Single Phase Underground Distribution Substation Replacement (NMP17)

Regulatory Business Case (RBC) 2024-29

PowerWater

Contents

1. Summary

This business case has been prepared to support the 2024-29 Regulatory Proposal. The business case demonstrates that Power and Water has undertaken appropriate analysis of the need for the expenditure and identified credible options that will resolve the need and ensure that Power and Water continues to meet the National Electricity Objectives and maintain the quality, reliability, and security of supply of standard control services and maintain the safety of the distribution system.

The proposed investment identified in this business case will undergo further assessment and scrutiny through Power and Water's normal governance processes prior to implementation and delivery.

This business case addresses the condition issues and risks of Single Phase Underground Distribution Substations.

1.1 Business need

Power and Water maintains a High Voltage underground distribution network in Darwin's urban area which includes SPUDS. The network is unique and only present in four of the northern suburbs of Darwin.

Single Phase Underground Distribution Substations (SPUDS) are primarily installed on a concrete plinth in the front yards of residential properties. SPUDS allow for HV switching to be performed with internal components designed to extinguish arcs during live switching operations. There are 323 SPUDS installed on the network.

In recent years, there has been an increasing number of SPUDS found to be exhibiting significant condition deterioration, in particular corrosion of the external tank leading to oil leaks and failure, as well as deterioration of the internal components required for operational switching.

These deterioration modes are strongly related to age and the harsh environmental conditions of the Northern Territory. Inspections have confirmed that these assets are in a deteriorated condition and are reaching the end of serviceable life earlier than expected, largely due to corrosion of the tank. It is estimated that 272 SPUDS will reach the end of their expected serviceable life by the end of the 2024-29 regulatory period.

Failure of a SPUDS has safety, reliability and environmental risks if not effectively mitigated. Safety hazards are the predominate risk caused by the asset due to the potential for an explosive failure and its location in residential properties, putting them in close proximity to the public.

In 2019 a refurbishment program was commenced to address an emerging condition issue with the SPUDS installed in the northern suburbs. The current rate of refurbishment and replacement of SPUDS is assisting maintain network performance as measured by the impact to unplanned outages of the asset fleet. As at June 2024, it is estimated that 191 SPUDS will reach end of life by the end of the 2024-29 regulatory period.

1.2 Options analysis

The options considered to resolve this need are shown in Table 1.

Table 1 Summary of credible options

Option No.	Option name	Description	Recommended

1	Replace on failure	Replace SPUDS once they have failed by undertaking reactive refurbishment or replacement of the assets	No
2	Targeted replacement and refurbishment	Implement a program to replace 4 and refurbish 23 SPUDS each year during the next regulatory period	Yes
3	Accelerated replacement and refurbishment	Implement a program to replace 6 and refurbish 32 SPUDS each year during the next regulatory period	No

As part of a holistic assessment, non-network solutions, capex/opex trade-offs and retirement or derating options were also considered, but found that none of these options addressed the underlying network issues.

A cost benefit analysis was completed for each of the options where the risk reduction, compared to Option 1, was used as the benefit achieved by the option.

1.3 Recommendation

The recommended option is Option 2 - proactive refurbishment and replacement of SPUDS, as a continuation of the existing replacement program (NMP17) at an estimated cost of $2.97 million (real 2021/22). Option 2 had the highest NPV, addressed the need and is found to be the best outcome for customers requiring safe and reliable networks.

Table 2 shows a summary of the expenditure requirements for the preferred option of proactive replacement for the 2024-29 regulatory period.

Table 2 Annual capital and operational expenditure ($'000, real 2021/22)

Item	FY25	FY26	FY27	FY28	FY29	Total
Capex	594	594	594	594	594	**2,970**
Opex	-	-	-	-	-	-
Total	**594**	**594**	**594**	**594**	**594**	**2,970**

2. Identified need

This section provides the background and context to this business case, identifies the issues that are posing increasing risks of SPUDS to Power and Water and its customers, describes the current mitigation program and its delivery status, highlights the consequence of asset failure, and provides a risk assessment of the inherent risk if no investment is undertaken.

2.1 Asset profile

Power and Water owns and maintains a High Voltage (HV) underground distribution network in Darwin's urban area which includes SPUDS. The network is unique and only present in four of the northern suburbs of Darwin.

SPUDS are primarily installed on a concrete plinth in the front yards of residential properties. SPUDS allows for HV switching to be performed with internal components designed to extinguish arcs during live switching operations.

The fleet consists of 323 substations with capacities of 50 kVA and 75 kVA, as shown in Table 3.

Table 3 Summary of SPUDS fleet

Suburb	50 kVA capacity	75 kVA capacity	Total
HOLMES		1	1
KARAMA	125	15	140
LEANYER	116	20	136
MALAK	43	3	46
Grand Total	284	39	323

In recent years, there has been an increasing number of SPUDS found to be exhibiting significant condition deterioration, in particular corrosion of the external tank leading to oil leaks and failure, as well as deterioration of the internal components required for operational switching.

These deterioration modes are strongly related to age and the harsh environmental conditions of the Northern Territory. As shown in Figure 1 the majority of the substations were installed over a 4-year period from 1980 to 1983 so now these assets are between 39 and 42 years old. Given a typical serviceable life of 45 years, these assets will reach their expected serviceable life from 2025.

Inspections have confirmed that these assets are in a deteriorated condition and are reaching the end of serviceable life earlier than expected, largely due to corrosion of the tank. A refurbishment and replacement program has already been established.

