Network Demand Management Plan

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Authorisations

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Responsibilities

This document is the responsibility of the Network innovation Team, Tasmanian Networks Pty Ltd, ABN 24 167 357 299 (hereafter referred to as "TasNetworks").

Please contact the Network Planning Leader with any queries or suggestions.

- Implementation All TasNetworks staff and contractors.
- Compliance All group managers.

Record of revisions

Section number	Details
0.1	DRAFT circulated for comment
0.2	DRAFT circulated for approval
1.0	Initial Issue
2.0	Major Revision for R19 submission

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Executive Summary

Demand management is an increasingly viable solution for managing network issues. These demand management solutions can be significantly cheaper than traditional network expansion. Demand management is often significantly more risky than traditional solutions. This is compounded by the fact that the properties of these solutions are often unknown.

We aim to remove these barriers using trials to prove the solution in the field. These trials are aimed at reducing the risk and quantifying the benefits of the solution. Trials are often funded through the Demand Management Innovation Allowance (DMIA). Once the trial is complete business as usual applications of the technology may be operated under the Demand Management Incentive Scheme (DMIS) or other capital or operational budgets.

TasNetworks is currently working to deliver two major trials:

- The emPOWERing you Tariff Trial; and
- The CONSORT Bruny Island Battery Trial.

TasNetworks plans to continue building these projects to bring them out of the trial phase. Once the trial phase is complete we can implement them across the network, achieving benefits for all customers.

1. Scope

The demand management plan sets out an alternative framework to avoid (or defer) network augmentation for managing emerging issues on the network.

It describes how TasNetworks will manage demand during high system load conditions to avoid network investment. In particular this includes:

- Control of customer demand;
- Control of customer generation (to address demand issues); and
- Use of energy storage.

This plan also considers how the Demand Management Incentive Scheme (DMIS) and Demand Management Innovation Allowance (DMIA) will be utilised.

2. Strategic alignment

This plan will assist TasNetworks to meet the strategic goals identified in the 2017 TasNetworks Corporate Plan. The relevant objectives are presented in Table 2.

Table 1 Strategic alignment

Strategic goals	Strategic measures	Objectives
Customers We understand our customers by making them central to all we do	Customer net promoter score	Provide customer-centric demand management solutions
	Lowest sustainable prices	Avoid network build for increasing demand
Our Business We care for our assets, delivering safe and reliable network and complementary services while transforming our business	Network service performance maintained	Utilise demand management for network support
	Sustainable cost reduction	Contribute to the business excellence framework, by running the network harder through demand management capabilities

This plan also considers the outcomes of the energy network transformation roadmap. This is shown in Table 2

Table 2 Network transformation roadmap

Milestone	Planned or in progress projects
By 2018, networks with very high distributed energy resources levels are implementing basic NOM functions to procure locational distributed energy resources services for network support, either directly from customers and/or through their agents.	• CONSORT Bruny Island Battery trial • Smart inverter program • Advanced load control trial
By 2018, develop and implement new guiding principles for all Standards Committees for the development and/or review of all future standards to enable the establishment of interoperability / open standards in a timely manner	• Smart inverter program
By 2018, the approaches and protocols to address the management and exchange of information between networks and distributed energy resources participants and allow effective coordination of the system in real time and supports full interoperability are determined. These approaches would be established with the highest levels of security including data management, information privacy and cyber security	• CONSORT Bruny Island Battery trial • Smart inverter program • Advanced load control trial

This plan also is a key part of meeting the goals in our 2025 vision, in particular our key programs:

- Voice of the customer;
- Network and operations productivity; and
- Enabling and harnessing new technologies and services

3. Regulatory considerations

3.1 National Electricity Rules (Rules)

Clause 15.1.1 (d) (3) (ii) of the Rules requires TasNetworks to have regard to future demand side developments when analysing the future operation of its distribution network.

Clause 15.1.1 (f) of the Rules requires TasNetworks to consider the potential for non-network alternatives such as demand side and generation options when undertaking annual planning reviews in conjunction with the transmission planning.

Clause 15.1.1(d) (3) of the Rules requires that where analysis of the expected future operation of the transmission network or distribution network indicates that any relevant technical limits of the transmission or distribution systems will be exceeded; then TasNetworks must carry out an economic cost effectiveness analysis of possible options to identify options that satisfy the regulatory test.

It is noted that the Australian Energy Market Commission (AEMC) has concluded its Review of National Framework for Electricity Distribution Network Planning and Expansion, and has prepared a Final Report and Rules which specify demand management requirements including the need for a *Demand Side Engagement Strategy*.

3.2 Regulatory Test

Promotion of economic efficient investment in the electricity network through the economic assessment of both network and non-network options to address network limitations is supported by clause 15.1.1 (3) of the Rules.

Clause 15.17.1 (b) states the purpose of the *regulatory investment test for distribution* is to identify the credible option that maximises the present value of the net economic benefit to all those who produce, consume and transport electricity in the *National Electricity Market*.

3.3 Electricity Supply Industry Act 1995 (ESI Act)

TasNetworks' license, issued under the ESI Act, for the transmission and distribution of electricity within Tasmania requires the business to comply with the requirements of the TEC to safeguard the interests of Tasmanian consumers with regard to price, quality and reliability of electricity supply.

