Attachment G.9

SAPN_Reliability Micro-grid trial

03 July, 2015

Contents

1. Executive Summary

The purpose of this business case is to seek approval for $2.9 (June 2015, $ million) to implement a micro-grid solution to remediate the low reliability feeder Springton (GU34), over the 2015-20 Regulatory Control Period (**RCP**).

Prior to the 2010-15 RCP, the Essential Services Commission of South Australia (**ESCoSA**) had a regime in place that provided monetary incentives to SA Power Networks to improve the performance of poor performing feeders. This regime was adopted because customers in general were willing to pay to improve the reliability to the worst served customers. Consequently, when establishing the 2010-15 Reliability Service Standard Framework, ESCoSA created a regime whereby SA Power Networks was required to publicly report on the worst performing 5% of feeders. The criterion for this was that a feeder's System Average Interruption Duration Index (**SAIDI**) exceeded 2.1 times the regional SAIDI average service standard target for two consecutive years.

Generally, poor performing feeders remain on this 'low reliability feeders' list for one or two years until improvements are implemented. However, there are currently 31 feeders which supply small remote communities whose reliability levels have exceeded the 2.1 times regional SAIDI threshold for at least three consecutive years. These feeders have on average exceeded the service standard target by more than four times. Given that only a small number of customers are affected, the lower service levels that these customers experience do not contribute materially to the overall reliability performance outcomes of the region. This means that SA Power Networks is not incentivised under the Service Target Performance Incentive Scheme (**STPIS**) to improve network reliability in these areas. However, we are required to report to ESCoSA on actions that we are taking to improve the reliability of supply to these areas.

The 31 distribution feeders (supplying approximately 3,900 customers) represent less than two per cent of the total number of feeders in our network. Of these 31 feeders, there are 24 feeders that have feasible reliability solutions similar to the hardening the network initiatives that can be implemented. For six of the remaining feeders, reliability issues can be addressed by managing reliability performance of the upstream network within the core reliability program. The other remaining feeder is considered suitable for a micro-grid trial which is the purpose of this business case. Once implemented, the proposed solutions will remove these feeders from the 'low reliability feeders' list.

In our Original Proposal, SA Power Networks proposed to undertake a micro-grid trial to remediate Springton which is one of our worst performing feeders. Using a combined distributed storage and centralised storage solution, this trial is aimed at improving the reliability performance of Springton, so that this feeder's performance is no longer in the 'low reliability feeders' list. This is consistent with ESCoSA's expectation under the service standard framework that customers' reliability performance would be restored closer to regional targets. It is SA Power Networks' intention to use this micro-grid trial as a template for future reliability remediation, or deferral of network augmentation, in other remote communities as circumstances allow.

Investigating the opportunities presented by micro-grid technology is also consistent with a number of insights gained from our Customer Engagement Program (**CEP**), in particular:

- our customers' desire to improve service to the worst served customers, particularly those on long radial feeders, most likely to be affected by severe weather events; and

- the need for SA Power Networks to remain up-to-date with new technologies and how these might integrate with the network and/or reduce costs.

The SAIDI performance on the Springton feeder is on average four times the annual SAIDI average regional service standard target (i.e. these customers have consistently experienced considerably worse performance than other customers for many years).

SA Power Networks considers that the performance experienced by these customers therefore needs to be addressed in line with ESCoSA's expectations that the customer's performance will not further decline but rather will but be partly restored to a service level closer to the average regional service standards and that this feeder will not be classified as a low reliability feeder for an extended period.

In accordance with the National Electricity Rules in 6.5.7 (e), this business case seeks to start addressing the specific concerns of electricity consumers on low reliability feeders, in the full understanding that it would be difficult and extremely expensive to re-design and implement a full network able to withstand all causes of poor reliability.

Micro-grids may offer an effective solution on a limited number of low reliability feeders where existing traditional solutions are not effective and/or are cost prohibitive. The proposed targeted reliability solution aims to mitigate the impact on this low reliability feeder, understanding that the net STPIS impact has been modelled (+$86k p.a.) and that SA Power Networks won't materially benefit financially (and in any case this modelled benefit would be largely offset by the equivalently modelled STPIS penalties expected under the separate 'Hardening the Network' project).