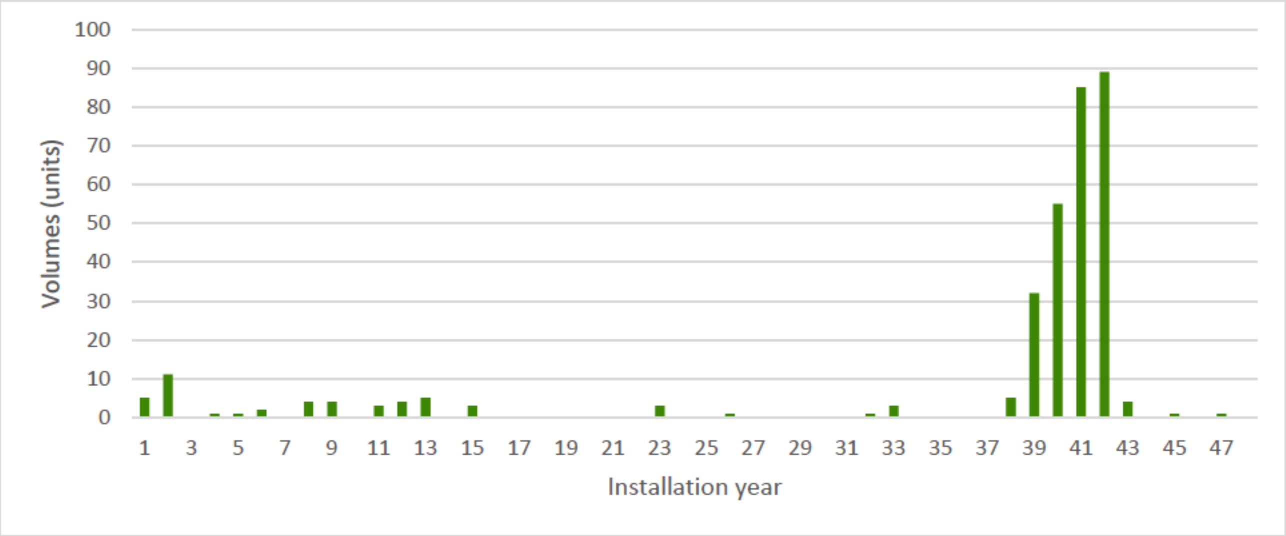

Figure 1 SPUDS age profile

2.2 Current and historical mitigation programs

In 2019 a program to replace or refurbish SPUDS, based on their observed condition in the field, was initiated. The program was included in the final determination for the 2019-24 regulatory period. Prior to this program, SPUDS were managed as part of the Volumetric Asset (NMFCR) program.

In the assessment, it was found that preventative maintenance to remove the debris, soil and water was ineffective in most locations as the materials build up in a short timeframe due to high vegetation growth rates and wet season conditions. As a result, the preferred option was to assess the SPUDS for condition and refurbish where possible or replace when necessary. However, during the 2019-24 regulatory period, a greater proportion of the assessed SPUDS required replacement due to the extent of deterioration making them irreparable.

The current program is addressing an average of 27 SPUDS per year and is expected to continue at the same rate for the remainder of the current regulatory period.

It is estimated that 272 SPUDS currently in service will have reached or exceeded their expected life by the end of the 2024-29 regulatory period. Of these, 81 will be addressed by June 2024 under the current program leaving 191 SPUDS at elevated risk due to deteriorated condition.

Figure 2 shows the actual expenditure incurred and the budget for the remainder of the current regulatory period. As shown, the project is expected to be delivered with less than a 10% variation to the forecast.

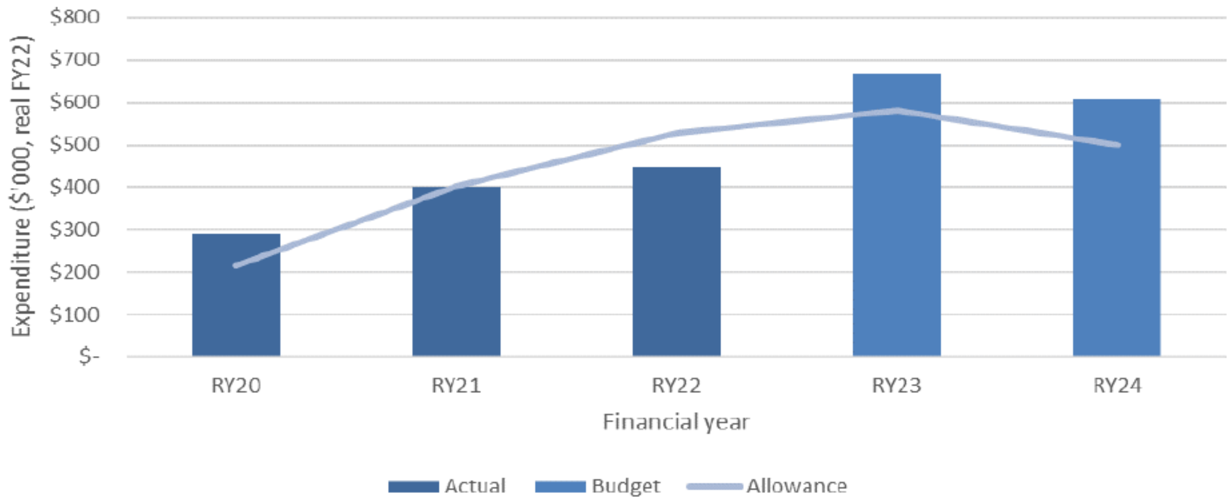

Figure 2 Actual expenditure and budget versus allowance (FY22 dollars) for the SPUDS program

2.3 Asset condition and emerging issues

2.3.1 Deterioration modes

The most common failure mode of SPUDS is corrosion of the bottom of the transformer tank which results in oil leakage and eventually failure due to loss of insulation and cooling. Corrosion is strongly related to age and the environmental conditions of the Northern Territory.

Since SPUDS are ground mounted outdoors on concrete plinths in residential gardens, moisture is retained around the tank, accelerating the corrosion of the base of the substation more quickly than for other types of transformers. A significant amount of water can pool around these assets during the wet season and be retained in the soil and other debris (such as leaves and other vegetation) that builds up around the substations keeping them in contact with moisture for prolonged periods.

