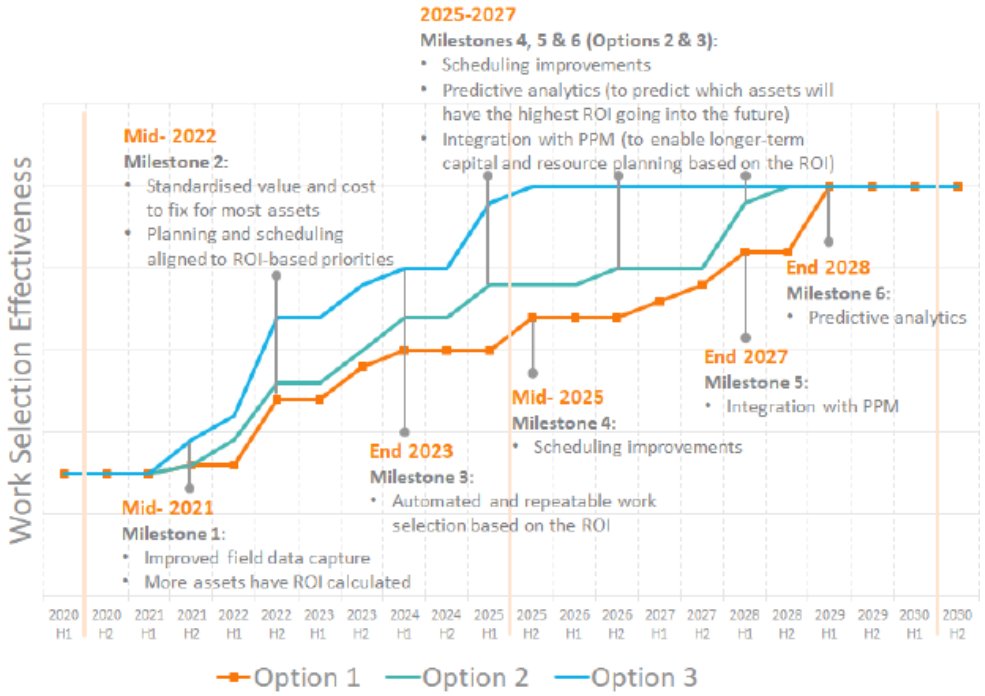
benefits. SAPN advised that there are two sources of repex deferral benefits in the next RCP, as described below:[64]

- **Value approach** – '*This benefit is being achieved through taking a new approach to valuing and selecting our work based on the delivered foundations of: asset data for key asset types in critical areas, risk quantification, and initial phase of new V&V capability*.' SAPN states that this source has generated (or will generate) the $63m benefit in the current RCP and is the source of a further $142m repex deferral benefit in the next RCP; and
- **Works selection** – '*This benefit will be achieved through establishing new risk pilots, continuing to invest in our foundations (adding asset types from critical areas and improving risk/value capabilities) and improving our work selection effectiveness*.' SAPN states that this is the source of the further $65m repex deferral benefit in the next RCP and a further $30m benefit in the 2025-30 RCP. SAPN also state that the $65m (Dec $2017) benefit '*results from improving our Work Selection Effectiveness, which will enable a greater percentage of asset replacement and refurbishment work to be selected based on a higher Return on Investment (ROI).*' SAPN defines Work Selection Effectiveness as a percentage of annual repex budget allocated to fixing defects based on their ROI, where ROI is the ratio of the risk value of the defect to the cost to fix that defect.

207. SAPN advised that it determined the relative improvement in Work Selection Effectiveness as a result of the proposed Assets & Work Program by estimating the difference between: (i) what it estimates that it would have spent without the Assets & Work initiative; and (ii) what it forecasts it will spend with the Assets & Work initiatives in place. SAPN has identified the difference for the three options it considers in its business case, as shown in the figure below. It appears that the quantum of repex reduction has been derived from the judgement of internal SAPN experts.

[64] SAPN's response to information request AER IR008- updated capex model and repex-20-190312-PUBLIC. Page 4.

Figure 17: Work selection effectiveness profiles for each option in the Assets and Work Program



Source: SAPN-IR008- updated capex model and repex-20-190312-PUBLIC. Page 5

208. Rather than the benefit being evident in a reduction in capex, SAPN's position is that '*[in] the absence of the A&W program, the budget of replacement projects/programs used as an input into the above benefits calculations would increase.*'[65] Similarly, the total $142m in deferred repex due to the transition to the Value Approach is not included in the baseline as SAPN states that it has already been taken into account in its 'reduced' capex forecast for the next RCP.[66]

209. In our view, both the claimed benefits from work in the current RCP and the claimed benefits from proposed work in the next RCP should be clearly identifiable as a proportionate reduction in SAPN's actual and forecast repex. We have not seen sufficient evidence of this to justify the benefits claimed by SAPN.

210. We sought evidence of the benefits arising from the Assets & Work Program as part of our review of aspects of SAPN's repex program, as discussed in section 8. We did not see evidence of the claimed repex benefits in the aspects of the proposed repex forecast that we were asked to review.

211. We consider that SAPN has not provided sufficient evidence that the proposed forecast capex represents a prudent or reasonable level of expenditure for two reasons:

- the claimed benefits arising from repex deferral are likely to be overstated because it has assumed in its analysis that the repex capex is not required at some point in the future, which is not a reasonable assumption; and
- regardless, we cannot identify the repex benefits claimed to derive from the Assets & Work program – although we note that the AER in its own review of the

[65] SAPN's response to information request AER IR008- updated capex model and repex-20-190312-PUBLIC. Page 4.

[66] Our scope of work does not, however, cover all of SAPN's proposed repex; therefore, we have not investigated this claimed repex reduction.

remaining aspects of repex may find evidence of the repex benefits claimed by SAPN.

Worker Safety – Fatigue management

212. We consider that SAPN has not provided sufficiently compelling information to justify the proposed option and associated forecast capex. We did not see evidence of an increased risk above that which currently exists, and which would jeopardise SAPN's exemption from the Heavy Vehicle National Law (South Australia).

GIS consolidation

213. SAPN advised in its Business Case[67] for the GIS consolidation project that *'[t]he growing need for geospatial enablement calls for a GIS with a more standardised and flexible architecture. In its present form, SA Power Networks' GIS is unable to support some important business and customer requirements, including:*

- the need to support near real-time geographic views of the impact of maintenance of a network asset
- on the electrical connectivity of the adjacent network, to enable effective prioritisation of work;
- the need to provide timely electrical network connectivity information to enable risk-based operational decisions to be made; and
- the need to capture and easily maintain detailed geospatial representation of both the high voltage (HV) and the low voltage (LV) network, and to effectively and efficiently share this information with the ADMS, OMS and other GIS data reliant corporate systems.'

214. We consider the selected option[68] to be a prudent assumption for expenditure forecasting purposes in that the primary driver of the project is to maintain the quality, reliability and security of supply of standard control services. We consider that the additional drivers described by SAPN as: (i) addressing the operational risks (i.e., to maintain service levels) associated with the current two GIS systems; and (ii) being able to better meet future demands (such as for timeliness and accuracy of more complex spatial and other data); are sufficient for completing the work by 2025.

215. We note that SAPN has identified a significant number of project risks and dependencies. We present our view of portfolio level risks, which include consideration of the risks posed by the GIS consolidation project in section 4.4.

[67] SAPN. Attachment 5.37. GIS Consolidation Business Case - January 2019. Confidential. Page 9.

[68] Consolidating the GIS capability into a single platform by decommissioning the customised and relatively old G/Technology GIS tool and upgrading the ArcGIS tool.

4.7 Assessment of proposed OT capex

4.7.1 SAPN's forecast

216. The network operational IT program (OT) is a continuation of existing programs, with forecast capex of $22.2m in the next RCP as shown in the table below, and comprised of four projects:[69]

- TNC Management ($2.8m);
- UPAX/Business telephone network ($2.2m);
- OT security ($5.0m); and
- ADMS/OMS upgrade ($12.2m).

Table 10: SAPN's operational IT programs for the next RCP70

$m, real June 2020	Forecast					Total Next RCP
	2020/21	2021/22	2022/23	2023/24	2024/25	
Total	**5.1**	**2.5**	**2.7**	**5.2**	**6.8**	**22.2**

Source: SAPN. Attachment 5 - Capital expenditure. January 2019. Table 5-43.

4.7.2 Our assessment

TNC management

217. SAPN's asset management strategy for Telecommunications Network Management Systems is a 'Targeted Replacement/Evolution Plan' for the majority of hardware and applications over a period of 3-10 years applying lifecycle guidelines.[71] SAPN used external advice on the strategy, need, timing, and cost of the proposed work for the next RCP. What is proposed is generally commensurate with historical expenditure, noting that periodically above average expenditure is required for larger system upgrades/replacements.

218. Based on the information provided we are satisfied that SAPN has reasonably identified the capex required to enable it to meet its service performance regulated guidelines.

UPAX/Business telephone network

219. SAPN's Mitel PABX includes hardware and software for the CMET 1, CMET 2 and UPAX systems. SAPN's asset management strategy and expenditure forecast is based on (i) maintaining and upgrading the UPAX and CMET 2 systems in line with vendor and manufacturer support and upgrade lifecycles, and (ii) migrating users to the CMET 2 system because the CMET 1 system is at end-of-life.[72]

[69] SAPN. Attachment 5 - Capital expenditure. Table 5-44.

[70] SAPN did not provide the forecast capex for each program by year of the next RCP

[71] SAPN's response to information request AER IR003-Attachment 5-AssetPlan 3.3.08TNCManagementSystems. Page 6

[72] CMET mainly supports voice services.

220. Based on the information provided we are satisfied that SAPN has reasonably identified the capex required to enable it to meet its service performance regulated guidelines.

OT security

221. The OT security project is based on *'maintain[ing] the highest industry standards of security monitoring and preparedness as required by a critical infrastructure organisation, we are deploying a business wide security upgrade with a focus on segregating, monitoring and protecting the OT networks that support critical operational functions.*[73] We are satisfied that the proposed upgrades and the costs of the upgrades are likely to be prudent and efficient.

ADMS/OMS upgrade

222. In the supporting Business Case, the strategy for both the ADMS hardware and software is presented as follows:[74]

- The ADMS is currently being extended to include an integrated Outage Management System (OMS) and the hardware supporting the system is scheduled for refresh in the current RCP. The refresh will suffice until the end of the next RCP (perhaps with extended support); and
- The ADMS software (v3.6) will be retained to allow for the OMS integration and for the latest version to be widely deployed and tested, noting that it includes a Distributed Energy Resource Management System (DERMS) module. SAPN propose upgrading to v3.8 or a later version by 2024/25.

223. SAPN has identified a number of benefits from moving to v3.8, including:

- maintaining cyber security protections;
- real time control of embedded generation;
- tools to facilitate DER connection;
- improved management of DER; and
- improved network modelling.

224. We have a number of concerns with the information presented:

- In SAPN's recent Capital Expenditure report,[75] the emphasis is on cyber security – no mention is made of the need for the DERMS module;
- In the Business Case, the proposed ADMS capex is $7.4m, whereas in the Capital Expenditure report the forecast capex is $12.2m. The difference is not explained or acknowledged in those documents, however, we understand that the difference is due to the infrastructure upgrade, which is now planned to occur in the next RCP;
- The justification presented for the software upgrade does not appear to comply with SAPN's governance and management framework, including the

[73] SAPN. Attachment 5 - Capital expenditure. Page 105.

[74] SAPN. Attachment 5.23. DGA Consulting – Network Control – Projects Review 2020-25. January 2019. Page 14.

[75] SAPN, Attachment 5 - Capital expenditure. Page 105.

expenditure forecasting guidelines - no options analysis is provided, and no attempt has been made to quantify the benefits of the DERMS features; and

- It is not clear whether there is a dependency or otherwise between the proposed ADMS upgrade and SAPN's proposed LV and Distribution Transformer BAU Quality of Supply program,[76] LV monitoring project,[77] and LV management project.[78]

225. If the driver for the software upgrade is to align with the Australian Energy Sector Cyber Security Framework (AESCSF), as indicated in SAPN's Capital Expenditure document, then it may be that version 3.7 (without the DERMS module) is a more prudent investment in the next RCP. However, the cost of this option is not presented by SAPN in the documentation provided to us.

226. We consider that there is: (i) a reasonable case for the infrastructure upgrade of $4.8m in the next RCP; (ii) a reasonable case for some form of upgrade to the ADMS/OMS software at some time in the next 10 years; but there is (iii) insufficient information to conclude that the proposed $7.4m capex for the ADMS/OMS system upgrade is likely to satisfy the capex criteria.

4.8 Findings and implications for SAPN's proposed IT and OT capex forecast

4.8.1 Findings

Likelihood that SAPN will not efficiently achieve the proposed program in the next RCP

227. We consider that SAPN has a systemic bias to under-estimate the time required for efficient IT project delivery. It has proposed a significant program of work with complex interdependencies. With evidence that some current projects that are precedents to proposed projects in the next RCP are already running late, we consider it likely that SAPN will not efficiently deliver its proposed IT Portfolio Plan and that some of the work that it proposes will be deferred to the subsequent RCP.

Majority of proposed recurrent IT capex is justified

228. SAPN has provided sufficient evidence to justify the majority of its proposed recurrent IT capex, with the exception being a relatively small 'IT management, risk and governance' project.

Level of proposed non-recurrent IT capex not justified

229. For its proposed SAP upgrade, SAPN's supporting information assumes that an upgrade to SAP S/4 is required in the next RCP and does not consider the realistic option of deferral to the 2025-30 RCP (or later) by using third party vendor support

[76] SAPN. Attachment 5.10. Distribution System Planning Report. Section 18.

[77] SAPN. Attachment 5.10. Distribution System Planning Report. Section 19.

[78] SAPN. Attachment 5.18. LV Management Business Case.

in the interim. If adopted, this approach is likely to lead to a lower level of capex than SAPN has proposed.

230. For its proposed Assets and Work program, SAPN has not presented sufficient evidence of tangible benefits that would be sufficient to justify the proposed expenditure, and we also did not see evidence that SAPN has accounted for such benefits in the pole and pole-top repex forecast that we reviewed.

231. The proposed worker fatigue management project similarly lacks compelling justification of the need for an IT solution, as against alternative risk mitigation options.

232. The cost associated with the ring-fencing obligation should be borne by other parties, not by regulated customers.

Proposed level of ADMS/OMS upgrade capex not justified

233. In reviewing SAPN's proposed OT expenditure, we consider that there is insufficient information to conclude that the proposed ADMS/OMS software upgrade component of the project is likely to be prudent and efficient.

4.8.2 Implications

234. Based on the projects and programs we reviewed, we consider that both the IT and OT components of SAPNs capex forecast exceed reasonable forecasts of prudent and efficient expenditure requirements. We consider that a small reduction to SAPN's proposed recurrent IT capex forecast and more significant reductions to its non-recurrent IT and to its proposed OT program of work, would not only represent reasonable forecasts of SAPN's prudent and efficient expenditure requirements, but would also address the identified deliverability concerns regarding the capacity of SAPN to deliver the portfolio of work that it has proposed for this period.

5 Proposed cable and conductor repairs expenditure

5.1 Introduction

5.1.1 Context for this section

235. In this section, we provide our advice on SAPN's proposed expenditure on cable and conductor repairs. SAPN has proposed re-classifying most of this expenditure from capex to opex. We have therefore assessed the proposed expenditure first as 'totex' and secondly, we have assessed SAPN's proposed re-classification.

5.1.2 What has been asked of us

236. The AER has requested EMCa's advice on two aspects of SAPN's proposed forecast in cable and conductor minor repairs, specifically:

- Is SA Power Networks' re-categorisation of cable and conductor minor repairs reasonable?[79] This is to be assessed by reference to:
  - how other businesses typically treat 'reactive' expenditure such as cable and conductors repairs;
  - whether SA Power Networks' reasons for proposing the re-categorisation (i.e., opex step change) are reasonable;
  - whether the repairs will extend the life of the asset (or not) and are consistent with industry practice; and

[79] SAPN has proposed re-classifying the majority of such expenditure as opex, but not all.

  - whether SA Power Networks' proposed treatment of certain cable and conductor minor repairs as opex is *more* likely to reflect prudent and efficient costs than if it is treated as repex.

- Is SA Power Networks' forecast expenditure (be it opex or capex) prudent and efficient?
  - If opex, advise on whether the proposed opex step change is prudent and efficient. This advice will assist the AER in forming its position as to whether SAPN's proposed opex forecast is consistent with its obligations under cl. 6.5.6 of the NER.
  - If capex, advise whether this expenditure would be prudent and efficient capital expenditure. This advice will assist the AER in forming its position as to whether this expenditure is consistent with its obligations under cl. 6.5.7 of the NER (capex objectives and criteria).

237. The AER has also requested that we provide our reasons for accepting or not accepting SAPN's forecast.

5.2 Summary of proposed expenditure

5.2.1 Proposed expenditure

238. SAPN has proposed cable and conductor repair expenditure (totex) of $88.2m in the next RCP, an average of $17.6m per year as shown in the table below

Table 11: SAPN's proposed cable and conductor repairs expenditure

$m, real June 2020	Forecast					Total
	2020/21	2021/22	2022/23	2023/24	2024/25	Next RCP
Total Expenditure - Cables	11.4	11.4	11.4	11.4	11.4	**56.8**
Total Expenditure - Conductors	6.3	6.3	6.3	6.3	6.3	**31.5**
Totex Cables & Conductors	**17.6**	**17.6**	**17.6**	**17.6**	**17.6**	**88.2**

Source: EMCa analysis of data in SAPN response to information request AER IR019

239. We also show the breakdown of opex and capex for cables and for conductors in the following tables. SAPN proposes $22.0m (25%) of this as capex, with the remaining $66.2m (75%) as opex.[80]

[80] These figures are from SAPN's response to AER IR039. In its RP (Attachment 5, page 28) SAPN states that it has proposed $68.2m as opex, and this figure is also reflected in its Attachment 6 (at page 23). SAPN does not explicitly show its proposed year-by-year cable and conductor totex or repex in its RP documents. However, page 41 of Attachment 5 shows total repex over the next RCP of $9.5m for cables and $13.9m for conductors, for a total of $23.4m. Combining these figures would give a totex forecast of $91.6m. The reason for the difference between these figures is unclear, but does not affect our assessment.

Table 12: SAPN's proposed cable repairs expenditure[81]

$m, real June 2020	Forecast					Total Next RCP
	2020/21	2021/22	2022/23	2023/24	2024/25	
Opex (forecast)	9.5	9.5	9.5	9.5	9.5	**47.7**
Capex (forecast)	1.8	1.8	1.8	1.8	1.8	**9.1**
Total Expenditure	**11.4**	**11.4**	**11.4**	**11.4**	**11.4**	**56.8**
Proportion of capex	*16%*	*16%*	*16%*	*16%*	*16%*	*16%*

Source: EMCa analysis of data in SAPN response to information request AER IR019

Table 13: SAPN's proposed conductor repairs expenditure

$m, real June 2020	Forecast					Total Next RCP
	2020/21	2021/22	2022/23	2023/24	2024/25	
Opex (forecast)	3.7	3.7	3.7	3.7	3.7	**18.6**
Capex (forecast)	2.6	2.6	2.6	2.6	2.6	**12.9**
Total Expenditure	**6.3**	**6.3**	**6.3**	**6.3**	**6.3**	**31.5**
Proportion of capex	*41%*	*41%*	*41%*	*41%*	*41%*	*41%*

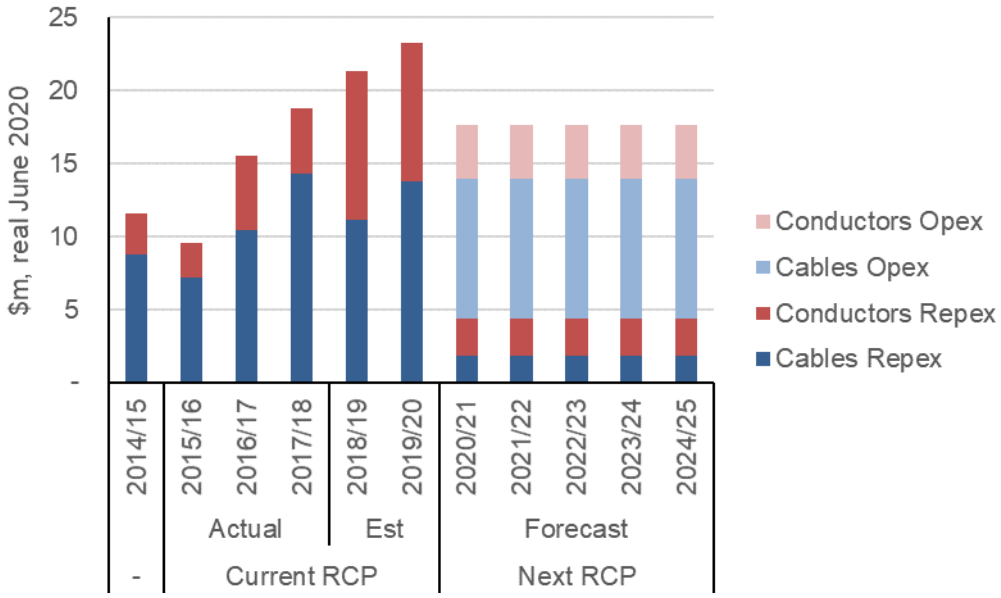
Source: EMCa analysis of data in SAPN response to information request AER IR019

240. Because the proposed opex component of forecast cable and conductor expenditure (total of $66.2m) was previously categorised as capex, it is not present in SAPN's 'base year' opex expenditure that it has used for its 'base step trend' opex forecast. Therefore, SAPN has proposed the opex allowance as a 'step change'.

241. The figure below shows SAPN's proposed totex allowance, in the context of its historical expenditure and its estimated expenditure in the final two years of the current RCP. The graph shows how 100% of cable and conductor repair expenditure up to the end of the current RCP is treated as 'repex' (and has been steadily increasing). From the beginning of the next RCP, SAPN proposes that 75% of forecast cable and conductor expenditure be classified as opex and 25% as repex (with a flat annualised expenditure profile).

[81] This excludes SAPN's proposed CBD 11kV PILC replacement, which is not within the scope of our review and also does not appear to be classified as 'underground cable' repex in SAPN's RP (Attachment 5, page 41, table 5-13).

Figure 18: Historical and proposed cable and conductor repairs expenditure[82]



Source: EMCa analysis of data in SAPN response to information request AER IR019

5.2.2 SAPN's expenditure forecasting method

242. SAPN has proposed the total expenditure allowance (i.e., comprising the opex and capex components)[83] as being equal to its estimated total expenditure in the current RCP. At the time of preparing its proposal, SAPN based its forecast on three years of actual expenditure (2015/16 to 2017/18), together with its estimated expenditure for the final two years of the current RCP. It proposes this allowance in fixed annual amounts, for cables and conductors, for each year of the next RCP.

243. SAPN has then allocated these total amounts according to capex / opex proportions that it has 're-cast' from its then most recent year of 'actual' expenditure, which was for 2017/18. These allocation proportions are shown in the tables above. For conductors, the allocation is 41% capex and 59% opex. For cables, the allocation is 16% capex and 84% opex. SAPN claims that these historical expenditure allocations are reasonably representative of future expenditure allocations.

244. SAPN has not modelled asset health or forecast expenditure requirements for underground cables or conductors based on CBRM, due to the absence of reliable data.

245. SAPN has included a dedicated planned project for the replacement of problematic 11kV PILC cable in the CBD area. We have not been asked to review this project. Accordingly, the proposed expenditure on this project is ignored in the assessment which follows.

[82] Excludes 11kV PILC program.

[83] We will refer to this as 'totex'

5.3 Assessment of proposed total expenditure

5.3.1 Cables

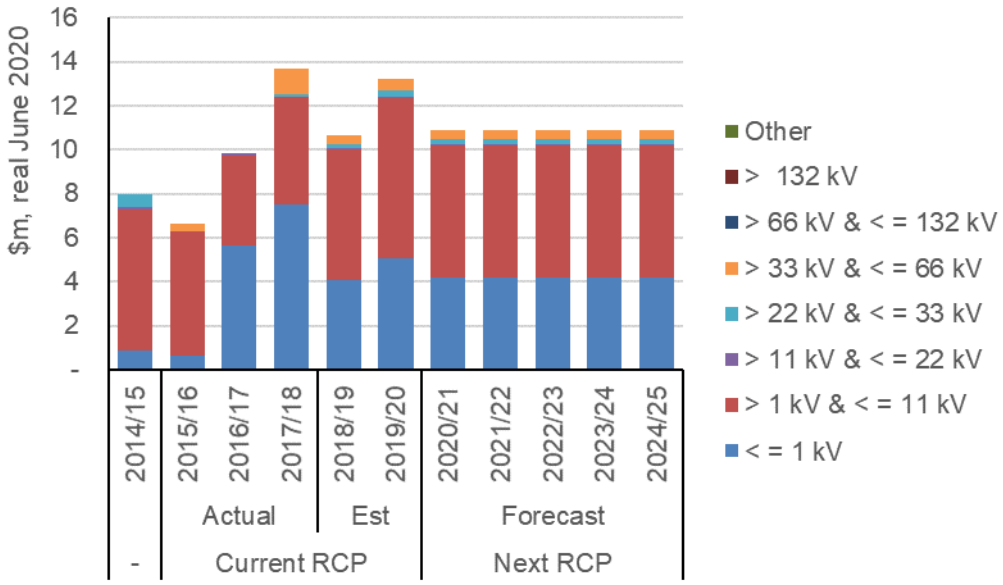
Basis for our assessment

246. SAPN has sought to forecast its required cables expenditure based on its historical expenditure, while also considering asset condition and trends. We have therefore reviewed both its historical expenditure and its asset management strategies and asset performance.

Historical expenditure by asset category

247. In the figure below, we show SAPN's historical, estimated and forecast cables capex by asset category, excluding the proposed 11kV PILC cable replacement.