3.4 Tasmanian Electricity Code (TEC)

TasNetworks as a DNSP must submit to OTTER and publish annually, under clause 8.3.2 of the TEC, an Annual Planning Report that includes a description of feasible options for meeting forecast demand including opportunities for embedded generation and demand management.

TasNetworks as an NSP has an obligation under clause 8.6 of the TEC that the tariff applicable to a customer or an individual contract with a customer connecting to the distribution network provides that the customer must comply with various conditions as set out in the TEC. Those conditions include but are not limited to such things as: access, protection of TasNetworks owned equipment, safe condition, interference to other customers, protection co-ordination, power factor, load balance and limitation of voltage fluctuation. Clause 8.8 of the TEC sets out the information to be included in tariff or individual contract conditions that the customer must supply

on request for the purpose of planning the distribution system. Details include but are not limited to such things as: existing load profile, forecasts of load growth, and anticipated new loads.

3.5 AER DMIS/DMIA for TasNetworks

The AER, in accordance with clause 6.6.3 of the Rules, developed and published a Demand Management and Embedded Generation Connection Incentive Scheme (DMIS) applicable to TasNetworks for the regulatory control period to 1 July 2019. The AER initially applied DMIS to Aurora Energy and has transferred it to TasNetworks through the business merger.

The AER has since released an updated demand management incentive scheme and innovation allowance in August 2017. TasNetworks has based future plans on this draft scheme and anticipates its application to TasNetworks for the regulatory control period 2019-24.

A notable change to this scheme is the application of Demand Management Incentive Scheme to TasNetworks for the first time. This scheme's objective is to provide distributors with an incentive to undertake efficient expenditure on relevant non-network options relating to demand management.

4. The problem

Peak demand generally drives network expansion. Peak demand occurs only for short periods however. This is shown in Figure 1.

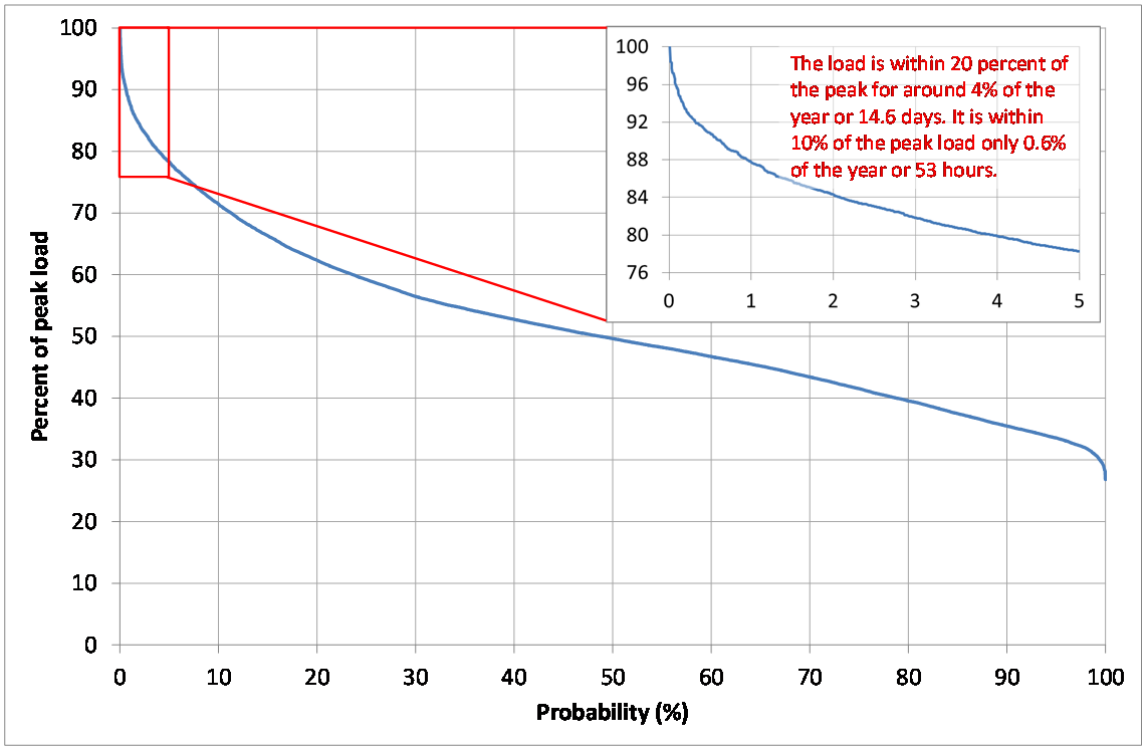


Figure 1: Load in Tasmania in 2014

Load is in the top 10th percentile of peak less than 1% of the time. The effect of the peak demand is compounded by solar generation. This has an effect of 'hollowing' the duration curve. This is because network-supplied energy is substituted during the traditionally low-load midday. This is shown in Figure 2.