Accumulation of debris and vegetation occurs over a rapid time scale and would be impractical and costly to address due to regular preventative clean up measures requiring site visits by field crews. There are no cost-effective options for slowing or preventing the corrosion that occurs in existing SPUDS given the very local environmental conditions.

Due to the SPUDS being located on or near residential properties, members of the public are likely to be in proximity to the assets. Electrical failure due to loss of insulating oil causes a fault and due to the deteriorated asset condition, containment of fault energy cannot be guaranteed. This elevates the safety risk posed by SPUDS.

2.3.2 Emerging issues

An additional issue that has been identified during the current program is the need to upgrade earthing of the unit to align with newer standards. When the older SPUDS were initially installed, requirements were limited to contact shared copper cable. The new (current) standard requires better earthing for improved safety, so as refurbishment or replacement has occurred, the SPUDS have been brought into compliance with the current standard. Alignment with updated earthing standards[1] published in 2022 requires the earthing at each location to be improved compared to standards that applied at the time of installation. As a result, the scope at each site has expanded and therefore costs per unit have increased.

Operationally, there is no ability to transfer loads between substations in the SPUDS network. Therefore, in the event of a failure or need for maintenance, generators are required to maintain customer supply or there are extended outages.

Examples of deterioration are shown in Figure 3.

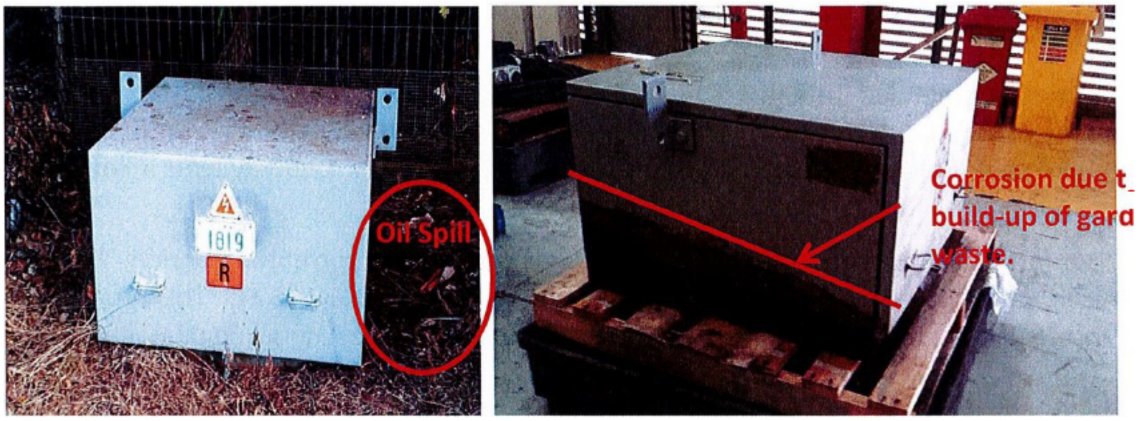

Figure 3 Common SPUD installation condition and impacts

2.3.3 Asset failure performance

During the past 10 years an average of 4 asset failures of SPUDS per year have resulted in an outage to customers, with a maximum of 7 failures. Despite the introduction of a targeted maintenance and replacement program, the number of failures has not materially changed. This indicates that the failure rate as a percentage of the remaining assets is increasing, demonstrating that the condition of the population is deteriorating.

Figure 4 shows the number of planned (maintenance or replacement) and unplanned (in-service failure) outages that have occurred during the past 10 years. The significant increase in planned outages from 2018/19 is due to the initiation of the replacement and refurbishment program this regulatory period.

[1] Energy Networks Australia (ENA) ENA EG-0 and EG-1

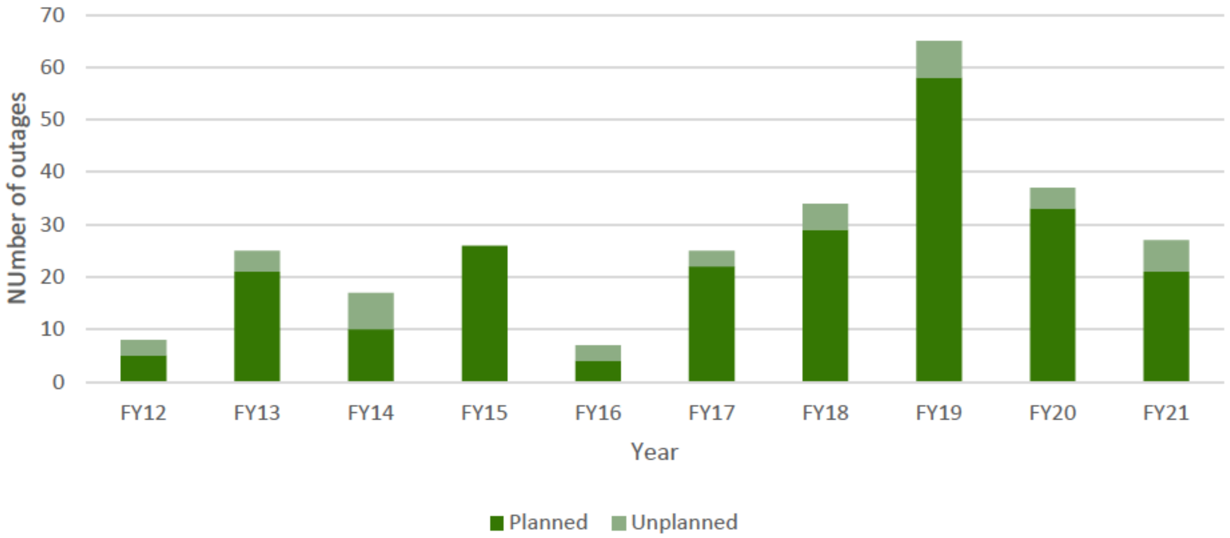

Figure 4 Number of planned and unplanned outages caused by SPUDS

2.4 Consequence of failure

There are three key consequences of SPUDS failure that are aligned to the Risk Quantification Procedure.

