Attachment G.6

SAPN G.6_PUBLIC _Reliability_Hardening the network

03 July, 2015

Contents

1. Executive Summary 3
2. Rule requirement 5
3. Background 6
3.1 Historical Performance 6
3.2 BOM Observations 8
3.3 Customer Consultation 9
4. Business Case Objectives 10
4.1 Objectives 10
4.2 Relationship to Business Strategies and Programs 10
4.3 Relationship to National Electricity Rules Expenditure Objectives 11
4.4 Meeting the National Electricity Rules Expenditure Criteria 12
5. Project Scope 13
6. Business Case Options 14
6.1 Option 1 – Do nothing 14
6.1.1 Delivery Costs 14
6.1.2 Expected Benefits 14
6.1.3 Expected Disbenefits 14
6.1.4 Timescale 15
6.1.5 Major Business Risks 15
6.2 Option 2 – Hardening the network 16
6.2.1 Delivery Costs 16
6.2.2 Delivery cost assumptions 16
6.2.3 Expected benefits 17
6.2.4 Timescale 19
6.2.5 Major business risks 20
7. Investment appraisal 21
8. Recommendation 22
Appendix A - Combined impact of reliability improvement programs 23
Appendix B – Capital evaluation 25

1. Executive Summary

The purpose of this business case is to seek approval for $17.3 (June 2015, $ million) to implement initiatives to harden the network against severe weather events, over the 2015-20 Regulatory Control Period (**RCP**).

SA Power Networks, in accordance with the current jurisdictional reliability service standard framework, is required to use its best endeavours to meet overall regional reliability targets. However, due to increased severity and frequency of severe weather events in the 2015-20 RCP, our performance during major event days (**MEDs**) during those weather events has declined. Some customers are experiencing much worse performance than the targets and this is contributing to, on average, an additional 60 minutes without supply to all customers per year in the 2010-15 RCP compared with the 2005-10 RCP.

Consistent with its historical approach, the Essential Services Commission of South Australia (**ESCoSA**) will focus on our performance during MEDs in the 2015–20 RCP. It is ESCoSA's expectation that our performance during MEDs and the associated severe weather events will not decline but improve. ESCoSA's Service Standard Framework requires ongoing regional and MED monitoring of SA Power Networks' reliability performance to ensure that any decline in performance is highlighted and addressed.

To mitigate the deterioration in our reliability performance attributable to MEDs, SA Power Networks proposed in its Original Proposal to harden our network in locations that are consistently affected by lightning and wind storms which result in MEDs.

SA Power Networks undertook a comprehensive Customer Engagement Program (**CEP**) prior to preparing its Original Proposal. Throughout our CEP, customers and stakeholders expressed support for programs aimed at:

- further protecting some parts of the network, particularly in regional areas which are more susceptible to damage from storms, especially lightning strikes; and
- upgrading and reinforcing the network where the network supply configuration to an area is susceptible to failure (eg single radial supply lines in rural and remote areas).

Furthermore, in their 'Climate extremes analysis for South Australian Power Network operations' (set out in Attachment 10.2 to the Original Proposal), the Bureau of Meteorology (**BOM**) predicted the trend in severe weather events is likely to continue. Consequently, SA Power Networks expects that overall reliability performance will deteriorate unless the network's performance during severe weather events is addressed.

The 'hardening the network' program comprised a number of strategies to reduce the impact of the increased number and severity of severe weather events that result in MEDs, and return reliability performance closer to historic average levels for those customers affected by supply interruptions on MEDs.

Based on our high level of customer support, SA Power Networks' developed a program of work to harden the distribution network against the effects of storms and lightning by implementing targeted cost effective hardening solutions including:

- re-insulating vulnerable sections of overhead power lines to minimise insulator failures from the impact of lightning strikes;

- alternative network asset configuration / standards to reduce supply interruptions related to vegetation impacts from outside the prescribed clearance zone; and

- installation of fuse saver devices to reduce storm related transient faults leading to permanent interruptions.

The net Service Target Performance Incentive Scheme (**STPIS**) impact after these initiatives have been implemented has been calculated as -0.06% of revenue p.a. or -$387k p.a. Based on these calculations SA Power Networks won't benefit financially (ie we are likely to incur a penalty), from this program of work.

From a customer perspective, the hardening the network program has a net customer Value of Customer Reliability (**VCR**) benefit in the order of $12 million p.a., noting that we assume in our conservative modelling that customers will only receive 50% of these benefits[1] resulting in a net present benefit of $53.4m (NPV = +$53.4m over 35 years), using VCR as an indicator of the value of reliability to customers.

A positive NPV in this case indicates that the value to customers is significantly greater than the cost of the improvements and therefore would be in the long term interests of customers.

[1] That is, we have applied a conservative discount of 50% to the forecast customer VCR benefits in our modelling.

2. Rule requirement

Clause 6.5.7(a) of the National Electricity Rules (**NER**) provides that SA Power Networks must submit a building block proposal that includes a forecast of the capital expenditure required to meet the capital expenditure objectives for the 2015-20 RCP. This includes capital expenditure required to comply with all applicable regulatory obligations or requirements associated with the provision of Standard Control Services (**SCS**) and to maintain the reliability of SA Power Networks' SCS.

The AER must accept the proposed capital expenditure forecast that SA Power Networks includes in its building block proposal if the AER is satisfied the forecast capital expenditure for the 2015–20 RCP reasonably reflects the capital expenditure criteria. In making this assessment the AER must have regard to the capital expenditure factors.

In particular, in assessing the expenditure required to comply with all of these obligations, SA Power Networks is required to have regard to *'the extent to which the forecast includes expenditure to address the concerns of electricity consumers identified by the DNSP in the course of its engagement with electricity consumers'* [2](Consumer Engagement Factor).