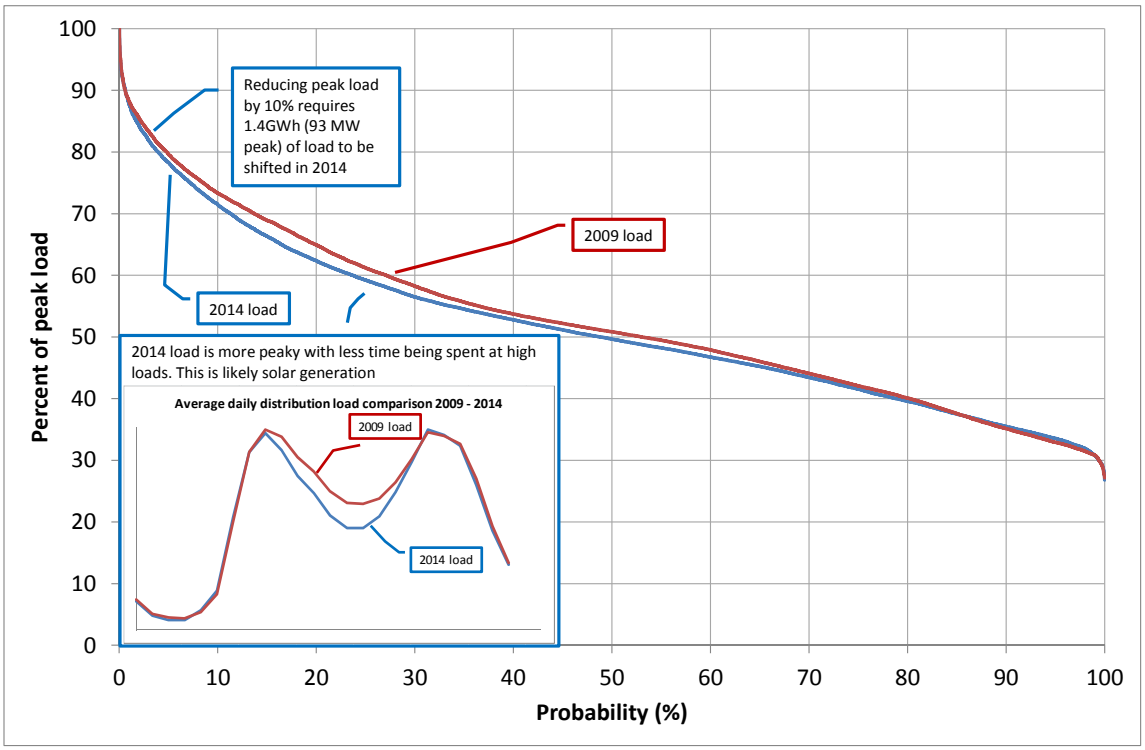


Figure 2: Change in loading patterns over recent years

The daily demand profile in Tasmania is different to other states in Australia in particularly because Tasmania is winter peaking and much of the load is industrial. The average daily demand shape is shown in Figure 3.

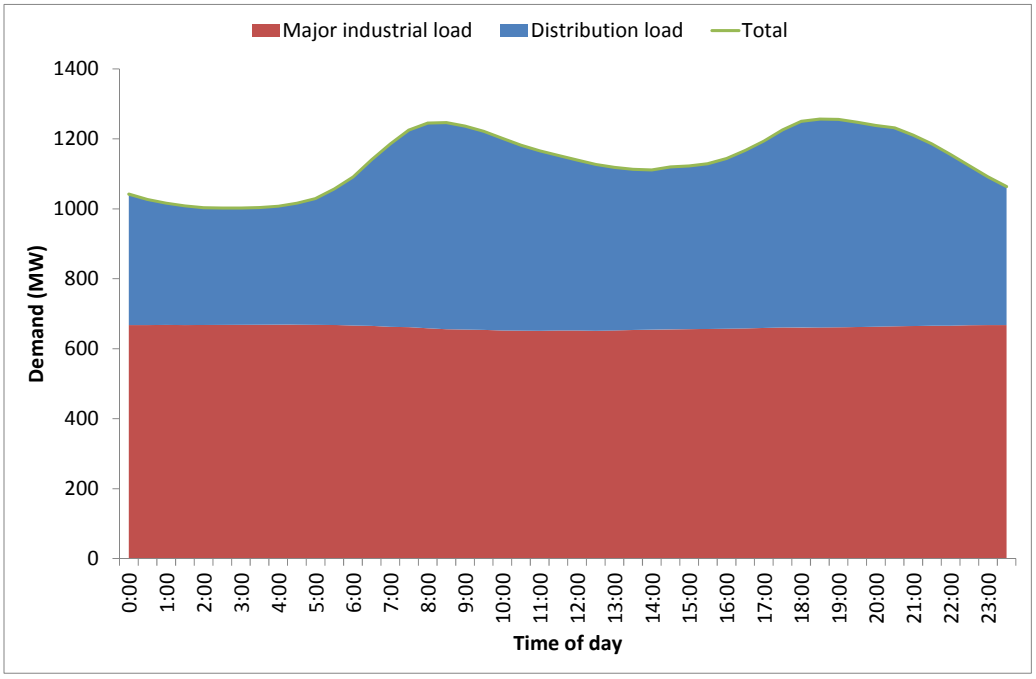


Figure 3: Average daily demand profile

The network generally has a (mostly) constant capability to supply load. Thus the 'ideal' load (from a network augmentation point of view) would be constant – i.e. no variation over a day. This allows the network to be sized exactly to meet average (as well as peak) demand. The real variation in load requires a network that is sized to meet peak, but with much of its capacity unused most of the time.

There are many uncertainties in predicting where and when peak demand will occur. Residential peaks are strongly correlated to the maximum daily temperature. That is, demand increases as temperature decreases. The correlation can be attributed to space and hot water loads.