Figure 19: Historical and proposed cable repairs expenditure by asset category



Source: EMCa analysis of data in SAPN response to information request AER IR019

248. The increase in capex for LV cables (≦ 1 kV, shown in dark blue) incurred in 2016/17 and 2017/18 is evident from the above figure. SAPN estimates that capex for LV cables will continue to remain elevated in the remaining two years of the current RCP. There is also a step increase in capex for 33-66kV cables in 2017/18, and an estimated increase in 1-11kV cables in 2018/19. Both of these increases are forecast to persist through the next RCP. These increases have a material impact on the total estimated expenditure to be incurred during the current and next RCP.

249. As the estimated capex to be incurred in the current RCP is used as the basis for calculation of the expenditure required in the next RCP, including the opex step change, we sought to further understand the drivers of this expenditure.

Asset management strategy & performance

250. In response to our information request, SAPN provided information on underground cable 'works' as outlined in the figure below. This information helps to distinguish

works driven by (i) cable defects; (ii) works driven by cable failures; and (iii) 'projects' driven by more pervasive issues.

Figure 20: Underground cable repair works and projects, by drivers

			No. of works complete		
Type of work	Driver of work	Scope of work	2015/16	2016/17	2017/18
Planned work (DD notification)	Raised from cable defect identified from non-routine asset inspection	- Condition assessment - Localised defect - Repair	2	5	10
Unplanned work (FM notification)	Initial notification - Raised from unplanned cable failure Follow up notification - Raised if follow up repair work is required	- Condition assessment - Localised defect - Repair	1276	1960	1494
Project	- Cable has suffered multiple failures (HV and LV) and repair no longer most economic solution - Testing of the cable insulation following repairs indicated cable in poor condition (HV only) - Diagnostic (condition assessment) testing where cables are found to be in poor condition and at high risk of failure (HV only) - Local field staff knowledge of environmental factors (eg white ants or water ingress) and repair no longer most economical solution	- Condition assessment - Project Management - Detailed Design - Replacement	3	2	12

Source: SAPN response to information request AER IR039, Question 47

251. SAPN has stated that the number of cable failures has remained relatively stable since 2011 but was higher in 2016/17 and 2017/18 due to increased LV cable failures.[84] SAPN considers the higher failure rate in 2016/17 to be as a result of higher rainfall at that time. SAPN states that '*[m]ost LV cable failures are due to insulation breakdown and present a relatively low network risk and consequently the increase in 2016/2017 was not investigated further*.'[85]

252. Whilst a new planned program has been introduced for replacement of problematic 11kV PILC cables in the CBD, SAPN states that LV cables will continue to be fixed on failure due to the relatively low consequence of fault events.

253. SAPN has not presented additional information to contend whether the failure rate is expected to improve or decline over the next RCP. The changes in the composition of expenditure evident in the RIN data at a category level are also not adequately explained. Absent information to the contrary, we consider that an average of relevant historical expenditure provides a reasonable indicator of ongoing requirements. While 2016/17 works were higher than in the years before and after, we still consider it reasonable to include this year in such an average.

5.3.2 Conductors

Basis for our assessment

254. As with cables, and consistent with the basis for SAPN's own forecast, we have assessed SAPN's proposed conductor expenditure by reviewing both its historical expenditure and its asset management strategies and asset performance.

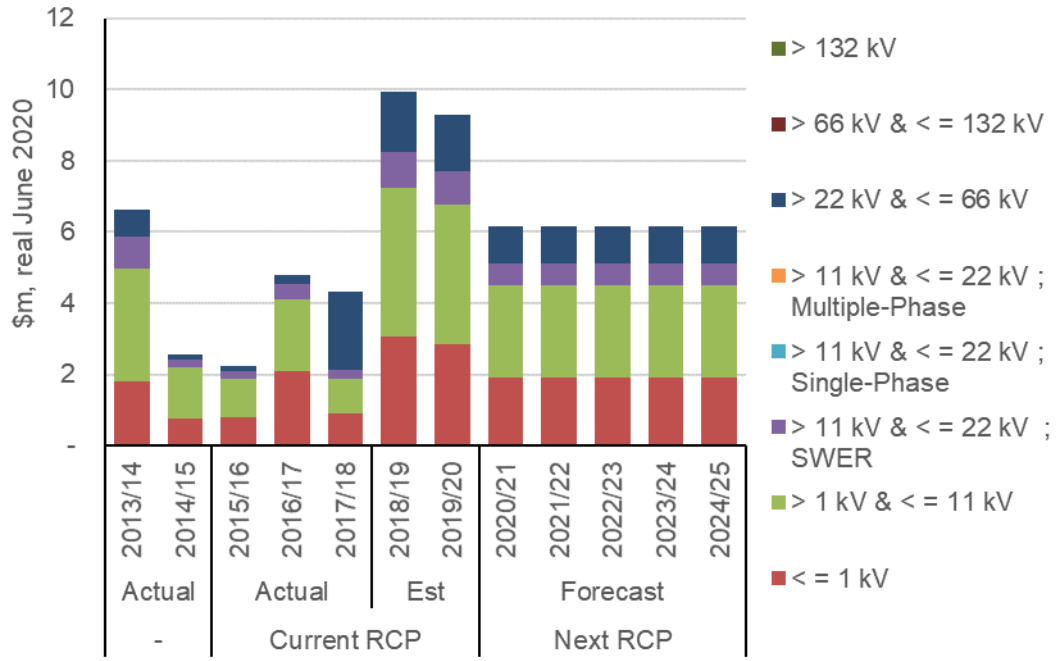
Historical and forecast expenditure by asset category

255. In the figure below, we show SAPN's historical, estimated and forecast conductor expenditure by asset category.

[84] SA Power Networks – 2020-25 Regulatory Proposal – Attachment 5 – Capital expenditure. Page 43.

[85] SA Power Networks – Power Asset Management Plan – Manual No. 16. Page 144.

Figure 21: Conductors capex by asset category



Source: EMCa analysis of data in SAPN response to information request AER IR019

256. SAPN's estimated increase in conductor replacement expenditure in 2018/19 and 2019/20 is evident from the above figure. These significant estimated increases from historical actual expenditure have a material impact on the total estimated capex to be incurred during the current RCP.

Asset management strategy & performance

257. As with cables, SAPN provided the following information on conductor repair 'works' and projects as provided in the figure below. This information helps to distinguish works driven by conductor defects, works driven by conductor failures and 'projects' driven by more pervasive issues. Similar to the information provided for cables, there was a higher number of unplanned works in 2016/17 due to conductor failures in that year.

Figure 22: Conductor repair works and projects, by drivers

			No. notification (completed)		
Type of work	Driver of work	Scope of work	2015/16	2016/17	2017/18
Planned work (DD notification)	Raised from conductor defect identified from routine asset inspection	- Condition assessment - Localised defect - Repair	61	71	107
Unplanned work (FM notification)	Initial noti - Raised from unplanned conductor failure Follow up noti - Raised if follow up repair work is required	- Condition assessment - Make-safe - Repair	1208	2032	1099
Project	- Where there are multiple previous conductor failures and repair is no longer economic - If multiple locations of corrosion or deterioration are identified through the inspection program and repair is not practical or economic - Proactive replacement of conductor where risk (likelihood and consequence) associated with failure warrants replacement.	- Condition assessment - Project Management - Detailed Design - Restringing with new conductor	4	2	6

Source: SAPN response to AER IR039, Question 47

258. SAPN states that while '*we have several major conductor replacement projects scheduled for the 2018/19 and 2019/20 regulatory years, historically most conductor repair works have been reactive minor repairs (i.e., inserting a short section of new conductor to replace the damaged section) after a fault has occurred'* and that *'we plan to continue this practice however as explained previously, we plan to now re-categorise these costs to maintenance (opex).'*[86]

259. We draw two conclusions from this that are relevant to our assessment of SAPN's forecast:

- It is reasonable to assume an ongoing level of expenditure that is not dissimilar to historical expenditure; and
- Due to the proposed major conductor replacement projects scheduled for 2018/19 and 2019/20, SAPN expects to see a higher proportion of conductor repair capitalised than would have been the case if its proposed new capitalisation policy had been applied historically.

5.3.3 Assessment of cables and conductors totex

Assessment basis

260. In its forecasting approach, SAPN has assumed that the current RCP level of activity is a reasonable indicator of the future level of activity. However, both the recent and expected level of expenditure activity is volatile and increasing. When interrogating the volume of cable and conductor activity actually incurred on the network, we observe that lower levels of work in the first three years of the current RCP were explained by SAPN as generally arising from:

- the delayed final determination in 2015/16; and
- higher unplanned storm activity in 2016/17.

261. This information suggests to us that the historical activities undertaken for the cable and conductor asset categories are subject to priorities of the business and unique

[86] SA Power Networks – 2020-25 Regulatory Proposal – Attachment 5 – Capital expenditure. Page 45.

storm events and, in aggregate, do not accurately reflect an underlying, stable level of recurrent expenditure.

262. Of particular concern to us is that SAPN's forecast for the next RCP is based on current RCP expenditures, which include its estimates for 2018/19 and 2019/20. As figures above show, SAPN's estimated expenditures in 2018/19 and 2019/20 are considerably higher than actual expenditure in the three prior years, particularly for conductors. Furthermore, for cables, SAPN's 2016/17 expenditure was higher than normal due to abnormal rain. We consider that the combined influence of SAPN including two years of higher-than normal estimates, coupled with abnormally high 2016/17 cable expenditures, has resulted in SAPN over-estimating its future requirements.

263. In its response to our information request, SAPN has also provided an updated estimate of its expenditure for 2018/19, which is $2.3m less than the estimate it used in deriving the forecast in its Regulatory Proposal.[87]

264. We consider that SAPN's forecast totex for cable and conductor repairs of $88.2m for the next RCP, averaging $17.7m per year, is not reasonable; however absent information to the contrary, we consider that SAPN's actual historical expenditure would provide a reasonable guide to its forecast requirements.

5.4 Assessment of proposed re-categorisation

5.4.1 Basis for SAPN's proposed re-categorisation of expenditure

265. In its RP, SAPN justifies its proposed re-categorisation of cable and conductor repairs as opex as follows:

> '*…we consider that the inter-generational equity concerns raised during the AER's review of the regulatory tax approach warrant re-categorising this type of expenditure as opex rather than capex. Cable and conductor minor repair work is more akin to repairs and maintenance rather than refurbishment and essentially only benefits current customers.*'[88]

266. At our onsite meeting, SAPN elaborated further on the distinction that it is proposing to make between what it would consider to be minor repair work (and therefore categorise as opex) and what it would consider to be refurbishment (and therefore continue to categorise as repex). In summary, some of the rationale presented to us was that:

- Minor repair work is work that would typically be discarded when a subsequent refurbishment is undertaken, whereas a refurbished section of conductor or cable would be retained in the event of subsequent further refurbishment of the cable or conductor;

[87] SAPN response to IR039, question 48. We have converted SAPN's response (which was provided in $2017/18) to $2020 and compared it with information in SAPN's response to IR019, also converted to $2020.

[88] SAPN RP, Attachment 5 – Capital Expenditure, page 28

- Minor repair work could therefore not be considered to be extending the life of the asset, but its purpose is rather either addressing a failure or addressing a defect that is likely to lead to failure;
- Refurbishment is of a scale such that it is treated internally as a 'project', and is therefore subject to project protocols in regard to decision-making, resourcing and management of the work; and
- Refurbishment of cables would typically involve replacing a whole section of cable; similarly, conductor refurbishment typically involves replacing a whole section of conductor. Minor repair works on the other hand tend to involve cutting and re-joining and/or patching a new and much shorter length of cable or conductor, and/or application of a joint or sleeve.

267. Subsequent to the onsite meeting, SAPN also provided the information replicated in the figures above. This shows that applying this policy retrospectively would have typically resulted in only single-digit numbers of works being defined as capex 'projects' in each year, but in excess of 2,000 cable and conductor minor repair works. It also shows that the minor repair works comprise both planned and unplanned works, the vast majority of which are unplanned works resulting directly from cable and conductor failures.

5.4.2 Our assessment of the basis for re-categorisation from capex to opex

268. We consider that the distinction between minor repairs and refurbishment that SAPN proposes is reasonable and that there is, and will continue to be, a reasonable delineation between these types of works. Given that the driver for minor repairs is a need to address a current failure or imminent failure, we consider that there is a reasonable argument to justify such expenditure as 'operational' in nature. Similarly, we consider that it is reasonable to view what SAPN proposes to continue defining as refurbishment projects, as contributing to extension of the life of the assets, and therefore to capitalise such expenditure for regulatory purposes.

269. We consider that these arguments apply irrespective of the 'tax treatment' arguments that SAPN presented in its RP, though this may have been a catalyst for it considering the matter. Moreover, we believe that SAPN's proposed treatment is consistent with the delineation that we typically observe in other DNSPs.

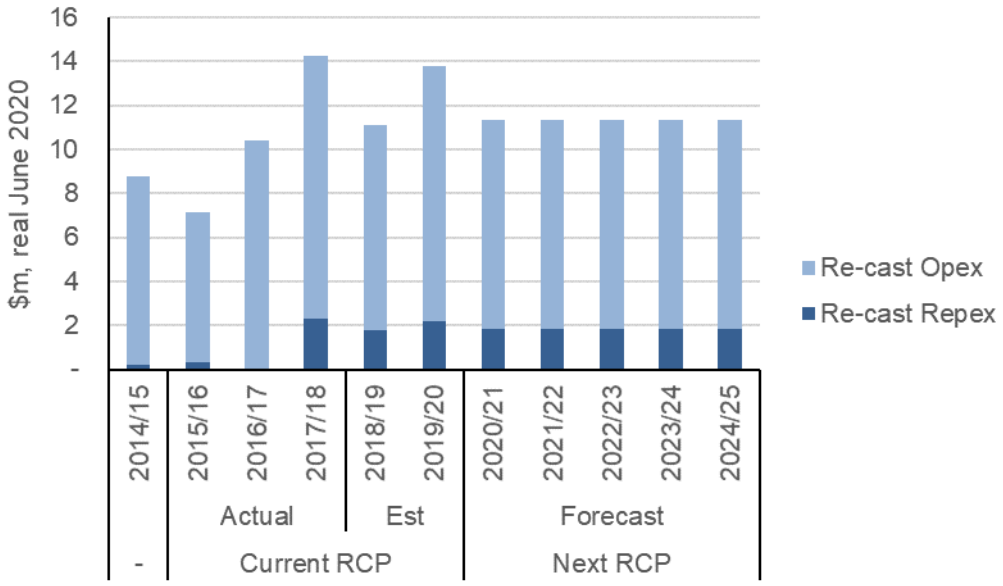
270. SAPN's statement of accounting practice defines capital expenditure (inter alia) as expenditure that '*results in the creation of a new asset of a permanent nature; or extends the operating life'* of the asset, and defines operating expenditure as '*(e)xpense…not classified as capital expenditure'*.[89] SAPN's proposed regulatory accounting classification appears to be consistent with these definitions.

5.4.3 SAPN's recast of its historical expenditure

271. SAPN has recast its current RCP cable and conductor repairs expenditure as a basis for deriving its allocation of forecast totex as between opex and repex. This recast of current RCP expenditure is shown with SAPN's forecasts, for cables and conductors respectively, in the two figures below.

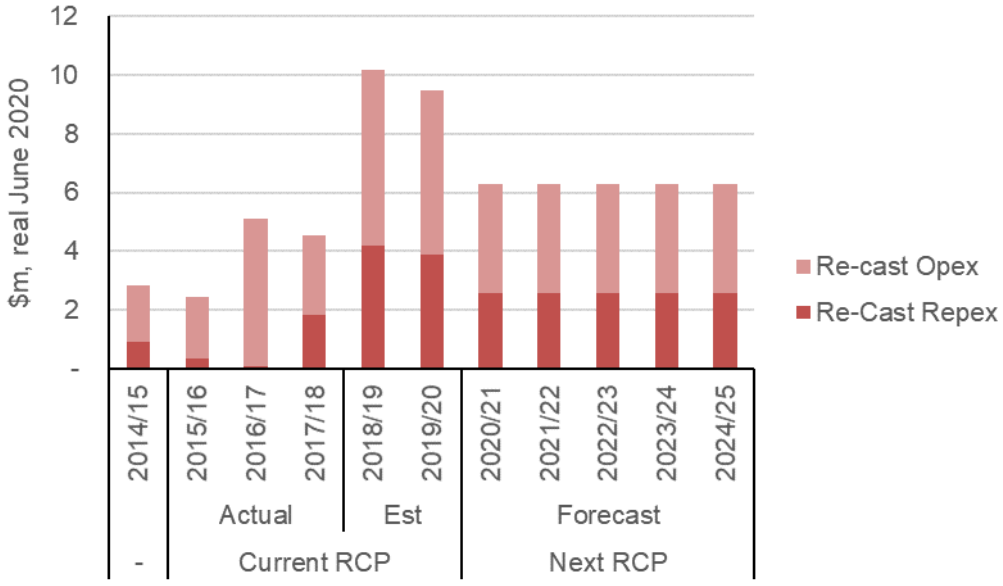
[89] Accounting Practice and Guidelines, SAPN RP supporting document 18.21

Figure 23: SAPN re-cast of cable repair expenditure into capex and opex



Source: EMCa analysis of data in SAPN response to AER IR019

Figure 24: SAPN re-cast of conductor repair expenditure into capex and opex



Source: EMCa analysis of data in SAPN response to AER IR019

272. SAPN proposes using the 2017/18 ratios of opex and capex to totex that it had recast at that time as appropriate ratios for the next RCP. As described previously, this resulted (with SAPN's rounding) in it proposing a ratio of 16%:84% capex to opex for cables and 41%:59% capex to opex for conductors. As presented in section 5.2.1, this resulted in a proposed opex forecast of $9.5m per year for cables and $3.7m per year for conductors (in $2020).

273. In response to our information request, SAPN provided an updated estimate of cable and conductor repair expenditure for 2018/19, recast into opex and capex according to its proposed re-categorisation policy. For both assets, this shows a smaller proportion defined as opex, with ratios of 21%:79% capex to opex for cables and 64%:36% capex to opex for conductors. Consistent with SAPN's use of the latest data in its RP, we consider that these updated ratios provide a reasonable guide to apportioning a forecast totex requirement for each of cables and conductors, between opex and capex.

274. While assessment of SAPN's overall repex forecast is not within our scope, SAPN's proposed recategorization of cable and conductor repairs to opex has implications for any repex forecast that relies on historical repex information.

5.4.4 EMCa estimate of proposed opex and capex

275. In response to our information request, SAPN provided an updated estimate of cable and conductor repair expenditure for 2018/19, recast into opex and capex according to its proposed re-categorisation policy. For both asset types, this later information shows a smaller proportion defined as opex, with ratios of 21%:79% capex to opex for cables and 64%:36% capex to opex for conductors. Refer to the table below. Consistent with SAPN's use of the latest data in its RP as a basis for re-categorising, this provides updated ratios that can now be used for forecasting purposes.

276. In the table below, we show: (i) SAPN's recast historical data; (ii) the 2017/18 ratios it proposes; (iii) its updated ratios; and (iv) our application of those updated ratios to the revised forecast totex that we described in section 5.3.3. This approach would result in the following adjusted opex forecasts:

- For cables, forecast opex of $8.3m per year compared with SAPN's forecast of $9.5m per year; and
- For conductors, forecast opex of $1.6m per year compared with SAPN's forecast of $3.7m per year.

277. An adjusted forecast of $9.9m for an opex step change for cable and conductor repair would be 25% less than SAPN's proposed amounts.[90]

[90] We have not re-forecast cable and conductors ***repex***, since this was not within our scope and is only a very minor component in considering SAPN's overall repex forecast. However, SAPN's proposed recategorization would have implications for any repex forecast that relies on historical repex information and would tend to reduce that forecast.

Table 14: Alternative estimate of SAPN's historical expenditure as a basis for next RCP forecast

$m, real June 2020	Actual					Average Annual using 2018/2019 ratio	Average SAPN proposal
	2014/15	2015/16	2016/17	2017/18	2018/19		
Cables							
Opex	8.5	6.8	10.4	12.0	9.7	**8.3**	9.5
capex	0.2	0.3	0.1	2.3	2.6	**2.2**	1.8
Totex	**8.8**	**7.2**	**10.4**	**14.3**	**12.3**	**10.6**	**11.4**
%capex	*2.5%*	*4.8%*	*0.5%*	*16.0%*	*21.3%*	*21.3%*	*16.0%*
Conductors							
Opex	1.9	2.1	5.0	2.7	2.4	**1.6**	3.7
capex	0.9	0.3	0.1	1.8	4.3	**2.7**	2.6
Totex	**2.8**	**2.4**	**5.1**	**4.5**	**6.7**	**4.3**	**6.3**
%capex	*31.8%*	*13.6%*	*1.7%*	*40.7%*	*63.7%*	*63.7%*	*41.0%*
Total	**11.6**	**9.6**	**15.5**	**18.8**	**19.0**	**14.9**	**17.6**

Source: EMCa assessment based on data from SAPN responses to AER IR019 and IR039 (questions 47 and 48)

278. To understand and mitigate any bias that may exist in the above assessment method, we reviewed a number of methods for developing an alternate estimate of opex which considered: (i) alternate ranges of historical data; (ii) alternate capex/opex ratios; and (iii) review of historical volume of maintenance and repair activities, based on SAPN's revealed costs. While no single forecast can be considered to be definitive, we are satisfied that the proposed opex in the table above, is within a reasonable range of estimated values.

5.5 Findings and implications for SAPN's cable and conductor expenditure forecasts

5.5.1 Findings

Proposed recategorization is reasonable

279. We accept SAPN's rationale for re-categorization of a proportion of repair and maintenance expenditure for cables and conductors as opex, consistent with industry practice. The opex proportion is associated with: (i) small segments of cable or conductor (with the majority resulting from failures or localised defects); (ii) a large number of repair projects (several thousand per year) with a small unit cost per repair; and (iii) repaired lengths would be abandoned if the cable or conductor was subsequently replaced.

280. This is contrasted with repex, which: (i) is driven largely by condition assessments, and involving material lengths replaced; (ii) consists of a small number of 'projects' (typically less than 10 per year); and (iii) repaired lengths likely to be retained in the event of further conductor or cable replacement.

281. This treatment of such expenditure is consistent with industry practice and expenditure that SAPN proposes to categorise as opex typically will not extend the

life of the asset. As information on such expenditure is extended with time, we consider that it will form a reasonable basis for forecasting prudent and efficient future requirements.

Proposed total expenditure and opex step change are both overstated

282. We consider that SAPN's forecast totex for cable and conductor repairs of $88.2m for the next RCP, averaging $17.7m per year, is not reasonable. Information provided by SAPN does not support the proposed totex or its apportionment between capex and opex. In updated information provided in response to our information request, SAPN spent less in 2018/19 than it estimated in its proposal and its 2018/19 apportionment to opex is lower than for 2017/18, which it has proposed as the basis for its forecast.

SAPN's maintenance and repair opex is currently at the lower end of industry comparators

283. We undertook some limited analysis based on the published CA RIN data to understand the proportion of SAPN's maintenance and repair type opex relative to its peers. We were not able to isolate costs associated with cable and conductor, as the costs are not reported in this way by DNSPs. However, we did observe that SAPN is on the lower end of the band of DNSPs when comparing the level of maintenance and repair opex when normalised for route length. Whilst not conclusive, this also supports SAPNs advice to us during our onsite discussion that it does not currently treat maintenance and repair expenditure for cable and conductors as opex.[91]

5.5.2 Implications for SAPN's proposed opex step change

284. We have reviewed SAPN's proposed opex step change, as presented in its RP and in its RIN. SAPN's proposed step increase of $14.2m in 2020/21 is higher than the step increase of $13.5m for each of the subsequent years.[92] This is not consistent with SAPN's claimed forecasting method, which uses an annual average totex and a single capex to opex ratio in determining its forecast.

285. In response to our information request,[93] SAPN provided actual costs for 2018/19 and a revised forecast with consistent totex in each year and consistent allocation of that totex as between capex and opex. SAPN provided this information in $2018, whereas its RP information was presented in $2020. We converted this to $2020 using the CPI indices that appear to have been applied elsewhere in SAPN's workings, however this resulted in a slightly lower 'step change' opex forecast of $66.2m, as presented in section 5.2.

286. While we acknowledge the argument for a possible differential cost escalation factor to be applied, this appears to be barely material. In the absence of information to calculate this, and being mindful of materiality, we propose that a reasonable opex step change would be of the order of $9.9m per year (in $2020). Alternative interpretations of CPI growth rate assumptions (as above) and

[91] Maintenance and repair opex would also include inspection related activities.

[92] SAPN. Attachment 5. Page 23. Also in SAPN RIN data sheet '2.17 Step changes'.

[93] SAPN's response to information request AER IR019

alternative opex apportionment calculation sequences provide a range of approximation around this estimate.

6 Aspects of proposed augex

6.1 Introduction

6.1.1 Context for this section

288. In this section we provide our assessment of SAPN's forecast expenditure on: (i) Low Voltage and distribution transformers to remediate quality of supply (QoS) issues; and (ii) Sub-transmission capex.

6.1.2 What has been asked of us

289. We have been requested by the AER to provide our opinion of the prudency and efficiency of the type of investment, and total investment proposed by SAPN in the 2020-25 RCP associated with:

- Connections capex;[94]
- Low voltage & distribution transformers (quality of supply) capex; and
- Sub-transmission capex.

290. We are to provide an indication of the impacts and implications of our findings for this capex forecast and provide an opinion on an alternative estimate, where relevant.

291. In regard to SAPN's Low Voltage & distribution transformers (quality of supply) capex, we are to provide an assessment of the Low Voltage & Quality of Supply Remediation project,[95] with reference to: (i) SAPN's ability to manage voltages having regard to the application of AS4777; and (ii) SAPN's forecast levels of PV and storage, including how it has accounted for the implications of current South Australian subsidies of storage and PV.