Reliability capital expenditure is required in order for us to maintain our reliability performance and comply with the ESCoSA service standards for reliability set out in the South Australian Electricity Distribution Code (**EDC**) Compliance with the EDC is a condition of our Distribution Licence.

[2] NER clause 6.5.6(e)(5A).

3. Background

3.1 Historical Performance

The performance of the South Australian distribution network has been adversely affected by the increasing number and severity of severe weather events observed since 1 July 2010. The average severity of MEDs3, as measured by the average daily System Average Interruption Duration Index (**SAIDI**), has doubled from 8.6 to 17.5 minutes from the 2005-10 RCP compared to the first four years of the current 2010-15 RCP. The overall annual contribution from MEDs has increased from 14 to 83 minutes.

Because of this severe weather, SA Power Networks has observed a marked deterioration in the performance of the network during MEDs since 2010. This has been reported in ESCoSA's 'Performance of SA Power Networks (Report 2) 2012/13'. Figure 1 below shows the major causes of supply interruptions during MEDs and their contribution to the USAIDI (ie the average minutes of loss of supply per customer).

Figure 1 – MED USAIDI contribution by cause, in minutes.

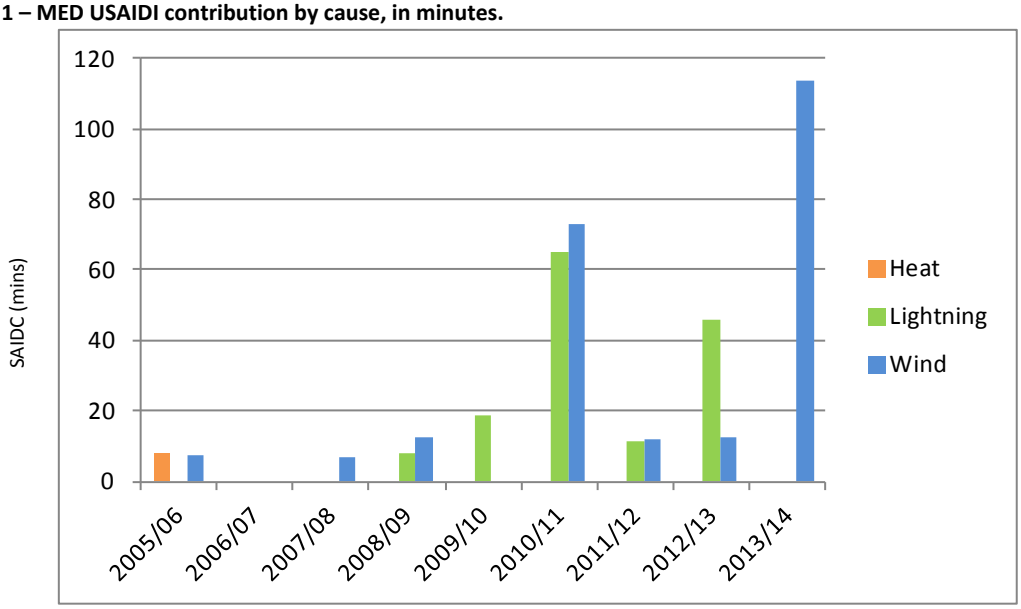
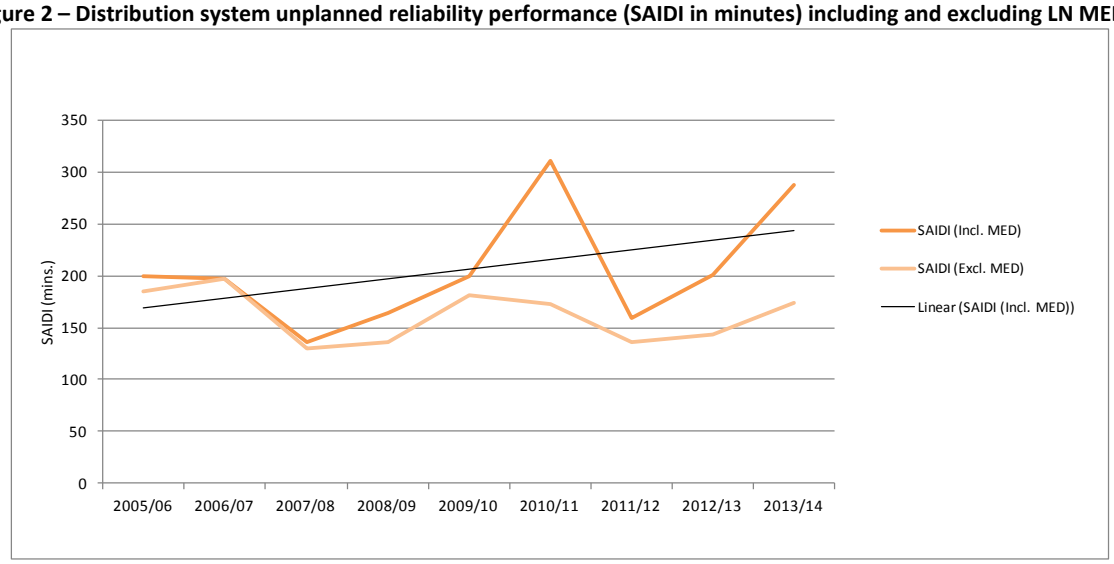


Figure 2 shows the SAIDI trends including and excluding MED[4] supply interruptions. The underlying trend (excluding MEDs) is essentially flat indicating that SA Power Networks has been successful in maintaining the average reliability performance at historical levels on days that do not qualify as MEDs. This indicates that in general there has been no deterioration in the network's underlying vulnerability to supply interruptions.