Peak demand is also related to local developments. When a major change happens in an area (such as commissioning an irrigation scheme) the load growth in the area can be very rapid.

Electric vehicles, particularly if left uncontrolled, could change the nature of demand significantly again. If charging is uncontrolled they will add to especially the evening peak, forcing more network to be built.

As more embedded generation is installed over time network problems are triggered by peak generation rather than just load. This plan considers this issue concurrently.

4.1 What is demand management?

Demand management is in general an attempt at changing the load to more closely resemble the 'ideal' constant load. This is usually performed by:

- Either substituting the energy source of some load around the peak; or
- Shifting load from the peak to other times.

The effect of these methods on the load duration curve is shown in Figure 4.

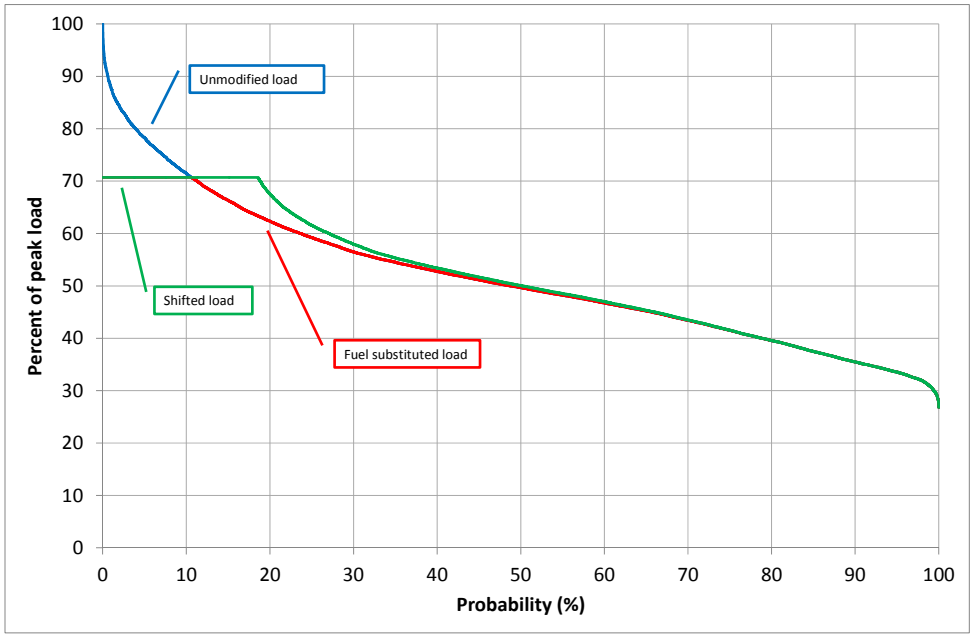


Figure 4: Effect of demand management on load

The effect of this demand management is to reduce the size of the network requirement to that required to supply the new, lower, peak.

4.2 Demand Management options

When considering demand management it is important to consider the target to be managed. For instance demand management could be:

- Targeted at a particular class of customers (such as residential customers);
- Targeted in a particular area (such as a zone substation);
- Targeted at a particular technology (such as residential batteries); or
- A combination of these.

An example is the smart battery program, as discussed in 6.2. This program targets a particular technology (customer batteries) and focuses on a group of customers (residential, but not exclusively).

New demand based time of use tariffs are also a form of residential demand management. Customers reduce their demand at peak times while they act o reduce their energy bills. We have detailed our tariff plans in our tariff structure statement.

Larger commercial and industrial customers usually require a specific arrangement. We have completed a survey[1] of these customers that revealed there was up to 40 MVA of demand that we could manage. The largest potential is from manufacturing load (16 MVA). Load reductions are split between the use of backup generators and the rescheduling or shutting down of manufacturing processes.

[1] See R0000139512

4.2.1 Aggregators

There are two business options to deploy demand management and embedded generation:

1. TasNetworks owns and/or operates the scheme and interacts directly with customers; and
2. TasNetworks engage third parties to provide the required services by dealing with the end-use customers. Such service providers are often referred to as aggregators.

Aggregators take distributed or disparate sources of network support and control them so that they appear to the network as a single source. This means that TasNetworks only needs to have an interface with one provider rather than many small ones. The function of an aggregator is shown in Figure 5

