Investment Evaluation Summary (IES)

Project Details:

Project Name:	MV Statcom Trial
Project ID:	00921
Thread:	Non Network Solutions
CAPEX/OPEX:	CAPEX
Service Classification:	Standard Control
Scope Type:	A
Work Category Code:	NNNOC
Work Category Description:	Non Network Solutions Network Optimisation Capex
Preferred Option Description:	Install fixed 200 kVAr MV pole mounted capacitor and one 250 kVA portable MV statcom.
Preferred Option Estimate (Nominal Dollars):	$463,296

	18/19	19/20
Unit ($)	N/A	N/A
Volume	1	1
Estimate ($)		
Total ($)	$187,599	$187,599

Governance:

Project Initiator:	Andrew Fraser	**Date:**	02/04/2015
Thread Approved:	Andrew Fraser	**Date:**	19/10/2015
Project Approver:	Stephen Jarvis	**Date:**	19/10/2015

Document Details:

Version Number:	1

Related Documents:

Description	URL
Unit rate estimates	http://projectzone.tnad.tasnetworks.com.au/business-projects/nis-program/DD17SAM/Deliverables/Non-Networks%20Solutions/MV%20statcom%20trial/Cost%20Estimate%20unit%20rates%20for%20Network%20Planning.xlsx
Economic analysis MV statcom	http://projectzone.tnad.tasnetworks.com.au/business-projects/nis-program/DD17SAM/Deliverables/Non-Networks%20Solutions/MV%20statcom%20trial/TasNetworks%20NPV%20Template_MV_statcom2.xlsm

Section 1 (Gated Investment Step 1)

1. Background

Bruny Island 11 kV network experiences peak demand for approximately 70 hours per year. This results in PQ issues to customers on the fringes of the network. The main feeder supplying 80% of the island also experiences poor power factor (less than 0.95) for approximately 50 per cent of the year. Currently TasNetworks is managing the peak demand issue by using portable diesel generation on the island. There is a proposed project currently that will deploy residential energy storage to reduce diesel usage. These solutions address the very short peak periods, however due to the high fuel operating costs is not viable for managing the continuous PQ issues.

In 2013 TasNetworks considered getting a large centralised battery to manage these network issues. The cost for this solution was too high and it was not implemented.

The traditional solution to address the voltage constraint is to connect a second voltage regulator on the island. This would address the PQ issues; however is a high cost solution for a problem that occurs for 70 hours per year. An alternative is to acquire a portable reactive support device that is able to manage voltage regulation, flicker (due to large motor starts or loads), and voltage balancing and power factor correction. When the device is not required on Bruny Island it can be deployed to another location.

1.1 Investment Need

The aim of this project is to:

- Mitigate the power quality issues on Bruny Island in a cost effective way;
- Show that reactive pwoer compensation provides are asl incerase in active power transfer capability to Bruny Island; and
- Determine if portable voltage regulation devices provide a real incremental benefit over traditional power quality solutions.

1.2 Customer Needs or Impact

THis project will ensure residents of Bruny Island have power quality that complies with regulations. the customers will recieve this benefit at a lower cost than if a traditional solution had been used.

1.3 Regulatory Considerations

This project is required to achieve the following capital expenditure objectives as described by the National Electricity Rules section 6.5.7(a):

- Meet or manage the expected demand for standard control services;
- comply with all applicable regulatory obligatons or requirements associated with the provision of standard control services;
- maintain the quality, reliability and security of supply of standard control services; and

- maintain the reliability and security of the distributon system through the supply of standard control services

The most expensive credible opton is less than $5m and therefore does not require a regulatory investment test.

2. Project Objectives

The aim of this project is to trial MV voltage regulation technology as a cost-effective alternative to augmenting the network with fixed voltage support devices such as voltage regulators. The proposed trial will:

- Prove the technology for specified voltage regulation problems;
- Prove the technology is effective on networks with short term load unbalances by injecting reactive power into specific phases only;
- Prove that MV statcoms can improve the power factor on Bruny Island resulting in more active power transfer across the submarine cable.

If the trial is successful, handover of the MV statcom as a business as usual capability, including documentation for design, installation, operation and maintenance, staff training and support and HSE procedures.