[94] Our review of SAPN's proposed connections capex is in section 7

[95] This is a subset of SAPN's 'LV & Distr bution Transformer (QoS) augex 'project' referred to in SAPN. Attachment 5.10. Distribution System Planning Report. Table 8. The balance of the expenditure item in this table is directed to its proposed 'Low Voltage Monitoring Strategy'.

292. In providing our opinion regarding SAPN's proposed Sub-transmission capex, we have been requested by the AER to consider (i) how SAPN has accounted for the impacts of DER and ADMD trends; and (ii) whether it has considered a reasonable range of options.

6.2 Summary of proposed expenditure

6.2.1 Overview

293. SAPN has proposed total augex of $372.0m in the next RCP. Compared to actual and estimated augex of $400.0m in the current RCP, this represents a reduction of $28.0m (7.5%), as shown in the tables below.[96]

Table 15: Forecast total augex by asset category for next RCP

$m, real June 2020	Forecast					Total Next RCP
	2020/21	2021/22	2022/23	2023/24	2024/25	
Subtransmission, Switching and Zone Substations	8.1	7.2	3.8	2.8	1.9	**23.8**
Subtransmission Lines	7.3	3.5	0.0	0.5	4.5	**15.9**
HV Feeders	5.1	2.6	2.5	3.1	3.4	**16.7**
Distribution Substations	2.2	2.3	2.4	2.5	2.6	**12.1**
LV Feeders	1.8	1.9	2.0	2.1	2.2	**10.0**
Other Assets	56.2	61.4	59.2	59.6	57.1	**293.5**
Total	**80.8**	**79.0**	**69.9**	**70.6**	**71.7**	**372.0**

Source: SAPN RIN.

Table 16: Actual/estimated total augex for current RCP

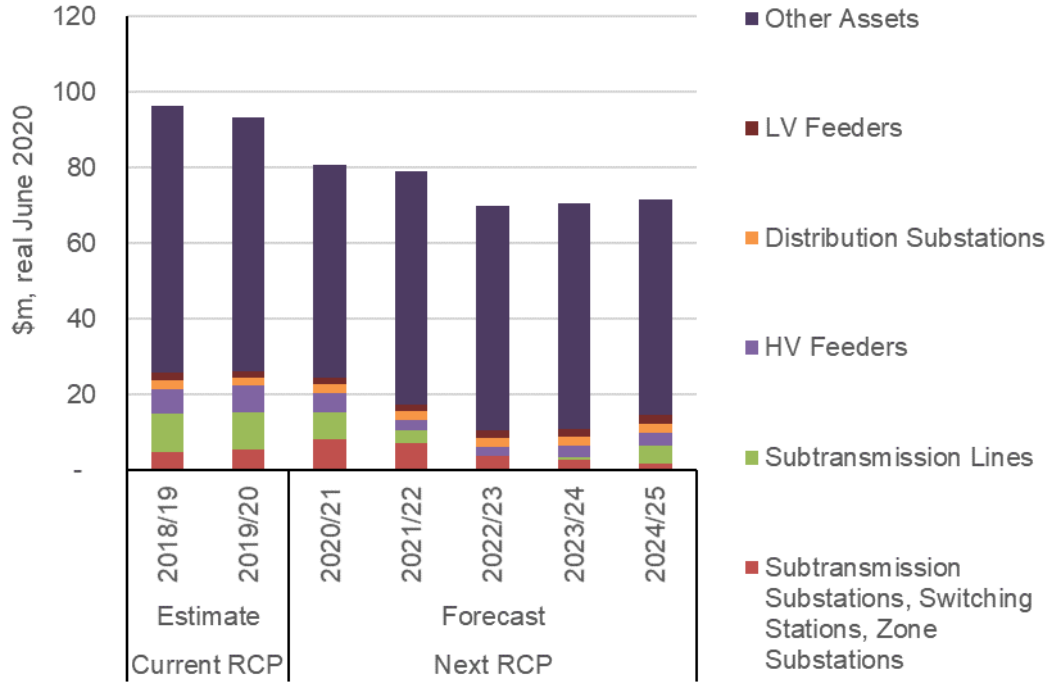
$m, real June 2020	Actual			Estimate		Total Current RCP
	2015/16	2016/17	2017/18	2018/19	2019/20	
Augex	**55.7**	**63.9**	**90.9**	**96.2**	**93.3**	**400.0**

Source: SAPN RIN.

294. The figure below shows SAPN's estimated augex, by asset category, for the last two years of the current RCP and forecast augex for the next RCP. SAPN did not provide historical asset category expenditure detail for the previous or current RCP for comparison.

[96] Augex by asset category was not available for the current RCP, and therefore total augex is shown only

Figure 25: Estimated augex for last two years of current RCP, and forecast augex for next RCP



Source: SAPN RIN.

295. In the absence of information regarding actual historical asset category expenditure, we have limited our observations to a comparison between estimated augex in 2018/19 and 2019/20 and forecast augex for each year of the next RCP. We observe a downward trend in forecast augex that appears to be driven by reductions in Other Assets, Sub-transmission Lines and HV Feeders.

6.3 Assessment of aspects of proposed augex

6.3.1 Introduction

296. In this section we consider SAPN's proposed expenditure for the specific aspects of augex requested in AER's scope:

- LV and distribution transformer (Quality of Supply) capex - Low Voltage & Quality of Supply Remediation project; and
- Sub-transmission capex:
  - New Myponga to Square Water Hole 66kV sub-transmission line; and
  - New Athol Park to Woodville 66kV line and associated work.

6.3.2 Low Voltage & Quality of Supply Remediation project

297. The data and analysis provided in SAPN's Business Cases[97] refers to calendar years and $2017 dollars, and this is the only expenditure information available to us that isolates the LV and QoS expenditure and the composition of programs under this heading. Unless indicated otherwise, we have based our assessment on this information.We assume for the purpose of this report that the $2017 expenditure

[97] presented in section 18 of Attachment 5.10 Distribution System Planning Report

forecast in SAPN's business cases is consistently incorporated in SAPN's total proposed augex, though we have not been provided evidence that would confirm this.

298. In the absence of better information, the expenditure proposed for the period 2020-24 in calendar years is considered equivalent at least for Business Case justification purposes, to expenditure proposed on a financial year basis for the next RCP.

SAPN's forecast

299. SAPN refers to the Business as Usual (BAU) function of reactively remediating quality of supply (QoS) issues as involving:[98]

- *'responding to customer enquiries regarding quality of supply;*
- *performing investigation and remedial works to resolve customer enquiries or alleviate LV network constraints (such as upgrading overloaded transformers);*
- *analysing and determining the feasibility of inverter-based embedded generation connections less than 200kW; and*
- *LV, distribution transformer and Single Wire Earth Return (SWER) network planning.'*

300. SAPN's Business Case[99] proposes a continued BAU approach to quality of supply issues over the next RCP at a total capex of $48m ($2017) for the period 2020-24, increasing in $0.4m increments in each year. We note that its tabulated breakdown of forecast expenditure totals to the lower value of $47.1m as shown in the table below. SAPN has not provided a reason for this variance.

Table 17: Forecast LV & QoS remediation capex by calendar year

$m, real 2017	Forecast					Total
	2020	2021	2022	2023	2024	Next RCP
QS Team Management	1.5	1.5	1.5	1.5	1.5	**7.5**
LV Regulator	0.2	0.3	0.3	0.3	0.3	**1.3**
Replace TF (same pole, increased capacity, with taps)	3.0	3.2	3.2	3.4	3.6	**16.4**
Restring Conductor	0.5	0.5	0.5	0.5	0.6	**2.6**
Infill TF (no HV extension)	3.1	3.3	3.3	3.5	3.7	**16.9**
Infill TF (with HV extension)	0.2	0.3	0.3	0.3	0.3	**1.3**
LV Data Loggers (model CHK PQ35)	0.2	0.2	0.2	0.2	0.2	**1.1**
Total	**8.8**	**9.2**	**9.3**	**9.7**	**10.1**	**47.1**
SAPN Proposed	8.8	9.2	9.6	10.0	10.4	**48.0**

Source: SAPN. Attachment 5.10. Distribution System Planning Report. January 2019. Section 18 – Table 20.

301. For comparison, SAPN's actual and estimated capex for LV and QoS remediation in the current RCP is $41.1m ($2017),[100] as shown in the table below. We

[98] SAPN. Attachment 5.10. Distribution System Planning Report. January 2019. Section 18.

[99] SAPN. Attachment 5.10. Distribution System Planning Report. January 2019. Section 18.

[100] SAPN has not nominated the financial basis, however is assumed to be $2017

understand that SAPN's forecast for the next RCP is based on actual expenditure for the 2015-17 period and estimated expenditure for 2018/19 in the current RCP.

302. We note that SWER-related capex is the subject of a separate Business Case.

Table 18: Actual/estimated and forecast LV & QoS remediation for current RCP by calendar year

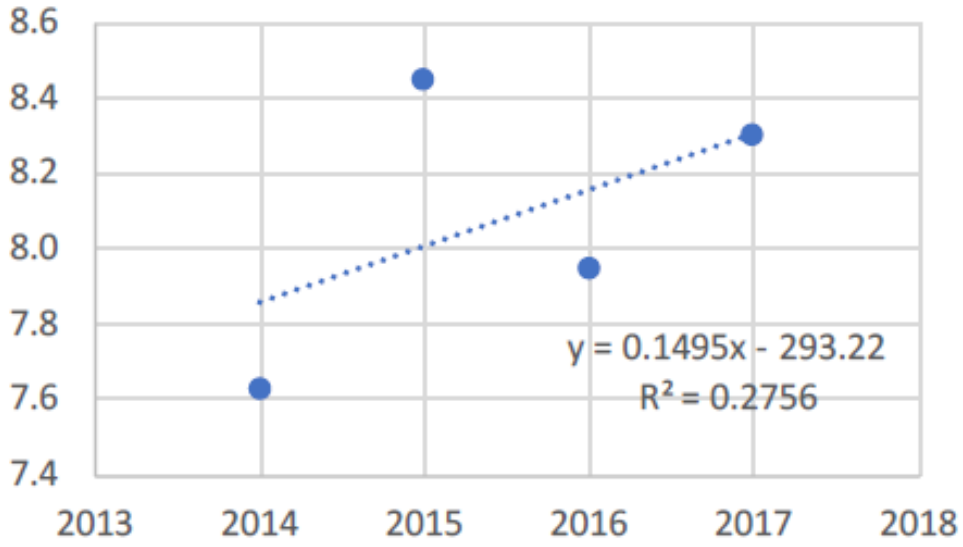
$m, real 2017	Actual			Estimate		TOTAL Current RCP
	2015	2016	2017	2018	2019	
BAU Augex	8.5	7.9	8.3	8.0	8.4	**41.1**

Source: SAPN. Attachment 5.10. Distribution System Planning Report. January 2019. Section 18 – Table 17

Basis for SAPN's forecast expenditure

303. SAPN has applied a historical expenditure trend methodology to forecast the capex required through to 2024 by extrapolating 2014-2017 actual expenditure on BAU QoS remediation, as shown in the figure below. In its Business Case, SAPN has determined its forecast capex of $48.0m ($2017) for the 2020-24 period from the 'line of best fit' that it has derived from these four observations.

Figure 26: Actual capex for LV & QoS remediation project ($m, 2017)



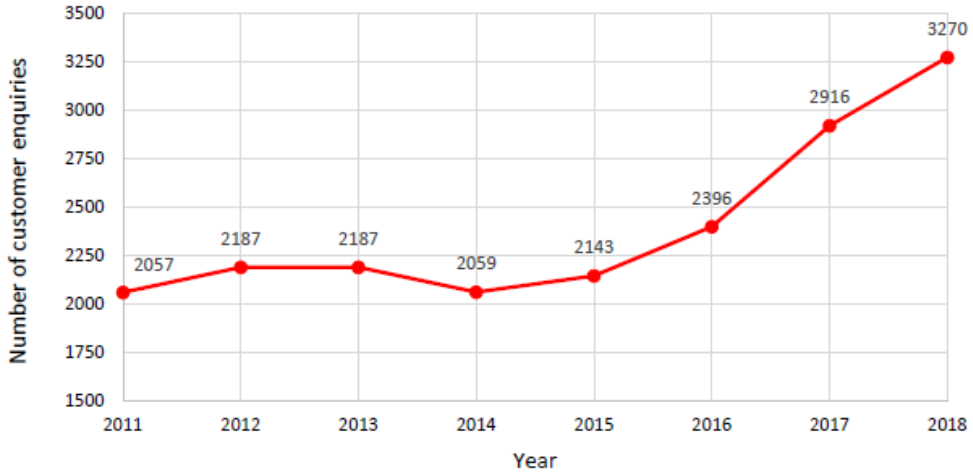
Source: SAPN. Attachment 5.10. Distribution System Planning Report. January 2019. Figure 19.

Increasing trend of QoS enquiries

304. In support of its historical trend-based forecast, SAPN has identified an increasing trend of QoS customer enquiries, as shown in the figure below, primarily from voltage excursions outside of mandated limits caused by increasing levels of DER.[101]

[101] SAPN. Attachment 5.10. Distribution System Planning Report. January 2019. Page 84

Figure 27: Residential QoS customer enquiries



Source: SAPN. Attachment 5.10. Distribution System Planning Report. January 2019. Figure 21.

305. SAPN considers that there are many network impacts which have not been observed to date and which it expects to emerge in the near future that are likely to require significant additional capex to address - unless new strategies are employed. The identified issues are:

- a high uptake of Distributed Energy Resources (DER) other than PV, such as electric vehicles, battery storage, fuel cells and Virtual Power Plants (VPP); and
- saturation of DER consuming all hosting capacity on a wide scale.

SAPN initiatives to mitigate QoS remediation costs

306. A number of initiatives are either in place or proposed by SAPN as part of the next RCP, that are designed to either directly or indirectly reduce QoS root-causes and SAPN's remediation costs.

Customer-generated issues

307. SAPN advises that it first seeks to determine whether the customer's issue is caused by the customer's equipment or is otherwise on the customer's side of the service point. If this is the case, the customer is responsible for the remediation cost (i.e., for work on the customer's side of the service point).

PV standards

308. SAPN advises that it introduced mandatory rooftop connection conditions from 1 December 2017 to mitigate the negative impact of additional DER on voltages and to maximise the ability of the network to absorb DER without augmentation. '*These connection conditions include:*

- maximum out of balance export to network of 5kW;
- PV limit voltage raised to 258V at PV; and
- power quality Volt-var and Volt-watt response mode characteristics applied to limit voltage rise due to PV when voltage exceeds threshold.'[102]

[102] SAPN. Attachment 5.10. Distribution System Planning Report. Page 94.

Increasing network hosting capacity

309. SAPN has proposed the following initiatives in its RP for increasing network hosting capacity to reduce QoS issues:[103]

- Tariff Structure Statement - which proposes new network tariffs designed to encourage customers to shift load to the middle of the day (i.e., when there is a surplus of rooftop PV generation);
- Distribution Management Innovation Allowance - to fund further trials to shift hot water loads from the night to the middle of the day;
- LV transformer monitors – addition of monitors to provide enhanced visibility of the LV network; and
- Development of new operational systems and business processes - to actively manage the integration of rooftop PV, battery storage and VPPs into the distribution network.

SAPN's cost estimates

310. In the Business Case, SAPN provides a breakdown of the unit costs for each of the BAU QoS investigations and remediation activities, using the calendar year 2017 average for each activity. For the next RCP, SAPN has applied the 2017 average unit costs to extrapolated volumes of activity.

Our assessment

SAPN's current remediation work is reasonable

311. SAPN has identified the reactive investigation and remediation work it undertakes to address voltage and thermal capacity issues as they arise. Its remediation methods range from rebalancing load and generation between phases, to more expensive solutions involving upgrading transformers, replacing conductors or installing voltage regulation equipment. We consider SAPN's approach to the reactive remediation of issues to be reasonable.

312. SAPN's unit cost estimates for the next RCP are based on recent historical unit costs in the current RCP and are a reasonable basis for forecasting unit costs in the next RCP.

SAPN's historical trend analysis is not sufficient basis for the forecast capex

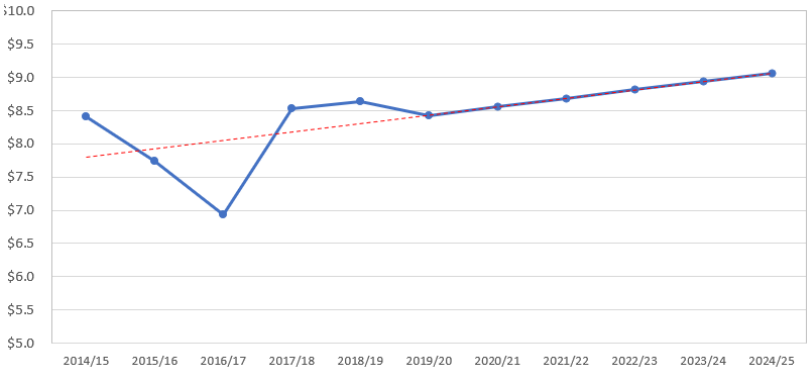
313. SAPN's use of a historical-expenditure trend methodology to forecast its BAU QoS expenditure in the next RCP is limited by using only four data points with the latest being from calendar year 2017. As shown in Figure 26, the R-squared value for SAPN's linear regression is very low.

314. We asked SAPN to provide its latest BAU QoS capex information. In its response, SAPN provided financial year information and an updated forecast of $44.1m ($2017) for the next RCP, also based on extrapolation of the historical trend, as shown in the updated figure below provided by SAPN using Financial Year information rather than the Calendar Year information in the Business Case.[104].

[103] SAPN. Attachment 5.18. LV Management Business Case. Page 8.

[104] The calendar year equivalent from the same response is $43.8m

Figure 28: SAPN's updated historical and forecast BAU QoS remediation capex ($m, 2017)



Source: SAPN's response to information request AER IR039-Q33&35-Quality of Supply CY and FY Actuals 20190531-Public, modified by EMCa

315. Whist the historical trend forecasting method applied by SAPN has some merit, SAPN's analysis is still based on only five data points. This approach should be a starting point only. SAPN appears to have only considered factors which may increase QoS enquiries in its justification of higher investigation and remediation costs indicated by its trend analysis. However, we consider that SAPN should also consider the potential impact of changes that it has recently implemented and/or proposes to implement to mitigate QoS issues and remediation costs, including:

- the 'primary operational benefit' of the LV Monitoring Strategy included for the next RCP to achieve avoided QoS investigation costs of $11.3m over the next RCP;[105]
- the ongoing reduction in overvoltage excursions from both the 'enforcement' of AS4777 standards and the likely impact of increasing penetration of more sophisticated rooftop PV inverters; and
- the impact of proposed tariff changes, which would have an immediate impact on hosting capacity.

316. The proposed hot water load trial is unlikely to have a material impact on QoS perturbations or hosting capacity in the next RCP.

317. Furthermore, there is low correlation between enquiries and QoS BAU expenditure. For example, accounting for the lag between QoS enquiries and remediation expenditure, enquiries hit a new peak in CY2017, but a new peak in expenditure was not established in CY2018, with the corresponding QoS capex at a 5-year low of $6.9m ($2017).[106]

SAPN has considered other approaches to mitigate QoS remediation costs

318. In its LV Management Business Case, SAPN considered other approaches to mitigate network remediation costs, including connection pricing for DERs, export tariffs for DER and changes to standard voltage levels.[107]

[105] SAPN. Attachment 5.10. Distribution System Planning Report. Table 27.

[106] SAPN's response to information request AER IR039, IR039-Q33&35-Quality of Supply CY and FY Actuals 20190531-Public.

[107] SAPN. LV Management Business Case. Pages 10-11.

319. Based on the information provided by SAPN, we consider that these approaches are not available for the next RCP (in accordance with the AEMC's positions of 'no change' to any of the policies underpinning the current arrangements)[108] and, in the case of standard voltage levels, not available in subsequent RCPs (because South Australia already uses the 230V +10%/-6% standard).

Impact of battery energy storage schemes

320. The South Australian Government's $100m battery storage subsidy scheme, which is available to 40,000 households, could have either a positive or negative impact on hosting capacity in the next RCP. If batteries are allowed to export electricity to the grid at any time, this may reduce hosting capacity and lead to increased QoS issues. However, if the storage and export capacity is managed to increase hosting capacity, QoS issues can be mitigated.

321. We note from SAPN's business case that it is aware of the potential negative impact on QoS and is developing new operational systems and business processes to actively manage the DER integration into the distribution network.

6.3.3 New Myponga-Square Water Hole 66kV line

What SAPN has proposed

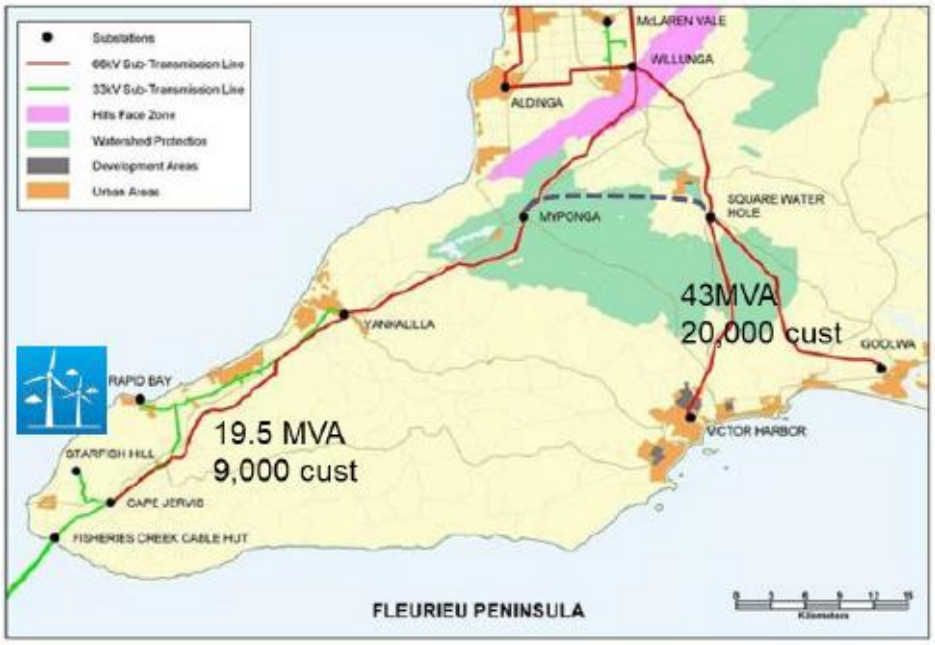
Overview

322. SAPN has proposed a new 66kV powerline from Myponga substation to Square Water Hole substation to improve reliability for customers south of these substations. SAPN has forecast $21.6m (Dec $2017) for this project on the basis that it is likely to satisfy the market benefits test of the RIT-D.

323. The figure below shows the Fleurieu Peninsula, where there are radial lines emanating in different directions from Willunga. Contingency events on the 16.6km long Willunga - Myponga line result in loss of supply for up to 9,000 customers. Similarly, an outage on the 15.3km line between Willunga and Square Water Hole substations may result in loss of supply of up to 20,000 customers. There is a 32MW wind farm at Starfish Hill and a 6MW diesel at Kangaroo island (not shown on the map, beyond Fisheries Creek Cable Hut).

[108] SAPN. LV Management Business Case. Pages 10-11.

Figure 29: Fleurieu Peninsula Sub-transmission system



Source: SAPN. Attachment 5.10. Distribution System Planning Report. Figure 15

SAPN's input assumptions

324. In its analysis of the market benefit of the proposed powerline, SAPN has applied the following key parameters in its cost benefit analysis (CBA) model:[109]

- Line reliability: 0.015 outages/km pa (or about 1 fault every four years);
- Load recovery time: 8 hrs;
- Generator start time: 30 minutes;
- Load factor: 0.48 east radial; 0.38 west radial;
- Period of analysis: 25 years;
- Forecast load growth: 0%;
- Discount rate: 6.5%;
- Start year: 2020; and
- VCR: $38,000/MWh.

Options considered by SAPN

325. SAPN considered the following deferral options:

- Power factor correction; and
- Replacement of 66kV insulators on the Willunga – Myponga line to improve reliability.

326. In its Business Case and supporting cost benefit analysis, SAPN considered the following network options:

- Option 1: Build a new 66kV line between Myponga – Square Water Hole substations, with the proposed open point on the new power line at Myponga,

[109] SAPN. Attachment B-Myponga – SWH 66kV line RIT-D Cost Benefit Analysis-20190517-Public.xls.

faults on the Willunga – Myponga line will not be restored until the open point is closed;

- Option 2: Build a second single circuit 66kV line between Willunga and Square Water Hole and another between Willunga and Myponga in parallel with the existing lines; and
- Option 3: Build a new double 66kV circuit lines to replace the existing single circuit lines.

327. SAPN also considered one non-network solution that was offered from a third party external supplier in response to an RFT in 2010 which comprised a 60MW diesel peaking power station to be located south of the Square Water Hole substation.

Our assessment

328. Based on the information provided in the Business Case and CBA model we consider that the line reliability, load recovery time, and generator start time assumptions are reasonable. However, we have significant concerns on other aspects, and which are described below.

329. We also consider that the power factor deferral option is unlikely to be viable for the reason stated by SAPN. The reason(s) why the insulator upgrade of the Willunga – Myponga line is not viable is not provided in the SAPN Business Case. Of the three network options presented, the preferred option 1 is likely to be economically superior to the other two.

330. Our understanding is that the Starfish Hill windfarm is not able to be operated in an islanded configuration, therefore its generating capacity of 36MW cannot contribute to reducing unserved energy.