2.4.1 Health and Safety

SPUDS are part of the underground network and are primarily installed in the front yards of residential properties in four of the northern suburbs of Darwin. This means the assets are in close proximity to the public. Since the primary mode of failure is oil loss leading to internal flash over, and the older transformers in corroded condition are not arc-flash rated, the assets pose an elevated hazard to safety.

The worst case outcome of a failure, although low probability, is an arc flash resulting in the SPUDS catching on fire or exploding and not being contained by the corroded enclosure. While there have not been any incidents as a result of SPUDS failure, the risk is present and will continue to increase if appropriate mitigating actions are not taken.

Safety is the primary driver, and the risk cost of safety is included in our risk assessment model.

2.4.2 Service delivery

The SPUDS contribute to the reliability performance of the power network. There are an average of four asset failures per year with each failure affecting an average of 13 customers for an average duration of 3 hours. As the impact is predominately on residential customers, the economic impact is approximately $1,200 per outage based on the FY22 VCR and outage records.

Long term maintenance of network reliability, while low individual impact, is the secondary driver for ensuring the condition of the asset fleet is maintained.

2.4.3 Environment

The deterioration mode identified with the SPUDS results in oil leaking into the ground surrounding the asset. Analysis of the outage data found that 33% of outages caused by SPUDS (planned and unplanned) were identified to be caused by oil leaks[2].

The SPUDS contain approximately 50 litres of oil, which will leak into the ground in residential gardens causing localised contamination[3]. Power and Water is likely to incur a cost to clean up the contaminated soil and may also be subject to penalties for pollution.

2.5 Risk assessment

The risk posed by the SPUDS fleet due to the identified type issue has been quantified by applying Power and Water's Risk Quantification Procedure. This procedure has been developed based on good industry practice and takes into account recent guidelines and determinations made by the AER, AS ISO 31000 Risk Management, and other professional publications.

The assessment has been undertaken based on the counterfactual case, that is, on the basis that Power and Water does not undertake any specific measures to address the risk and only addresses faults reactively. Figure 5 below shows the increasing level of risk that would be incurred by Power and Water in the absence of any mitigating actions.

The dominant components are the health and safety impacts as a result of the assets being located within residential properties, and the additional cost (reactive replacement premium) of replacing the assets under reactive fault conditions.

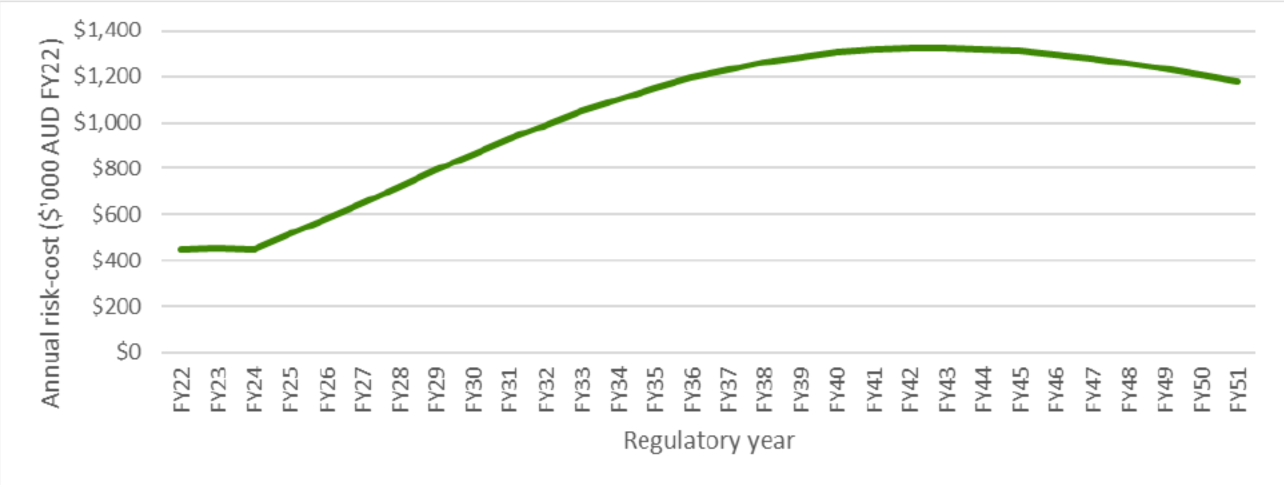

Figure 5 Current risk with base case scenario

The risk is flat from 2021/22 to 2023/24 as this includes the risk mitigation achieved from the current program. The risk starts to increase from 2024/25 when the current program ends. Also, the risk starts to decrease after 2041/42. This is because the modelling includes the assumption that as assets fail, they are

[2] An additional 43% of outages did not have sufficient information recorded to determine the issue being addressed. Hence, the number of defects what included an oil leak is likely to be higher than 33% so our use of this as an assumption in the risk assessment is conservative.

[3] Power and Water reports any spills to the NT Environment Protection Authority in line with requirements of Section 14 of the *Waste Management and Pollution Control Act 1998*

replaced, to continue to provide power supply to customers. Hence, even under this counterfactual case, the asset fleet is renewed over time albeit at a higher (emergency) cost and disruption to our customer supplies for extended periods. However, this renewal is much slower and requires Power and Water to accept increased risk for a prolonged period of time.

The risk assessment demonstrates that there is an increasing risk across the fleet of assets. The reduction in risk that is achieved by different credible mitigation options, along with the cost of the option and any other direct financial cost savings, is used to identify the preferred option in section 4.

2.6 Summary

There are 323 SPUDS on the network, of which 272 will reach the end of their expected serviceable life by the end of the next regulatory period. Of those, 191 will not be treated beyond June 2024.