3. Strategic Alignment

3.1 Business Objectives

The strategic and operatonal performance objectves relevant to this project are derived from TasNetworks 2014 Corporate Plan, approved by the board in 2014. This project is relevant to the following areas of the corporate plan:

Sustainable Cost Reduction - reducing the initial capital and ongoing costs for reactive support devices on the network, in particular when they are low usage devices and opportunities for relocating the devices to another area of the network is available.

Network Service Performance - Develop a cost effective solution to address the voltage control issues associated with long and heavily loaded feeders and embedded generation.

3.2 Business Initiatives

The strategic key performance indicators that will be impacted through undertaking this project are as follows:

Network service performance – meet network planning standards

4. Current Risk Evaluation

Some customers located on Bruny Island may experience poor quality of supply during peak periods.

4.1 5x5 Risk Matrix

TasNetworks business risks are analysed utilising the 5x5 corporate risk matrix, as outlined in TasNetworks Risk Management Framework.

Relevant strategic business risk factors that apply are follows:

Risk Category	**Risk**	**Likelihood**	**Consequence**	**Risk Rating**
Customer	Customers experience poor power quality	Possible	Minor	Low
Environment and Community	Operation of mobile generators (to address network constraint) results in fuel spill	Unlikely	Minor	Low
Financial	Excessive operational or network augmentation costs to address non-compliant voltages.	Rare	Minor	Low
Network Performance	Under-utilisation of the network due to poor power factor	Unlikely	Minor	Low
Regulatory Compliance	Voltage non-compliance with T.E.C	Possible	Moderate	Medium
Reputation	TasNetworks seen as risk averse and not willing to innovate	Unlikely	Minor	Low

Section 1 Approvals (Gated Investment Step 1)

Project Initiator:	Andrew Fraser	**Date:**	02/04/2015
Line Manager:		**Date:**	
Manager (Network Projects) **or** **Group/Business Manager (Non-network projects):**		**Date:**	
[Send this signed and endorsed summary to the Capital Works Program Coordinator.]			

Actions			
CWP Project Manager commenced initiation:		**Assigned CW Project Manager:**	
PI notified project initiation commenced:		**Actioned by:**	

Section 2 (Gated Investment Step 2)

5. Preferred Option:

The preferred option for this project is to:

- Procure a 250 kVA mobile STATCOM to be normally placed at Bruny Island; and
- Install a 200 kVAR of poletop capacitor permanently on Bruny Island.

This soltion is the optimal mix of dynamic (STATCOM) and stepped (poletop capacitors) reactive support.

5.1 Scope

The scope of this project is two fold:

1. Address specific PQ non-compliances on Bruny Island.
2. Introduce fast acting voltage control into the network.

This scope includes:

- Installing one 200 kVAr 11 kV pole mounted capacitor-
- Purchasing one 250 kVAr Statcom (to be located on Bruny Island generator site south of the neck).

Included in the project is the commissioning and additional schemes with SCADA to optimise the operation of the statcom based on upstream recloser data.

5.2 Expected outcomes and benefits

The preferred solution is the statcom and this would be run as a trial project. This is so TasNetworks would gain a better understanding of statcoms and their advanced control systems and how to coordinate them with other devices on the network such as regulators and generators.

5.3 Regulatory Test

No credible opton is greater than $5 million therefore a regulatory investment test is not required.

6. Options Analysis

The options considered include MV pole mounted capacitors, STATCOM, voltage regulator and hybrid solutions. Each option provides adequate reactive support to address the T.E.C non-compliance.

6.1 Option Summary

Option description	
Option 0	Do nothing. Continue to operate mobile generators on the island to address non-compliant voltages on the island.

Option 1	Install multiple fixed MV capacitors (total 500 kVAr) south of Bruny Island at a new green field site that includes new poles, equipment, controller and modems, installation and some detailed harmonics analysis of the local network.
Option 2	Install a second voltage regulator south of Bruny Island at a new green field site including procuring land and equipment, installation and re-tapping many transformers on the island.
Option 3	Install two 250 kVA portable statcoms at an existing generator connection site at the Bruny Island neck. The statcom would be a portable device fitted out in a shipping container and would only require commissioning tests such as scada and voltage coordination with upstream voltage regulator.
Option 4 (preferred)	Install fixed 200 kVAr MV pole mounted capacitor and one 250 kVA portable MV statcom.