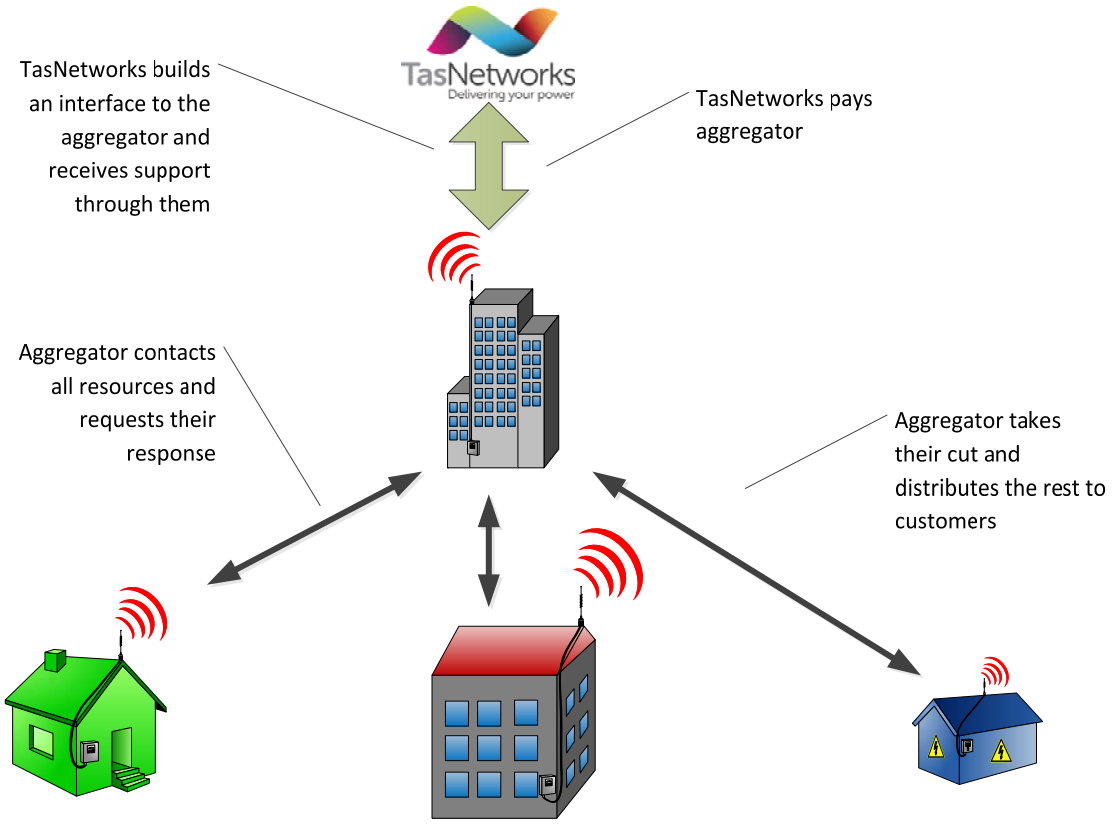


Figure 5: Aggregator function

Aggregators can provide benefit to TasNetworks when there are multiple sources of network support. This is particularly the case for residential support where many small support services must be added to generate a significant or meaningful level of support. Aggregators also share the risk of providing network support services.

5. Current projects

This section provides a summary of some key past projects. These projects are a building block to our future work. Future projects take the outcomes of the past work and integrate it into the rest of our business.

5.1 emPOWERing you trial

The emPOWERing you trial installed 600 advanced meters on residential customers in the Bridgewater area. These meters are used to build our knowledge on how our customers consume energy and what actions we can take to modify their consumption. It also provides better information to our network planners to ensure we build a network that is suited to our customer's consumption. A map of the trial area is shown in Figure 6.

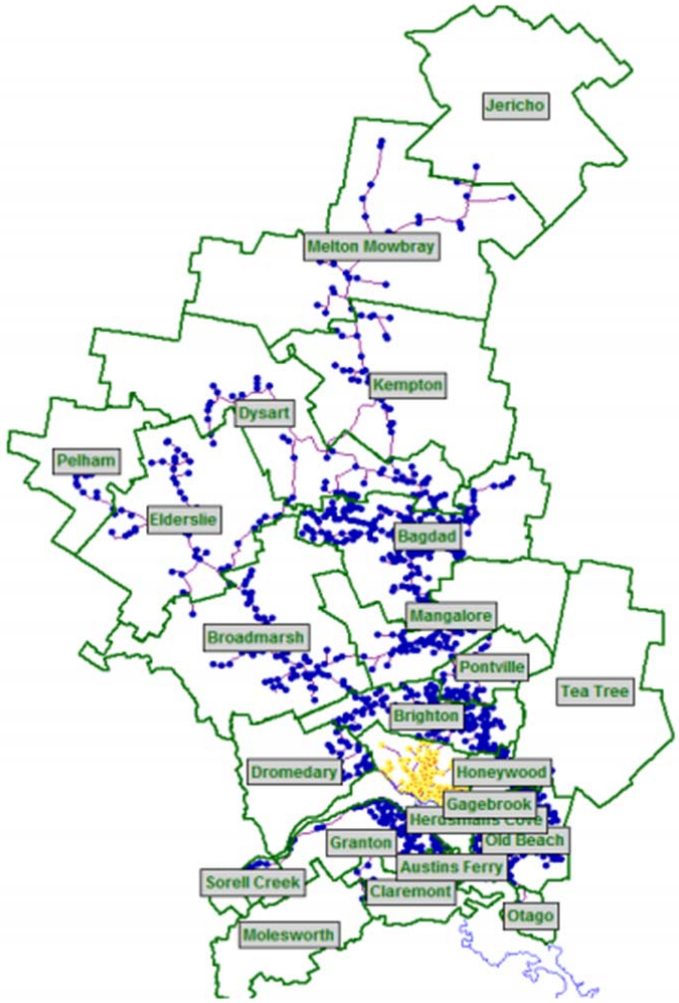


Figure 6 Trial area

The Tariff Trial will support TasNetworks to

- Build social license in relation to tariff reform;
- Gather information and data to inform our Tariff Reform Strategy;

- Understand customer usage patterns and support impact analysis, e.g. understand what the customer's bill will look like (compare old and new tariff structures);
- Provide an opportunity to test customer communication and education processes in relation to pricing prior to mass roll out; and
- Assist customers in understanding tariff reform and build community awareness in respect to changing tariff offerings.

