Investment Evaluation Summary (IES)

Project Details:

Project Name:	DSO Framework early stage implementation
Project ID:	02845
Business Segment:	Distribution
Thread:	Innovation
CAPEX/OPEX:	CAPEX
Service Classification:	Standard Control
Scope Type:	C
Work Category Code:	NNNOC
Work Category Description:	Non Network Solutions Network Optimisation Capex
Preferred Option Description:	Implement early stage DSO technology
Preferred Option Estimate (Dollars $2016/2017):	$840,000

	19/20	20/21	21/22	22/23	23/24
Unit ($)	N/A	N/A	N/A	N/A	N/A
Volume	1.00	1.00	1.00	1.00	1.00
Estimate ($)	N/A	N/A	N/A	N/A	N/A
Total ($)	$420,000	$420,000	$0	$0	$0

Governance:

Works Initiator:	Andrew Fraser	Date:	24/09/2018
Team Leader Endorsed:	Andrew Fraser	Date:	24/09/2018
Leader Endorsed:	Stephen Jarvis	Date:	26/11/2018
General Manager Approved:	Wayne Tucker	Date:	26/11/2018

Related Documents:

Description	URL

Section 1 (Gated Investment Step 1)

1. Overview

1.1 Background

There is considerable disruption in network businesses arising from policy, technological and customer change. This is transforming how customers think about, produce and use electricity. This transition to a decarbonised, decentralised and digitalised system is significant and requires significant response from networks. A more decentralised system introduces new participants in the marketplace (e.g. businesses, households, and their agents). The way these participants engage with both transmission and distribution operators will be key to sector transformation.

The extent of this change impacts the business models and future roles for network companies. TasNetworks, along with other Distribution Network Providers (DNSPs), need to continue challenging its current business model, roles, capabilities and skills, and consider their evolution to a Distribution System Operator (DSO). The increased penetration, use and sophistication of Distributed Energy Resources (DER) in Australia's energy industry has given rise to conversations surrounding how best to manage these new distributed networks as the industry moves away from the traditional one-way energy flow to consumers.

The role of the DSO is to ensure reliability and efficiency in the operation of networks/ systems that have DER. This can consist of the maintenance and management of the distribution system, with a key factor being the integration of all elements of the system. The transition of DNSPs to DSOs is being led by Energy Networks Australia (ENA), and is highlighted in their Open Energy Networks (OpEN) framework. The objective of OpEN is to identify:

- System requirements that must be addressed for the optimisation of DER connected to the distribution system; and
- How to mitigate barriers to DER entry, and how best to facilitate this with innovative solutions.

A key step is identifying constraints and converting these to operating envelopes. The operating envelopes provide a bound to which the DER can freely operate, providing customer value through access wholesale and ancillary markets or simply exporting to the grid at feed in tariff rates.

The operating envelopes are sent to a master DER controller in the home via a communications network. The constraints will initially be static, especially in areas with low DER penetration, but will increasingly become dynamic as the penetration increases. This investment is to generate static operating envelopes and communications interface.

The transition of TasNetworks to a DSO requires new technologies, systems and processes, which will bring new challenges around integration, flexibility, and dynamic, real-time network management. Given the DSO transition is in its infant stage, the following needs to be supported:

- Develop a future-state operating model and roadmap towards a DSO, with immediate focus on undertaking the network optimisation role;
- Engage with industry (e.g. the regulator, other DNSPs, retailers and customers) to promote the need and benefits of the DSO role; and
- Enhance capability to optimise and manage a highly distributed energy network.

The establishment of DSOs also creates an elevated need for a new level of interaction and coordination with transmission system operators (TSOs). Despite TasNetworks operating both transmission and distribution

networks in Tasmania, this interaction across the network will be critical to its success.

1.2 Investment Need

DER are growing rapidly in the NEM, driven by increased customer awareness and uptake. This growth in customer uptake of DERs, primarily rooftop PV and batteries, has already resulted in significant impacts to power quality in a number of jurisdictions, challenging existing approaches used by network businesses to manage voltage levels within regulated standards, and increasingly poses risks to network reliability and network security that networks must now manage, particularly with increasing deployment of virtual power plants (VPPs).

Efficiently harnessing VPPs, through a DSO framework, offers a more cost effective approach to managing isolated and/or small loads than building new network infrastructure. This is particularly the case where localised generation and storage can be deployed efficiently. TasNetworks has recently undertaken the Bruny Island pilot, which identified the large opportunity for network investment deferral that this technology could unlock. This trial has demonstrated that coordinated battery storage is twice as effective at reducing peak demand than uncoordinated batteries.