Load factor assumption is too high

331. The CBA model includes a load duration curve with a load factor of 0.24 (worksheet LoadDurationCurve). A 25% load factor is typical of residential areas. However, the model uses fixed, hard-coded load factors of 48% and 38% for the radial lines through Square Water Hole and Myponga, respectively, respectively. The market benefit is very sensitive to the assumed load factor (i.e., the lower the load factor, the less energy supplied is at risk and the lower the market benefit). This anomaly is unexplained.

332. Furthermore, SAPN's Business Case does not contemplate the impact of lower load factors that may arise with increasing DER, particularly the combination of PV, BESS, and VPPs, which is likely to reduce overall and average energy at risk.

333. A sensitivity study with declining load factors is one way of testing the robustness of the market benefits.

SAPN's CBA model has issues regarding key assumptions

334. In addition to the load factor issue discussed above, we found a number of other issues with SAPN's CBA model (which is focused on variations of Option 1) that include:[110]

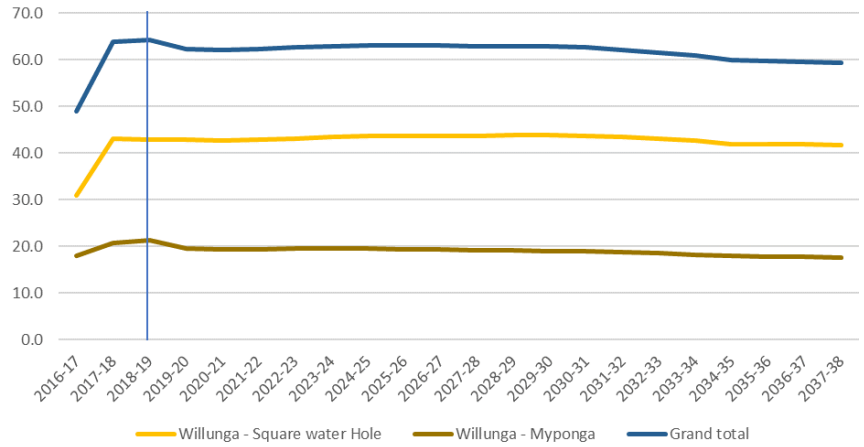
[110] SAPN. Attachment B-Myponga-SWH 66kV line RIT-D Cost Benefit Analysis-20190517.xls.

- cost information in the model is not substantiated in the Business Case, noting that the low case cost of $18.1m capex ($2017) in the CBA model is significantly less than the $21.6m capex ($2017) quoted in the Business Case – the higher figure will reduce market benefits;
- the peak load assumptions are higher than in separate information provided by SAPN[111] and appear to be based on non-coincident substation peak load rather than more realistic coincident peaks – use of the lower coincident peak loads will reduce market benefits;
- given the load growth uncertainty, a shorter analysis period is more prudent than what appears to be SAPN's base case assumption of 25 years – a 10-year analysis period will reduce market benefits; and
- the contribution of the 6MW Kangaroo Island diesel generator does not appear to be properly accounted for in the analysis – doing so will reduce market benefits.

Load forecast is flat with potential for decline due to growth in DER

335. SAPN's load forecast is shown to be flat over the study period, which is likely to be a reasonable base case, however a sensitivity analysis with reducing loads (i.e. low load case) would be prudent given the possible impact of DER on the peak load drawn from the network over time.

Figure 30: SAPN's coincident, reconciled Fleurieu Peninsula peak load forecasts



Source: EMCa analysis of SAPN. Attachment D -2018 Coincident Forecast-20190517.xls

Insufficient options have been considered

336. Whilst SAPN has considered a number of options in its CBA model, the assessment of the 60MW diesel non-network solution offered in 2010 is not one of them. Nonetheless, in its Business Case, SAPN notes that it determined that $19.3m ($2017) capex is required to connect the power station to the network and a network control service fee or equivalent would need to be paid. It therefore concludes that this solution is unlikely to be viable. Whilst this conclusion is reasonable, no supporting data is provided.

337. Alternative non-network solutions should be included in SAPN's options analysis which would guide third parties if SAPN decides to proceed with the RIT-D process.

[111] SAPN. Attachment D-2018 Coincident Forecast-20190517-Public.xls.

338. SAPN dismissed reliability improvement of the Willunga-Myponga line, without explanation. This option and operational measures to reduce restoration time should be considered for completeness.

339. Lastly, the option of enhancing the Starfish Hill wind farm to provide the capability to operate in an islanded configuration should be considered as this has the potential to reduce unserved energy for loss of the radial line extending through Square Water Hole.

6.3.4 New Athol Park – Woodville 66kV line

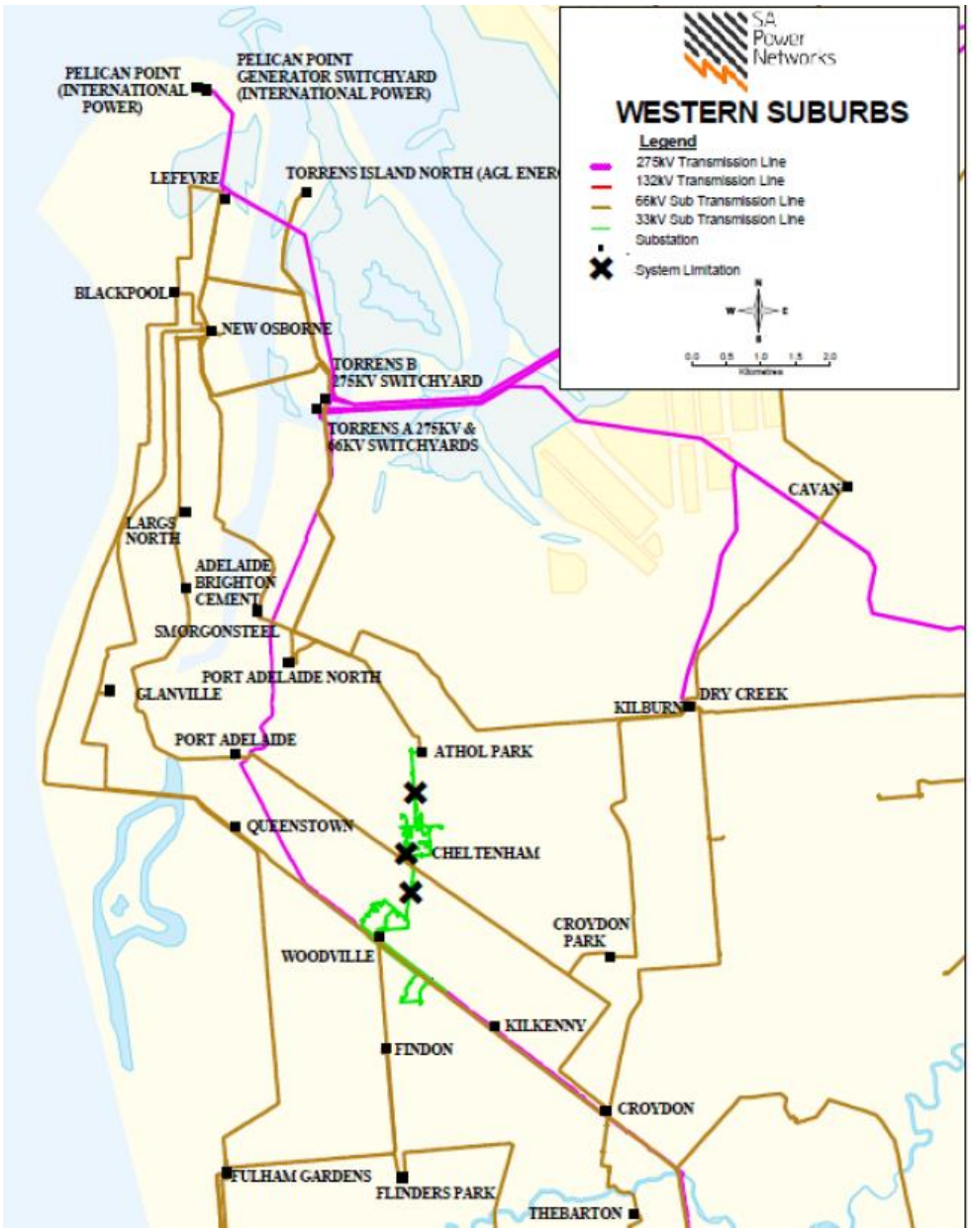
What SAPN has proposed

Overview

340. SAPN has proposed constructing a new 66kV line between Athol Park and Woodville Substations, and splitting the existing TIPS – Port Adelaide North – Athol Park three-ended line into two distinct 66kV circuits. The figure below shows the current configuration of the western suburbs network.

341. The project is designed to address overloads on the New Osborne-Glanville and Glanville – Queenstown 66kV lines following a credible single contingency event (e.g., an outage of the Blackpool-Fulham Gardens 66kV line). SAPN has forecast $16m ($Dec17) for this project, with $6m in the next RCP and $10m in the following RCP on the basis of satisfying its planning criteria.

Figure 31: Western Suburbs region map



Source: SAPN. Distribution Annual Planning Report. Figure 21.

Overloads and SAPN's Planning Criteria

342. SAPN states that the '*[t]otal load growth in the Metro West 66kV network has been slow over recent years, however there has been a shift in the timing of the peak as a result of declining industry and increased residential load... As a result, the load during peak times has shifted geographically from the northern region (more industrial) to the southern region (more residential)…, this geographic shift in the peak load has now resulted in N-1 constraints at summer peak'.*[112]

343. The predicted overloads occur on meshed sub-transmission lines - an outage of the Blackpool - Fulham Gardens 66kV line will result in an overload of the New Osborne – Glanville and Glanville – Queenstown 66kV lines.

[112] SAPN. Attachment 5.10. Distribution System Planning Report. Page 65.

344. SAPN has applied the corresponding deterministic N-1 criteria for which at 10% PoE load forecast, no lines should be loaded above their emergency rating.[113]

345. As shown in the figure above, the Athol Park substation is radially supplied. It supplies a peak load of 19MW. This does not contravene SAPN's planning criteria.

Options considered by SAPN

346. SAPN considered power factor correction as a deferral option, but because the power factor in the region is close to unity, any correction would not address the system constraint.

347. In its Business Case and supporting cost benefit analysis, SAPN considered the following network options:

- **Option 1**: Construct a new 66kV line between Athol Park and Woodville substations and split the existing TIPS – Port Adelaide North – Athol Park three-ended line into two distinct 66kV circuits (the preferred option);
- **Option 2**: Construct a new 66kV line between New Osborne and Woodville substations;
- **Option 3**: Install a new 275/66kV transformer at City West substation, connecting into the Metro West region though a new 66kV line to New Richmond substation; and
- **Option 4**: Demand Management – based on a 20MW generator.

348. SAPN advises that based on its own '*cursory examination*' it is unlikely that the non-network solution would be viable because a third-party provider would likely be unable to find a suitable site.

Our assessment

Insufficient options have been considered

349. Based on the information provided in the Business Case and the CBA model, of the network options considered, the preferred option is likely to offer the least negative NPV of the options considered by SAPN. However, in our view, a prudent network operator should consider means other than power factor correction for deferring the proposed network augmentation, particularly given the uncertainty of future load flows[114] and the likely impact of DER and other initiatives[115] on peak loads. We consider that the following three options should have been explicitly discussed in the Business Case and included in the CBA analysis:

- Dynamic line rating (New Osborne – Glanville, Glanville – Queenstown): indicatively 10% to 30% additional capacity is realised for a fraction of the cost of traditional network solutions. Given the short line length, only one or two monitoring points at most would be needed and the cost is likely to be only a few hundred thousand dollars;
- Changing the impedance of lines to alter power flows; and

[113] SAPN. Attachment 5.10. Distribution System Planning Report. Table 3.

[114] It is possible that load characteristics and location could shift again.

[115] As described in section 6.6.3

- Uprating the overload capacity by upgrading constraints – SAPN's Business Case does not specifically identify the limiting components.

Issues with SAPN's CBA model

350. In addition to the load factor issue discussed above, we found a number of other issues with SAPN's CBA model (which includes a Demand Management option):[116]

- the source of peak load assumptions is not apparent, nor whether they are based on non-coincident substation peak load or the more appropriate coincident peaks;
- given the load growth and load flow uncertainties, a shorter analysis period is more prudent than what appears to be SAPN's base case assumption of 25 years – a 10-year analysis period will reduce market benefits;
- the sensitivity analyses presented in the model do not include a lower load scenario, which we consider to be a necessary study to test the robustness of the results when other options are introduced as suggested.

351. A more explicit statement of the counterfactual would be a useful addition to facilitate comparative analysis.

6.4 Findings and implications for reviewed aspects of SAPN's proposed augex forecast

6.4.1 Findings

Proposed expenditure is overstated

352. SAPN has not provided sufficiently compelling information to justify the forecast augex for the projects that we were asked to review. In particular, we consider that

- SAPN has not adequately considered interdependencies between the three QoS projects that it has proposed, nor has it sufficiently justified a level of expenditure above that which it has been incurring for addressing quality of supply issues;
- The Myponga–Square Water Hole project analysis of net market benefits relies on optimistic assumptions. With more reasonable input parameters and sensitivity studies, the market benefit from the proposed investment is unlikely to be positive enough to proceed with the planned investment; and
- The New Athol Park – Woodville 66kV line project does not consider all options. In particular, there may be viable lower cost alternatives that may reveal that the overloads are less likely to occur than the current modelling suggests, allowing deferral of the proposed augmentation capex.

Proposed LV and Distribution QoS is overstated

353. We consider that it is reasonable to assume that the AS4777-related impact and the impact of other initiatives are collectively likely to at least offset the potential for increasing QoS enquiries and costs over the next RCP.

[116] SAPN. Attachment E-RegTestRCA Eval-AtholParkWoodville-20190517.xls.

Myponga–Square Water Hole does not appear to be justified

354. The proposed new line only reduces interruptions to supply if the contingency event occurs on the relatively small proportion of sub-transmission network between Willunga and Myponga and Willunga and Square Water Hole substations, respectively. With more reasonable input parameters and sensitivity studies, the market benefit from the proposed investment is unlikely to be positive enough to proceed with the planned investment.

New Athol Park – Woodville 66kV line does not appear to be justified

355. SAPN has not provided sufficiently compelling information to justify the forecast project and the $6m capex proposed in 2024 and 2025. In particular, we consider there may be viable lower cost alternatives that may reveal that the overloads are less likely to occur than the current modelling suggests, allowing deferral of the proposed augmentation capex.

6.4.2 Implications

356. While it is not within our scope to assess SAPN's overall augex, we consider that the proposed augex for the three projects that we have considered is not a reasonable forecast of prudent and efficient expenditure requirements and is overstated. On the information provided, we consider that the two proposed sub-transmission projects are not justified.

357. With regards to LV and distribution QoS remediation, we consider that SAPN's historical average expenditure levels provide a reasonable guide to its expenditure requirements for the next RCP, based on its current strategy for dealing with these issues. However, if the AER approves SAPN's proposed LV Monitoring Strategy, its expenditure requirements should be less, reflecting cost reduction benefits that SAPN identifies in support of its business case for that strategy.

7 Proposed connections capex

7.1 Introduction

358. In this section we provide our assessment of SAPN's connections capex forecast. We first summarise SAPN's proposed connections capex, then review SAPN's forecasting methodologies and governance framework and how they were applied. We provide our review of SAPN's forecast for each category of connections expenditure. Finally, we present the findings from our assessment and advise the implications that these findings have for determining a reasonable forecast of prudent and efficient connections capex for SAPN.

7.2 What has been asked of us

359. The AER is seeking our opinion on the robustness of the connections forecast modelling in general and, in particular, the following:

- how SAPN has accounted for any trends in After Diversity Maximum Demand (ADMD) in its connection costs over the forecast period and the implications of the trend in ADMD on the capacity and hence the cost of the network development as it relates to connection costs; and
- the timing of Major Customer Connections and the costs of these connections.

7.3 Summary of proposed expenditure

7.3.1 Overview

360. SAPN's proposed connections capex is expressed as net connections capex, which is derived from the gross connections capex forecast less the forecast capital contributions made by customers.

361. SAPN has proposed net connections capex of $213.2m for the next RCP compared to its actual/estimated expenditure in the current RCP of $178.2m, as shown in the tables below. This represents a forecast increase of $35.0m.

Table 19: Forecast total connections capex for next RCP

$m, real June 2020	Forecast					TOTAL Next RCP
	2020/21	2021/22	2022/23	2023/24	2024/25	
Connections (gross)	111.3	113.2	114.4	114.0	110.2	563.2
Contributions	70.6	70.3	70.8	70.6	67.8	350.1
Net capex	**40.7**	**43.0**	**43.6**	**43.4**	**42.5**	**213.2**

Source: SAPN RP

Table 20: Actual/estimated total connections capex for current RCP

$m, real June 2020	Actual			Estimate		TOTAL Current RCP
	2015/16	2016/17	2017/18	2018/19	2019/20	
Connections (gross)	94.5	90.6	90.0	104.8	95.7	475.7
Contributions	64.9	56.9	56.3	62.4	57.0	297.5
Net capex	**29.7**	**33.6**	**33.8**	**42.4**	**38.7**	**178.2**

Source: SAPN RP

362. The higher forecast gross connections capex for the next RCP relative to the current RCP is largely due to higher capex for Major Customer Connections (for commercial and industrial customers). SAPN explained that due to an economic slowdown in South Australia during the current RCP, capex for Major Customer Connections reduced during the early years of the current RCP. Capex for Major Customer Connections is expected to increase in the final two years of the current RCP, including a number of defence projects and government backed infrastructure projects. SAPN's economic forecaster, BIS Oxford Economics (BISOE), has forecast the increase in Major Customer Connections capex in the final years of the current RCP to be sustained through the next RCP.

363. SAPN also explained that the above-mentioned economic slowdown was the reason it expects to underspend the AER's connections capex allowance for the current RCP by approximately $28.2m (13.7%) on a net basis, as shown in the table below.

Table 21: Actual/forecast connections capex for current RCP versus AER allowance

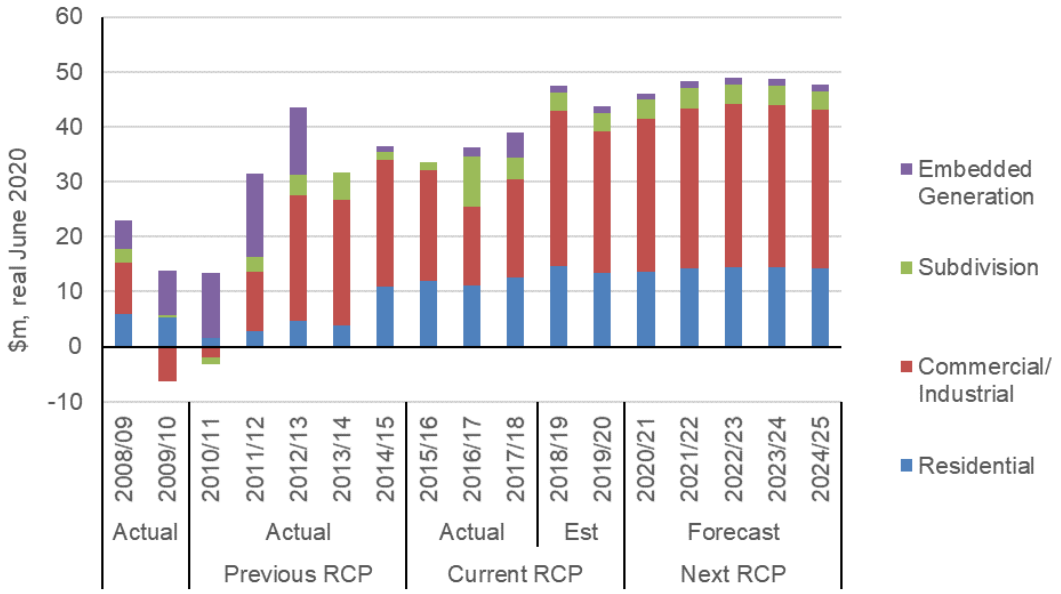
$m, real June 2020	Gross Capex	Customer Contributions	Net Capex
Allowance	613.5	407.1	206.4
Actual and forecast	475.7	297.5	178.2
Variance	**-137.8**	**-109.6**	**-28.2**
Variance (%)	*-22.5%*	*-26.9%*	*-13.7%*

Source: SAPN RP

364. The figure below shows SAPN's actual, estimated, and forecast net connections capex, by connections category, for the previous, current and next RCPs. The four categories of connections capex are: (i) Embedded generation; (ii) Subdivision; (iii) Commercial/Industrial; and (iv) Residential. Commercial/Industrial and Residential are the two main categories of expenditure.

365. SAPN did not provide a breakdown of its connections capex forecast in its RP, so we have relied on data submitted in SAPN's Reset RIN for this figure (which we acknowledge does not include overheads). This figure illustrates the relative impact of Major Customer Connections (primarily Commercial/Industrial) on the overall connections capex forecast.

Figure 32: Net connections capex for the previous, current and next RCPs, by connections category



Source: SAPN Reset RIN.

7.4 SAPN's connections capex governance and management framework, and forecasting processes

7.4.1 Introduction

366. In this section, we provide our assessment of SAPN's expenditure governance and management framework and forecasting methodologies specific to connections capex.

7.4.2 Connections capex governance and management framework

367. SAPN advised that its connections capex forecast was developed through combined input from its connections team and its consultant, BISOE. SAPN advised that this process led to at least four forecast iterations between BISOE's first draft in 2017 and its final report in November 2018.

7.4.3 Connections capex forecasting processes

368. SAPN has classified all connection services into the following four categories for the purposes of forecasting:

- Minor Customer Connections;
- Medium Customer Connections;
- Major Customer Connections; and
- Real Estate Developments.

369. These categories are different to the RIN categories, which we understand is to better align the categories with key economic drivers and available data to support forecasting.

370. SAPN engaged BISOE to produce its connections capex forecasts. BISOE developed a model for each identified connections category, which was underpinned by key drivers identified for each category.

371. BISOE and SAPN also developed a bottom-up forecast for Major Customer Connections capex for the earlier years of the next RCP. The bottom-up forecast declines over the period as the number of 'known' projects decreases. However, SAPN's forecast for Major Customer Connections capex is based solely on BISOE's top-down economic model, and it is unclear how the bottom-up forecast contributed to the forecast for Major Customer Connections capex other than to serve as a potential floor to the outcome from the model. BISOE applies a 'residual' to account for the difference between the bottom-up forecast and its top-down modelling outcomes, with the residual increasing in size each following year as the known volume of connection projects decrease.[117]

372. BISOE provided separate capex forecasts for each connections category. However as described in the section below, SAPN has proposed connections capex that is significantly greater than the BISOE forecasts. Further, SAPN has not provided individual forecasts (with supporting evidence) for each Connections category that reconcile with SAPN's total forecast for Connections capex.

7.4.4 Our assessment

373. It was not evident that the proposed connections capex forecast was subject to a top-down review or challenge at a management level, a process that we consider would have given greater confidence to its forecasts. Through such a process we would expect management to review and challenge the assumptions underlying the forecasts in the context of management and the Board's strategic objectives and vision for SAPN. Management also brings a fresh perspective to reviewing the forecasts and can identify issues not evident to staff focused on the detail. This is especially relevant since actual/estimated connections capex in the current RCP is significantly below the AER allowance, and the forecast expenditure for the next RCP is 19.6% higher than in the current RCP. These two factors alone justify careful scrutiny of the forecasts by management.

374. We accept that the certainty of bottom-up forecasts for new connected loads will deteriorate over the forecast period, with greater certainty in the shorter term and

[117] As explained by BISOE in SAPN's response to information request AER IR039, Q55 & Q57. Page 2.

less certainty in the longer term. Accordingly, economic models such as those utilised by BISOE are both helpful and necessary to forecast connections capex.

375. While the BISOE models are described by SAPN, and a considerable amount of contextual data was provided, we were not given access to BISOE's models to review and we were not given a clear answer as to whether SAPN itself has access to these models. Accordingly, we were unable to assess how forecasts for key drivers, and modelling assumptions, were applied in the models. Absent such information, it is not possible for us to form an opinion on the validity of the forecasting models, and we can only observe the forecasting process.

376. Further, as explained above, it is not evident how the bottom-up forecast of Major Customer Connections capex has been utilised to support and verify the outcomes from the economic model. Given the 'residual' increases each year to fill the gap between the bottom-up and top-down modelling outcomes, the value of the bottom-up forecasts do not appear to have any impact on the output from BISOE's top-down economic model used as the basis for SAPN's Major Customer Connections capex forecast.

7.5 Assessment of proposed connections capex

377. In this section, we assess SAPN's capex forecast for each category of connections expenditure.

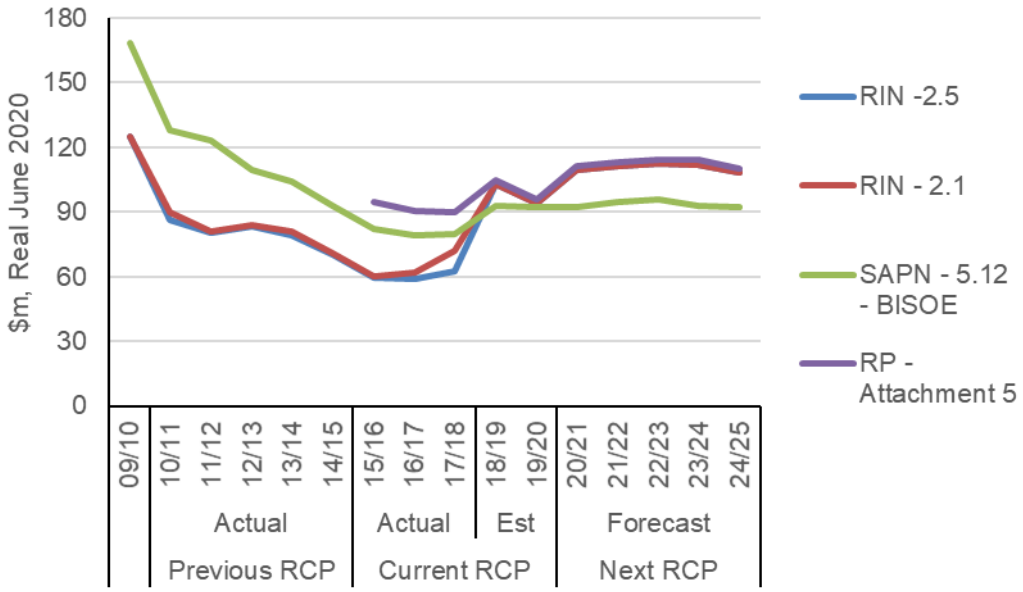
7.5.1 Material data discrepancies

378. In this section, we outline material data discrepancies between RP supporting documents specific to the forecast connections capex. Based on the information available to us, we identify the likely cause and magnitude of the discrepancies and our views regarding how these discrepancies should be considered as part of the AER's review.