Assuming benefits to customers are progressively realised over a five-year regulatory period and then continue for another 30 years, then from a customer perspective, the micro-grid solution has a net customer VCR benefit in the order of +$72k p.a. and therefore a net present cost of $1.7m (NPV = -$1.7m over 35 years), using VCR as an indicator of the value of reliability to customers.

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' (**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.

3. Background

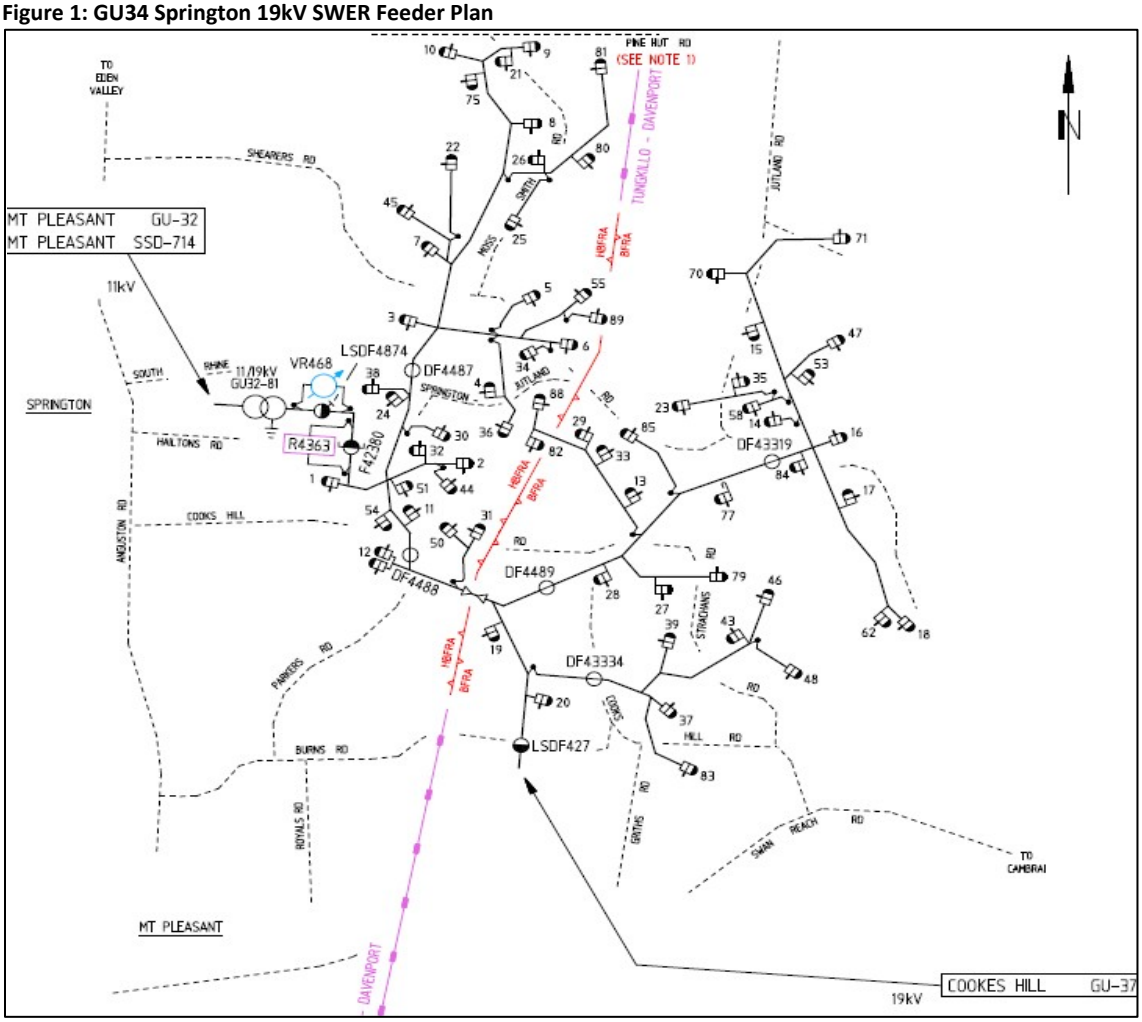
3.1 Historical Performance

ESCoSA defines 'Low Reliability Distribution Feeders' as feeders within a particular region which have exceeded 2.1 times the SAIDI service standard for two consecutive financial years.