The SPUDS are exhibiting a common failure mode of corrosion of the enclosure and tank that results in oil loss and eventual failure of the transformer. The deterioration mode is strongly linked to asset age. Preventative maintenance (clearing away debris and vegetation) was found to be ineffective due to rapid build-up, and advanced deterioration of the SPUDS.

Failure of a SPUDS has safety, reliability and environmental risks if not effectively mitigated. Safety hazards are the predominate risk caused by the asset due to the potential for an explosive failure and its location in residential properties, putting them in close proximity to the public.

In 2019 a refurbishment and replacement program was commenced to address the emerging condition issue with the SPUDS installed in the northern suburbs. The current rate of refurbishment and replacement of SPUDS is assisting maintain network performance as measured by the impact to unplanned outages of the asset fleet. As at June 2024, it is estimated that 191 SPUDS will reach end of life by the end of the 2024-29 regulatory period.

Options to address these issues are discussed in section 4.

3. Options analysis

This section describes the various options that were analysed to address the increasing risk to identify the recommended option. The options are analysed based on ability to address the identified needs, prudency and efficiency, commercial and technical feasibility, deliverability, benefits and an optimal balance between long term asset risk and short-term asset performance.

3.1 Comparison of credible options

Credible options are identified as options that address the identified need, are technically feasible and can be implemented within the required timeframe. The following options have been identified:

- Option 1 – Replace on failure. This option proposes to only replace SPUDS once they have failed by undertaking reactive refurbishment or replacement of the assets.
- Option 2 – Targeted replacement: This option proposed to implement a program to replace 4 and refurbish 23 SPUDS each year during the next regulatory period
- Option 3 – Accelerated replacement: This option proposed to implement a program to replace 6 and refurbish 32 SPUDS each year during the next regulatory period

A comparison of the three identified credible options and the issues they address in the identified need is depicted in Table 5 below.

These options are described and assessed in detail in the sections below.

Table 4 Summary of options analysis outcomes

Assessment metrics	Option 1	Option 2	Option 3
NPV ($'000, real 2021/22)	-	13,728	12,792
BCR	-	4.9	4.5
Capex ($'000, real 2021/22)	-	2,970	4,230
Meets customer expectations	○	●	●
Aligns with Asset Objectives	○	●	◑
Technical Viability	●	●	●
Deliverability	●	●	◑
Preferred	✗	✓	✗

● Fully addressed the issue ◕ Adequately addressed the issue ◑ Partially addressed the issue ○ Did not address the issue

Notes:

- The NPV is calculated in comparison to Option 1 (hence Option 1 has a zero NPV) and is calculated over the 30 year assessment period.

- The capex is only the capex required for the 2024-29 regulatory period
- The cost of replacing assets that fail in service is included in the risk quantification, hence there is no capex requirement for Option 1.

3.1.1 Option 1 – Replace on failure

This option proposes to only replace SPUDS once they have failed by undertaking reactive refurbishment or replacement of the assets. This is the counterfactual case as it is not the current practice but represents the minimum possible that can be done by Power and Water.

Reactive replacement incurs additional costs due to the cost of outages, higher on-call labour costs, increased disruption to surrounding areas and potential environmental clean up in the event of oil spills. Additionally, safety risks to the public are higher given the close vicinity of assets to households.

This approach is not aligned with PWC's business objective for operating a safe and reliable network. The increasing replacement volumes recorded in recent years has confirmed the need for a focused investment to proactively address the SPUDS degradation issue.

This approach will therefore result in increasing risk cost due to the higher cost of reactive replacement works, adverse system performance impacts resulting in higher amounts of energy not supplied and elevated public safety risk. The quantified risk-cost of this option has been assessed using the Risk Quantification Procedure, with the outcome shown in Figure 6 below.

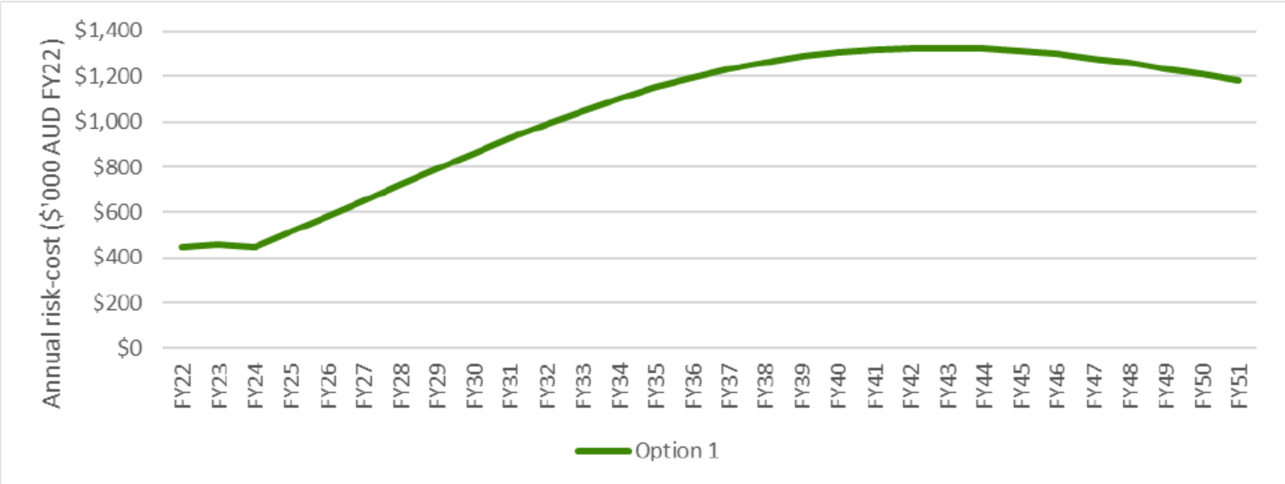

Figure 6 Risk profile achieved through Option 1

While this option is deliverable and technically feasible (it is a reactive activity), it results in deteriorating network performance and increasing safety risk to both the public and workers. This option was assessed to result in the highest residual risk of the credible options, indicating that it does not directly address the underlying need.