Description of data discrepancies

379. For the fifteen-year period 2009/10 – 2024/25, there are material discrepancies between the data reported in SAPN's Reset RIN, RP, and BISOE's report. We sought explanations from SAPN for these discrepancies; however, these were only partially explained in SAPN's response. The figure below shows the magnitude of the discrepancies between each data source.

Figure 33: Comparison of Gross connections capex data from RIN, BISOE, and RP sources



Source: EMCa analysis of RIN, RP, and BISOE data

380. From SAPN's response, we understand that the data reported in the RP and the BISOE report includes overheads, whereas the RIN reports direct expenditure. SAPN stated that the historical data in the RIN, particularly the early years, is not necessarily reliable due to data quality issues.[118]

381. SAPN further explained that it has adjusted the BISOE forecast by adding three additional expenditure categories: (i) Gifted Assets; (ii) EG[119] and; (iii) Reg Adjustment.[120] Whilst we could not see evidence of this, we understand from SAPN that 'Gifted Assets' are also included in Customer Capital Contributions, and thus should not impact the net Connections capex forecast due to a proportional offset (i.e., the incremental amounts net each other out).

382. SAPN did not explain the nature of the adjustments for 'Reg Adjustment' and did not demonstrate how these adjustments were calculated. As such, there is insufficient evidence to justify making these adjustments to BISOE's forecasts.

383. Adjustments for 'Reg Adjustment' are material at around an additional $10m per annum, or nearly $47m for the next RCP. The figure below illustrates the materiality of these adjustments.[121]

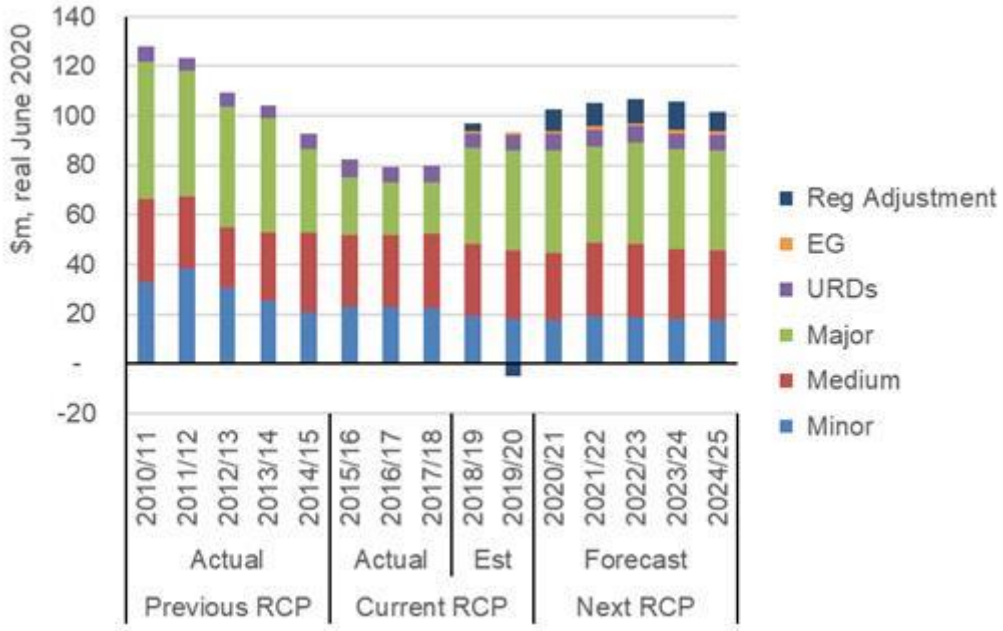
[118] SAPN's response to information request AER IR 039. Question 61.

[119] We understand this to be connections for 'embedded generation'.

[120] SAPN's response to information request AER IR 039. Question 61.

[121] We were not provided with adjustment data for years preceding 2018/19.

Figure 34: Gross connections capex for the previous, current and next RCPs, by category, including SAPN adjustments



Source: EMCa analysis of SAPN's response to IR039 Q61

384. We also note that SAPN mixed $2018 and $2020 in its reconciliation, and the adjustment methodology does not hold for net connections capex, where the BISOE figures[122] are higher than the figures reported in the RIN. Conversely, for gross connections capex, the BISOE figures are lower than the figures reported in the RIN.

385. As explained in an earlier section, SAPN did not provide individual forecasts for each connections category that reconcile with its total connections capex forecast. Due to the data discrepancies, we have also been unable to observe or review forecasts for each individual connections expenditure category that reconcile with the total connections capex forecast. This has made it difficult to assess SAPN's connections capex forecast, and, on the basis of the information provided, it is difficult for us to have confidence in the forecasts proposed.

7.5.2 Assessment of proposed connections capex

Major Customer Connections

386. SAPN has proposed a $35.0m increase in net connections capex for the next RCP. This is largely due to a significant forecast increase in Commercial/Industrial (Major Customer Connections) capex in the next RCP. In the absence of reliable data to show expenditure detail, we have based our assessment on total net connections capex.

387. SAPN explained that an economic slowdown in South Australia depressed Major Customer Connections in the current RCP, whereas the forecast for the next RCP represents a return to a 'normal' level of activity and expenditure for this category.[123]

[122] As reported in SAPN's Connections Management Plan 2020 to 2025, Appendix A.

[123] SAPN RP. Page 89.

388. BISOE's economic model forecasts Major Customer Connections capex marginally above the bottom-up project forecast for the first year and predicts capex to remain at approximately that level for the remainder of the next RCP.

389. BISOE states that 'Non-residential Commencements' and 'Engineering Construction Work' are key drivers of Major Customer Connections capex. BISOE describes the relationship between these drivers and Major Customer Connections capex in SAPN's response to our information request.[124]

390. From information provided by SAPN, we observe an increase in 'Non-residential Commencements' expenditure in 2017/18, and a corresponding increase in Major Customer Connections capex the following year.[125] However, we do not observe any relationship between 'Engineering Construction Work' and Major Customer Connections capex.

391. From the limited information that we were provided on BISOE's model, it appears that BISOE has used the 'Non-residential Commencements' forecast as the key (and possibly only) driver of Major Customer Connections capex. However, BISOE did not demonstrate its basis for forecasting 'Non-residential Commencements' to remain at approximately current levels throughout the next RCP rather than reverting to the historical average of the current RCP.

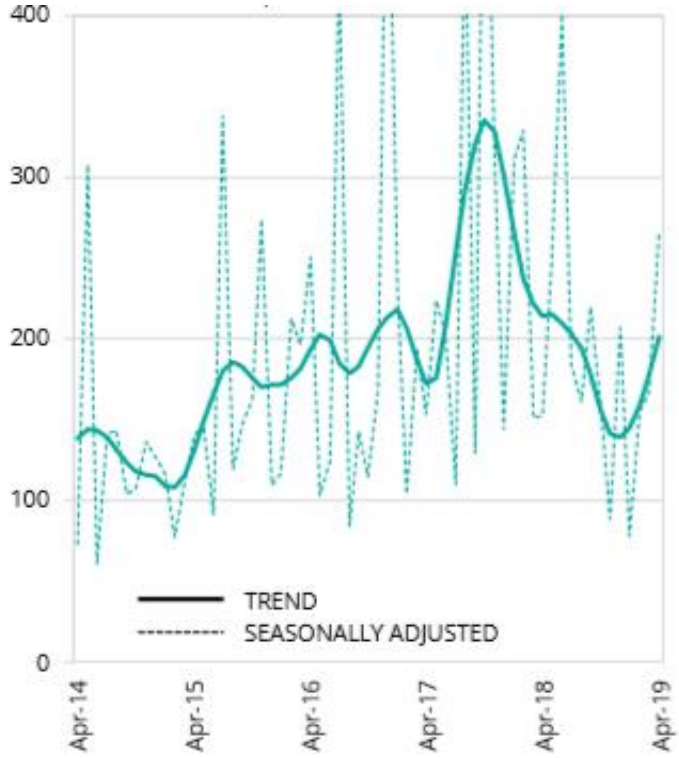
392. Other data sources also appear to suggest that 'Non-residential Commencements' may not remain at current levels. As illustrated in the figure below,[126] the South Australian Government reports that Non-Residential Building Approvals peaked in 2017/18 and declined significantly in 2018/19, returning to 2015-17 levels. We did not observe this decline in BISOE's analysis.

[124] SAPN's response to information request AER IR039. Question 57.

[125] SAPN's response to information request AER IR039-Q55&Q57-BISOE MajorConnects_Oct18 20150531

[126] For clarity, the graph shown in Figure 36 is from the 'Building Approvals' Report, which includes historical analysis of 'buildings approved', including non-residential.

Figure 35: South Australian Non-Residential Buildings Approved - $m per month



Source: Government of South Australia, Department of Treasury and Finance, Building Approvals, April 2019[127]

393. In the absence of compelling justification for BISOE's 'Non-residential Commencements' forecast, we are not convinced that Major Customer Connections Capex will remain at around current (2018/19) levels throughout the next RCP when the current high value publicly funded projects conclude. These projects are expected to be completed in the current RCP and so have no bearing on the forecast for the next RCP.

Minor and medium customer connections

394. For minor and medium customer connection capex, historical expenditure is relatively stable over the prior ten-year period. This historical trend appears consistent with the capex forecast in the next RCP.

Real estate developments

395. SAPN advised that, based on analysis of transformer load tests conducted at two real estate developments, it has reduced its ADMD by 1 to 2 kVA.[128] SAPN also demonstrates in its analysis that connection costs reduce significantly as ADMD reduces.[129]

396. Given the trend to lower ADMD, as evidenced by SAPN's own analysis, SAPN's Real Estate Developments capex should be reduced to reflect lower ADMDs. However, this will also lead to lower capital contributions.

[127] https://www.treasury.sa.gov.au/__data/assets/pdf_file/0005/94415/Building-Approvals_April-2019.pdf

[128] SAPN's response to information request AER IR039, Question 66.

[129] SAPN. Attachment 5.17. Table 10.

7.6 Findings and Implications for SAPN's proposed connections capex forecast

397. In this section, we outline our findings on SAPN's connections capex forecast, and the implications of our findings.

7.6.1 Findings

Connection forecast undermined by inconsistent data and insufficient justification for the proposed increase

398. SAPN has proposed a $35.0m increase in net connections capex for the next RCP despite estimating to underspend its net connections capex AER allowance in the current RCP by $28.2m. Confidence in SAPN's connections forecasts is undermined by inconsistencies and material unexplained discrepancies in the data that SAPN has provided. This includes differences in historical data series and unreconciled or unexplained differences in aggregate and at the customer category level between the claimed basis for the forecast and the proposed forecast itself.

399. SAPN has not justified the adjustments for 'Embedded Generation', and a 'Reg Adjustment', that it has made to its consultant's (BISOE) forecasts.

Inadequate internal challenge

400. We did not see evidence that SAPN has subjected its increased forecast to management review and challenge to test the efficiency, prudency and reasonableness of the proposed expenditure.

Forecasts for real estate developments are overstated

401. SAPN's proposed capex for Real Estate Developments is likely to be overstated given it has not taken account of reduced connection costs as a result of declining ADMD.

Forecast increase for major customer connections is not supported by the evidence SAPN provided

402. SAPN's proposed capex for Major Customer Connections is likely to be overstated. SAPN states that its forecast is based on its consultant's forecast together with its assessment of known connection prospects, though it has not matched the forecast in its Regulatory Submission to either source. SAPN has not provided sufficient evidence to justify a recurrent level of Major Customer expenditure in the next RCP based on its estimated 2018/19 expenditure, and which represents a high-point. Other evidence suggests that a reasonable scenario is for major connections expenditure to decline from the current high-point over the middle and later years of the next RCP.

7.6.2 Implications

403. We consider that SAPN's connections capex forecast in its RP is overstated and is not a reasonable forecast of its efficient and prudent connections expenditure requirements. We consider that a level of forecast expenditure similar to SAPN's

forecast expenditure for the current period is more likely to reflect the level of expenditure that SAPN will actually incur.

8 Aspects of proposed repex

8.1 Introduction

8.1.1 Context for this section

404. In this section, we provide our assessment of aspects of SAPN's repex forecast, namely the forecast expenditure for the poles and pole-top structure asset categories. We first summarise SAPN's total proposed repex, before providing our review of SAPN's forecast for the two specific repex asset categories that we have been asked to review.

8.1.2 What has been asked of us

405. The AER has requested EMCa's advice on whether SAPN's forecast repex on poles and pole-top structures is prudent and efficient. The scope of our review includes reviewing SAPN's forecasting methodology, including the use of the CBRM and the 'Value and Visibility' approach, and all other information used by SAPN in coming to our view of prudency and efficiency.

406. In undertaking our review, the AER has requested that we consider:

- the service level outcomes directly related to the performance of the pole and pole-top asset populations (e.g., SAIFI, fire starts, etc.);
- poles and pole-top defect history - in particular, how SAPN is assessing the risks of defects and whether these practices are reasonably likely to reflect a reasonable estimate of the risks involved; and
- SAPN's strategy - which may be impacting the forecast volumes for pole plating and pole replacement over time, including the relative costs.

407. The AER has also requested that we provide our reasons for accepting or not accepting SAPN's forecast.

8.2 Summary of proposed expenditure

8.2.1 Overview

408. SAPN has proposed a total repex forecast of $637.2m for the next RCP as shown in the table below, complete with asset category detail. Compared to SAPN's actual and estimated expenditure in the current RCP of $609.7m, this represents a forecast repex increase of $27.5m.

Table 22: Forecast total repex by asset category for next RCP

$m, real June 2020	Forecast					Total
Category	2020/21	2021/22	2022/23	2023/24	2024/25	Next RCP
Pole top structures	22.3	23.3	23.4	23.6	23.7	**116.3**
Overhead conductors	2.4	2.5	2.5	2.6	2.6	**12.6**
Underground cables	4.4	4.5	4.6	4.6	4.6	**22.7**
Service lines	7.5	7.8	7.9	7.9	8.0	**39.1**
Transformers	11.2	11.6	12.4	11.6	10.9	**57.8**
Switchgear	9.7	10.3	11.2	11.1	10.3	**52.5**
SCADA, network control and protection systems	9.5	9.2	8.4	8.8	9.3	**45.1**
Other - stobie poles	32.5	33.9	34.2	34.4	34.6	**169.6**
Other - various	23.3	26.0	26.7	24.0	21.4	**121.4**
Total	**122.8**	**129.3**	**131.2**	**128.6**	**125.3**	**637.2**

Source: SAPN Reset RIN.

409. SAPN's actual and estimated expenditure for total repex in the current RCP is of $609.7m, as shown in the table below. This represents a $108.9m shortfall relative to the AER allowance of $718.6m.

Table 23: Actual and estimated total repex by asset category for current RCP[130]

$m, real June 2020	Actual			Estimate		Total Current RCP
	2015/16	2016/17	2017/18	2018/19	2019/20	
Pole top structures	25.4	21.0	25.6	30.3	27.4	**129.7**
Overhead conductors	0.3	0.1	1.8	4.8	4.9	**11.9**
Underground cables	0.3	0.1	2.3	2.0	2.7	**7.4**
Service lines	7.2	6.5	9.2	9.1	7.3	**39.3**
Transformers	6.4	6.5	14.6	15.3	15.8	**58.6**
Switchgear	4.3	7.3	17.3	16.8	12.9	**58.6**
SCADA, network control and protection systems	2.6	7.6	11.3	9.0	12.4	**42.9**
Other - stobie poles	20.4	25.7	29.7	33.0	35.4	**144.2**
Other - various	16.0	16.7	27.3	26.9	30.1	**116.9**
Total	**83.1**	**91.6**	**139.0**	**147.1**	**148.9**	**609.7**
AER allowance	125.4	143.7	149.6	151.8	148.2	**718.6**
Difference	*-42.3*	*-52.1*	*-10.6*	*-4.7*	*0.8*	***-108.9***

Source: SAPN Reset RIN.

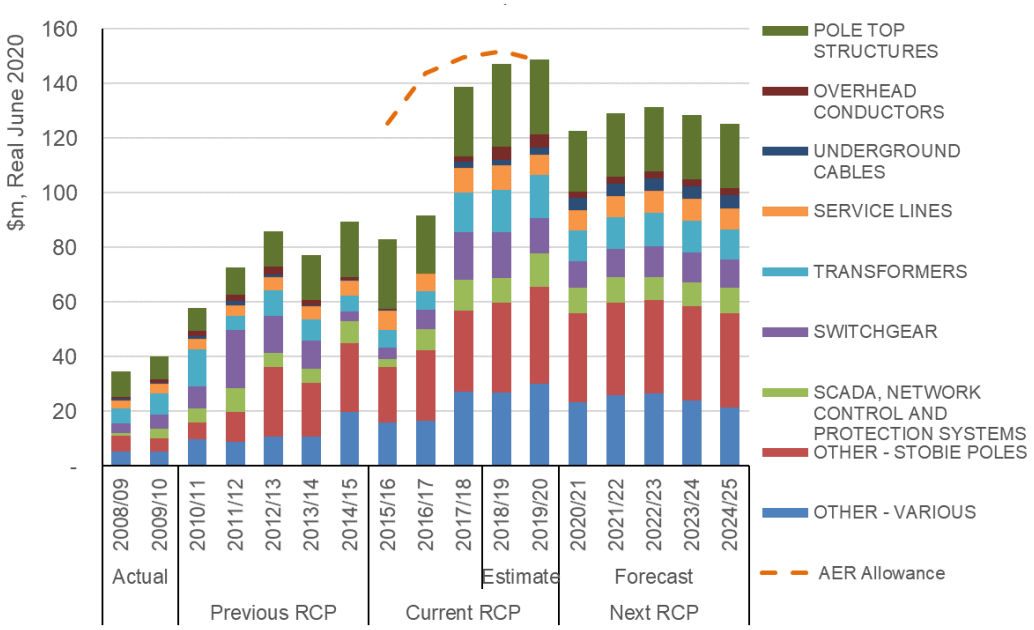
410. For the next RCP, forecast Pole-top structure repex of $116.3m and Other - stobie poles repex (hereinafter referred to as 'Poles') of $169.6m comprise $285.9m. This represents 44.9% of SAPN's total forecast repex for the next RCP.

[130] SAPN identify the pole-related expenditure for stobie poles as part of the 'other' asset category of repex. We have extracted the pole-related expenditure and show this as a separate line item.

411. For the current RCP, forecast Pole-top structure repex of $129.7m and Poles repex of $144.2m comprise $273.9m. Coincidentally, this also represents 44.9% of SAPN's total actual and estimated repex for the current RCP.

412. The expenditure profile, by asset category, for the previous, current and next RCP is shown in the figure below.

Figure 36: Forecast total repex by asset category – previous, current and next RCP[131]



Source: SAPN Reset RIN.

413. We observe that SAPN's actual and estimated repex in the current RCP is forecast to be $108.9m lower than the approved AER allowance, with the forecast shortfall being greatest when compared to actual repex.

414. We also observe a step-change increase in repex in 2017/18 compared to 2016/17. This change arises from higher expenditure across every repex category. SAPN estimates that it will maintain this elevated level of expenditure for the last three years of the current RCP. We consider that this is indicative of a systemic over-forecasting bias, and which we review as part of our assessment of aspects of the forecast expenditure.

415. In the next RCP, SAPN forecasts a decrease of approximately $20m per year in total forecast capex compared with the 2018-20 period of the current RCP. This decrease reflects in reductions in forecast repex across most asset categories.

416. Specific to the two repex categories that we were asked to review, when comparing forecast expenditure in the next RCP to the current RCP, Pole-top structure repex is forecast to decrease by $13.4m (11.5%), while Poles repex is forecast to increase by $25.4m (17.6%).

[131] SAPN identify the pole-related expenditure for stobie poles as part of the 'other' asset category of repex. We have extracted the pole-related expenditure and show this as a separate line item.

8.3 SAPN's governance and management for its repex forecast

417. In this section, we provide an overview of SAPN's expenditure governance and management framework that was used to develop its repex forecast. We subsequently assess the extent to which the expenditure forecast developed in accordance with this framework is likely to be prudent and efficient.

8.3.1 SAPN's approach

Overview

418. SAPN has developed its repex forecast consistent with the governance and management framework described in section 3 of this report. SAPN states that the '*scope of each capex plan has been developed using a risk-based approach that aligns with SA Power Networks' capital governance procedures (refer Supporting Document 5.2 – Capital Governance Process).*'[132] Also, that the '*approach to developing forecasts for capex uses a 'bottom-up approach' whereby the network needs are identified and costed using historical building block estimates based on delivery of similar programs and projects.*'[133]

419. SAPN describes the proposed repex forecast and asset renewal program for the 2020–25 RCP as being '*a flattening off of the 2015-20 RCP repex profile with the aim of maintaining network risk at historical satisfactory levels*.'[134]

Development of repex forecast

420. SAPN describes the drivers of its repex forecast as:[135] (i) condition; (ii) defects; (iii) age of asset components – some components require replacement as they have exceeded their serviceable life; and (iv) risk 'value' – a defect with a higher value of consequence of failure is prioritised ahead of other defects.

421. SAPN describes the build-up of its forecast capex as '*built up using current values of costs in 2017 dollars. The costs are then escalated for forecast changes in the real input costs anticipated over the 2020-25 RCP. These escalators are consistent for both capex and opex.*'[136]

Asset management strategy

422. SAPN has a system of documents that describe its approach for managing network assets, including the Strategic Asset Management Plan (SAMP) and Powerline Asset Management Plan (PAMP). SAPN also refer to detailed Asset Plans developed for each asset class, which '*provide a detailed explanation of the maintenance and replacement practices applied to our assets.*'[137]

[132] SAPN. Attachment 5 – Capital expenditure.

[133] SAPN. Attachment 5 – Capital expenditure.

[134] SAPN. Attachment 5.9. Repex Overview. Page 6.

[135] SAPN. Attachment 5 – Capital expenditure.

[136] SAPN. Attachment 5 – Capital expenditure. Page 26.

[137] SAPN. Attachment 5.9. Repex Overview. Page 16

Risk management approach

423. SAPN describes changes to its asset management approach as being an *'evolution over the past 40 years from a reactive 'fix on fail' approach, to a priority (time-based system) to one that considers maintenance risk values (MRV) on the network. Finally, over the last decade, we have moved to a concept of value which considers not only the risk reduction afforded by rectifying a defect but also the cost of rectifying that defect. We use this ratio of risk reduction and cost to ensure the most prudent and efficient allocation of resources is applied to maintain risk.'*[138]

424. SAPN describes its value-based approach as a *'methodology used to ensure the highest value/lowest cost work is undertaken. Where previously SAPN used a time-based priority to rectify defects (with no regard to consequence or cost), we now use the probability and consequence of defects and cost to remedy to select work (i.e., a cost/benefit approach).'*[139]

Application of value-based approach

425. For all identified network defects SAPN states that it has, since 2016, used its value-based approach to remove identified network risks more prudently and efficiently to:[140]

- more accurately identify and quantify the value of risk associated with an asset defect — to calculate the return on investment for rectifying a defect by assessing a wider range of risk parameters (e.g., bushfire risk, safety, environment, customer value, compliance risks, expenditures, probabilities and consequences of failures); and
- employ new work planning approaches using geographic information systems to make all work visible to work planners so that they can efficiently bundle work programs in similar geographic areas. This avoids excessive or unnecessary costs, such as increased truck visits and labour hours, and reduces the number of planned outages customers experience by bundling work.

426. SAPN undertakes this by application of its Value and Visibility tool for line assets. From 2018/19, this tool is being implemented on substation assets to assess the level of risk present in the network arising from identified defects and other required works for small and medium repeatable jobs.

Determination of work value

427. In the description of the work value methods in the Poles asset plan, SAPN state that '*Work Value aims to calculate the risk of asset failure'* and is represented by the equation below

$$Value = Pe\ \Sigma consequence \times Pc$$

where
Pe= likelihood of event occurring
Pc= likelihood of consequence being realised if the event occurs

[138] SAPN. Attachment 5.9. Repex Overview. Page 7.

[139] SAPN's response to information request AER IR019.

[140] SAPN. Attachment 5.9. Repex Overview. Page 29.

$consequence$= magnitude (in $s) of a consequence resulting from the event, usually asset failure.

428. Whether the defect will lead to an event that will then lead to the consequence has been ascertained by Subject Matter Experts (SME) who allocate a 'defect code consequence factor' within a scale of:

- 0 = rare/never;
- 0.2 = sometimes/occasionally;
- 0.5 = often;
- 0.7 = usually; and
- 1 = always.

429. These factors are used to modify the likelihood of an event leading to a consequence (P_C=consequence likelihood * defect code consequence factor).