A total of 31 feeders (supplying approximately 3,900 customers) have been identified as low reliability distribution feeders, which have appeared on the list in excess of two consecutive years i.e. three years running, representing approximately 2% of the total number of feeders in the Network (refer to the Low Reliability Feeders business case). This business case specifically addresses the performance on GU34, the Springton 19kV power line.

Springton is supplied from SSD438 – Angas Creek Substation via SD381 – Angas Creek – Tungkillo 33kV feeder and GU32 – Mt Pleasant 11kV feeder. Refer to Figure 1.

Figure 1: GU34 Springton 19kV SWER Feeder Plan



The SAIDI performance on this feeder is on average four times the annual SAIDI average service standard target (i.e. these customers have consistently experienced considerably worse performance than other customers for many years).

Our underlying reliability performance is in line with ESCoSA's standards and our legal requirement is that our network's 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 overall performance experienced by some customers as explained above.

SA Power Networks considers the poor network performance experienced by these customers is unacceptable and needs to be addressed in line with ESCoSA's expectations that our performance will not further decline but instead will be improved over time, in accordance with the expectations of the South Australian service standard framework. We note that ESCoSA requires reporting and monitoring of low reliability feeders and that we must include in our annual report what actions are being taken to improve the reliability of these feeders.

A comparison of GU34's performance against the average for the State and the ESCoSA geographic region can be seen below:

Table 1 – Comparison of GU34 vs Average for the State and region

Reliability Measure	GU34 (including upstream outages)	Average for State	Average for ESCoSA region (Eastern Hills / Fleurieu Peninsula)
Average SAIDI (hrs pa) (2009/10 – 2013/14)	19.5	2.98	4.92
Average SAIFI (outages pa) (2009/10 – 2013/14)	7	1.68	2.80
Average CAIDI (hrs pa) (2009/10 – 2013/14)	2.8	1.78	1.76

Both the SAIDI and System Average Interruption Frequency Index (**SAIFI**) for GU34 are significantly higher than the State average, with the SAIDI just over 6.5 times the State average, SAIFI over four times the State average, and Customer Average Interruption Duration Index (**CAIDI**) over 1.5 times the State average. Even when comparing GU34 to the average for the Eastern Hills/Fleurieu Peninsula geographic region, the SAIDI is four times higher.

Based on actual supply interruption data over the period 07/08/2012 to 03/06/2014, there has been one supply interruption on GU34 and 17 supply interruptions upstream that has resulted in an outage on the Springton power line. Based on this historic data it is clear the majority of the supply interruptions are upstream from this community and therefore any actions taken to maintain supply remotely (via batteries and solar) from the traditional network will be beneficial to the community.

Most of the upstream supply interruption durations were less than four hours, as evidenced by the CAIDI being just under three hours. However two of the upstream supply interruptions out of the 17 were between four to five hours in duration. Given a switchable battery's life is reliable for approximately four hours, the Springton feeder on average may experience two supply interruptions that result from the upstream network, over the trial period where the interruption may exceed the proposed battery life.

3.2 Customer Consultation

Commencing in November 2012, SA Power Networks has undertaken 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 key 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 regard to responding to severe weather events, the Talking Power consultation program confirmed:

- 88% of customers support further protecting the network to harden against lightning and storms;
- rural customers and stakeholders would like to see a more robust network supplying their communities;
- 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;
- our customers' desire to improve service to the worst served customers, particularly those on long radial feeders, who are most likely to be affected by severe weather events; and
- the need for SA Power Networks to remain up-to-date with new technologies and how these might integrate with the network and/or reduce costs.

Customer surveys have indicated that customers are generally satisfied with current levels of network reliability. However, there are pockets of customers who experience very poor levels of reliability performance. The ESCoSA consumer preferences survey (2002) established the form of the current service standards framework and determined that customers were willing to fund improvements in reliability to those customers who 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 these reliability concerns expressed by customers, with regard to the performance on these low reliability feeders.

SA Power Networks was guided by these customer insights and has investigated the potential of micro-grids to manage network reliability for poorly served customers in the future. It is considered prudent to undertake this trial to better understand the potential applications, opportunities and costs involved to successfully implement a micro-grid solution.