This option is not recommended.

3.1.2 Option 2 – Targeted replacement and refurbishment

This option proposes to continue the existing proactive replacement and refurbishment program at a rate of 27 SPUDS p.a. and a total of 135 SPUDS over the 2024-29 regulatory period. The program will target the SPUDS that are identified through normal inspection processes and address the issues through either replacement or refurbishment, as well as upgrading the earthing to the modern standard, according to the timeframes set by the priority assigned to each asset according to standard processes.

The estimated cost for this option is $3.0 million (real 2021/22) for the 2024-29 regulatory period with a NPV of $2.6 million (real 2021/22) . The NPV of the option, including the incremental risk benefit compared with the counterfactual case over a 30 year period, is $13.7 million (real 2021/22) and it has a BCR of 4.88.

The forecast number of units to be replaced and refurbished for Option 2 are shown in Table 5.

Table 5 Forecast scope of work - volume of replacements completed and forecast

Program	2024-25	2025-26	2026-27	2027-28	2028-29	Total
Replacement	4	4	4	4	4	20
Refurbishment	23	23	23	23	23	115
Total renewal	**27**	**27**	**27**	**27**	**27**	**135**

At the end of 2024-29 regulatory period, an estimated 56 SPUDS that exceed their expected serviceable life will be still on the network[4].

The resultant quantified risk-cost of this option is shown in Figure 7 compared to the base case (Option 1). It demonstrates that the proactive targeting of these assets quickly removes risk-cost to the network and is a benefit attributed to this program. The modelling assumes that the refurbishment and replacement rate continues into the subsequent regulatory period to 2030/31.

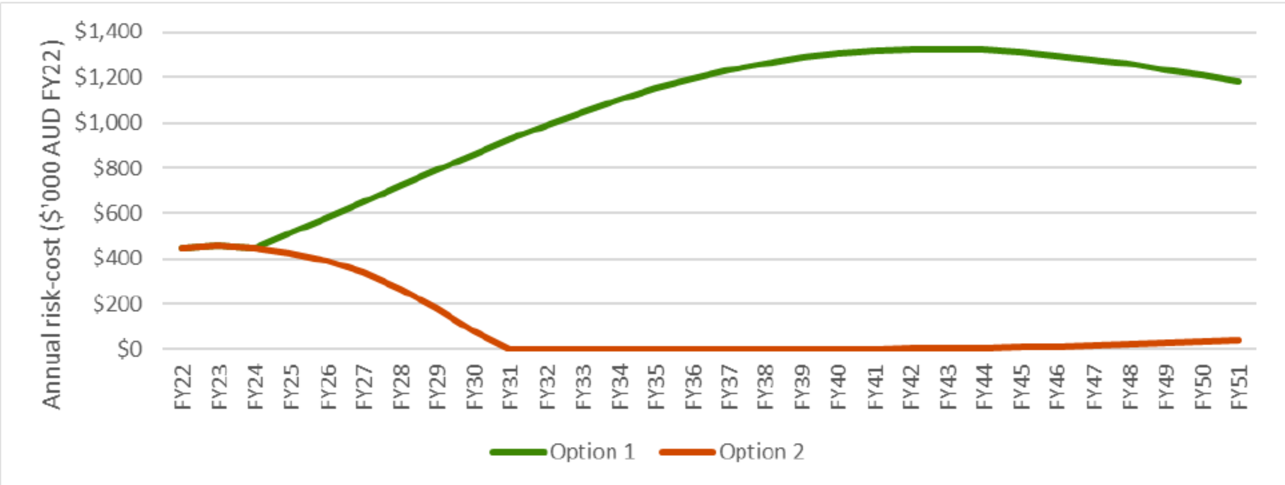

Figure 7 Risk reduction achieved through Option 2

Option 2 has the highest NPV of the options assessed, aligns with the asset objectives and represents a prudent level of risk reduction for the size of the program.

[4] 81 SPUDS will be addressed during the current period, leaving 191 to be addressed in total. This option addresses 135 of those, leaving 56 remaining on the network at the end of the 2024-29 regulatory period.

The proposed refurbishment and replacement volume of 27 SPUDS p.a. has been established based on continuing the program at the current rate. It has also been assessed using the volume of assets forecast to reach end of life using the conditional probability of failure calculation undertaken in the risk quantification model. This volume has been further validated based on an assessment SPUDS of the volumes delivered during the period 2018/19 to 2020/21 period indicate that each year an average of 23 SPUDS will be refurbished and 4 replaced for a total of 27 SPUDS addressed.

This option is recommended.

3.1.3 Option 3 – Accelerated replacement and refurbishment

This option proposes to continue the existing proactive replacement and refurbishment program at an accelerated rate of 38 SPUDS p.a. and a total of 191 SPUDS over the 2024-29 regulatory period. As described for Option 2, the program will target the SPUDS that are identified through normal inspection processes and address the issues through either replacement or refurbishment, as well as upgrading the earthing to the modern standard, according to the timeframes set by the priority assigned to each asset according to standard processes.

The refurbishment and replacement rate will be increased by 11 SPUDS p.a. relative to Option 2 to reduce the network risk more quickly by removing all SPUDS identified to be in deteriorated condition by the end of the next regulatory period.

The total estimated cost for this option is $4.2 million (real 2021/22). The NPV of the option, including the incremental risk benefit compared with the counterfactual case, is $12.8 million (real 2021/22) and it has a BCR of 4.44.

The forecast number of units to be replaced and refurbished for Option 3 are shown in Table 5.