The trial operated in three phases:

- Phase 1, October 2016 to October 2017 – install meters and monitor consumption patterns ("control" data)
- Phase 2, October 2017 to October 2018 – test network tariff(s) and retail tariff offerings
- Phase 3, Review results, undertake analysis and incorporate learnings into the business

The data from this trial has been used to:

- Update how we plan the network to reflect actual usage patterns
- Tune or tariff offerings so they are more attractive to customers; and
- Test our approach to customer engagement and information.

The project costs are as shown in Table 3.

Table 3 emPOWERing you trial project cost

Year	Cost
2016/17	$705,000
2017/18	$720,000
2018/19	$590,000
Total	**$2,015,000**

5.2 CONSORT Bruny Island Battery Trial

The CONSORT Bruny Island Battery Trial is an ARENA funded research project and field trial, which will address how batteries can be used by householders to manage their energy while simultaneously being used to help manage the network. During the trial, up to 40 battery systems will be installed in homes on Bruny Island in Tasmania's south-east. Working in conjunction with rooftop solar generation, these batteries will be coordinated to alleviate congestion on Bruny's undersea power supply cable and to reduce the reliance on costly and polluting diesel generation during peak season, will help to stabilise network voltages within acceptable levels, while simultaneously enabling householders to make optimal use of their own solar power generation.

The CONSORT Bruny Island battery trial tests a customer led future where we can procure network support from customers with batteries. In this trial customers are both consumers of energy and providers of services back to the network. It then tested:

- If this solution is able to solve real network problems;
- How the customers feel and what they do with this technology in their homes;
- What the critical factors to consider in future use of this technology.

The GridSmart battery program (discussed in 6.2) follows on from this project.

There are five project participants in this ARENA funded trial:

- Australian National University;
- University of Sydney;

- University of Tasmania;
- TasNetworks; and
- Reposit Power.

The funding for this project is shown in Table 4

Table 4 CONSORT Bruny Island Battery Trial Project costs

Project Year	TasNetworks DMIA Cash	TasNetworks In-kind	Total project
1/4/2016 to 30/9/2016		$59,855	$1,000,330.00
1/10/2016 to 30/9/2017	$200,000	$84,343	$2,366,792.00
1/10/2017 to 30/9/2018		$39,523	$2,045,799.00
1/10/2018 to 31/3/2019		$16,279	$836,203.00
Total	$200,000	$200,000	$6,249,124.00

6. DMIA Projects in the 2019-2024 revenue period

The AER's Demand Management Innovation Allowance (DMIA) is highly important to TasNetworks to allow us to implement demand management solutions. It allows us to test solutions so we can quantify their costs and benefits. With this information we can accurately plan and implement these solutions elsewhere in the network

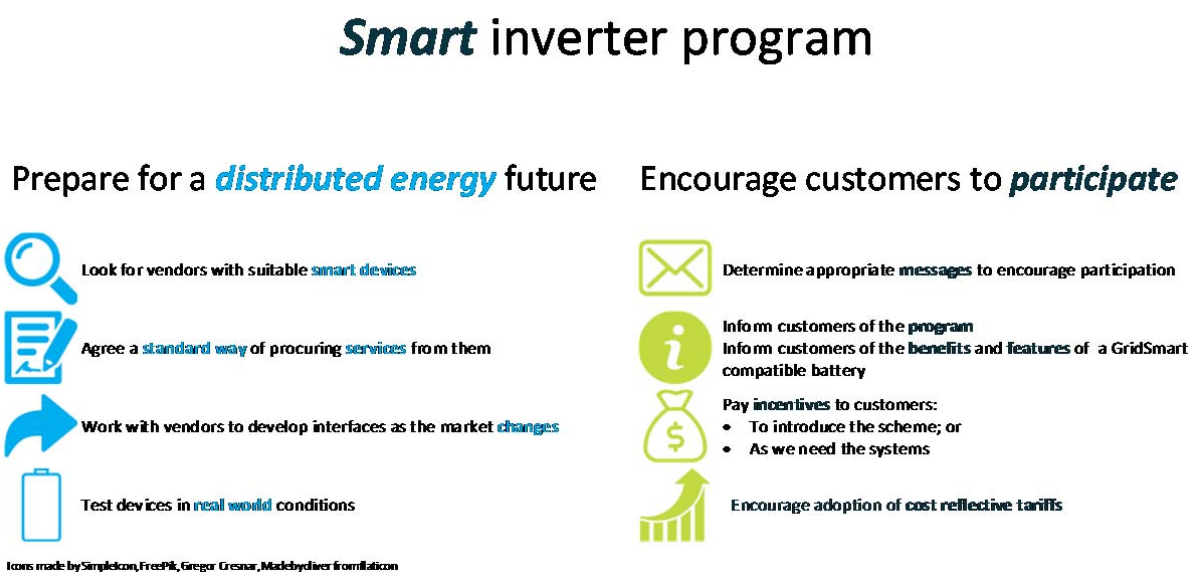
6.1 Resourcing and funding

Generally when implementing these solutions we will aim to:

- Use DMIA funding to fund trials where we cannot be sure of the solution domain or it requires research;
- Leverage the DMIA funding in trials where possible by bringing on external parties and approaching other funding bodies such as ARENA; and
- Convert to a DMIS project when we have enough information to use it to replace a network solution.