4. Business Case Objectives

4.1 Objectives

In accordance with the National Electricity Rules in 6.5.7 (e), the objectives of this business case are as follows:

- In accordance with the NER 6.5.7 (e), address the concerns of electricity consumers supplied by low reliability feeders where no STPIS incentive exists (due to the low number of customers impacted and the proportionally significant rectification costs);
- Manage / reinforce reliability performance of the identified low reliability feeders, which have been on the low reliability feeder list for three consecutive years, by partly restoring the network performance to bring it closer to the average regional service standards; and
- Develop SA Power Networks' understanding of the costs (capital and operational) and broader benefits of micro-grid technology and assist in assessing applications and / or other deployments where they are most likely to be effective and cost efficient.

SA Power Networks has developed this program in response to the low reliability performance of the Springton power line, and the concerns of electricity consumers as identified in the course of our engagement with electricity customers as described in the National Electricity Rules 6.5.7 (e).

This business case has also been developed in line with our Corporate Policy for Asset Management authorised by General Manager Network Management and our Asset Management Plan (Manual 15).

4.2 Relationship to Business Strategies and Programs

The project contributes to achievement of strategic objectives as described below.

Table 2 - 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 manage / reinforce reliability performance of the selected feeder and is the least cost means of arresting the continued poor network performance experienced by our worst served customers.

Corporate Strategic Objective	Contribution
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 affected feeders / communities by helping to return the reliability performance of the Springton feeder closer to the average regional service standards.
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	This would contribute to SA Power Networks' knowledge of micro-grid technologies and their applicability for future applications.

Table 3 - 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 4 - 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 and also manage the performance of feeders that meet ESCoSA's definition of a low reliability feeder.

National Expenditure Objectives	Contribution
Maintain the quality, reliability and security of supply of services provided by SA Power Networks	This program will manage/reinforce the reliability performance of the selected low reliability feeders.
Maintain the reliability and security of the distribution system i.e. the electricity networks	Not applicable

4.4 Meeting the National Electricity Rules Expenditure Criteria

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

Table 5 - 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 historic 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 incorporates a set of highly targeted and prioritised strategies from which optimised cost effective solutions are selected. SA Power Networks' personnel also have regard to industry developments to ensure our practices are in line with good industry practice.
Realistic expectation of demand 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. Scope

The scope of the project is to implement a micro-grid solution on the Springton 19kV power line (GU34) to manage and reinforce the reliability of supply to these poorly served customers, closer to the average regional service standards. This will be achieved by installing a combination of centralised and distributed battery storage.

The objective of the micro-grid trial is to enhance SA Power Networks' understanding of the costs (both capital and operational) and the broader benefits of micro-grid technology. The outcome of this trial will assist SA Power Networks to assess other micro-grid deployments to determine where they are most likely to be effective and cost efficient.

If a micro-grid can provide significantly improved reliability for the customers affected at similar cost to conventional solutions, or where conventional solutions would not be effective, it may be justified from a customer service perspective. However, the trial will also review whether micro-grids can:

- provide an alternative augmentation option as well as providing voltage support and renewable energy integration;
- provide a feasible option for areas identified as bushfire safer places that may be disconnected from the main electricity grid during a bushfire event; and
- be cost effective in providing electricity in 'edge-of-grid' applications where the construction of a long grid connection may prove very costly.

The AER received a stakeholder submission which suggested that we should delay our reliability improvement programs for hardening the network and improving low reliability feeders, pending the outcome of the trial micro-grid solution.

Micro-grids may offer an effective solution on a limited number of low reliability feeders where existing traditional solutions are not effective or are cost prohibitive. However, it should be noted that micro-grid battery storage (at this point in time) can only support supply of electricity for up to four hours. This means a micro-grid would only benefit two of the 31 worst performing feeders because most low reliability feeders have an average interruption duration of greater than four hours.

While micro-grid technologies will be further evaluated as potential solutions to some network constraints, they are not currently a viable solution to all, or even the majority of, low reliability feeder performance issues.

Any delay in implementing the proposed hardening of the network and low reliability feeder programs will not support SA Power Networks' ability to manage the service to the worst served customers and will further exacerbate customers experiencing similar or deteriorating performance.

5.1 Selection Criteria

The Springton power line is one of the ESCoSA classified low reliability feeders because its reliability performance had exceeded 2.1 times the regional SAIDI service standard for the three years commencing 2010/11.