6.2 Summary of Drivers

Option	
Option 0	This option consumes high amounts of fuel when used for many hours per year. In future years with increases in demand on the island, this option will require more annual deployments and higher fuel usage and will not be economically feasible.
Option 1	This option requires 5 capacitor banks to allow fine voltage control south of Bruny Island. It is a lower cost solution compared to a statcom, however capacitors would introduce harmonics onto a network that already has harmonic content. Power factor correction is an additional benefit from this technology. When a new cable is installed it may need to be relocated depending on the new cable route. The existing voltage unbalance during peak periods may be exacerbated by the capacitors.
Option 2	This option would address the voltage network constraint on the island. However when a new cable is installed, the regulator will need to be relocated depending on the new cable route and thus may result in sunk civil and fencing costs and having to re-tap approximately 60 transformers. A closed delta voltage regulator does not balance the voltage unbalance on the network and is an expensive option for a network constraint that currently occurs for 70 hours per year.
Option 3	This option offers optimum voltage control and is capable of managing voltage unbalance by injecting more reactive power onto one or more phases to address the issue . Due to its portability it may be used at alternate sites or for planned outages. As this would be a new technology trialling the advanced control system. This would include co-optimise it with a mobile generator and upstream voltage regulator for optimum voltage regulation on the island as well as power factor correction. This option allows for future expansion of the statcom to include batteries when they are economically viable. This technology provides more precise voltage control as it uses power electronics and is capable of injecting and absorbing reactive power. Statcoms do not contribute harmonics into a network and therefore are suitable for Bruny Island.

Option 4 (preferred)	This option offers same benefits as the option 3. However it substitutes one of the statcoms for a capacitor which means the capacitor provides continuous static reactive power whilst the statcom can address dynamic issues such as flicker, brownouts and additional reactive support during peak periods during holiday periods providing a total of 450 kVAr reactive support.

6.3 Summary of Costs

Option	Total Cost ($)
Option 0	$0
Option 1	$763,480
Option 2	$630,706
Option 3	$520,000
Option 4 (preferred)	$463,296

6.4 Summary of Risk

This project intends to rectify voltage non-compliance by using new technology.

6.5 Economic analysis

Option	Description	NPV
Option 0	Do nothing. Continue to operate mobile generators on the island to address non-compliant voltages on the island.	$0
Option 1	Install multiple fixed MV capacitors (total 500 kVAr) south of Bruny Island at a new green field site that includes new poles, equipment, controller and modems, installation and some detailed harmonics analysis of the local network.	$96,166
Option 2	Install a second voltage regulator south of Bruny Island at a new green field site including procuring land and equipment, installation and re-tapping many transformers on the island.	$85,422
Option 3	Install two 250 kVA portable statcoms at an existing generator connection site at the Bruny Island neck. The statcom would be a portable device fitted out in a shipping container and would only require commissioning tests such as scada and voltage coordination with upstream voltage regulator.	-$25,634
Option 4 (preferred)	Install fixed 200 kVAr MV pole mounted capacitor and one 250 kVA portable MV statcom.	$99,975

6.5.1 Quantitative Risk Analysis

6.5.2 Benchmarking

6.5.3 Expert findings

6.5.4 Assumptions

The economic analysis made the following assumptions:

- submarine cable fails in 2026 and then fixed reactive support device would need to be relocated for new cable route;
- S&C MV statcom cost is $250k plus $50k internal costs
- Pole top capacitor installed is $75,198
- Closed delta voltage regulator cost is $335,900 +cost of adjusting tap position on downstream transformers (cost $34.8K)

Section 2 Approvals (Gated Investment Step 2)

Project Initiator:	Andrew Fraser	**Date:**	02/04/2015
Project Manager:		**Date:**	

Actions			
Submitted for CIRT review:		**Actioned by:**	
CIRT outcome:			