Some of the system and market operation challenges include the lack of DER visibility, causing AEMO difficulty in operational forecasting and balancing the system, and maintaining system strength. In addition, the response of DER to disturbances may also have significant impact on system stability and the high levels of DER may hinder the successful operation of Emergency Frequency Control mechanisms. The increasing share of demand being met by Solar PV will make it more likely that AEMO will need to adjust normal market operations.

Establishing a DSO is critical for technical stability. This will enable cost effective and safe integration with the integrated grid. This includes developing a DSO framework that is based on open standards, extended monitoring, advanced planning and feeder hosting analysis, and the mapping of DER.

The network of the future will see dynamic management of supply and demand through collaborative agreements with customer owned generation. Solar PV and battery storage, both large and small, will be called upon by fully automated DSO platforms sending demand response signals. Charging of Electric Vehicles is likely to be managed in low demand or oversupply periods to balance the capacity of the local network. These changing demands of customers need to be adequately considered and planned for now to unlock their potential.

With opportunities and future market model risks presented, minor investments now will improve the evidence base for the future-state operating model, providing direction in operationalising new services, enhancing TasNetworks capabilities, and advocating for a future network role. These learnings can be shared with other network businesses in Australia to maximise the value of pilot investments.

1.3 Customer Needs or Impact

TasNetworks has undertaken a range of activities to gather feedback, and to understand the issues and concerns that are important to our customers. We have a range of customers, from very large customers directly-connected to our transmission network to large and small customers connected through our distribution network. TasNetworks continues to undertake customer engagement as part of business as usual and through the voice of the customer program. This engagement seeks in depth feedback on specific issues relating to:

- TasNetworks' Business Vision 2025;
- TasNetworks Grid Vision scenarios, including key load, generation and interconnection scenarios;
- New technologies and the future network;
- Customer's preferences on service, price and reliability;
- Regulatory Framework including incentive schemes;

- Forecast expenditure programs; and
- Transmission Pricing Strategies and Methodologies.

Through the engagement, customers have identified that we are meeting most customers' needs from an overall reliability perspective, but for some their needs and expectations are changing especially in regards to safety, restoration of faults/emergencies and reliability of supply. Customers identified TasNetworks needs to provide for their future needs including: affordability, environmentally sustainable, communicative, innovative, efficient and reliable services.

This project directly addresses the use of innovative technologies to improve the management of assets.

1.4 Regulatory Considerations

The regulations are still forming with regard to DSO frameworks. TasNetworks is taking the role of innovating in this space first to assist the development of the regulations.

2. Project Objectives

The objectives of the DSO framework project are:

- Maximise the DER hosting capacity of the network;
- Enable customers to receive the energy supply services they demand in a reliable and safe manner;
- Build a scalable foundation for the DSO;
- Support lowest cost (network and non-network) solutions for customers;
- Provide non-network investment options (e.g. for repex and augex);
- Actively participate and influence the formation of DSO frameworks nationally;
- Support balanced, controlled and optimised real-time network control that integrates DER; and
- Maximise the utilisation of the existing network assets.

3. Strategic Alignment

3.1 Business Objectives

Strategic and operational performance objectives relevant to this project are derived from TasNetworks 2017-18 to 2021-22 Corporate Plan, approved by the board in 2017. This project is relevant to the following areas of the corporate plan:

• We understand our customers by making them central to all we do;

• We enable our people to deliver value; and

• We care for our assets, delivering safe and reliable networks services while transforming our business.

3.2 Business Initiatives

This is a new program of work and aligns with the following business strategies:

The business initiatives that relate to this project are as follows:

- Safety of our people and the community, while reliably providing network services, is fundamental to the TasNetworks business and remains our immediate priority
- We care for our assets to ensure they deliver safe and reliable network services

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

- Price for customers – lowest sustainable prices
- Zero harm – significant and reportable incidents
- Sustainable cost reduction – efficient operating and capital expenditure

The TasNetworks Transformation Roadmap 2025 lists the following for consideration:

- Voice of the customer: We anticipate and respond to your changing needs and market conditions.
- Network and operations productivity: We'll improve how we deliver the field works program, continue to seek cost savings and use productivity targets to drive our business.
- Electricity and telecoms network capability: To meet your energy needs and ensure power system security, we'll invest in the network to make sure it stays in good condition, even while the system grows more complex.
- Predictable and sustainable pricing: To deliver the lowest sustainable prices, we'll transition our pricing to better reflect the way you produce and use electricity.
- Enabling and harnessing new technologies and services: By investing in technology and customer service, we'll be better able to host the technologies you're embracing.