Table 6 Forecast scope of work - volume of replacements completed and forecast

Program	2024-25	2025-26	2026-27	2027-28	2028-29	Total
Replacement	6	6	6	6	6	30
Refurbishment	32	32	32	32	33	161
Total renewal	**38**	**38**	**38**	**38**	**39**	**191**

At the end of the next regulatory period, all SPUDS that exceed their expected serviceable life and are identified to be in deteriorated condition will be removed from the network.

The resultant quantified risk-cost of this option is shown in Figure 7 compared to the base case (Option 1). It demonstrates that the proactive targeting of these assets quickly removes risk-cost to the network and is a benefit attributed to this program.

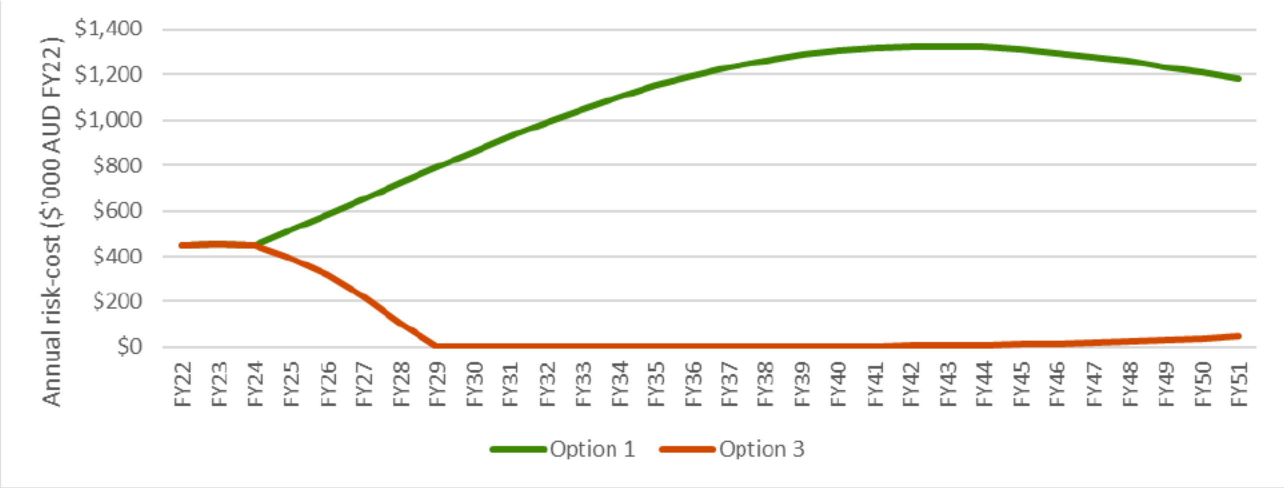

Figure 8 Risk reduction achieved through Option 3

While this option addresses the identified need and represents a more aggressive reduction in risk than option 2. However, it has a higher level of capex than option 2 associated with replacing the remaining population of SPUDS within the next regulatory period, and a lower NPV.

This option is not recommended.

3.2 Non-credible options

Our analysis also identified a number of options found to be non-credible. These options were identified to not be credible for the reasons set out below:

3.2.1 Convert to a three phase network and retire SPUDS – more expensive, negative impact on other projects, not likely to meet the Capex Criteria

Converting to a three phase network approach would impact on the Northern Suburbs Cable Replacement (NS Cable) program which is addressing cable issues in the same suburbs. The priorities of the two programs would be competing and trying to align them would result in a sub optimal outcome for the cable replacement or a significant delay with the SPUDS replacement to align with the NS Cable program, hence not resolving the safety issues related to the SPUDS. Therefore it would result in a suboptimal safety and/or reliability outcome.

Although this option would enable significant upgrades and expansion of capacity to the network, this would be a more expensive exercise due to the incremental additional cost of three phase cables, three phase transformers and other related network changes. These changes are not considered necessary for the safe and reliable operation of the network nor to meet forecast demand. Hence, this option is not likely to meet the capex criteria nor be more efficient than the Options 2 and 3.

3.2.2 Retire or de-rate assets to extend life – does not address the need

Total retirement of the assets is not a credible option as the SPUDS are required for safe and reliable distribution of the electricity network. However, when an individual SPUDS requires replacement or refurbishment, an assessment will be made about whether or not it can be retired or the network can be converted to three phase to meet the current normal design practice.

3.2.3 Non-Network alternatives – does not address the need

Due to the type and function of these assets, there are no non-network alternatives or solutions that can be implemented in place of direct asset replacement with like for like (modern equivalent) assets. When a SPUDS is identified for replacement, Power and Water undertakes an assessment of whether the size or connection points can be changed to reduce cost or to meet future demand most efficiently.

3.2.4 Demand management – does not meet the customers needs

SPUDS service predominantly residential customers and as a result there is little capacity or interest by customers to implement demand management.

3.2.5 Capex/Opex Substitution – does not address the need

Since the driver of this investment is significant corrosion across a fleet of assets caused by the same environmental factors, it is not feasible to substitute capital expenditure with operational expenditure to resolve the risk. Operational intervention to clear around the SPUDS was found to be ineffective due to the rapid build up of soil and debris, particularly during the wet season.

Only capital expenditure to replace or refurbish the SPUDS will resolve the underlying issues.

4. Recommendation

The recommended option is Option 2 – Targeted replacement and refurbishment at an estimated total cost of $3.0 million (real 2021/22) over the 2024-29 regulatory period. The program will replace 20 SPUDS and refurbish a further 115 to effectively manage network risk.

The proposed program is consistent with the NT National Electricity Rules Capital Expenditure Objectives as the expenditure is required to maintain the quality, reliability, and security of supply of standard control services and maintain the safety of the distribution system.

This option mitigates the increasing risks arising from obsolescence, non-compliance with technical code requirements and withdrawal of manufacturer support, whilst retaining recovered units in spares to serve as emergency spares to mitigate reliability impacts as the obsolete relays are transitioned off the network over time.