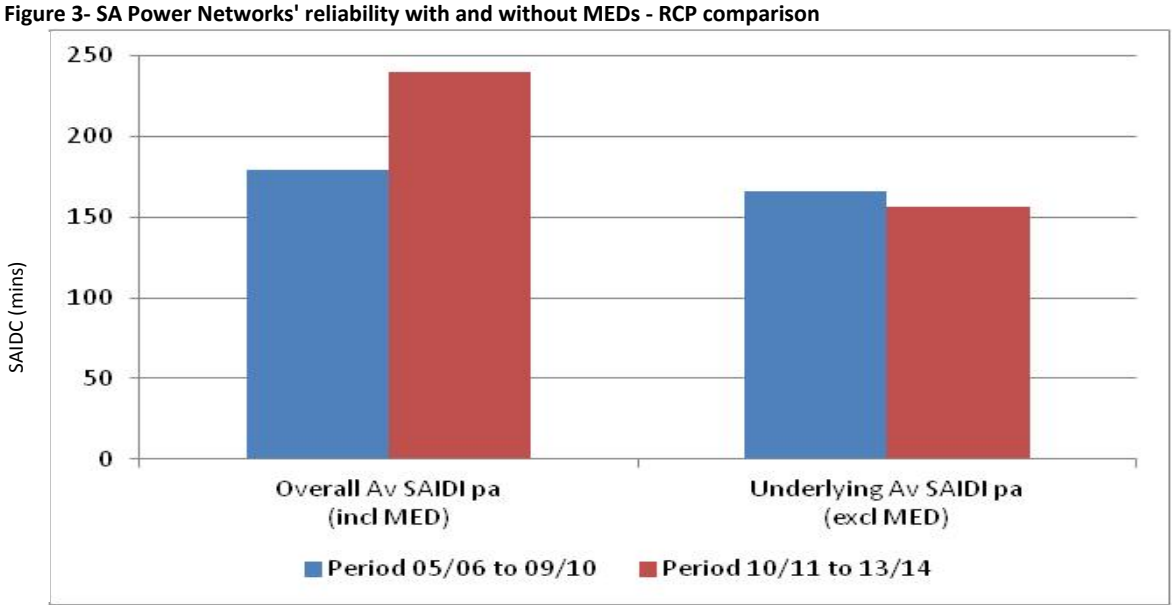
[3] As determined using the natural logarithm (ie the standard AERs STPIS methodology)
[4] As determined using the natural logarithm methodology

Figure 2 – Distribution system unplanned reliability performance (SAIDI in minutes) including and excluding LN MEDs.



While our average underlying reliability performance remains steady, the increasing frequency and intensity of severe weather events has resulted in a deterioration of our overall reliability performance. Customers are now experiencing an additional 60 minutes of 'loss of supply' interruptions per year on average compared to the 2005-10 RCP, as shown in Figure 3 below.

Figure 3- SA Power Networks' reliability with and without MEDs - RCP comparison



Our underlying reliability performance is in line with ESCoSA's standards and our legal requirement that our networks' reliability performance is no worse than at the time the assets were leased from the South Australian Government. However our underlying reliability performance tends to mask the actual performance experienced by customers during MEDs. SA Power Networks understands that it would be difficult and extremely expensive to re-design and build a full network to withstand all severe weather events. However our customers consider it important to implement targeted cost effective hardening solutions that aim to mitigate the impact on the network from future severe weather events. It is also ESCoSA's expectation that our performance during MEDs will not further decline but be improved over time, in accordance with the expectations of the South Australian service standard framework.