We find that we are able to get better learnings on the project by being involved in its implementation (learning by doing) rather than relying on information feedback from external vendors.

6.2 Smart inverter program



The smart inverter program aims to create a way to encourage customers who are considering purchasing a battery anyway to install a smart battery.

To manage the network when the bulk of the energy consumed in it may come from embedded generation we must be able to control it. If we do this correctly we can also use this solution to reduce customer bills when we build less network.

The project will do this by:

- Finding vendors who have platforms that can offer the services we require;

- Developing the appropriate external communications methods to help customers decide if they wish to participate; and
- Offer some small payment for service to initial customers (through vendors).

It is a step on the path to a full business as usual implementation. The key questions we are answering in this project are:

- What sort of services can we procure from customers and how much are they worth to us – especially when we don't control their location?
- How do we work with multiple disparate vendors to solve one problem, what are the key risks?
- What do we need to do to encourage customers to adopt smart devices – what do they want to know about, what are their key triggers?
- How much can we drive down the cost of procuring support?

This project will provide the information we need to lower the entry point of demand management solutions to the point where we can use them more widely. It will lead to future DMIS projects. Our aim is to reduce the cost of customer demand response below the cost of using diesel generation for the same support.

In this trial we aim to procure around 2 MW of network support.

The proposed project cost is shown in Table 5. This project is expected to be DMIA funded.

Table 5 Smart inverter project costs

Year	Cost
2017/18	$50,000
2018/19	$300,000
2019/20	$300,000
2020/21	$300,000
Total	$650,000

6.3 Peer – Peer energy trading trial

Increasingly our customers are interested in peer-peer energy trading. In this model, surplus energy is traded directly with another customer elsewhere in the network rather than with the market pool. Vendors claim several benefits to this approach:

- There is a social benefit to keeping energy local;
- Customers may get a higher feed in tariff than they otherwise would; and
- Because energy is traded locally, TasNetworks should charge a lower network price for these customers.

As TasNetworks, we need to consider how we will manage peer-peer trading on the network. This project aims to answer these questions:

- Is there a change in network power flows when customers are participating in peer-peer trading?
- If there is not, how can we encourage behaviour that reduces network investment?
- If we can demonstrate behaviour that reduces network investment, how do we package these benefits in a way that creates the behaviour we require while not creating cross-subsidies or unintended consequences?

We are currently engaging with a proponent and research institutions with intent of implementing the project over the next year. The project would be a two year research trial.

The proposed project cost is shown in Table 5.

Table 6 Peer-Peer energy trading trial project costs

Year	Cash contribution	In-kind contribution
2018/19	$50,000	$50,000
2019/20	$50,000	$50,000
Total	$100,000	$100,000

6.4 Advanced load control trial

The GridSmart battery program and tariff trial mostly do not consider what the customer is doing behind the meter. This is appropriate in most circumstances, but there are places where a more in-depth approach may be warranted. This would be where we may be able to integrate network requirements explicitly into a process.

There are several examples where this may be the case:

- Irrigation, where there is water infrastructure overlaid on top of the energy network; and
- Embedded networks, particularly when they are run on top of our network.

The key questions answered in this trial are:

- What is the scope for special network tariffs for groups of customers and how would we define them?
- What other services could we procure from groups of customers (such as reliability)?
- What network benefit is there to deep integration in the customer's control systems?

This project will consider the ring fencing and contestability rules by engaging external stakeholders to provide services that are best provided by the competitive market. Similarly behind the meter controls will be implemented by suitable external vendors.

The approximate timing and cost of this trial is shown in Table 7

Table 7 Advanced load control project costs

Year	Cost
2019/20	$50,000
2020/21	$200,000
2021/22	$400,000
2022/23	$100,000
Total	$750,000

7. Demand management Projects in the 2019-2024 revenue period

7.1 North Hobart Transformer Deferral

North Hobart is supplied by two 45 MVA (continuous) transformers. Due to load growth in the Hobart CBD these transformers will become overloaded at some time in the 2024-2029 revenue period, as described in our Greater Hobart area strategy. This project aims to encourage customers to install demand response capability as they do scheduled works. This will build demand response capability so that when the transformers reach their loading limit the demand response capacity to resolve it exists already. This project will include:

- A program to engage with customers in the area to educate them of the opportunities; and
- Targeted incentives to encourage uptake of demand response capacity using a market approach.

The expected budget for this project is in

Table 8 North Hobart transformer deferral project costs

Year	Cost
2019/20	$200,000
2020/21	$200,000
2021/22	$200,000
2022/23	$200,000
2023/24	$200,000
2024/25	$200,000
Total	$1,200,000