4.1 Strategic alignment

This program aligns with the Asset Objectives defined in the Strategic Asset Management Plan (SAMP) and Asset (Class) Management Plans (AMP). The capital investment into distribution substations outlined in this program will contribute to the Corporation achieving the goals defined in the boards Strategic Directions and SCI Key Result Areas of Health and Safety and Operational Performance.

The "Power and Water Corporation Strategic Direction" is to meet the changing needs of the business, our customers and is aligned with the market and future economic conditions of the Northern Territory projected out to 2030.

This proposal aligns with Asset Management System Policies, Strategies and Plans that contributes to the D2021/260606 "Power and Water Strategic Direction" as indicated in the table below.

Table 7 Alignment with corporate strategic focus areas

	Strategic direction focus area	Strategic direction priority
1	Customer and the community at the centre	Improve Public Health and Safety
2	Always Safe	Cost Prudency

4.2 Dependent projects

There are no other projects or other network issues that are known to be dependent on the resolution of this network issue and this issue is not dependant on the completion of any other projects.

There is a close relationship between this project and the Northern Suburbs Cables replacement program, however, they are not dependent upon each other and are carried out as separate projects.

4.3 Deliverability

The program maintains a broadly similar level of replacement volumes to the current period. The volume of work is achievable with current internal and contracted resourcing levels available within the NT.

Site access for the removal, installation and refurbishment activities may need to be negotiated on a site by site basis. Easements do not exist for the majority of SPUDS.

Reputational risk needs to be considered when disturbing established residential gardens and council parks. Customer complaints have occurred during previous replacements. Early stakeholder notification and consultation is required to prevent delays to the delivery of the program and costs associated with resolving stakeholder issues.

4.4 Customer considerations

As required by the AER's Better Resets Handbook[5], in developing this program Power and Water has taken into consideration feedback from its customers.

Feedback received through customer consultation undertaken at the time of writing this PBC, has demonstrated strong support amongst the community for appropriate expenditure to enable long term maintenance of the network to ensure continued reliability, maintainability and safety of supply[6].

4.5 Expenditure profile

The SPUDS identified for replacement and refurbishment in the next regulatory period makes up approximately 42% of the total population. Replacement will be targeted based on the outcomes of inspections and priority of defects identified by the field crews. Replacements will typically be with the same capacity SPUDS, however each location will be assessed for load growth and the appropriately sized SPUDS will be installed[7].

Table 8 shows a summary of the expenditure requirements for 2024-29 regulatory period 2025-29 and financial evaluation metrics, respectively.

Table 8 Annual capital and operational expenditure ($'000, real 2021/22)

Item	FY25	FY26	FY27	FY28	FY29	Total
Capex	594	594	594	594	594	**2,970**
Opex	-	-	-	-	-	-
Total	**594**	**594**	**594**	**594**	**594**	2,970

[5] Better Resets Handbook – Towards Customer Centric Network Proposals, Australian Energy Regulator, Dec 2021
6 Darwin Peoples Panel forum, 2 and 3 April 2022
7 D2009/311881 NPR0918 Loading of Single Phase Substations

4.6 High level scope

This program aims to replace 20 SPUDS and refurbish 115 SPUDS during the next regulatory period. The individual assets selected will be based on inspection and testing by the field crews and the assets will be addressed according the to the timeframe specified by the priority assigned to the defect.

Due to the publication of revised standards regarding substation earthing, the scope of each replacement has increased slightly, relative to the current program, so the cost of the program each year is expected to increase. The additional cost will cover small scale excavation with installation of conducting materials, typically in the form of a metal rod, which the SPUD can connect to. Many older assets had a simplistic connection to copper cable, which is no longer in alignment with safety requirements.

Upgrading earthing of the SPUDS will be required in all scenarios considered.

Appendix A. Cost estimation

The forecast expenditure for this program utilises unit cost experienced in this program across 2019/20 to 2021/22 as shown in the table below. This includes an allowance for the earthing system upgrades.

Table 9 Unit costs applied for Option 2 ($,000 real 2021/22)

Capex	Number of units	Unit cost	Total
Total SPUDS Replacement	20	[redacted]	[redacted]
Total SPUDS Refurbishment	115	[redacted]	[redacted]
Total Capex	**135**		[redacted]

Table 10 Breakdown of refurbishment unit cost ($,000 real 2021/22)

Activity	Cost item	[redacted]
Refurbishment	Labour	[redacted]
	Materials	[redacted]
	Stores	[redacted]
Earthing	Labour	[redacted]
	Services	[redacted]
Total Refurbishment cost		[redacted]

Appendix B. Key assumptions

A key assumption is that the historical asset refurbishments and replacements from 2018/19 to 2020/21 can reasonably be used to estimate projected capex and numbers of projects for the 2024-29 regulatory period. This analysis was undertaken during 2021/22 so the information available was not complete.

The probability of asset at EOL resulting in an outage is conservatively set to 15% based on historical data. Historical data indicates that 30% of the SPUDS would fail calculated average number of annual failures during the past 10 years divided by the forecast volumes of assets reaching end of life in 2021/22. This was reduced to 15% to make a conservative assessment and not overstate the risk.

The asset type risk is set to high due to the possibility of an arc fault and the enclosure not being rated to contain an arc fault. The Public Safety Factor is set to 2 (double the probability of each severity compared to the network average values provided by Ofgem) due to the assets being located in residential premises and therefore having a higher probability of members of the public being in close proximity.

The Energy Not Supplied (ENS, measured in MWh) is based on review of the historical outage data to determine the average ENS per outage.

To determine the survival curve parameters, the normal distribution was applied with the sqrt of the mean age (sourced from the CA RIN) as no other improved data was available. This approach is aligned with the AERs Repex model.

Contact

Power and Water Corporation
55 Mitchell Street, Darwin NT 0800
Phone 1800 245 092
powerwater.com.au

PowerWater