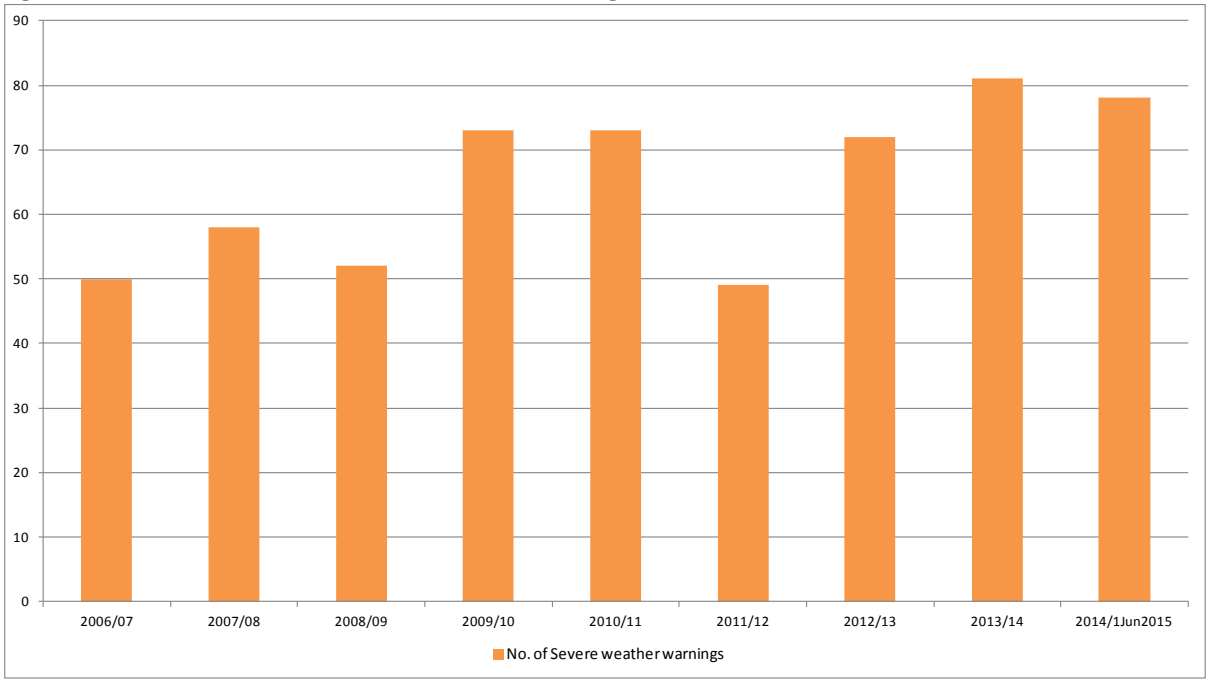
3.2 BOM Observations

SA Power Networks commissioned the BOM to provide an insight into the likely future trends in South Australia's climate. In its 'Climate Extremes Analysis for South Australian Power Network Operations' report (**BOM report**), the BOM notes there is an observable trend of rising temperatures and increased thunderstorm and lightning activity as quoted below:

> *"Correlations with the Inter-decadal Pacific Oscillation, a major mode of climate variability, suggest increased thunderstorm and lightning activity may occur in the next 10 to 20 year timeframe."* [5]

In support of this observation, the graph below demonstrates a step increase (on average) in severe weather warnings issued by the BOM in South Australia since 2009/10.

Figure 4 - Number of BOM Severe Weather Warnings issued



Further the BOM states:

> *"A significant increase in the duration of heat events, which is likely to cause heat stress in trees, has been observed since the late 1990's. This suggests that when wind events do occur, the increased heat stress may result in more material being blown around by winds."* [6]

Therefore it is feasible that there will be a continued trend in supply interruptions as a result of vegetation impacting the overhead network during severe weather events.

Given that lightning and wind are major causes of supply interruptions during MEDs, it is predicted that the current poor performance on MEDs will continue to deteriorate over the2015-20 RCP, unless work is undertaken to manage the performance of the network by hardening the network against lightning and storms in areas that are most affected by storm activity, as proposed in this business case.

[5] BOM, Climate Extremes Analysis for South Australian Power Network operations, page 5.
[6] BOM, Climate Extremes Analysis for South Australian Power Network operations, page 5.

3.3 Customer Consultation

Commencing in November 2012, SA Power Networks undertook a comprehensive CEP leading up to our 2015-20 reset submission in October 2014. The results of this process were progressively published including in the consultation document 'The South Australian Distribution Network: Directions and Priorities 2015 to 2020' which is available from the consultation website 'talkingpower.com.au'.

During the research stage of our Talking Power CEP we provided relevant information on key topics and asked our customers and stakeholders what they expected from SA Power Networks over the next five years and beyond. This was undertaken in the context that any investments and operating costs would be managed within a 'no more than CPI' increase in their network charges.

Specifically, with respect to 'responding to severe weather events' the Talking Power consultation program confirmed that:

- 88% of customers support further protecting the network to harden against lightning and storms;
- customers in poorly-served/low reliability network areas understand the causes of the level of reliability that they receive e.g. due to the long radial feeders in remote locations;
- 89% of customers surveyed supported upgrading and reinforcing areas of the network that are impacted by local demand, the environment, and the type of supply to the area;
- customers supported our efforts to identify emerging issues early and prioritise preventative maintenance to mitigate risk; and
- rural customers and stakeholders would like to see a more robust network supplying their communities to ensure our network services support the development of their communities.

This consultation highlighted a number of issues which concerned SA Power Networks' customers. Included in the insights developed by the CEP is the fact that SA Power Networks' customers want SA Power Networks to:

- Harden the network against lightning and storms (being the third highest community safety and reliability initiative indicated by customers); and
- Continue managing assets and investment to drive reliability, manage risk and support economic growth. Customers rank any asset management initiatives with a direct impact on reliability and/or preventing potential safety hazards as most important.

Customer surveys indicated that customers are satisfied with current levels of network reliability. However, there exist pockets of customers who are very dissatisfied with the current levels of reliability performance. The ESCoSA consumer preferences survey (2002) that established the form of the current service standards framework, determined that customers were willing to fund improvements in reliability to those customers that had poor performance. This finding was reinforced by SA Power Networks' CEP which indicated that 88% of customers support further protecting the network to harden against lightning and storms. In accordance with the NER Rules (6.5.7 (e)), this business case is consistent with the need to address the reliability concerns expressed by consumers, with regard to the performance of the network on MEDs.

4. Business Case Objectives

4.1 Objectives

The business case objectives are as follows:

- In accordance with the NER 6.5.7 (e), this business case seeks to address the concerns of electricity consumers in circumstances where no STPIS incentive exists; and
- Manage the declining trend in reliability performance on MEDs, by hardening some of the most vulnerable sections of SA Power Networks' network against lightning and storm damage.

SA Power Networks has developed this program in response to the deteriorating reliability performance during MEDs, the concerns of electricity consumers as identified in the course of its engagement with electricity consumers as described in the National Electricity Rules 6.5.7 (e) and in response to the expected increase in severe weather events as predicted by the BOM.

4.2 Relationship to Business Strategies and Programs

The hardening the network program contributes to achievement of SA Power Networks' strategic objectives as described below.