7.2 Bruny Diesel generation and battery storage

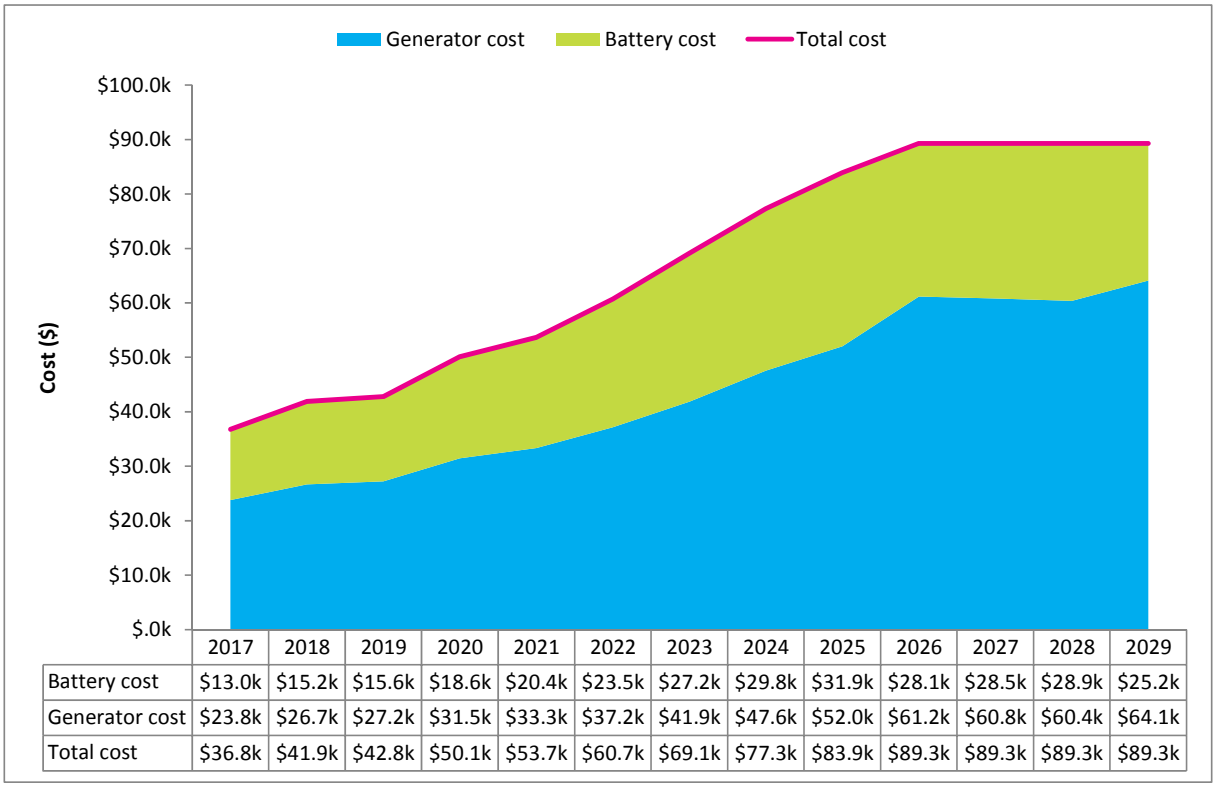
TasNetworks has operated diesel generators on Bruny Island to manage cable load since 2012. This is a more economical solution to replacing the aged submarine cables supplying the island.

With the commissioning of the batteries under the CONSORT Bruny Island Battery Trial the operation costs reduce as the batteries are more cost effective.

The installed battery capacity is used in preference to the diesel generator. Reducing its operation and the number of times it is used each year. Following the 3 year CONSORT Bruny Island Battery Trial project TasNetworks intends to continue using the batteries installed under the project.

Similarly when the smart inverter project becomes operational we hope to engage more batteries as they connect on the island. This will gradually reduce the amount of diesel generation we need.

Figure 7 shows the expected costs for this solution.



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Battery cost	$13.0k	$15.2k	$15.6k	$18.6k	$20.4k	$23.5k	$27.2k	$29.8k	$31.9k	$28.1k	$28.5k	$28.9k	$25.2k
Generator cost	$23.8k	$26.7k	$27.2k	$31.5k	$33.3k	$37.2k	$41.9k	$47.6k	$52.0k	$61.2k	$60.8k	$60.4k	$64.1k
Total cost	$36.8k	$41.9k	$42.8k	$50.1k	$53.7k	$60.7k	$69.1k	$77.3k	$83.9k	$89.3k	$89.3k	$89.3k	$89.3k

Figure 7 Expected costs for Bruny Island battery and diesel generator

7.3 Other potential projects

Other network augmentation projects will be considered for DMIS as the time arises. The outcome of some trials such as the smart inverter program will be critical in determining how many of these are economic. There are other projects in the program of work where a current preferred network solution may be replaced with a non-network option.

8. Financial summary

The forecast spend in this demand management plan is presented in Table 9.

Table 9 Forecast spend

Project	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
CONSORT Bruny Island Battery Trial (DMIA)	$50,000						
emPOWERING you trial (DMIA)	No expenditure in period						
Smart inverter program (DMIA)	$300,000	$300,000	$200,000				
Peer-Peer trading trial (DMIA)	$50,000	$50,000					
Advanced load control trial (DMIA)		$50,000	$200,000	$400,000	$100,000		
Future DMIA trial					$300,000	$400,000	$400,000

Bruny generator/battery (operational demand management)	$42,000	$43,000	$50,000	$54,000	$61,000	$69,000	$77,000
North Hobart transformer deferral (DMIS)		$200,000	$200,000	$200,000	$200,000	$200,000	$200,000
Total DMIA	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000
Total DMIS	$0	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000
Total OPEX	$42,000	$43,000	$50,000	$54,000	$61,000	$69,000	$77,000