Network and asset performance

430. SAPN describes its network performance as measured by SAIDI[141] and SAIFI[142] in terms of the '*…underlying reliability trend (excluding MEDs), which is stable with the average reliability performance maintained at historical levels.*'[143] For fire start events, the trend is '*relatively stable over the long term largely attributed to our Bushfire Risk Management Committee which regularly monitors performance and the implementation of risk management strategies.*'[144]

431. In its asset plans, SAPN provide tables and charts on the number and trend of Distribution Defects (DD) notifications and failures to support its view that the '*number of defects identified for both poles and pole-top structures on the network each year has varied, however the number of outstanding defects continues to escalate as the rate of rectification is lower than the rate of identification.*' [145] In terms of the relative priority of the identified and backlog defects, to ascertain the network risk, SAPN stated that it no longer used a time-based priority categorisation for defects and instead relied on its risk-value vs cost (ROI) method for prioritising work selection.

432. SAPN also presents the value of outstanding defects in terms of work value units. From this analysis SAPN conclude that '*the rate at which we are identifying defects through our asset inspections and the total risk associated with these defects is exceeding the rate at which we have been completing works to remove the identified network risks*.'[146]

[141] System Average Interruption Duration Index

[142] System Average Interruption Frequency Index

[143] SAPN. Attachment 5.9. Repex overview. Page 11.

[144] SAPN. Attachment 5.9. Repex overview. Page 30.

[145] SAPN's response to information request AER IR017.

[146] SAPN. Attachment 5.9. Repex Overview. Page 16.

8.3.2 Our assessment

Asset performance does not indicate network performance is in decline

433. SAPN's own analysis of the trends in network performance and relevant service measures indicates that network performance remains stable and there is insufficient evidence to indicate that network performance is being adversely impacted by declining asset performance.

Insufficient data to conclude the trend in the number of defects is increasing

434. SAPN has provided the number of defects in its Asset Plan and in response to our request for information.[147] These two sources of information differ and were not reconciled by SAPN. Whilst both sets of data suggest that the level of defects being identified for poles and pole-top structures is increasing, SAPN state that the increase in defects evident from 2013/14 is '*possibly related to the inspections moving from HBFRA [High Bushfire Risk Area] (country low pole density) to metro areas (NBFRA [Non Bushfire Risk Area] high pole density). Also, many of the metro feeders were previously out of inspection cycle, with some having no known previous inspection history*.'[148] We provide our assessment of the defect history in our assessment of the proposed expenditure below.

435. An increase in inspections is likely to identify a higher volume of defects and is not, by itself, an indicator that the level of network risk is increasing. We sought to understand the criticality or risk of the identified defects as the risk associated with each defect will likely differ and therefore the risk mitigation and urgency of the risk mitigation may also differ. SAPN rely on its value-based approach to prioritise its work and provide a level of differentiation between defects. We have therefore sought to understand this approach in greater detail, and its relationship to the methods employed for development of a forecast expenditure that meets the requirements of the NER.

Backlog of defects is not an accurate indicator of network risk

436. SAPN presents an increasing backlog of outstanding defects, measured in terms of 'work value'. In its response to our request for information,[149] SAPN states that '*the 'work value' charts show the total risk value (probability of failure x consequence) of all identified defects on the network. The risk values are an index and not an economic cost expressed in dollars.'*

437. SAPN concludes from its own analysis that the '*work value of raised and completed defects has plateaued since around 2015*' and that in '*mid-2018, the completed work value was on track to exceed the work value of defects which will constrain the total outstanding work value if maintained*'. This suggests to us that:

- the current level of expenditure is likely to be sufficient to constrain the current level of level of risk as measured by SAPN using this method;

[147] SAPN's response to information request AER IR039.

[148] SAPN. Pole Asset Plan 3.1.05.

[149] SAPN's response to information request AER IR019. Question 12b.

- the backlog of defects appears to be independent of SAPN's own assessment of risk; and
- SAPN will likely continue to undertake work based on its assessment of value which may not lower the backlog of defects.

SAPN's value-based approach differs from its expenditure forecasting method

438. We sought to understand how the concepts of work value and risk value were used in the forecasting methods presented in its documentation. In its response to our request for information,[150] SAPN state that the '*value-based approach is not a forecasting tool but rather a work prioritisation and selection methodology. Where possible we have used CBRM models to develop expenditure forecasts (e.g., poles), however for pole-top structures a CBRM model is not practical as we have limited data.*' Based on this information, we conclude that SAPN applies a different risk assessment approach to develop its forecast than it applies in delivery of its work program. We consider the implications of this further in our assessment of the proposed expenditure that we have been asked to review.

Consequence factors used in assessment of value determined for worst case events

439. Whilst SAPN identifies a range of possible outcomes associated with an event, it applies the worst-case value for use in its risk analysis through the use of moderation factors.

440. In the description of the work value methods in the Poles Asset Plan, key consequences and cost ranges that are considered for calculating the distribution defect notification work value include:

- SAPN employee injured or killed ($0 to $200m);
- Member of public injured or killed ($500k to $500m);
- Bushfire start ($0 to $600m); and
- Environmental damage ($0 to $200m)

441. Given the magnitude of the worst-case consequence values described above, SAPN has adopted moderating factors based on the likelihood of an event leading to a consequence. It states that these factors were derived from historical data. However, SAPN did not provide evidence to support this claim.

442. For example, SAPN states that based on its historical data, there was a 1 in 1000 chance that a defect would result in the maximum consequence for a bushfire, a 1 in 100 chance that 10-20% of the consequence would be realized, and a 1 in 10 chance that 1%-2% of the consequence would be realized.[151] SAPN aggregates the individual probabilities to determine '*an overall likelihood of the bushfire maximum consequence being realized of 1/1000+1/100*0.15+1/10*0.015=0.004*'.[152]

[150] SAPN's response to information request AER IR019. Question 12a.

[151] SAPN. Pole Asset Plan 3.1.05.

[152] SAPN. Pole Asset Plan 3.1.05.

443. SAPN has also not provided evidence to support selection of its maximum consequence values as they are higher than values we are familiar with as adopted by other NSPs. The use of consequence values and, in particular, the proposed maximum consequence values in its assessment of ALARP,[153] SFAIRP,[154] or use of disproportionate multiplication factors is also not described by SAPN.

444. We were not provided access to the tool in which the risk calculations were applied and were therefore unable to confirm how the moderating factors were applied in practice to the maximum consequence values. We remain concerned that this approach, whilst seeking to moderate the impact of worst-case events, is likely to overstate the consequence value due to the magnitude of the maximum values applied.

445. We understand a similar approach is used as part of the CBRM tool as it has been applied for the development of the forecast repex for poles, and as such similar concerns would also likely be present in the risk modelling relied upon for this purpose. We discuss this further in our review of the proposed poles repex forecast.

No evidence of deferral savings from IT investment

446. We have not found evidence of the deferred repex benefits claimed from SAPN's Asset and Works Program, or where reductions to SAPN's repex forecast for poles and pole-top structures has been applied to the proposed forecast expenditure for the next RCP.

447. SAPN claims that '*[i]f the Asset and Works IT expenditure is not allowed we would need to review our pole top expenditure forecast*.'[155] However we have not been provided with the basis for this claim, particularly as:

- For poles - the forecast is developed using a CBRM tool and not the V&V tool;
- For pole-top structures - the forecast is based on current expenditure and therefore the current prioritisation process of defect rectification as *'the value-based approach is built into our forecast by virtue of it being applied to our recent historic expenditure;'*[156] and
- Neither forecast appears to be contingent on or incorporate reductions and/or efficiencies that arise from, SAPN's IT program expenditure.

448. During our onsite discussion, we asked SAPN to explain the value (including repex benefit) derived by moving from its previous MRV method to its current V&V method, circa 2016. In response, SAPN provided examples of the outputs of the two methods to highlight that it was not possible to directly compare the two methods, or to retrospectively determine the variance to expenditure or value delivered. SAPN states that '*[a]s the valuing methodology has been progressively implemented and refined over time the value for closed notifications are not comparable to current values associated with current notifications ('old' values cannot be compared with 'current' values).*'[157]

[153] As Low As Reasonably Practicable.

[154] So Far As Is Reasonably Practicable.

[155] SAPN's response to information request AER IR019.

[156] SAPN's response to information request AER IR019.

[157] SAPN's response to information request AER IR039.

449. Further, SAPN states that its new process has resulted in an increase (not a reduction) in repex replacements for pole-top structures in the 2015-20 RCP in contrast to the 2010-15 RCP.[158]

8.4 Assessment of proposed poles repex forecast

8.4.1 SAPN's approach

Expenditure summary

450. SAPN has proposed $169.6m for the management of poles assets in its repex forecast for the next RCP. The expenditure is categorised against individual categories in the 'other' repex expenditure category as shown in the table below. Approximately 20% of expenditure is allocated to pole refurbishment, with the 80% remainder allocated to pole replacement.

Table 24: Forecast repex for Poles for the next RCP[159]

$m, real June 2020	Forecast					Total
	2020/21	2021/22	2022/23	2023/24	2024/25	Next RCP
< = 1 kV; stobie pole	6.8	7.1	7.2	7.2	7.2	**35.5**
> 1 kV & < = 11 kV; stobie pole	14.1	14.7	14.8	14.9	15.0	**73.6**
> 11 kV & < = 22 kV; stobie pole	3.6	3.8	3.8	3.8	3.9	**18.9**
> 22 kV & < = 66 kV; stobie pole	1.4	1.4	1.4	1.4	1.4	**7.1**
Pole refurbished; stobie pole	6.6	6.9	7.0	7.0	7.1	**34.6**
Total	**32.5**	**33.9**	**34.2**	**34.4**	**34.6**	**169.6**

Source: SAPN Reset RIN.

451. Forecast expenditure in the next RCP represents an increase of $25.4m (17.6%) from actual/estimated expenditure in the current RCP, with increases across all pole asset categories. Actual/estimated expenditure for the current RCP is provided in the table below for comparison.

[158] SAPN's response to information request AER IR019.

[159] SAPN identify the pole-related expenditure for stobie poles as part of the 'other' asset category of repex. We have extracted the pole-related expenditure and show this as a separate line item.

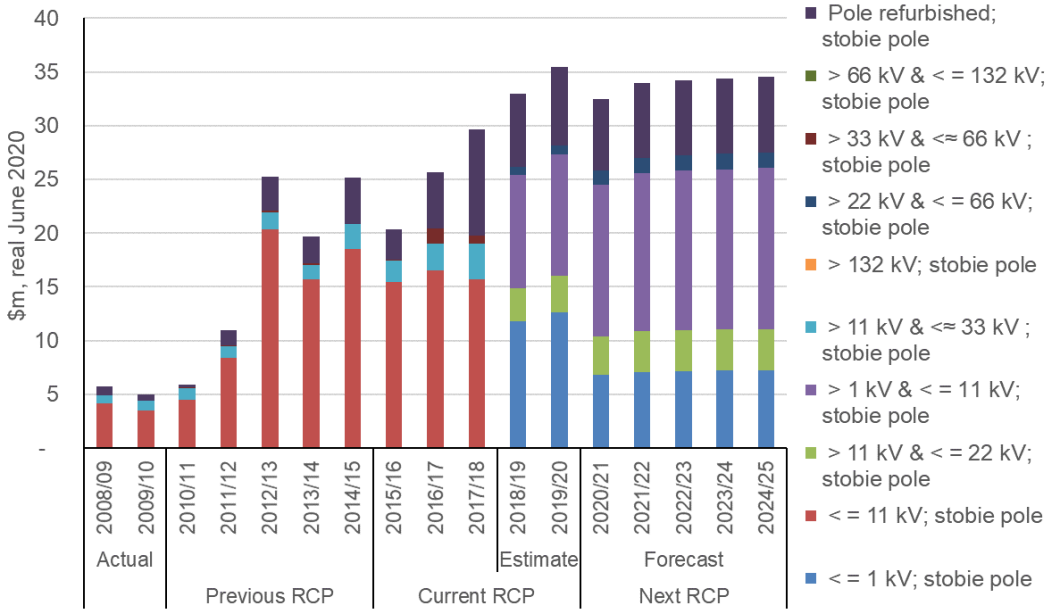
Table 25: Actual/estimated repex for Poles for the current RCP[160]

$m, real June 2020	Actual			Estimate		Total Current RCP
	2015/16	2016/17	2017/18	2018/19	2019/20	
< = 1 kV; stobie pole	-	-	-	11.8	12.6	**24.4**
> 1 kV & < = 11 kV; stobie pole	-	-	-	10.5	11.3	**21.8**
< = 11 kV; stobie pole	15.5	16.5	15.7	-	-	**47.7**
> 11 kV & < = 22 kV; stobie pole	-	-	-	3.1	3.4	**6.5**
> 11 kV & <≈ 33 kV ; stobie pole	1.9	2.5	3.3	-	-	**7.8**
> 22 kV & < = 66 kV; stobie pole	-	-	-	0.8	0.8	**1.6**
> 33 kV & <≈ 66 kV ; stobie pole	0.1	1.4	0.8	-	-	**2.3**
Pole refurbished; stobie Pole	2.8	5.3	9.9	6.8	7.3	**32.1**
Total	**20.4**	**25.7**	**29.7**	**33.0**	**35.4**	**144.2**

Source: SAPN Reset RIN.

452. The expenditure profile, by pole asset category, for the previous, current and next RCP is shown in the figure below.

Figure 37: Actual, estimated and forecast repex for Poles asset category for the previous, current and next RCP ($m, real June 2020)



Source: SAPN Reset RIN

453. The changes to the composition of poles expenditure (both during and between RCPs) is evident in the above figure. For example, in the next RCP, a lower proportion of expenditure is allocated to LV poles, [161] whereas a higher proportion of expenditure is allocated to 11kV poles.

[160] SAPN identify the pole-related expenditure for stobie poles as part of the 'other' asset category of repex. We have extracted the pole-related expenditure and show this as a separate line item.

[161] Which correspond with the asset category of less than or equal to 1kV

Strategy summary

454. SAPN has included a description of its proposed pole replacement and refurbishment programs in Attachment 5.9 Repex Overview of its RP, and in the Asset Plan 3.1.05 - Poles. SAPN states that its strategy for the next RCP is to '*undertake sufficient asset renewal investment such that the total risk at the end of the period (2024/25) is equal to the total risk at the start of the period (2019/20).*'[162]

Benchmarking

455. SAPN has included pole benchmarking analysis of SAPN vs other DNSPs and concludes that SAPN has the lowest level of average annual repex per pole (even with one of the higher reported failure rates amongst DNSPs). SAPN states that '*this shows SA Power Networks lifecycle management of poles is very efficient.*'[163]

Forecasting method

456. SAPN states that '*[d]ue to the increasing risk of our pole population, our preferred forecasting methodology for poles is the risk based CBRM approach*.'[164] SAPN has applied a CBRM model referred to as 'RIVA' to develop its expenditure forecasting, which includes the following steps:[165]

- Asset Health Analysis - a bottom-up assessment for condition of each pole asset to derive an overall health of the population of poles;
- Probability of Failure Analysis - derived from historic performance in terms of the number of pole failures per year;
- Consequence and criticality analysis - to determine the impact of the several failure modes of an asset in order to calculate its overall risk; and
- Risk Calculation - the risk posed by an asset is a summation of each modelled consequence multiplied by its criticality factor and associated probability of failure (POF) for the various failure modes.

457. SAPN identify that <1% of its pole population have advanced deterioration with a Health Index (HI) of greater than 7; and 9% have observable to serious deterioration with a HI in the range of 4 to 7.

Scenario modelling

458. In response to our request for information,[166] SAPN has provided an overview of its pole modelling scenarios whereby its RIVA/CBRM model produces an estimate of *'the total risk as of Jan 2018 and projects the growth of that risk forward to 2024/25*.'[167]

[162] SAPN. Pole Model Scenario Modelling, provided in response to information request AER IR017.

[163] SAPN. Attachment 5.9 Repex Overview. Page 53.

[164] SAPN. Attachment 5 - Capital expenditure. Page 43.

[165] SAPN. CBRM Modelling Overview – Poles, provided in response to information request AER IR017.

[166] SAPN. Pole Model Scenario Modelling, provided in response to information request AER IR017.

[167] SAPN. Pole Model Scenario Modelling, provided in response to information request AER IR017.

459. SAPN adjusts for work completed in the period Jan 2018 – Jun 2018 (corresponding with the end of the 2017/18 regulatory year) and work forecast to be completed in the remainder of the current RCP. Having determined the opening risk level at the commencement of 2020/21 and forecast risk level from the CBRM/RIVA model, SAPN determine the risk to be removed from planned and unplanned work as the difference between these two figures.

460. SAPN describes the assumptions and steps applied to its Pole Model[168] in its documentation for the preferred Maintain Risk scenario, and consideration of the maintain HI and business as usual options.

Changes to the model since the current RCP

461. SAPN states that the CBRM model has been improved significantly since it was first built and used to forecast repex for the 2015-20 RCP. SAPN identify the key changes as:[169]

- Additional asset condition information – refining the volume of poles and improving data collected from 70% of poles having inspected condition information; and
- Volume of poles that can be plated is based on condition information.

8.4.2 Our assessment

Reconciliation of repex forecast data

462. We understand that SAPN's forecasting model has been developed in real 2018 dollar terms and that its RIN is submitted in real 2020 dollar terms. We observe a close correlation between the two forecast expenditure total values, albeit stated to be on a different financial basis. This suggests to us that the CBRM model outputs were actually expressed in real 2020 dollar terms, but this is unclear from the documentation provided.

463. The forecast expenditure includes a scaling factor of 1.0237 applied by SAPN due to its assessment of poles in the network (647,000) being higher than the number of poles included in its CBRM model (632,000).

464. In response to our request for information, SAPN states that the '*proposed total repex investment on poles to maintain the risk of this asset category is $169.6M as stated in the RIN.'* This value aligns with the table above. However SAPN also states that, *'Attachment 5 – Capital expenditure states $146.4M which is the repex investment proposed specifically for pole renewal expenditure programs (pole plating and pole replacements) identified through our inspection and condition monitoring program with the balance allocated to the renewal of poles for rectifying conductor line clearances where identified clearances do not meet legislated requirements under Electricity (General) Regulations 1997. These line clearance defects are also identified through our inspection program and the repex investment for this planned work ($23.2M) forms part of the $69.3 safety related repex.*' [170]

[168] SAPN. Pole Outputs Model provided in response to information request AER IR017, and subsequently updated in SAPN's response to information request AER IR019.

[169] SAPN. Attachment 5.9. Repex Overview. Page 56.

[170] SAPN's response to information request AER IR019.

465. SAPN provides a further breakdown in its Attachment 5 of the forecast repex as $111.3m for pole replacement and $35.1m for pole refurbishment, totalling $146.4m. We have relied on the expenditure forecast and profile provided in the RIN as the basis for our assessment as outlined below.

Inclusion of line clearance defects is not supported

466. SAPN state that it has based its forecast on its CBRM model after considering other techniques. However, SAPN also state that the forecast repex includes additional pole renewal expenditure in response to rectifying conductor line clearances that do not meet legislative requirements. The inclusion of this additional $23.2m for the purpose of line clearance rectification appears to undermine the reliability of the CBRM model as the primary forecasting method, which it determined by an assessment of condition and risk rather than as a result of a breach of compliance obligations, which is likely to have a different risk profile. Whilst a level of unplanned expenditure is included in the CBRM model, the information we have been provided suggests this is for unplanned failures and not line clearance defects.

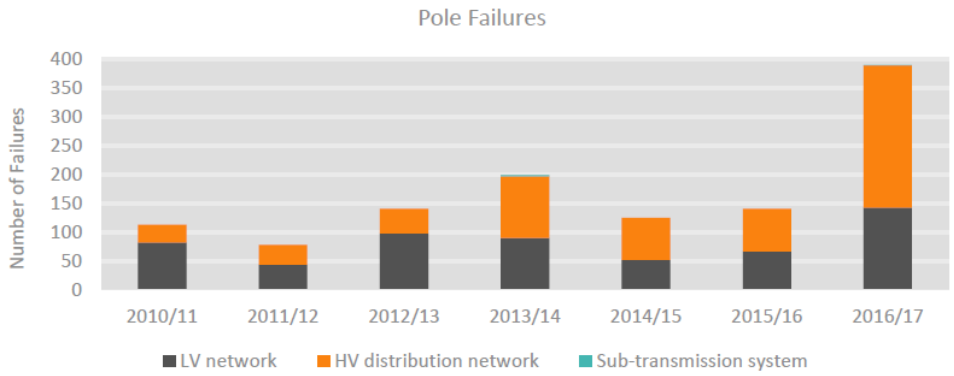
467. The rectification of line clearance defects is a different driver for pole renewal and may also include associated pole-top structure and conductor capex. SAPN has included a dedicated line clearance rectification program totalling $18.5m (Attachment 5.8) and the relationship between these two programs is not evident.

468. SAPN has not provided sufficient evidence to support the inclusion of the additional $23.2m safety related capex for rectifying line clearance issues into the pole repex forecast in the next RCP, and which undermines the reliance placed on its CBRM model as the sole basis for its pole repex forecast.

Network performance and asset data do not indicate declining trend

469. SAPN include a chart of pole failures, reproduced in the figure below.

Figure 38: Poles historical failures



Source: SAPN Poles Asset Plan. Figure 11.

470. From this chart, SAPN appears to conclude that the pole failure rate is increasing, whereas SAPN's own analysis suggests that the increased number of pole failures in 2016/17 is more likely the result of severe storms that occurred in that year. The storms are believed to have had the effect of weakening poles in certain locations, such that they failed shortly after the storm events.

471. SAPN states that[171] '*when the distribution of these FM notifications over the year is compared to when the MEDs occurred there is a substantial increase in notifications either in the same month of shortly thereafter.'*

472. However, in its PAMP[172] SAPN states that '*the historical number of pole failures has remained relatively stable since 2010–2011 aside from the relatively high number of failures in 2013–2014 and 2016–2017'* which SAPN explains due to the reasons stated above.

473. Alongside our review of the network performance data in earlier sections, we do not consider that SAPN has demonstrated that an increase in pole renewal expenditure is required to address an increasing level of risk in its pole population.

Adoption of CBRM approach to pole assets is reasonable

474. SAPN has implemented its CBRM approach in its RIVA model, and engaged EA technology in its development. Further, SAPN claim to have verified the outputs of RIVA to the outputs of the original EA technology model to provide confidence in its approach.

475. SAPN has included provision for pole refurbishment and replacement in its forecasting model, whereby an assessment is made as to whether the pole is able to be refurbished by re-plating, and in these cases a lower cost solution is able to be applied.

476. SAPN also claims to have calibrated its model to reflect real world network risk by using actual historical average failure rates, replacement and plating rates, mean lives and unit costs as inputs to its model to compare with actual performance observations. SAPN does not appear to have undertaken external verification or an external audit of this process or its results, and we are therefore unable to verify these claims.

Conservative risk and consequence values likely to result in an overstated forecast

477. SAPN's CBRM model includes a risk formula being the multiple of the probability of failure, consequence value and criticality factor. SAPN describe the interaction of consequence and criticality in its CBRM model as '*[c]onsequence and criticality are used in CBRM to determine the impact of the several failure modes of an asset in order to calculate its overall risk. Consequences provide the model with an understanding of the average impact, whilst criticality presents factors that will vary the severity of an average impact into an expected impact. The consequences in CBRM attempt to capture the varying levels of effects caused by failure. These consequences may include minor, significant or major categorisation of a failure (severity based) or are directly related to specific consequences such as bushfires and fire starts, need for repairs or an asset falling over*.'[173]

478. SAPN include a summary of the consequence values in Appendix C of the CBRM Modelling Overview – Poles document for each of its consequence factors. SAPN has applied very large financial consequence values to its consequence factors. For

[171] SAPN. Pole Asset Plan 3.1.05.

[172] SAPN. Attachment 5.8. Powerline Asset Management Plan. Page 152.

[173] SAPN. CBRM Modelling Overview – Poles. Provided in response to information request AER IR017.

example, $260m for the average consequence of a bushfire against the safety consequence factor, and $250m for a 'non-condition bushfire' for its CAPEX consequence factor.

479. SAPN cites the information source as either EA technology or SAPN, and does not provide further evidence to support the selection of these or other listed consequence values.

480. The application of the individual criticality factors and consequence factors are built into SAPN's CBRM model and the individual impact was not able to be reviewed. We would expect that these values are more closely aligned with a maximum consequence value, rather than average consequence values. Where maximum consequence values are applied, they should be moderated to reflect that a maximum consequence does not occur for every failure event. Whilst the criticality factors may act in a similar way to moderate the likelihood, we were not provided with a copy of the model to review the impact of the criticality factors, or to assess the sensitivity of the results to these values.

481. Without application of moderation factors that seek to reflect the likelihood of a maximum consequence occurring should a failure event also occur, we consider that the resulting risk values are likely to be inflated. As noted in our review of the governance and management processes that apply to the repex forecast, we consider that SAPN's risk assessment practices are likely to be conservative.