Table 1 - Contribution to corporate strategic objectives

Corporate Strategic Objective	Contribution
Delivering on the needs of our shareholders by achieving our target returns, maintaining the business' risk profile, and protecting the long term value of the business	This program is expected to maintain SA Power Networks' risk profile.
Providing customers with safe, reliable, value for money electricity distribution services, and information that meets their needs	This program is expected to deliver a cost effective means of arresting the deteriorating reliability performance of the network during MEDs.
Maintaining our business standing in the community as an exemplary corporate citizen of South Australia.	This program is expected to support SA Power Networks' standing in the community by helping to arrest the decline in performance of the network during MEDs.
Ensuring that our workforce is safe, skilled and committed, and that our resourcing arrangements can meet our work program needs	This program will reduce the frequency that our employees operate in relatively hostile and difficult working conditions.
Maintenance and development of key capabilities that will help sustain our success into the future	Not applicable

Table 2 - Contribution to corporate core areas of focus

Corporate Core Areas of Focus	Contribution
Energised and responsive customer service	Positive
Excellence in asset management and delivery of service	Positive
Growth through leveraging our capabilities	Not applicable
Investing in our people, assets and systems	Not applicable

4.3 Relationship to National Electricity Rules Expenditure Objectives

Table 3 - Contribution to the National Electricity Rules expenditure objectives

National Expenditure Objectives	Contribution
Meet or manage expected demand over the period	Not applicable.
Comply with regulatory obligations	In submitting its regulatory proposal, SA Power Networks must satisfy the AER of the extent to which the capital expenditure forecast includes expenditure to address the concerns of electricity consumers as identified in the course of engagement with electricity consumers. This program seeks to directly address this requirement.
Maintain the quality, reliability and security of supply of services provided by SA Power Networks	This program is expected to manage the customers' expectations of reliability during MEDs. Overall the program results in a small decline in distribution system SAIDI on non-MEDs, but an improvement overall (is on MEDs). This decline in SAIDI is due to days which were previously classified as a MED, no longer being classified as a MED.
Maintain the reliability and security of the distribution system ie. the electricity networks.	Not applicable – covered in other areas.

4.4 Meeting the National Electricity Rules Expenditure Criteria

The costs estimated to achieve this program represent efficient and prudent expenditure as detailed below.

Table 4 - Activities to Meet the National Electricity Rules expenditure criteria

National Expenditure Criteria	Activity
Efficient cost of achieving the objective(s)	All estimated costs have been calculated based on actual historical costs. Where possible competitive prices have been obtained. Costs are considered to be efficient based on historical expenditure.
Cost of a prudent operator	The planned scope of works to harden the network incorporates a set of highly targeted and prioritised strategies from which optimised cost effective solutions are selected. SA Power Networks' personnel are also have regard to industry developments to ensure our practices are in line with good industry practice.
Realistic expectation of forecast and cost inputs	Forecast reliability outcomes and benefits have been estimated by analysing our reliability performance since 2009/10 using the standard IEEE MED exclusion method (not the superseded Box-Cox method) and assessing the improvement that would have occurred if the proposed programs had been in place across this period.

5. Project Scope

The scope of the hardening the network program is to harden the most vulnerable sections of the distribution network against storm related wind and lightning, to better meet community expectations by partly addressing the decline in overall reliability performance that has occurred during MEDs by implementing targeted cost effective hardening solutions.

This will be achieved by a combination of strategies including:

- re-insulating vulnerable sections of overhead power lines to minimise insulator failures from the impact of lightning strikes;
- alternative network asset configuration / standards to reduce supply interruptions related to vegetation impacts from outside the prescribed clearance zone; and
- installation of fuse saver devices to reduce storm related transient faults leading to permanent interruptions.

Power lines have been selected for the hardening the network program based on meeting one or more of the following criteria in outage statistics since 2009/10:

	Worst served during Major event Days		Hazards during Storm Events		
Selection criteria	3 or more major event day (MED) interruptions	MED av State SAIDI > 0.2 pa	2 or more Conductors Down on MEDs	1 or more Fire Start during MEDs	Highest Tree / lightning outages SAIFI 2 pa & or State SAIDI 0.3 mins pa

The sections of power line to be hardened were selected by identifying the locations where supply interruptions have occurred as a result of lightning or vegetation impacts during MEDs. The power line hardening strategies listed above will be implemented to reduce the likelihood of similar supply interruptions occurring in the future.

There will be some improvements during non-MED days but this is considered minor in comparison to MEDs. Furthermore these improvements are offset by a reduction in the number of MEDs – these factors have been taken into account in our overall performance calculations. The net annual STPIS impact has been calculated (- 0.06% of revenue or approximately -$387k p.a.) demonstrating SA Power Networks won't benefit financially. Rather is it more likely SA Power Networks will incur a small penalty under the STPIS as a result of this initiative.

6. Business Case Options

The two options considered were:

- Do Nothing. Reliability performance and customer service on MEDs would be expected to continue to decline.

- Invest to harden the network against the effects of storm related wind and lightning, with the aim to better meet community expectations by partly addressing the decline in overall network performance that has occurred during MEDs in the 2010-15 RCP.

  This will be achieved by implementing targeted cost effective hardening solutions that will mitigate approximately 15 minutes of the 60 minute MED SAIDI increase that customers have experienced in the current RCP.

Additional operational measures to identify potential improvements to outage and restoration times have not been considered here as they are part of a more detailed on-going business operational review and are considered to be medium to longer term solutions. Increasing OPEX (eg increasing resources to respond to MEDs) by an amount equivalent to the annualised cost of the capital expenditure proposed to harden the network would have a limited impact on reducing the SAIDI impact during MEDs.

It is recommended Option 2 – Hardening the network be approved for the amount of $17.3 (June 2015, $ million) to implement initiatives to harden the network over the 2015-20 RCP.

This proposal is based on targeted cost effective network hardening solutions that aim to mitigate the impact of severe weather with the understanding that there is likely to be a small net penalty to SA Power Networks from the STPIS impact (ie -0.06% of annual revenue).

6.1 Option 1 – Do nothing

6.1.1 Delivery Costs

Not Applicable as this option is the do nothing case.