4. Current Risk Evaluation

The risks associated with not proceeding with the DSO framework relate to customer impacts (through limited DER export), impacts to network performance (through uncoordinated VPPs) and the missed opportunities from utilising DER as network supports.

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 as follows:

Risk Category	Risk	Likelihood	Consequence	Risk Rating
Customer	Reduced customer choice in adopting DER technology, by limiting export	Likely	Major	High
Environment and Community	Inability to adopt and support a national transformation initiative	Likely	Moderate	High
Financial	Higher cost of transmission and distribution through poor network utilisation, and building for peak DER export events.	Possible	Moderate	Medium
Network Performance	Poor power quality (e.g. voltage fluctuations) performance increases	Rare	Minor	Low
Regulatory Compliance	Compromise the ability of DERs to be adopted within regulatory standards	Possible	Moderate	Medium
Safety and People	Compromise organisational innovation and cultural change, causing a divergence from national and international best network management practice	Possible	Moderate	Medium

Section 2 (Gated Investment Step 2)

5. Preferred Option:

Establish a DSO framework through funding human resources and technology.

5.1 Scope

The DSO framework will be developed over the full five years of the RCP, however more funding will be allocated to the first two years of the RCP. This results from an immediate requirement to develop minimum static operating envelopes. Additionally, once the framework is established the project will transition into monitoring and continuous improvement of the framework in the final years of the RCP.

The DSO framework will be developed to complement the Open Energy framework, which is currently under development with Energy Networks Australia (ENA). Both the Open Energy framework and TasNetworks DSO framework aim to achieve the ENA's Electricity Network Transformation Roadmap (which was developed in collaboration with CSIRO).

While the Open Energy framework remains a work in progress, a number of interim actions have been recommended to network businesses. These include:

- Understanding DER constraints
- Improving visibility and monitoring of DER.

The DSO framework will also be established to leverage existing TasNetworks capability and learnings, including the Bruny Island project. The Bruny Island project was a pilot that installed an embedded network on the remote island that incorporated solar PV, batteries, and diesel gensets. These assets were actively controlled by Reposit Power as the DER aggregator. The DSO framework will incorporate pilots like this to transition them into TasNetworks BAU.

The scope of the project has been separated into people, process, and technology requirements.

People

The DSO framework will be based around collaboration. TasNetworks staff understand that the transition to DSO is common across all networks and significant work is being done in each network business and by ENA. The project team will establish continuous communications across jurisdictions to ensure learnings are shared across networks. It will be encouraged that collaboration extends to partnering with other networks to undertake, or observe, in each other's DSO projects.

In order to develop the DSO framework, which requires new software and technology capabilities, resourcing will be required to deliver the project. While TasNetworks has the capability internally within the Innovation team and the Operational Technology team, a mixed software development team of internal resources and external resources will be deployed to provide sufficient capacity to deliver the project in a timely manner. Most of this effort will be expended in the initial two years of the RCP.

Transitioning to a DSO will require significant process and cultural change. Cultural change is something that will be funded and addressed over the full 5 years of the RCP. Moving to a DSO model requires new thinking around generation assets, energy management, and network management. It is expected that much of the cultural change will be required to evolve from a current mindset of building network assets to managing generation and load to better utilise existing network assets.

Process

The DSO framework will support long-term operational and business process change. It is expected that most processes will need to be changed to accommodate transition to a DSO. A number of major and immediate changes that will commence being addressed through the DSO framework include:

- Advance the concept, definition and management of active and passive DER
- Develop new planning processes around DER envelopes, embedded networks and microgrids
- Develop and enforce DER connection processes
- Establish, re-develop or refine load/ generation standards
- Manage load/ generation standards
- Rollout standardised implementation processes (e.g. contracts with aggregators)
- Develop common platform to connect to the customer or third-party smart platforms/ inverters
- Identify, prioritise and select where hosting capability and network capacity exists
- Integrate DER management across Planning, Operations, and Asset Strategy areas of the business
- Develop communication channels with customers as the owners of DER
- Integrate with customers as the owners of DER
- Integrate DSO consideration into repex and augex processes
- Optimise EV charging arrangements.

The DSO framework will identify and address many more process change requirements.