The Springton power line has been evaluated as being the most suitable low reliability power line for a micro-grid solution because it meets the following criteria considered necessary to implement a successful trial:

- the township is located within 4 hours of Adelaide and therefore it is reasonably accessible;
- the Springton power line has less than 1.5MW of load;
- the community has more than 100 customers;
- it's a location with an existing high penetration of distributed solar photo voltaic (**PV**) systems;
- it's a location with a high penetration of electric hot water systems;
- it is a remote country town on a rural line or SWER line; and
- there is no major augmentation work planned for the area over the trial period.

Consideration was also given to the following factors:

- the topology of the target feeder;
- the availability of load data for the target feeder;
- the types of outages experienced in the past by the poorly served community (i.e. a significant portion of the historic supply interruptions being upstream from the community);
- avoiding feeders with major customers, life support and critical customers; and
- the needs of other essential services supplied by the feeder (i.e. Police, CFS etc).

Table 6 outlines the selection criteria for the Springton power line.

Table 6 - Selection criteria for GU34

Criteria	Measure	GU34
Distance from Adelaide	< 4hrs	1hr 5mins
Feeder Load	< 1.5MW	Peak load measured March 2013 to be 207kVA. Existing isolating transformer is 150kVA (currently 138% loaded).

Number of customers	> 100 customers	125 customers
Types of outages	Feeder often affected by upstream outages.	• Largely affected by upstream outages. • Based on actual outage data over the last 2 years (07/08/2012 – 03/06/2014) there has only been one outage on GU34 and 17 outages upstream.
Planned work	No major work planned by Network Planning in the next reset period.	• No major work planned. • Minor planned work to upgrade isolating transformer and install SCADA (estimated cost $100k).
Penetration of solar PV	High (preferably > 25%)	30%
Penetration of electric hot water	High (preferably > 50%)	50%
Topology of feeder	• Feeder supplying a small country town or SWER. • Suitable terrain and enough open space along feeder to install large battery bank.	• Relatively short, dense SWER. • Lots of open space available.
Availability of data	• Preferably a feeder with SCADA. • If feeder does not have SCADA then select a feeder which has load test data.	• No SCADA installed on GU34. • Limited data available for GU34. Some summer load data available from December 2012 – March 2013 and winter load data available from June 2010 – August 2010.
Type of customers	Avoid feeders with: • Major customers • Life support customers • Critical customers Give consideration to other essential services (i.e. Police, CFS etc).	No customers identified in these categories.

Customer engagement will be an important aspect to achieve a successful micro-grid trial. The benefits of the trial need to be clearly and carefully discussed with the customers impacted to gain their support and manage their expectations. In addition, for a distributed storage solution, individual units will be required to be installed on customer premises. Customer engagement in the initial project development stage and during longer term project evaluation will be required and an allowance has been made in the project estimate for this.

5.2 Micro-grid options considered

Three micro-grid options were considered as follows:

Table 7 – Micro-grid options

Options	Description
Centralised storage	All-in-one large scale network support solution (e.g. large battery bank)
Distributed storage	Small scale network support solutions implemented on the customers premises (e.g. small battery banks)
Combination of centralised and distributed storage (Recommended)	An integrated combination of large scale and small battery banks

A centralised storage unit is beneficial because when the Springton feeder is isolated (or islanded) from the upstream network, the local network voltage and frequency is maintained.

A system that incorporates distributed storage provides improved voltage regulation, enables the storage to be positioned near individual loads and provides increased redundancy. There is also the potential for individual customers with storage units to have their supply maintained in the event of a fault on GU34 itself.

Implementing a combined storage solution means that the centralised storage unit can be much smaller than would be required for a purely centralised storage solution.

Implementing a system which combines both centralised and distributed storage is recommended as it will enable both technologies to be investigated.

6. Business Case Options

The options considered in this business case are:

1. Do Nothing. Reliability performance and customer service to poorly served customers on the Springton feeder will remain unchanged; and

2. Invest in a micro-grid solution to manage the reliability performance of the Springton feeder, to:

    - partly restore its reliability performance to bring it closer to the average regional service standards, in line with community expectations;

    - improve the experience of some of our consistently worst served customers; and

    - endeavour to meet customer and ESCoSA expectations.