6.1.2 Expected Benefits

No benefits are expected for this option.

6.1.3 Expected Disbenefits

The BOM report to SA Power Networks ‘Climate extremes analysis for South Australian Power Network operations’ (reference document) discusses a number of important trends in the South Australian climate which impact on the network. These include:

- higher temperatures;

- increased heatwave events;

- increased fire risk; and
- increased thunderstorm and lightning activity in the next 10 to 20 years.

The BOM report also discusses the fact that an increase in the frequency of extreme temperatures is expected to lead to an increase in heat stress on trees, making branches more likely to fall during windy days. This in turn leads to an increased likelihood of supply interruptions caused by vegetation impacting our overhead power lines.

Table 5 - Expected disbenefits

Disbenefit	Consequence outcome (Value, Measure)
MED SAIDI and SAIFI are expected to continue to deteriorate in line with historical trends of deteriorating performance particularly during MEDs. BOM data suggests an increasing likelihood of these events.	Poor reliability performance will lead to poor customer service and will likely lead to customer complaints and/or regulatory intervention in the future.

6.1.4 Timescale

Not applicable as option 1 is to do nothing.

6.1.5 Major Business Risks

Major business risks of not proceeding with this program are as follows:

Table 6 - Major business risks of not proceeding with the program

Risk ID	Risk Description (Risk Line Item)	Consequence Description	Inherent Likelihood	Inherent Consequences	Risk Rating
1.1	Reliability performance not meeting customer expectations	• Poor customer service • Regulatory intervention • Customer complaints • Media attention	Likely	Minor	Medium
1.2	Safety of field crews responding to supply interruptions in adverse weather conditions and safety of the public	Increased supply interruptions on MEDs increase the safety risk to crews and the public (e.g. increasing number of wires down events)	Likely	Moderate	High

6.2 Option 2 – Hardening the network

6.2.1 Delivery Costs

The table below is a summary of the project delivery costs. Refer to the capital evaluation in Appendix B for a detailed view of these costs.

To achieve the specified objectives, a budget of $17.3 (June 2015, $ million) has been estimated over the 2015-20 RCP to harden sections of 78 powerlines (both sub-transmission and distribution). The total is comprised as follows:

Table 7 - Delivery costs

Reliability improvement	2015/16	2016/17	2017/18	2018/19	2019/20	Total
Hardening the network	2.0	3.0	3.6	4.0	4.6	**17.3**

6.2.2 Delivery cost assumptions

The estimated cost of delivery of this program has been estimated based on historical costs of doing similar work in the recent past.

Other assumptions include:

- Levels of expenditure between mitigation categories may vary from year to year based on an annual review of performance trends and are apportioned towards the highest network performance MED contributors and mitigation effectiveness; and

- Cost estimates are derived using a zero based approach from unit costs for each mitigation solution to determine the overall cost and number of projects.

6.2.3 Expected benefits

The following benefits are expected:

Table 8 - Expected benefits

Benefit Type	Benefit Effect	Benefit	Measure	Date Benefit Expected	Value
Reliability Customer Benefit (VCR)	Address the reliability concerns expressed by consumers throughout our Customer Engagement Program	Customers experience improved reliability during MEDs	Customer VCR benefit (conservatively assuming that 50% of the forecast VCR benefit is received by customers)	Progressively from 1/1/2016	+$6.2m p.a.
Reliability Benefit (STPIS)	Fewer supply interruptions on some non-MEDs valued by increased STPIS benefit but this is offset by a reduced no. of MEDs i.e. results in a slight STPIS penalty overall	STPIS benefit based on reduced impact of supply interruptions on non-MEDs offset by reduced no. of MEDs	Using normal reliability reporting systems based on the estimated number of supply interruptions mitigated compared to actual performance between 2009/10 and 2013/14, using the standard IEEE MED exclusion method (not the superseded Box-Cox method)	Progressively from 1/7/2016	- 0.06% of annual revenue - $387k p.a.

From a customer perspective, the hardening the network program has a net customer Value of Customer Reliability (**VCR**) benefit in the order of $12 million p.a., noting that we assume in our conservative modelling that customers will only receive 50% of these benefits[7] resulting in a net present benefit of $53.4m (NPV = +$53.4m over 35 years), using VCR as an indicator of the value of reliability to customers.

There is no material benefit to SA Power Networks in undertaking this program. Customers supplied by the 78 power lines will experience improved overall network performance during similar severe weather events (ie compared to those experienced in the 2010-15 RCP) in their locality.

The hardening the network program would have resulted in four days which were previously classified as MEDs no longer being classified as MEDs. Consequently, the underlying STPIS performance would have declined if this program of works had been completed during the 2010-15 RCP. This would have resulted in a reduction in annual revenue of -0.06%.

The Customer VCR benefit was determined by:

[7] That is, we have applied a conservative discount of 50% to the forecast customer VCR benefits in our modelling.

1. Calculating the average annual forecast consumption (**AAFC**) for the 2015-20 RCP for each feeder category (ie CBD, Urban, Rural Short and Rural Long) and for each customer VCR category (eg residential, agricultural, commercial and industrial)

2. An equivalent feeder category VCR (**EFVCR**) was determined by a weighted average for each feeder category using AEMO VCRs values for each customer category and the average forecast consumption for each feeder category

3. An equivalent feeder category average consumption (**EFAC**) per minutes was calculated for each feeder category (i.e. AAFC/9365.24*24*60)

4. The reliability modelling forecast the improvement in SAIDI (**IFSAIDI**) for each feeder category.

The VCR benefit was then calculated for each feeder category by multiplying the feeder average consumption per minute, the equivalent feeder VCR and the feeder category SAIDI improvement in minutes (i.e. EFVCR*EFAC*IFSAIDI), with the total VCR benefit being the sum of the individual feeder category benefits.