Sensitivity analysis for critical inputs to CBRM model not adequately tested

482. At the onsite meeting, SAPN stated that the risk values were individually small in value, and that its calibration to historical pole failures provided an effective means to mitigate any bias. SAPN also stated that '[*t]he poles CBRM model was calibrated through an iterative process to ensure the model outputs were aligned with real world observations*.'[174]

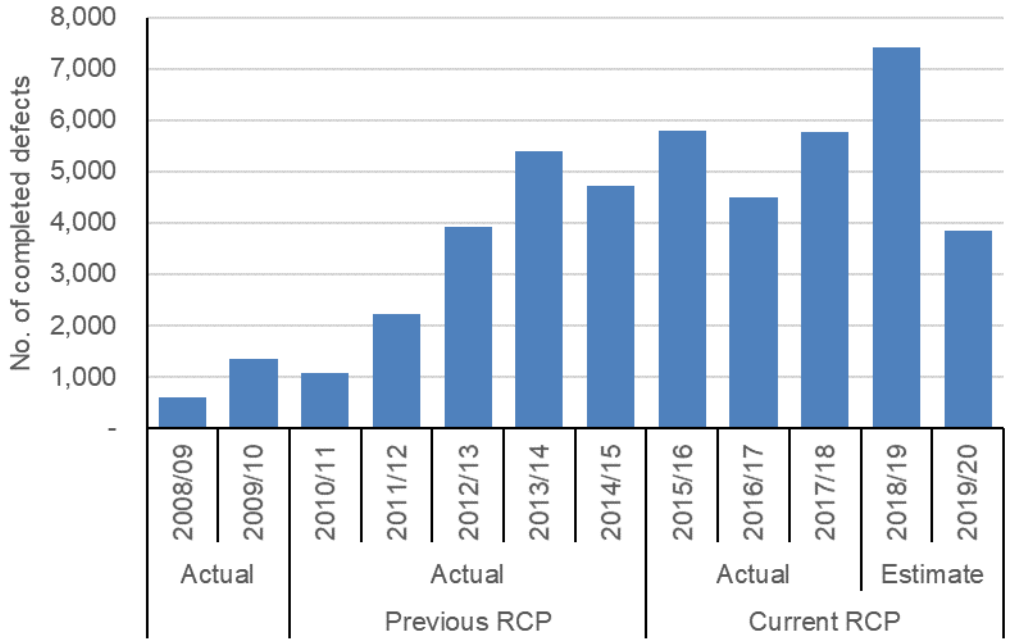
483. We requested that SAPN provide an explanation of any sensitivity analysis that had been undertaken to ascertain the sensitivity to these critical input values and demonstrate that a bias was not present. In response, SAPN described its verification process to reflect its observed performance as described above.

Completed defects appear relatively stable

484. The number of 'Completed' pole related defects appears relatively stable since around 2012, as shown in the figure below. When considering the near complete 2018/19 year, there is insufficient information provided by SAPN to conclude that the elevated level of completed defects in 2017/18 is representative of an increasing trend that would indicate an increasing level of network risk.

[174] SAPN. Attachment 5.9. Repex Overview. Page 55.

Figure 39: Completed pole defects by financial year[175]



Source: EMCa analysis of data contained in SAPN's response to information request AER IR039

485. It is likely that an increase in the number of inspections that SAPN claims to have undertaken has identified a higher number of defects, and once identified, corrective work is planned to be completed. Based on SAPN's stated approach of completing work based on highest value, we consider that it is also likely that SAPN has been completing a level of defect-based work that it considers has maintained its desired level of risk, including deferral of a proportion of identified defects. If the level of network risk was increasing, we would expect to see an increasing number of completed defects over a number of years and which is not evident in the above figure.

8.5 Assessment of proposed pole-top structures repex forecast

8.5.1 What SAPN has proposed

Expenditure summary

486. SAPN has proposed $116.3m for the management of its pole-top structures asset category in its repex forecast for the next RCP as shown in the table below.

[175] We have generated this view based on the data provided by SAPN in calendar years, based on the financial year of the completion date.

Table 26: Forecast repex for Pole top structures for the next RCP

$m, real June 2020	Forecast					Total Next RCP
	2020/21	2021/22	2022/23	2023/24	2024/25	
< = 1 kV	5.6	5.9	5.9	6.0	6.0	**29.4**
> 1 kV & < = 11 kV	10.5	11.0	11.0	11.1	11.2	**54.7**
> 11 kV & < = 22 kV	3.6	3.7	3.8	3.8	3.8	**18.7**
> 22 kV & < = 66 kV	2.6	2.7	2.7	2.7	2.7	**13.4**
Total	**22.3**	**23.3**	**23.4**	**23.6**	**23.7**	**116.3**

Source: SAPN Reset RIN.

487. Forecast expenditure in the next RCP represents a decrease of $13.4m from actual/estimated expenditure in the current RCP, as shown in the table below.

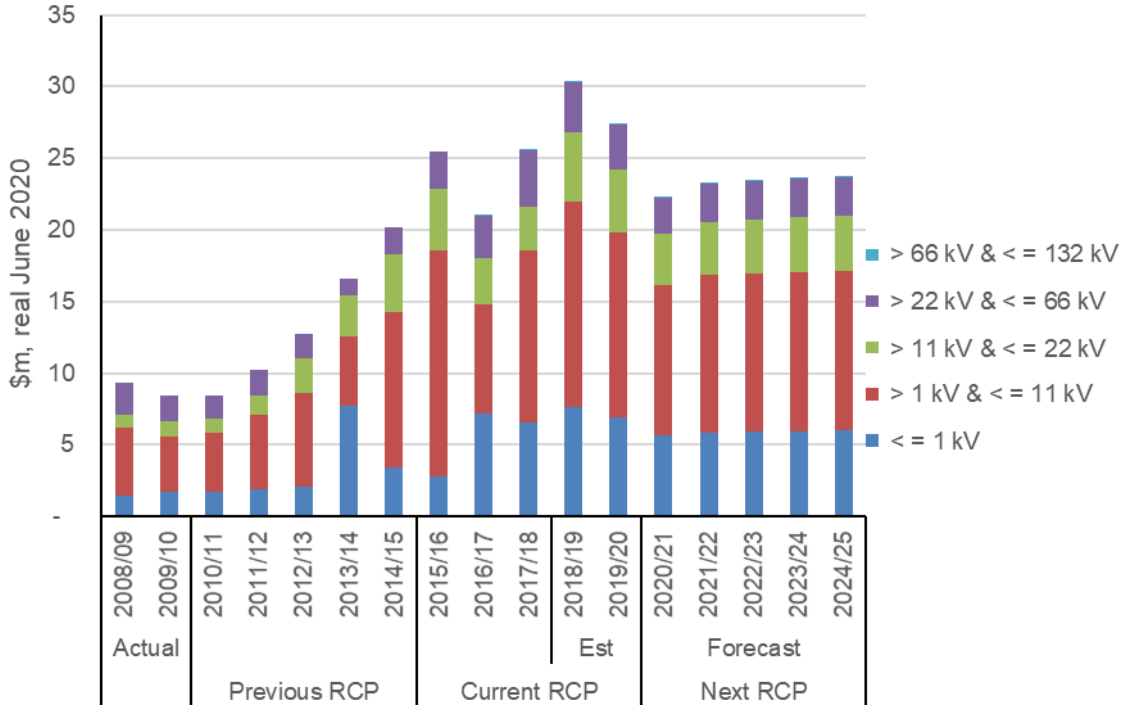
Table 27: Actual/estimated repex for Pole top structures for current RCP

$m, real June 2020	Actual			Estimate		Total Current RCP
	2015/16	2016/17	2017/18	2018/19	2019/20	
< = 1 kV	2.8	7.2	6.5	7.7	6.9	**31.1**
> 1 kV & < = 11 kV	15.8	7.6	12.0	14.3	12.9	**62.6**
> 11 kV & < = 22 kV	4.3	3.3	3.0	4.9	4.4	**19.9**
> 22 kV & < = 66 kV	2.5	3.0	4.0	3.5	3.2	**16.1**
Total	**25.4**	**21.0**	**25.6**	**30.3**	**27.4**	**129.7**

Source: SAPN Reset RIN.

488. The expenditure profile for the previous, current and next RCP, by pole-top structure asset category, is shown in the figure below.

Figure 40: Actual, estimated and forecast repex for Pole-top structures for the previous, current and next RCP)



Source: SAPN Reset RIN

489. Changes to the composition of the pole-top expenditure between RCPs are evident in the above figure. Expenditure for pole-top structures has been following an increasing trend since 2010/11 and extending this trend throughout the current RCP. For the next RCP, the expenditure trend is constant and at a reduced level of expenditure for most asset categories when compared with the current RCP.

Strategy summary

490. SAPN describes[176] its pole-top structure replacement strategy as being based on managing risk either through replacement arising from identified failures or identification of defects. SAPN also considers inclusion of planned programs where inspection information is not reliable and the asset failure presents an unacceptable high likelihood and consequence risk SAPN describes its program as including an increased rate of replacements up to 2018 which then plateau to approximately 14,000 replacements per annum based on current forecasts and a stable level of expenditure out to 2030.

Network performance and asset data

491. Like its pole asset population, SAPN claims that the number of in-service failures of pole top structures has trended upward since 2011. In its asset plans, SAPN identifies several emerging issues relating to the performance of its pole top structures which it claims are further exacerbating the failure rates.[177]

[176] SAPN. Attachment 5.8. PAMP. Page 164.

[177] SAPN. Attachment 5.7. SAMP.

Forecasting method

492. SAPN has based its proposed repex for pole top structures (which includes overhead line components and overhead switchgear) on the historical expenditure trend, describing it as a '*continued flat investment profile from the 2015-20 Regulatory Control Period.*[178]

493. SAPN has provided a model[179] that outlines the data and methodology used to determine the repex forecast. The model uses total actual expenditure for 2015/16 to 2017/18 and estimated expenditure for 2018/19 and 2019/20 (prepared as of late 2018) as the basis for proposing its repex forecast of $116.3m ($2018) for the next RCP.

8.5.2 Our assessment

Reconciliation of forecast data

494. We understand that SAPN's forecasting model has been developed in real 2018 dollar terms and that its RIN is submitted in real 2020 dollar terms. We observe a close correlation between the two forecast expenditure totals, albeit provided on a different financial basis. This suggests to us that the model outputs were actually expressed in real 2020 dollar terms, though this is not clear from the information provided.

495. In Attachment 5, SAPN states the forecast repex for pole-top structures as $94.7m (June 2020). SAPN provided clarification[180] of the breakdown in its Attachment 5 of the forecast repex as $94.7m for overhead line components renewals and $21.6m (being the balance) for overhead switchgear renewals (including OH switchgear planned and OH switchgear unplanned).

496. SAPN advised that expenditure included in the RIN for 2018/19 and 2019/20 is estimated to be higher than the expenditure replied upon in developing the forecast for the next RCP, with the difference being a reduction of approximately $10m. In its response to our information request,[181] SAPN states that the '*basis for the amended expenditure forecasts for 2018/19 and 2019/20 [included in the RIN correspond with] ...an increase in actual spend in 2018/19 to date and forecast 2019/20 expenditure*.' SAPN also states that the increased repex forecasts in those years '*...are not incorporated into the forecast expenditure for pole top structures for the 2020-25 RCP.'*

497. The 5-year average unit costs are derived from the total asset category reported repex ($2018) divided by the number of annual replacements across the 5-year period from 2013/14 to 2017/18 inclusive. We have relied on the expenditure forecast and profile provided in the RIN, being the most accurate representation of the expenditure to be incurred by SAPN, as the basis for our assessment.

[178] SAPN's response to information request AER IR017.

[179] SAPN. Pole Top Structures Forecast, provided in response to information request AER IR017.

[180] SAPN's response to information request AER IR019.

[181] SAPN's response to information request AER IR019.

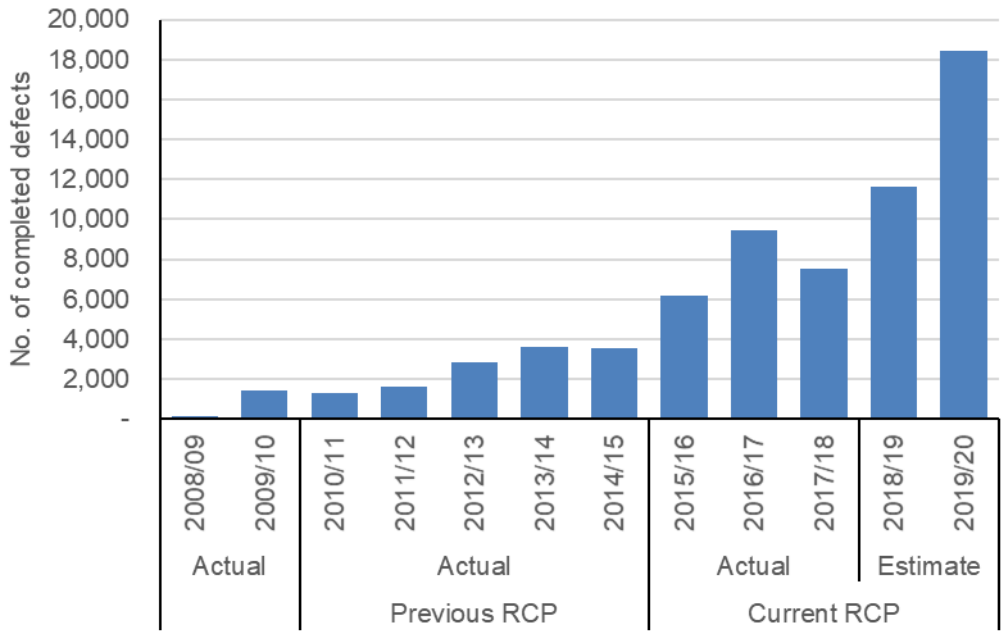
Network performance appears to be stable

498. Consistent with our review of the network performance data in preceding sections, we do not consider that SAPN has demonstrated that an increase in pole-top structure renewal expenditure is required to address declining network performance and/or an increasing level of risk in its pole-top structure population.

Higher work volumes are supported by completed defects

499. In the figure below, the number of 'Completed' pole-top structure related defects is steadily increasing year over year, with further significant increases in the last two years of the current RCP. This trend aligns with an increased level of expenditure, as evident in the RIN.

Figure 41: Completed pole-top structure defects for financial year[182]



Source: EMCa analysis of data contained in SAPN's response to information request AER IR039

500. Based on SAPN's stated approach of completing work based on highest value, we consider that it is likely that SAPN are completing higher priority work for pole-top structures, and that this higher volume of work has been sustained in the current RCP. We note that SAPN has proposed to reduce the forecast expenditure for the next RCP based on its assessment of estimated expenditure in the current RCP, thereby holding the expenditure at a level commensurate with the average of the period 2015/16 to 2017/18.

[182] We have generated this view based on the data provided by SAPN in calendar years, based on the financial year of the completion date.

8.6 Findings and implications for aspects of SAPN's proposed repex forecast

8.6.1 Findings

Asset management strategies do not support increasing expenditure

501. SAPN describes its asset management strategy for poles as maintaining the current level of risk in the network, as determined solely as an outcome of its CBRM model for poles and by maintaining the historical expenditure for pole-top structures.[183]

502. SAPN has proposed an increased level of expenditure for poles in response to its assessment of the condition and risk of its pole population over the next RCP. However, we consider that the model SAPN has relied upon to determine its forecast expenditure results in an overstated level of forecast expenditure due to: (i) conservative risk and consequence assumptions; and (ii) inclusion of non-condition based drivers.

503. SAPN does not explain the interaction of this program with other safety driven programs, such as its dedicated line clearance program. We consider that by not taking account of such interactions, it is likely that SAPN has forecast a higher aggregate level of expenditure than it will require.

504. For pole-top structures, SAPN's asset management strategy is to maintain risk through the management of identified defects, primarily based on a reactive approach. SAPN has not modelled pole top structures using CBRM to assess risk or asset health because they are so numerous, and varied, and data is limited.

Service level outcomes directly related to the performance of the pole and pole top asset populations remain stable

505. The network performance and service level outcomes related to pole and pole-top structure assets appear relatively stable. Accordingly, these trends do not provide compelling justification for a change in the strategy or increase in the level of expenditure above that incurred in the current RCP for these asset categories.

Poles and pole-top structure defect history

506. The increasing number of identified defects for poles and pole-top structures presented by SAPN is not, by itself, an indication of an increasing level of risk on the network. All defects are not equal, with some presenting a much higher risk (and therefore value) associated with corrective actions than others.

507. When reviewing the level of completed defects, as an indicator of the actual risk observed in the network and resultant action by SAPN, the level of work completed in the current RCP does not appear congruent with the basis for the forecast in the next RCP. Similarly, the reported asset failure data also does not support the proposed changes in the forecast expenditure in the next RCP.

[183] As noted earlier, excluding the impact of the increases level of actual and estimated expenditure expected to be incurred by SAPN in 2018/19 and 2019/20

508. SAPN's value-based approach seeks to assign a work value to the identified defects to prioritise its work scheduling and delivery. SAPN has presented increasing trends in outstanding work for poles and pole-top structures using this method, as a basis for arguing that increased expenditure is required to address the increasing risk and backlog of work. However, SAPN also states that the estimate of work value should not be used as an estimate of economic value.

509. We consider that the outstanding work value presented by SAPN is as a result of conservative input assumptions that are likely to overstate the risk, and therefore the level of work value. Accordingly, in its current form, our view is that this approach does not represent an effective tool to reflect the level of risk - or trend in the level of risk in the network - to support a change in asset management strategy or resultant expenditure.

510. SAPN has demonstrated that it uses its value-based approach to optimise delivery of its work program and claims to have deferred a level of repex through this. The result of this is reinforced by SAPN having underspent its previous forecasts and the AER's allowance, for the current and previous RCPs. We consider that SAPN is likely to continue to identify methods to defer a level of repex.

8.6.2 Implications

511. Based on the models and information provided by SAPN, we consider that SAPN's proposed repex forecast for poles and pole-top structures in the next RCP is above what we would consider to be a reasonable, prudent and efficient level of expenditure.

512. We consider that the work scheduling and prioritising methods applied by SAPN are also likely to lead to SAPN incurring a lower level of repex for the poles and pole-top structures asset categories than SAPN has proposed, as evident in the first three years of the current RCP.

513. Bottom-up adjustments, to remove the additional pole renewal program for line clearance defects, would result in a further reduction to repex for poles and pole-top structures. However, we note that combining these adjustments is not simply additive, since there are interactions between them, including that SAPN has not included the increases it expects to incur in the last two years for pole-top structures.

Appendix A - Record of Information Request Responses & RP Supporting Documents

Documents provided to us by AER for our assessment

Confidential documents

Item No.	Filename
1	AP 3.3.09 OT Cyber Security - Confidential.pdf
2	SAPN - 5.22.1 - EA Tech - LV Mgmt Strategy An 1 DER Hosting Capacity Assessment - 23 Nov 2018.pdf
3	SAPN - 5.32 - IT Investment Plan 2020-25 - January 2019 - Confidential.pdf
4	SAPN - 5.33 - Client Devices Refresh Business Case - January 2019 - Confidential.pdf
5	SAPN - 5.34 - IT Asset Management Plan 2019-2023 - December 2018 - Confidential.pdf
6	SAPN - 5.35 - Cyber Security Business Case - January 2019 - Confidential.pdf
7	SAPN - 5.36 - SAP Upgrade Business Case - January 2019 - Confidential.pdf
8	SAPN - 5.37 - GIS Consolidation Business Case - January 2019 - Confidential.pdf
9	SAPN - 5.38 - Protection Settings Management System Business Case - January 2019 - Confidential.pdf
10	SAPN - 5.40 - Ring-fencing Compliance IT Solution Business Case - January 2019 - Confidential.pdf
11	SAPN - 5.41 - Worker Safety Fatigue Risk Mgmt Business Case - January 2019 - Confidential.pdf
12	SAPN - 6.1 - IT Infrastructure Refresh Business Case - January 2019 - Confidential .pdf
13	SAPN - 6.3 - Critical Infrastructure Obligations Business Case Janurary 2019 - Confidential.pdf
14	SAPN - 6.7 - KPMG - Independent Analysis of CHED Services Arrangements - December 2018 - Confidential.pdf
15	SAPN IR011C Work Selection Effectiveness Baseline Calculation 20190405 Confidential.xlsx
16	SAPN-IR003-Attachment 5-AssetPlan3.3.08TNCManagementSystems (MdL).pdf
17	SAPN-IR003-Attachment 6-AssetPlan3.3.07OperationalTelephony.pdf
18	SAPN-IR003-Non-NetworkCapex-20190222-Public.pdf
19	SAPN-IR011B-ICT-20190405-Confidential.pdf
20	SAPN-IR011B-ICT-20190405-[redacted]
21	SAPN-IR011B-ICT-20190405-[redacted]
22	SAPN-IR011B-ICT-20190405-[redacted]
23	SAPN-IR011C-ICT-20190405-Confidential.pdf
24	Brief research on SAPN major customer connections.docx
25	SAPN - 20.18 CONFID - Acil Allen Maximum Demand Forecasting Tool.pdf
26	Augex material\SAPN - 5.12 - BIS Oxford Economics - Gross Customer Connections Expenditure Forecasts - 18 November 2018 - Confid.pdf
27	SAPN-IR003-5MinuteRule-20190222-Confidential\[redacted]
28	SAPN-IR003-5MinuteRule-20190222-Confidential\[redacted]
29	SAPN-IR003-5MinuteRule-20190222-Confidential\[redacted]p
30	SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
31	SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
32	SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
33	SAPN-IR003-Asset&Work-20190222-Confidential\A[redacted]

34 SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
35 SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
36 SAPN-IR003-Asset&Work-20190222-Confidential\Assets and Work Summary NPV.xlsx
37 SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
38 SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
39 SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
40 SAPN-IR003-Asset&Work-20190222-Confidential\SAPN-IR003-Assets&Work-20190222-Confidential.zip
41 SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
42 SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
43 SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
44 SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
45 SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
46 SAPN-IR003-Asset&Work-20190222-Confidential\[redacted]
47 SAPN-IR003-ClientDevices-20190222-Confidential\[redacted]
48 SAPN-IR003-ClientDevices-20190222-Confidential\[redacted]
49 SAPN-IR003-ClientDevices-20190222-Confidential\[redacted]
50 SAPN-IR003-ClientDevices-20190222-Confidential\[redacted]
51 SAPN-IR003-ClientDevices-20190222-Confidential\[redacted]
52 SAPN-IR003-CyberSecurity-20190222-Confidential\[redacted]
53 SAPN-IR003-CyberSecurity-20190222-Confidential\[redacted]
54 SAPN-IR003-CyberSecurity-20190222-Confidential\S[redacted]
55 SAPN-IR003-GISConsolidation-20190222-Confidential\[redacted]
56 SAPN-IR003-GISConsolidation-20190222-Confidential\[redacted]
57 SAPN-IR003-GISConsolidation-20190222-Confidential\[redacted]
58 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]
59 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]
60 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]
61 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]
62 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]
63 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]
64 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]
65 SAPN-IR003-PSS-20190222-Confidential\[redacted]
66 SAPN-IR003-PSS-20190222-Confidential\[redacted]
67 SAPN-IR003-PSS-20190222-Confidential\[redacted]
68 SAPN-IR003-PSS-20190222-Confidential\[redacted]
69 SAPN-IR003-Ringfencing-20190222-Confidential\[redacted]
70 SAPN-IR003-Ringfencing-20190222-Confidential\[redacted]
71 SAPN-IR003-Ringfencing-20190222-Confidential\SAPN-IR003-Ringfencing-20190222-Confidential.zip
72 SAPN-IR003-SAPUpgrade-20190222-Confidential\[redacted]
73 SAPN-IR003-SAPUpgrade-20190222-Confidential\[redacted]
74 SAPN-IR003-SAPUpgrade-20190222-Confidential\[redacted]
75 SAPN-IR003-SAPUpgrade-20190222-Confidential\[redacted]
76 SAPN-IR003-SAPUpgrade-20190222-Confidentia[redacted]

77	SAPN-IR003-WorkerFatigueRiskMgmt-20190222-Confidential\SAPN-IR003-WorkerFatigueRiskMgmt-20190222-Confidential.zip
78	SAPN-IR003-WorkerFatigueRiskMgmt-20190222-Confidential\Worker Safety Fatigue Risk Mgmt Option 1.xlsx
79	SAPN-IR003-WorkerFatigueRiskMgmt-20190222-Confidential\Worker Safety Fatigue Risk Mgmt Option 2.xlsx

Public documents

Item No.	Filename
1	SAPN - Customer and stakeholder engagement report - January 2019.pdf
2	SAPN - Electricity Distribution Proposal 2020-2025 -Overview - January 2019_0.pdf
3	SAPN - 0.3 - 2020-2025 Draft Plan - August 2018.pdf
4	SAPN - Attachment 16 - Connection Policy - January 2019.pdf
5	SAPN - Attachment 18 - List of Proposal documentation - January 2019 - Public (EMCa highlights).xlsx
6	SAPN - Attachment 18 - List of Proposal documentation - January 2019 - Public.xlsx
7	SAPN - Attachment 5 - Capital expenditure - January 2019.pdf
8	SAPN - Attachment 6 - Operating expenditure - January 2019.pdf
9	SAPN - Attachment 7 - Corporate income tax - January 2019.pdf
10	SAPN DAPR 2018-19 to 2022-23.pdf
11	SAPN Expenditure Forecasting Methodology 2020-25 - corrected 8 January 2019.pdf
12	Draft plan 2020-25\SAPN_Draft_Plan_web.pdf
13	Copy of SAPN-IR004-Questions 07 and 08.xlsx
14	SAPN - 0.13 - AnnShawRungie Capex Deep Dive Workshops Report - July 2018.pdf
15	SAPN - 0.15 - Think Human IT Deep Dive Workshop Report - June 2018.pdf
16	SAPN - 18.11 - Related Party Transactions Overview - January 2019.pdf
17	SAPN - 18.4 - SA Power Networks 2019-2023 Strategic Plan - January 2019.pdf
18	SAPN - 18.5 - SA Power Networks Future Operating Model 2016-2031 - May 2017.pdf
19	SAPN - 5.1 - Capex SEM model - January 2019.xlsx
20	SAPN - 5.10 - Distribution System Planning Report - January 2019.pdf
21	SAPN - 5.11 - Connections Management Plan 2020 to 2025 - January 2019.pdf
22	SAPN - 5.12 - BIS Oxford Economics - Gross Customer Connections Expenditure Forecasts - 18 November 2018.pdf
23	SAPN - 5.13 - Bushfire mitigation program strategy and justification - January 2019.pdf
24	SAPN - 5.14 - Bushfire mitigation program CBA methodology - January 2019.pdf
25	SAPN - 5.16 - CSIRO Electrically-Initiated Bushfire Suppression Model Analysis - 29 January 2019.pdf
26	SAPN - 5.17 - Future Network Strategy - 23 November 2017 - Public.pdf
27	SAPN - 5.18 - LV Management Business Case - 25 January 2019.pdf
28	SAPN - 5.19 - KPMG - Future Network Strategy - Technology Costs - 15 November 2018.pdf
29	SAPN - 5.2 - Expenditure Governance Procedures - January 2019.pdf
30	SAPN - 5.20 - Houston Kemp - Estimating avoided dispatch costs and VPP - Jan 2019.pdf
31	SAPN - 5.21 - EA Tech - LV Management Strategy - 18 December 2018.pdf
32	SAPN - 5.22.1 - EA Tech - LV Mgmt Strategy An 1 DER Hosting Capacity Assessment - 23 Nov 2018.pdf
33	SAPN - 5.22.2 - EA Tech - LV Mgmt Strategy An 2 Development of the Transform Model - 23 Nov 2018 - Public.pdf
34	SAPN - 5.23 - DGA Consulting - Network Control - Projects Review 2020-25 - 17 January 2019 - Public.pdf
35	SAPN - 5.23 - DGA Consulting - Network Control - Projects Review 2020-25 - 17 January 2019.pdf
36	SAPN - 5.25 - Reliability and Resilience Performance Management Strategy - January 2019.pdf
37	SAPN - 5.26 - Reliability and Resilience Programs - Hardening the Network - January 2019.pdf
38	SAPN - 5.27 - Reliability and Resilience Programs - Low Reliability Feeders - January 2019.pdf
39	SAPN - 5.3 - Safety, Reliability, Maintenance and Technical Management Plan (SRMTMP) - August 2018 Optimised.pdf