Technology

The DSO framework consists of a new planning level software tool to generate static constraints, as well as additional monitoring technology installed in the field. 70 Transformer sites have been proposed to recieve monitoring equipment to provide time series input data into the constraint management tool.

Initially, the new software capability will reside within TasNetworks existing planning tool, which is static, and then migrate into the ADMS, which will manage network assets in real-time (i.e. dynamic). It will be important that software effectively interface with various aggregators' platforms, ideally through standard interfaces.

To develop these additional software components, the team will scale up in the initial years using a combination of internal developer resources and external contractors/ consultants. Once the supporting software is developed, monitoring and upgrades of the software will be required for the remaining years in the RCP.

The DSO Implementation project will require investment in network monitoring to manage and measure the performance of network systems with increasing DER penetration, and will likely also include transformer monitors.

5.2 Expected outcomes and benefits

The capability provided by a DSO provides direct benefits to customers investing in DER through maximising all available network capacity through dynamic management.

At present, the only effective management tool is to limit the amount of DER connected in certain areas, once a certain penetration is reached. This is considered a blunt instrument, and has the effect of limiting generation to accommodate peak generation periods, whilst underutilising network capacity during all other periods.

The DSO approach calculates the amount of network capacity available at regular time intervals and communicates that with DER that can respond accordingly. The outcome is customers can invest and connect greater capacity DER, and maximise export generation revenue, rather than being limited. Customers may be curtailed when the network is congested, but will benefit at all other times.

TasNetworks does not presently limit the export of DER, however requires that systems greater than 10kW are three phase, resulting in many residential customers choosing 10kW or less. As penetration increases, it's likely that TasNetworks will limit DER export to 5kW, in line with the planned network after diversity maximum demand (ADMD), a level at which fairly apportions network access for all customers, but does not provide for efficient network utilistation. There will be other times of the day, particularly when storage is used that could utilise network capacity. The national average PV size is currently 6.5kW* so, limiting DER export to 5kW will on average reduce energy provided into the power system by 1.5kW. Already, 79% of systems installed in Tasmania are greater than 4.5kW, and 28% greater than 6.5kW. Across the forward 10 year forecast period for Tasmania, at approx. 1890 new systems per annum, and with the Clean Energy Regulators energy yield factor of 1.176MWh/kW, a reduction of $9.6M of PV generation will be lost through a blanket limit of 5kW export.

*Clean Energy Regulator (adjusted data) Australian Energy Council analysis Jan 2018)

5.3 Regulatory Test

This project is not subject to the regulatory investment test.

6. Options Analysis

The options considered in this project are to implement the early stage DSO or to do nothing. Given the down side risks in limiting customer DER export, the do nothing is not attractive. As mentioned earlier, the benefits to option one (preferred) are estimated as exceeding $9.6M.

6.1 Option Summary

Option description	
Option 0	Do nothing
Option 1 (preferred)	Implement early stage DSO technology

6.2 Summary of Drivers

Option	
Option 0	
Option 1 (preferred)	This option is driven by the need to begin the incremental investment toward efficient integration of high penetration DER, maximising network capacity and avoiding issues associated with uncoordinated DER.

6.3 Summary of Costs

Option	Total Cost ($)
Option 0	$0
Option 1 (preferred)	$840,000

6.4 Summary of Risk

The risks associated with not proceeding with the DSO framework relate to customer impacts (through limited DER export), impacts to network performance (through uncoordinated VPPs) and the missed opportunities from utilising DER as network supports.

6.5 Economic analysis

Option	Description	NPV
Option 0	Do nothing	$0
Option 1 (preferred)	Implement early stage DSO technology	$0

6.5.1 Quantitative Risk Analysis

A business case will be developed in line with the gated investment process, however early indications suggest that the proposed expenditure will be prudent and efficient.

This project provides long term benefits through the development of key enabling technology allowing a high penetration DER future that allow customers to connect high levels of DER, extract the maximum utilistation from existing network capacity and avoid the issues associated with uncoordinated DER.

6.5.2 Benchmarking

As a new innovation, the DSO domain is yet to be benchmarked. TasNetworks continues to actively participate in the industry efforts to develop a consistent DSO framework. We continue to engage with ENA and AEMO on the OpEN networks consultation. We are also actively sharing the information obtained through the Bruny Island Battery Trial with industry participants. We are involved in follow-on work with various ARENA funded DER projects, and collaborate to share knowledge and accelerate the transition to DSO with other networks and industry participants.

6.5.3 Expert findings

to be updated

6.5.4 Assumptions

to be updated