Hardening the network is designed to reduce the extent of supply interruptions on MEDs. While this is expected to result in a reduction of days classified as a MED by 20% (using the standard IEEE MED exclusion method, not the superseded Box-Cox method), interruptions on these feeders on days which are now above the MED threshold will be included in the underlying SAIDI and SAIFI figures. The hardening program will also lead to a reduction in the extent of supply interruptions on current non-MEDs. The combined effect however is not expected to significantly change the underlying SAIDI and SAIFI. Therefore, this program, as shown in the table below, leads to a small change in the MED threshold but does not affect the overall outcomes.

Detailed analysis has been carried out to determine the likely effect of the program in all aspects described above. The analysis was based on forecasting the proposed SAIDI and SAIFI improvements on those feeders selected for hardening (as described in Section 3) and subtracting this from the actual performance over the period 2009/10 – 2013/14 and then assessing the reliability / STPIS impact (using the standard IEEE MED exclusion method, not the superseded Box-Cox method).

This analysis is summarised in Table 9 below.

Table 9 - Analysis of impacts of the hardening of the network program

2010-2015 RCP	Do nothing	Post program	Impact
Overall Av. SAIDI (incl. MEDs) (minutes)	231.5	214.6	16.9
Underlying Av. SAIDI (excl. MEDs) (minutes)	161.1	162.6	(1.48)
Overall Av. SAIFI (incl. MEDs) (number)	1.718	1.644	0.074
Underlying Av. SAIFI (excl. MEDs) (number)	1.477	1.473	0.004
Total number of MEDs[8] (number)	20	16	(4)
STPIS Av. Net benefit (% pa)	0	(0.06)	(0.06)

The assessment suggests that hardening the network is likely to deliver on average an overall SAIDI improvement of 16.9 minutes pa, with 14.9 minutes being on MEDs and 2 minutes on non-MEDs. However, the reliability improvements are likely to result in four days that would otherwise be classified as a MED no longer being classified as an MED, which serves to erode the SAIDI improvement on non-MED days. The net result in underlying SAIDI (i.e. excludes MEDs) is a decline of 1.48 minutes (i.e. increase in SAIDI) and an improvement in SAIFI of 0.004 interruptions pa. The overall result is a STPIS penalty of approximately -0.06% of revenue pa (or about -$387k).

Therefore, based on our modelling using the standard IEEE MED exclusion method (not the superseded Box-Cox method), we will not benefit financially from the STPIS i.e. we are likely to incur a small STPIS penalty. There is a slight reduction of the MED threshold but this does not change the STPIS outcome.

The impact on reliability from all improvement programs is discussed further in Appendix A - Combined impact of reliability improvement programs.

The suite of mitigation solution approaches to be used in hardening the network has been used successfully in the past.

6.2.4 Timescale

The program is planned to be undertaken over the entire 2015-20 RCP. Its benefits will be felt progressively as each part of the program is delivered.

Table 10 - Project timescale

Timescale Activity	Start Date	End Date
Start and end dates of the project	1/01/2016	30/6/2020
Period/Date when business can first expect to accrue the benefits	1/07/2016	Ongoing

[8] Based on the standard IEEE exclusion methodology.

6.2.5 Major business risks

Residual business risks after mitigation by this option are as follows.

Table 11 - Major business risks associated with Option 2

Risk ID	Risk Description (Risk Line Item)	Consequence Description	Inherent Likelihood	Inherent Consequences	Risk Rating
2.1	Detriment to customer service and reputation caused by deteriorating reliability performance on MEDs	Partly redress the decline that has occurred during MEDs and minimise the likelihood of complaints.	Unlikely	Minor	Low
2.2	Safety of field crews responding to supply interruptions in adverse weather conditions and safety of the public	Fewer supply interruptions on MEDs reduce the safety risk to crews and the public (e.g. by reducing the number of wires down events)	Possible	Moderate	Medium

7. Investment appraisal

The investment analysis is summarised in the table below.

Table 12 – Investment appraisal

	Hardening the network
CAPEX (5 year) ($M)	17.3
Overall SAIDI improvement (mins.) pa	16.9
Overall SAIFI improvement (int.) pa	0.074
Underlying SAIDI improvement (mins.) pa	-1.48
Underlying SAIFI improvement (int.) pa	0.004
STPIS Benefit ($M) pa	-$0.39 (-0.06%)
VCR Benefit to Customers ($M) pa (assuming that 50% of the VCR benefit is received by customers)	$6.2
NPV (SAPN perspective) ($M)	-$16.1
NPV (Customer perspective) ($M)	$53.4

8. Recommendation

It is recommended that funding be endorsed for Option 2, with an allocation of $17.3 (June 2015, $ million) in capital expenditure over the 2015-20 RCP to harden the distribution network against the effects of storms and lightning.

Appendix A - Combined impact of reliability improvement programs

In its Preliminary Determination, the AER requested further information on whether SA Power Networks' cost-benefit analysis of the hardening the network program takes into account the new definition of MEDs.

SA Power Networks confirms the standard IEEE exclusion method was used to calculate MEDs, not the superseded Box-Cox method.

Table 13 provides forecasts of the average annual overall impact on SAIDI and SAIFI, and the impact on SAIDI and SAIFI excluding MEDs, as a combined result of our proposed reliability programs (including the hardening the network, low reliability feeders, Hawker-Elliston and micro-grid trial programs).