40 SAPN - 5.30 - Strategic Fleet Plan 2020-2025 - 18 January 2019.pdf
41 SAPN - 5.31 - Property Services Capital Expenditure 2020-2025 - January 2019.pdf
42 SAPN - 5.32 - IT Investment Plan 2020-25 - January 2019 - Public.pdf
43 SAPN - 5.32 - IT Investment Plan 2020-25 - January 2019.pdf
44 SAPN - 5.33 - Client Devices Refresh Business Case - January 2019 - Public.pdf
45 SAPN - 5.33 - Client Devices Refresh Business Case - January 2019.pdf
46 SAPN - 5.34 - IT Asset Management Plan 2019-2023 - December 2018 - Public.pdf
47 SAPN - 5.36 - SAP Upgrade Business Case - January 2019 - Public.pdf
48 SAPN - 5.39 - Five Minute Settlement Rule Business Case - January 2019 - Public.pdf
49 SAPN - 5.4 - ESCoSA Reliability Standards Review - 1 January 2019.pdf
50 SAPN - 5.40 - Ring-fencing Compliance IT Solution Business Case - January 2019 - Public.pdf
51 SAPN - 5.41 - Worker Safety Fatigue Risk Mgmt Business Case - January 2019 - Public.pdf
52 SAPN - 5.42 - Assets & Work Program Business Case - January 2019 - Public.pdf
53 SAPN - 5.42 - Assets & Work Program Business Case - January 2019.pdf
54 SAPN - 5.43 - CRM & Billing Completion Business Case - January 2019 - Public.pdf
55 SAPN - 5.6 - Asset Management Policy - January 2019.pdf
56 SAPN - 5.7 - Strategic Asset Management Plan (SAMP) - January 2019.pdf
57 SAPN - 5.8 - Powerline Asset Management Plan (PAMP) - January 2019.pdf
58 SAPN - 5.9 - Repex Overview - January 2019.pdf
59 SAPN - 6.1 - IT Infrastructure Refresh Business Case - January 2019 - Public.pdf
60 SAPN - 6.1 - IT Infrastructure Refresh Business Case - January 2019.pdf
61 SAPN - 6.2 - IT Applications Refresh Business Case - January 2019 - Public.pdf
62 SAPN - 6.2 - IT Applications Refresh Business Case - January 2019.pdf
63 SAPN - 6.3 - Critical Infrastructure Obligations Business Case Janurary 2019 - Public.pdf
64 SAPN - 6.3.1 - FIRB Electricity Business Security Committee. c 23 2018 Compliance Report - December 2018 - Public.pdf
65 SAPN-IR011C-ICT-20190405-Public.pdf
66 SAPN - 20.18 PUBLIC - Acil Allen Maximum Demand Forecasting Tool.pdf
67 SAPN - 5.10 - Distribution System Planning Report - January 2019 - Public.pdf
68 SAPN - 5.11 - Connections Management Plan 2020 to 2025 - January 2019 - Public.pdf
69 SAPN - 5.12 - BIS Oxford Economics - Gross Customer Connections Expenditure Forecasts - 18 November 2018 - Public.pdf
70 SAPN - 5.17 - Future Network Strategy - 23 November 2017 - Public.pdf
71 SAPN - 5.18 - LV Management Business Case - 25 January 2019 - Public.pdf
72 SAPN - 5.19 - KPMG - Future Network Strategy - Technology Costs - 15 November 2018 - Public.PDF
73 SAPN - 5.20 - Houston Kemp - Estimating avoided dispatch costs and VPP - Jan 2019 - Public.pdf
74 SAPN - 5.21 - EA Tech - LV Management Strategy - 18 December 2018 - Public.pdf
75 SAPN - 5.22.1 - EA Tech - LV Mgmt Strategy An 1 DER Hosting Capacity Assessment - 23 Nov 2018 - Public.pdf
76 SAPN - 5.22.2 - EA Tech - LV Mgmt Strategy An 2 Development of the Transform Model - 23 Nov 2018 - Public.pdf
77 SAPN IR#015 Augex and Connections 20190403 Public.pdf
78 CBRM methodology - preproposal material\AER CBRM Workshop 3Dec18.pdf
79 CBRM methodology - preproposal material\downloadzip.log
80 CBRM methodology - preproposal material\Q4 - CBRM Modelling Overview - Poles v2.docx
81 CBRM methodology - preproposal material\Q5 - CB - Forecast (Reset SBX) - DD Workshop graph 22.10.2018.xlsx
82 CBRM methodology - preproposal material\Q5 - Pole Model Scenario Modelling.pdf
83 CBRM methodology - preproposal material\Repex qus - Responses to the AER 6 Jan 2019.pdf
84 CBRM methodology - preproposal material\SAPN - Pole Outputs Model 20181221.xlsx
85 SAPN - RIN 1 - Workbook 1 - Regulatory determination template 2020-25 - February 2019.xlsm
86 SAPN - RIN 10 - Deloitte letter of audit - January 2019_0.pdf

87	SAPN - RIN 2 - Workbook 2 - New Historical Data 2008-09 to 2017-18 - January 2019.xlsm
88	SAPN - RIN 3 - Workbook 3 - CA - recast historical - January 2019.xlsm
89	SAPN - RIN 4 - Workbook 4 - EB - recast historical - January 2019.xlsm
90	SAPN - RIN 5 - Workbook 5 - EBSS - January 2019.xlsm
91	SAPN - RIN 6 - Workbook 6 - CESS model - January 2019(1).xlsx
92	SAPN - RIN 6 - Workbook 6 - CESS model - January 2019.xlsx
93	SAPN - RIN 7 - Workbook 7 - Bill Impacts - January 2019.xlsm
94	SAPN - RIN 8 - Cross reference table - January 2019.pdf
95	SAPN - RIN 9 - Basis of Preparation (BoP) - January 2019.xlsx
96	AP 3.1.05 Poles - Public.pdf
97	AP 3.1.06 Overhead Line Components - Public.pdf
98	AP 3.1.09 Underground Cables - Public.pdf
99	AP 3.1.10 Overhead Conductor - Public.pdf

SAPN documents received before/on assessment cut-off date (29th June 2019)

Item No.	Filename
1	AP 3.3.09 OT Cyber Security - Confidential.pdf
2	SAPN - 5.32 - IT Investment Plan 2020-25 - January 2019 - Confidential.pdf
3	SAPN - 5.33 - Client Devices Refresh Business Case - January 2019 - Confidential.pdf
4	SAPN - 5.34 - IT Asset Management Plan 2019-2023 - December 2018 - Confidential.pdf
5	SAPN - 5.35 - Cyber Security Business Case - January 2019 - Confidential.pdf
6	SAPN - 5.36 - SAP Upgrade Business Case - January 2019 - Confidential.pdf
7	SAPN - 5.37 - GIS Consolidation Business Case - January 2019 - Confidential.pdf
8	SAPN - 5.38 - Protection Settings Management System Business Case - January 2019 - Confidential.pdf
9	SAPN - 5.40 - Ring-fencing Compliance IT Solution Business Case - January 2019 - Confidential.pdf
10	SAPN - 5.41 - Worker Safety Fatigue Risk Mgmt Business Case - January 2019 - Confidential.pdf
11	SAPN - 6.1 - IT Infrastructure Refresh Business Case - January 2019 - Confidential .pdf
12	SAPN - 6.3 - Critical Infrastructure Obligations Business Case Janurary 2019 - Confidential.pdf
13	SAPN-IR003-Attachment 5-AssetPlan3.3.08TNCManagementSystems.pdf
14	SAPN-IR003-Attachment 6-AssetPlan3.3.07OperationalTelephony.pdf
15	SAPN-IR003-Non-NetworkCapex-20190222-Public.pdf
16	SAPN-IR003-5MinuteRule-20190222-Confidential.zip
17	SAPN-IR003-Assets&Work-20190222-Confidential.zip
18	SAPN-IR003-ClientDevices-20190222-Confidential.zip
19	SAPN-IR003-CyberSecurity-20190222-Confidential.zip
20	SAPN-IR003-GISConsolidation-20190222-Confidential.zip
21	SAPN-IR003-ITApplicationsRefresh-20190222-Confidential.zip
22	SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential.zip
23	SAPN-IR003-PSS-20190222-Confidential.zip
24	SAPN-IR003-Ringfencing-20190222-Confidential.zip
25	SAPN-IR003-SAPUpgrade-20190222-Confidential.zip
26	SAPN-IR003-WorkerFatigueRiskMgmt-20190222-Confidential.zip
27	SAPN-IR004-Variouscategories-20190222-Public.pdf
28	SAPN-IR008-updated capex model and repex-20190312-PUBLIC.pdf
29	SAPN - IR008 - Capex Program List - 190320 - Public.xlsx

30 SAPN-IR8-Information Request #008 - SAPN response Q1-20190320-PUBLIC.pdf
31 SAPN -IR010B NonNetwork ICT Recurrent -20190411 Public.pdf
32 SAPN-IR010(C)-IT Reconciliation to June 2020-20190703-Public.xlsx
33 SAPN-IR010(C)-Non-Network ICT Capex-20190703-Public.pdf
34 SAPN-IR010(D)-IT Reconciliation to June 2020-20190708-Public.xlsx
35 SAPN-IR010(D)-Non-Network ICT Capex-20190708-Public.pdf
36 SAPN-IR010-Non Network ICT recurrent capex-20190325-Public.pdf
37 PSS Historical Expenditure Confidential.xlsx
38 PSS Opt 2 - [redacted]
39 PSS Opt 2- [redacted]
40 SAPN IR011C Work Selection Effectiveness Baseline Calculation 20190405 Confidential.xlsx
41 SAPN-IR011B- [redacted]
42 SAPN-IR011B- [redacted]
43 SAPN-IR011B- [redacted]
44 SAPN-IR011B- [redacted]
45 SAPN-IR011C-ICT-20190405-Confidential.pdf
46 SAPN-IR011A-ICT-20190329 Public.pdf
47 SAPN-IR011A-ICT-20190329-Public (note portion of this response may be confidential - we are waiting on confirmation from SAPN).pdf
48 ADMS Costing Explanation.png
49 SAPN-IR#012 Asset Plan 3.3.07 Operational Telephony 20190328 Public.pdf
50 SAPN-IR#012 Asset Plan 3.3.08 TNC Management Systems 20190328 Public.pdf
51 SAPN-IR#012- Non Network Telecommunications capex 20190328 Public.pdf
52 SAPN-IR012B-Non Network Telco Capex-20190502-Public.pdf
53 SAPN IR#015 - Q4 20190409 Public.pdf
54 SAPN IR#015 Augex and Connections 20190403 Public.pdf
55 SAPN IR#15_Attachment A_Bat Interruptions 20190403 Public.xlsx
56 SAPN IR#15_Attachment B_Business Case ZSS SCADA Expansion_ 20190403 Public.xlsm
57 SAPN IR#15_Attachment C_AP 5.1.03 Substation Fences and Security 20190403 Public.pdf
58 SAPN IR#15_Attachment D_Asset Plan 3.2.10 Substation Earth Grids 20190403 Public.pdf
59 SAPN-IR017-EMCa Governance & REPEX-20190409-Q1a_Corporate Governance Policy Confidential.pdf
60 SAPN-IR017-EMCa Governance & REPEX-20190409-Q1b_Finance Policy Confidential.pdf
61 SAPN-IR017-EMCa Governance & REPEX-20190409-Q1c_Risk Management Directive Confidential.pdf
62 SAPN-IR017-EMCa Governance & REPEX-20190409-Q1d_Compliance Policy Confidential.pdf
63 SAPN-IR017-EMCa Governance & REPEX-20190409-Q1e_Environment Policy Public.pdf
64 SAPN-IR017-EMCa Governance & REPEX-20190409-Q1_Policy Diagram Confidential.pdf
65 SAPN-IR017-EMCa Governance & REPEX-20190409-Q2a_Manual 12 Network Maintenance Manual Confidential.pdf
66 SAPN-IR017-EMCa Governance & REPEX-20190409-Q2b_Manual 11 Line Inspection Manual Confidential.pdf
67 SAPN-IR017-EMCa Governance & REPEX-20190409-Q5a_CBRM Modelling Overview - Poles Confidential.pdf
68 SAPN-IR017-EMCa Governance & REPEX-20190409-Q5a_Pole Model Scenario Modelling Confidential.pdf
69 SAPN-IR017-EMCa Governance & REPEX-20190409-Q5a_Pole Outputs Confidential.xlsx
70 SAPN-IR017-EMCa Governance & REPEX-20190409-Q5b_Pole Top Structures Forecast Confidential.xlsx
71 SAPN-IR017-EMCa Governance & REPEX-20190409-Q7_Cable and Conductors Forecast Confidential.xlsx
72 SAPN-IR017-EMCa Governance & REPEX-20190412 Public.pdf
73 SAPN IR019 EMCa - SAPN 11to15-20190506 Public (002).pdf
74 SAPN-IR019-EMCa Governance & REPEX-20190409-Q15b_Cable and Conductors Forecast Public.xlsx
75 SAPN-IR019-EMCa Governance & REPEX-201905XX-Q14a_Pole Top Structures Forecast Public.xlsx
76 SAPN-IR020-LV Management Strategy-20190304-Confidential.pdf
77 SAPN-IR020-LV Management Strategy-20190304-Public.pdf

78 SAPN-IR022-Attachment A - SAPN - 5.12 BISOE - Nov 18 - Sect 3.4.2 Major Proj List-20190403-CONFID.xlsx
79 SAPN-IR022-Attachment B - NC-11373 PQE Installation Cost 261118-20190403-CONFID.xlsx
80 SAPN-IR022-Attachment C - Connections expenditure-charts_FINAL-20190403-CONFID.xlsx
81 SAPN-IR022-EMCa 16 to 20-201900506-Confidential.pdf
82 SAPN-IR022-EMCa 16 to 20-201900506-Public.pdf
83 SAPN-IR024 - repex template - response.xlsx
84 SAPN-IR024-Augex and Repex-20190510-Response 24 May -Public.pdf
85 SAPN-IR025-Demand Forecast -Response -20190509-Public.pdf
86 SAPN-IR025-SAPN-Attachment A - Major Cust Loads-20190509-CONFIDENTIAL.xlsx
87 SAPN-IR025-SAPN-Attachment B - Coincident Factors-20190509-Public.xlsx
88 SAPN-IR025-SAPN-Attachment C - WI-063B - Connection Point and Zone Substation Load Forecast Methodology-20190509-Public.docx
89 SAPN-Attachment A-Fleurieu Peninsula Loads-20190517-Public.xlsx
90 SAPN-Attachment B-Myponga - SWH 66kV line RIT-D Cost Benefit Analysis-20190517-Public.xlsm
91 SAPN-Attachment C-RFI-RFP001 Bulk Supply to the Fleurieu Peninsula-20190517-Public.pdf
92 SAPN-Attachment D-2018 Coincident Forecast-20190517-Public.xlsx
93 SAPN-Attachment E-RegTestRCA Eval-AtholParkWoodville-20190517-Public.xlsm
94 SAPN-Attachment F-Metro West Conductor Ages-20190517-Public.xlsx
95 SAPN-IR026- EMCa Major Augex projects (21-26)-20190517-Public.pdf
96 SAPN IR030 55 TV Invoice - Confidential.pdf
97 SAPN IR030 65 TV Invoice - Confidential.pdf
98 SAPN IR030 75 TV Invoice - Confidential.pdf
99 SAPN IR030 85 TV Invoice - Confidential.pdf
100 SAPN IR030 CAD HS Laptop Invoice - Confidential .pdf
101 SAPN IR030 CAD HS Workstation Invoice - Confidential .pdf
102 SAPN IR030 Laptop 1 Invoice - Confidential.pdf
103 SAPN IR030 Laptop 2 - Confidential.pdf
104 SAPN IR030 Large Monitor Invoice - Confidential .pdf
105 SAPN IR030 Meter Reader Invoice - Confidential .pdf.jpg
106 SAPN IR030 Monitor Invoice - Confidential .pdf
107 SAPN IR030 Plotter Invoice - Confidential .pdf
108 SAPN IR030 Projector Quote - Confidential.pdf
109 SAPN IR030 Smartphone Invoice - Confidential .pdf
110 SAPN IR030 Tablet Invoice 1 - Confidential .pdf
111 SAPN IR030 Tablet Invoice 2 - Confidential .pdf
112 SAPN IR030 Tough Device Invoice - Confidential .jpg
113 SAPN IR030 Video Conferencing Unit Invoice - Confidential .pdf
114 SAPN IR030 Voice Conferencing Unit Invoice - Confidential .pdf
115 SAPN IR030 Workstation 1 Invoice - Confidential .pdf
116 SAPN IR030 Workstation 2 Quote - Confidential .pdf
117 SAPN-IR030-ICT-20190522-Confidential.pdf
118 SAPN-IR030-ICT-20190522-Public.pdf
119 SAPN IR038 Addendum 1 20190520-Confidential.xlsx
120 SAPN IR038 IT Opex Costs and Benefits-Public.xlsx
121 SAPN-IR038-ICT Nonrecurrent capex-20190527-Confidential.pdf
122 SAPN - 5.2 - Expenditure Governance Procedures - January 2019 - Public.pdf
123 SAPN-IR039-EMCa follow up-20190531-Confidential.pdf
124 SAPN-IR039-EMCa follow up-20190531-Public.pdf
125 SAPN-IR039-Q27-2019 Budget 20190531-Confidential.pdf
126 SAPN-IR039-Q28-Reset 2020-25 Deliverables 20190531-Public.xlsx

127 SAPN-IR039-Q30-Memo - GM endorsement for CEO Stat Dec - 30 January 2019 20190531-Confidential.pdf
128 SAPN-IR039-Q30-Reset SteerCo-Minutes - 11 January 2019 20190531-Confidential.pdf
129 SAPN-IR039-Q30-Reset SteerCo-Minutes - 30 July 2018 20190531-Confidential.pdf
130 SAPN-IR039-Q33&Q35-Quality of Supply CY and FY Actuals 20190531-Public.xlsx
131 SAPN-IR039-Q37&Q38-Data 20190531-Public.xlsb
132 SAPN-IR039-Q51-CPMO-Monthly-Report 20190531-Confidential.pptx
133 SAPN-IR039-Q55&Q57-BISOE MajorConnects_Oct18 20150531-Public.xlsx
134 SAPN-IR039-Q55&Q57-BISOE Response to AER Qs_May2019 20190531-Public.pdf
135 SAPN-IR039-Q55&Q57AttachA-5.12 BISOE-Nov18-Sect 3.4.2 Major Proj List-Confidential.xlsx
136 SAPN-IR039-Q56-Connections Capex Actual 2019_Prop 2020 20190531-Confidential.xlsx
137 SAPN-IR039-Q59-BISOE April17 DRAFT Report 20190531-Public.pdf
138 SAPN-IR039-Q60-Major Proj List Updated 20190531-Confidential.xlsx
139 SAPN-IR039-Q61-Connections 20190531-Public.xlsx
140 SAPN-IR039-Q64-Demand 20190531-Public.xlsx
141 SAPN-IR040-New shorter standard asset life asset classes-201900603-Public.pdf
142 AER -IR#044 Q2 - Capex Program List - RepexMapping.xlsx
143 SAPN-IR#044 -Q1- Capex Program List 190603 Public - AER workings and questions V1.xlsx
144 SAPN-IR044-Augex and Repex-20190612-Confidential.pdf
145 SAPN-IR044-Augex and Repex-20190612-Public.pdf
146 SAPN-IR044-Q4 Notes to RIT-D spreadsheet-Public.pdf
147 SAPN-IR044-Q4 Pole top SVC's-Public.pdf
148 SAPN-IR044-Q4 Reg Test RCA Evaluation - Athol Park-Public.xlsm
149 SAPN-IR044-Q4 Reg Test RCA Evaluation - Lower Mitcham-Public.xlsm
150 SAPN-IR044-Q4 Reg Test RCA Evaluation - New Richmond-Public.xlsm
151 SAPN-IR044-Q4 Reg Test RCA Evaluation - Noarlunga Centre-Public.xlsm
152 SAPN-IR044-Q4 Reg Test RCA Evaluation - Northfield-Public.xlsm
153 SAPN-IR003-Attachment 5-AssetPlan3.3.08TNCManagementSystems.pdf
154 SAPN-IR003-Attachment 6-AssetPlan3.3.07OperationalTelephony.pdf
155 SAPN-IR003-Non-NetworkCapex-20190222-Public.pdf
156 SAPN-IR003-5MinuteRule-20190222-Confidential\[redacted]
157 SAPN-IR003-5MinuteRule-20190222-Confidential\[redacted]
158 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
159 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
160 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
161 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
162 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
163 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
164 SAPN-IR003-Assets&Works-20190222-Confidential\Assets and Work Summary NPV.xlsx
165 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
166 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
167 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
168 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
169 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
170 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
171 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
172 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
173 SAPN-IR003-Assets&Works-20190222-Confidential\[redacted]
174 SAPN-IR003-ClientDevices-20190222-Confidential\[redacted]

175 SAPN-IR003-ClientDevices-20190222-Confidential\[redacted]

176 SAPN-IR003-ClientDevices-20190222-Confidential\[redacted]

177 SAPN-IR003-ClientDevices-20190222-Confidential\[redacted]

178 SAPN-IR003-ClientDevices-20190222-Confidential\[redacted]

179 SAPN-IR003-CyberSecurity-20190222-Confidential\[redacted]

180 SAPN-IR003-CyberSecurity-20190222-Confidential\[redacted]

181 SAPN-IR003-CyberSecurity-20190222-Confidential\[redacted]

182 SAPN-IR003-GISConsolidation-20190222-Confidential\[redacted]

183 SAPN-IR003-GISConsolidation-20190222-Confidential\[redacted]

184 SAPN-IR003-GISConsolidation-20190222-Confidential\[redacted]

185 SAPN-IR003-ITApplicationsRefresh-20190222-Confidential\[redacted]

186 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]

187 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]

188 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]

189 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]

190 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]

191 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]

192 SAPN-IR003-ITInfrastructureRefresh-20190222-Confidential\[redacted]

193 SAPN-IR003-PSS-20190222-Confidential\[redacted]

194 SAPN-IR003-PSS-20190222-Confidential\[redacted]

195 SAPN-IR003-PSS-20190222-Confidential\[redacted]

196 SAPN-IR003-PSS-20190222-Confidentia [redacted]

197 SAPN-IR003-Ringfencing-20190222-Confidential\[redacted]

198 SAPN-IR003-Ringfencing-20190222-Confidential\[redacted]

199 SAPN-IR003-Ringfencing-20190222-Confidential\SAPN-IR003-Ringfencing-20190222-Confidential.zip

200 SAPN-IR003-SAPUpgrade-20190222-Confidential\[redacted]

201 SAPN-IR003-SAPUpgrade-20190222-Confidential\[redacted]

202 SAPN-IR003-SAPUpgrade-20190222-Confidential\[redacted]

203 SAPN-IR003-SAPUpgrade-20190222-Confidential\[redacted]

204 SAPN-IR003-SAPUpgrade-20190222-Confidential\[redacted]

205 SAPN-IR003-WorkerFatigureRiskMgmt-20190222-Confidential\Worker Safety Fatigue Risk Mgmt Option 1.xlsx

206 SAPN-IR003-WorkerFatigureRiskMgmt-20190222-Confidential\Worker Safety Fatigue Risk Mgmt Option 2.xlsx

207 SAPN-IR004-Questions 07 and 08.xlsx

208 SAPN-IR010(C)-IT Reconciliation to June 2020-20190703-Public.xlsx

209 SAPN-IR010(C)-Non-Network ICT Capex-20190703-Public.pdf

210 SAPN-IR011B-ICT-20190405-Confidential.pdf

211 SAPN-IR011B-ICT-20190405-[redacted]

212 SAPN-IR011B-ICT-20190405-[redacted]

213 SAPN-IR011B-ICT-20190405-[redacted]

214 SAPN-IR011C-ICT-20190405-Confidential.pdf

215 SAPN-IR011C-ICT-20190405-Public.pdf

216 SAPN IR011C Work Selection Effectiveness Baseline Calculation 20190405 Confidential.xlsx

217 SAPN IR038 Addendum 1, Assets and Works Program Dependency Relationships 20190520 PUBLIC.xlsx

218 SAPN IR038 Non-Recurrent ICT Capex 20190520 CONFIDENTIAL.docx

SAPN documents received after assessment cut-off date (29th June 2019)

None identified

SAPN yet to respond to EMCa questions

None identified.