It is recommended Option 2 – reinforce the Springton feeder using a micro-grid solution, be approved for the amount of $2.9 (June 2015, $ million) to be implemented over the 2015-20 RCP.

6.1 Option 1 – Do Nothing

This option is not recommended as it is not in the long term interests of our customers because it will leave SA Power Networks with limited knowledge and understanding of the benefits that a micro-grid can offer. Given the insights obtained from customers, and the potential opportunities for broader application, it is considered prudent for SA Power Networks to investigate the use of such a system and the benefits that it can provide in order to improve service to poorly served communities.

Although the present day costs to install a micro-grid solution utilising battery storage is relatively high, the costs of battery storage are expected to decrease substantially in the near future. Undertaking a micro-grid solution in the 2015-20 RCP will enable SA Power Networks to understand the benefits such a system can provide as well as the feasibility of integrating these systems into our network, for a range of applications beyond 2020 when the technology is expected to be more economic.

In the absence of undertaking this specific micro-grid solution, SA Power Networks will not be well placed to make the best use of micro-grid technologies in order to manage reliability to worst served customers, integrate new customer technologies, enable augmentation deferral and potentially avoid costly network extensions where applicable.

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

Table 8 - Expected disbenefits

Disbenefit	Consequence outcome (Value, Measure)
Reliability performance of these low reliability feeders will continue at historical levels Customer preferences as revealed through our CEP will not be met	Possible adverse consequences include: • Poor customer service • Adverse publicity from customers and media.

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 project are as follows.

Table 9 - Major business risks of not proceeding with the project

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	Possible	Minor	Low
1.2	Detriment to customer service reputation	Negative focus on and additional scrutiny of SA Power Networks performance	Possible	Minor	Low

6.2 Option 2 – Combined Centralised and Distributed Storage

This option is an integrated system of distributed storage and centralised storage. The number of distributed storage units will vary depending on the feeder topology and load requirements. Based on the load data available, it is estimated that 30 distributed units are required to cover the load requirements for the feeder. These units are proposed to be installed on customer premises, however will be connected on the network side of the meter and are managed by SA Power Networks. A take up rate of 1 in 4 is required and the likelihood of being able to install a residential battery storage unit near to existing solar PV systems is considered to be high due to the wide spread adoption of PV on the target feeder.

In conjunction with the storage trial, hot water load control will be utilised to attempt to manage the feeder load during outages.

6.2.1 Delivery Costs

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

To achieve the specified objectives, a budget of $2.9 (June 2015, $ million) has been estimated over the 2015-20 RCP to reinforce the low reliability Springton feeder. The total is comprised as follows:

Table 10 - Delivery costs

Reliability improvement	2015/16	2016/17	2017/18	2018/19	2019/20	Total
Micro-grid trial	0.0	0.0	0.5	1.4	1.0	**2.9**

6.2.2 Delivery Cost Assumptions

The estimated cost of delivery of the network alterations components of this option have been estimated based on historical costs of doing similar work, and the new technology component cost estimates are derived from indicative quotes from industry suppliers and advice from other network businesses.

6.2.3 Expected Benefits

The following benefits are expected:

Table 11 - Expected benefits

Benefit Type	Benefit Effect	Benefit	Measure	Date Benefit Expected	Value
Reliability Benefit (STPIS)	Fewer outages non-MED valued by increased STPIS benefit	STPIS benefit based on reduced impact of outages	Using normal reliability reporting systems based on the estimated number of outages mitigated compared to actual performance between 2010/11 and 2013/14 using the standard IEEE MED exclusion method (not the superseded Box-Cox method)	Progressively from 1/7/2016	Estimated $86k p.a. (+0.01% p.a.)

Based on financial modelling, it is not economic for SA Power Networks to invest in this program of works as the NPV is a cost of $2.0 million (i.e. the benefit is -$2.0 June 15, $ million). However, this program is considered necessary to address the concerns of electricity customers as identified by SA Power Networks in the course of our CEP (in accordance with the National Electricity Rules in 6.5.7 (e)).

In its Preliminary Determination, the AER recognised the micro-grid solution was a trial and that it was therefore difficult to accurately quantify the likely benefits in terms of reliability. To allow for reliability improvement, the AER needed to be satisfied that the proposed expenditure was not funded through the STPIS regime. The modelled benefit to SA Power Networks from the STPIS regime is a 0.01% revenue increase which is largely off-set by the hardening of the network revenue decrease.