Table 13 - Combined reliability programs impact on SAIDI and SAIFI

Reliability improvement pa	Hardening the network	Low reliability feeders	Remote communities	Micro-grid	Total
Overall SAIDI (minutes)	16.89	0.94	0.35	0.12	**18.31**
Overall SAIFI (number)	0.074	0.003	0.001	0.001	**0.079**
Underlying SAIDI (excl MEDs) (minutes)	(1.48)	0.68	0.32	0.12	**(0.36)**
Underlying SAIFI (excl MEDs) (number)	0.004	0.003	0.001	0.001	**0.008**

If these programs had been implemented for the entirety of the 2010-15 RCP, our analysis indicates the average overall annual SAIDI (including MEDs), would have been 18.3 minutes lower (being a better outcome for customers). This is less than one third of the average 60 minute increase that all customers have experienced in the 2010-15 RCP.

Further, we note that 15.2 minutes of those 18.3 minutes would have been associated with MEDs. Our analysis demonstrates that four MEDs in the analysed period would no longer be classified as MEDs if these reliability programs had been implemented. The average impact of these four days no longer being classified as MEDs would slightly increase (worsen) the underlying SAIDI (excluding MEDs) performance by 3.5 minutes.

However, combining the 3.1 minute improvement (18.3 minus 15.2 minutes) with the 3.5 minute decline, results in an overall decline[9] in our underlying reliability performance of 0.4 minutes per year

[9] The decline in underlying SAIDI is because four days which were previously classified as MEDs would not have been classified as MEDs and consequently the interruptions that would still occur on those days that were previously excluded, would now be included in the underlying reliability.

That is, based on our analysis, the combined programs will improve the experience of some of our worst served customers, in line with their preferences, but there will be no benefit to SA Power Networks because there will be no improvement in the underlying reliability performance.

Overall, the proposed expenditure for the hardening the network, low reliability feeders and Hawker-Elliston programs has a net present value over a 35 year period to customers of $54 million, using the latest VCR values from AEMO.

The overall STPIS outcome from implementing the three proposed expenditure programs is neutral with potential for a slight positive outcome of about 0.02% of revenue. (If all programs had been in place for the full 2010-15 RCP, the overall impact on the STPIS is a marginal increase of 0.02% of revenue per annum. This is equivalent to $0.182 million per year for the 2015-20 RCP.)

The overall STPIS outcome, shown in Table 14, is the result of four days previously classified as MEDs no longer being classified as MEDs.

Table 14 - Annual average reliability impacts from four programs of works

	Urban		Rural Short		Rural long		Dist System	
	SAIDI	SAIFI	SAIDI	SAIFI	SAIDI	SAIFI	SAIDI	SAIFI
Hardening the Network	(1.00)	0.007	(1.42)	(0.003)	(3.75)	(0.002)	(1.48)	0.004
Low reliability	0.00	0.000	2.48	0.013	2.02	0.006	0.68	0.003
Remote communities	-	-	0.53	0.002	1.51	0.003	0.32	0.001
Micro Grid	-	-	-	-	0.74	0.006	0.12	0.001
Total	(1.00)	0.007	1.60	0.012	0.52	0.012	(0.36)	0.008

Appendix B – Capital evaluation

CAPITAL EVALUATION - SA Power Networks' perspective

Project Name Hardening the network

Evaluation Factors

Discount Rate (Real Pre-Tax) 7.09% Policy rate for investment in core business assets

Base Year Ending 30 June 2015 Specify Date

Financial Analysis	0	1	2	3	4	5	6	7	8	9	10
Year ended 31/12:	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
Costs:											
Hardening the network	2,000	3,000	3,600	4,000	4,600	0	0	0	0	0	0
Total Capital	2,000	3,000	3,600	4,000	4,600	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Total operating	0	0	0	0	0	0	0	0	0	0	0
Total Costs	**2,000**	**3,000**	**3,600**	**4,000**	**4,600**	**0**	**0**	**0**	**0**	**0**	**0**
Benefits:											
VCR benefit	0	-77	-155	-232	-310	-387	-310	-232	-155	-77	0
Total Benefits	**0**	**-77**	**-155**	**-232**	**-310**	**-387**	**-310**	**-232**	**-155**	**-77**	**0**
Net Cash Flow	**-2,000**	**-3,077**	**-3,755**	**-4,232**	**-4,910**	**-387**	**-310**	**-232**	**-155**	**-77**	**0**

Pre Tax:	
Net Present Value	**-$16,082**

CAPITAL EVALUATION - Customer perspective

Project Name Hardening the network

Evaluation Factors

Discount Rate (Real Pre-Tax) 7.09% Policy rate for investment in core business assets

Base Year Ending 30 June 2015 Specify Date

Financial Analysis	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Year ended 31/12:	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**	**2026/27**	**2027/28**	**2028/29**	**2029/30**	**2030/31**	**2031/32**	**2032/33**	**2033/34**	**2034/35**	**2035/36**	**2036/37**	**2037/38**	**2038/39**	**2039/40**	**2040/41**	**2041/42**	**2042/43**	**2043/44**	**2044/45**	**2045/46**	**2046/47**	**2047/48**	**2048/49**	**2049/50**	**2050/51**
Costs:																																				
Hardening the network	2,000	3,000	3,600	4,000	4,600	0	0	0	0	0	0																									
Total Capital	2,000	3,000	3,600	4,000	4,600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total operating	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Costs	**2,000**	**3,000**	**3,600**	**4,000**	**4,600**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Benefits:																																				
VCR benefit	0	1,230	2,459	3,689	4,918	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148	6,148
Total Benefits	**0**	**1,230**	**2,459**	**3,689**	**4,918**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**
Net Cash Flow	**-2,000**	**-1,770**	**-1,141**	**-311**	**318**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**	**6,148**

Pre Tax:	
Net Present Value	**$53,386**