Detailed analysis has been undertaken to determine the likely effect of the proposed remediation works using a micro-grid solution on the selected worst performing feeder (Springton). The analysis was based on forecasting the proposed SAIDI and SAIFI changes on those communities and then subtracting the forecast performance from the actual performance over the period from 2009/10 to 2013/14. The findings were then assessed against the projected STPIS impacts. The results of this analysis are summarised in Table 12.

Table 12 - Analysis of impacts of the micro-grid trial if the micro-grid had been in place for the period from 1 July 2009 to 30 June 2014

	Without Micro-grid	With Micro-grid
Overall Av. SAIDI (excl. MEDs) (minutes)	19.5 hrs pa	8.1
Overall Av. SAIFI (excl. MEDs) (number)	7.0 pa	1.3

Assuming that, collectively, the value of customer reliability (**VCR**) provides a reasonable surrogate for the value to customers of the increased reliability, this allows the net present value of the micro-grid trial project to be assessed. Assuming benefits continue at the stated value for 35 years, the NPV is -$1.7m and would therefore not be considered financially viable for SA Power Networks on its business case alone. Refer to Appendix B for the capital evaluation.

Based on our modelling using the standard IEEE exclusion method (not the superseded Box-Cox method), we are likely to marginally benefit financially from the STPIS (+0.01% p.a.). Again, this would be largely offset by the financial penalties from the separate hardening the network project.

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 13 - 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

6.2.5 Major Business Risks

Residual business risks of this option are as follows.

Table 14 - 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 poor reliability performance	Partly return / restore performance closer to average reliability levels and minimise the likelihood of customer complaints	Unlikely	Minor	Low
2.2	Safety of field crews responding to outages, often in adverse weather conditions, and safety of the public	Fewer outages reduce the safety risk to crews and the public (e.g. by reducing the number of wires down)	Possible	Minor	Low

7. Investment Appraisal

The investment analysis is summarised in the Table 15 below.

Table 15 – Investment appraisal

	Micro-grid
CAPEX (5 year) ($million)	2.9
Overall SAIDI improvement (mins.) p.a.	0.12
Overall SAIFI improvement (int.) p.a.	0.001
Underlying SAIDI improvement (mins.) p.a.	0.12
Underlying SAIFI improvement (int.) p.a.	0.001
STPIS Benefit ($M) p.a.	0.086
VCR Benefit to Customers ($M) p.a.	0.072
NPV (SAPN perspective) ($M)	-2.1
NPV (Customer perspective) ($M)	-1.7

8. Recommendation

It is recommended that funding be endorsed for Option 2, with an allocation of $2.9 (June 2015, $ million) in capital expenditure over the 2015-20 RCP to reinforce SA Power Networks' low reliability Springton feeder.

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 16 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 16 - 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 in our underlying reliability performance of 0.4 minutes per year.

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 17, is the result of four days previously classified as MEDs no longer being classified as MEDs.

Table 17 - 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	Micro-grid trial - Springton	
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:											
Micro-grid trial - Springton	0	0	500	1,400	100	0	0	0	0	0	0
Total Capital	0	0	500	1,400	1,000	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	**0**	**0**	**500**	**1,400**	**1,000**	**0**	**0**	**0**	**0**	**0**	**0**
Benefits:											
VCR benefit	0	0	0	0	0	86	86	86	86	0	0
Total Benefits	**0**	**0**	**0**	**0**	**0**	**86**	**86**	**86**	**86**	**0**	**0**
Net Cash Flow	**0**	**0**	**-500**	**-1,400**	**-1,000**	**86**	**86**	**86**	**86**	**0**	**0**

Pre Tax:	
Net Present Value	**-$2,115**

CAPITAL EVALUATION - Customer perspective

Project Name Micro-grid trial - Springton

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:																																				
Micro-grid trial - Springton	0	0	500	1,400	1,000	0	0	0	0	0	0																									
Total Capital	0	0	500	1,400	1,000	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	**0**	**0**	**500**	**1,400**	**1,000**	**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	0	0	0	0	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
Total Benefits	**0**	**0**	**0**	**0**	**0**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**
Net Cash Flow	**0**	**0**	**-500**	**-1,400**	**-1,000**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**

Pre Tax	
Net Present Value	**-$1,656**