



Strategy

Network Innovation

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Responsibilities

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1 Introduction

The electricity industry is undergoing significant change; much of this change is being driven by disruptive technologies. This disruption is now the status quo and innovation is one of the strategies important to ensuring that TasNetworks continues to maximise the benefits of the existing networks to Tasmanian customers both big and small.

Innovation is required from all areas of TasNetworks. The purpose of this document is to focus the attention of TasNetworks on the key innovations that will assist with the evolution of TasNetworks and provide guidance on the use of innovation more broadly across TasNetworks.

TasNetworks wishes to be, and be seen as being innovative. In the context of the national and international power industry TasNetworks is a small player and generally adopts the approach of being a *fast follower* in terms of adopting new technologies. Rather than investing effort in the development of new technologies, we focus our efforts on how we can apply emerging technologies for the benefit of network users. In this way we can manage risk and use our compact networks to best advantage. Energy Networks Australia's recent Network Transformation Roadmap provides a mechanism to innovate collaboratively with other network businesses, recognising many of the issues facing networks are not unique to Tasmania.

Customers have an expectation that TasNetworks will be innovative and the metering and tariff reforms currently underway will be important planks in building the perception of TasNetworks as an innovative organisation. This has been a strong message from customers during the recent customer engagement process.

More recent drivers are the decarbonisation of the NEM and Tasmanian energy security, resulting in increasing large scale renewable connection within the Tasmanian network and potential new Tas-Vic interconnectors. This has introduced a new set of challenges that will require innovative solutions to maintain system security in Tasmania.

The innovation strategy sets the innovation direction and priorities to 2024. This strategy includes innovation objectives to guide overall innovation, as well as specific initiatives to focus attention and resources.

2 Scope

The strategy defines objectives to guide innovation projects at TasNetworks to ensure customer benefits are maximised with the efficient use of resources. The scope of this strategy applies to technical innovation on the transmission and distribution networks specifically. The strategy also defines a targeted innovation work program for implementation until 2024.

The Innovation Strategy scope includes research and development, technology trials and innovation adoption projects for network assets.

3 Strategic Context

The TasNetworks' vision to be "trusted by our customers to deliver today and create a better tomorrow" sets a direction to develop a network for the future. The TasNetworks business plan 2017-18 identifies the need to position the business for the future. The Network Innovation Strategy seeks to contribute to the delivery of this vision, by utilising both mature and emerging technology to the benefit of both TasNetworks and its customers.

The Network Innovation Strategy will assist the implementation of the following TasNetworks strategic initiatives:

- Customer Net Promoter score: through demonstrating innovation to customers;
- Lowest sustainable prices: by developing efficient network alternatives;

- Network service performance maintained: by developing new technologies to improve performance in poorly performing areas;
- Sustainable cost reductions: improving network utilisation through new technologies and information; and
- Efficient field and business services works delivery: leveraging technology to improve works efficiency.

3.1 Transformation Roadmap 2025

TasNetworks has developed a Transformation Roadmap 2025 to guide strategic activities required to transition the business to cater for the future needs of our customers. The Network Innovation Strategy seeks to develop key capabilities in alignment with the Transformation Roadmap 2025.

TasNetworks has contributed to the development of the ENA's Network Transformation Roadmap (NTR) that outlines a plan to transform energy networks by 2025. The NTR outlines multiple work streams that must be developed to ensure networks transition sustainably through the disruption facing the industry. The Network Innovation Strategy is influenced by the NTR and will align activities to ensure TasNetworks is actively contributing to progressing the NTR.

4 Environmental Drivers

The need for innovation is heavily influenced by external factors. The key drivers are:

1. Price increases and changing customer expectations;
2. Distributed Energy Resource uptake; and
3. ;
4. New Power System security considerations from changing Generation mix.

4.1 Price increases and customer attitudes

Customer attitudes towards the wider electricity supply industry, and specifically network businesses, have shifted in recent years. This is largely attributed to past price increases coupled with technology changes which provide customers with attractive alternatives to the traditional electricity supply model. Tasmania has been shielded from recent retail price rises seen on the mainland, due in a large part to the reduced network charges from July 2017. Despite this step change, the drive for value from the network remains strong.

Customers with trade exposure, facing continuous pressure to reduce costs, are increasingly looking for more options to achieve efficiencies.

Customers are now expecting a level of innovation in all of their services, and TasNetworks' surveys show customers rank innovation highly.

4.2 Distributed Energy Resource uptake

Solar photovoltaic (PV) technology continues to be adopted by customers. Battery storage has now started to be adopted by customers, with two batteries per week being connected in Tasmania. These technologies together have the potential to fundamentally shift customers' requirements of a network: customers will want to draw energy from the network at times of low prices, but use or export their stored energy at other times. Some customers see battery technology as an opportunity to leave the grid. This change of usage introduces technical and economic challenges to the network. It also presents TasNetworks with opportunities not previously available.

4.3 Power system security under changing generation mix

The national push for energy security following the recent events in South Australia during summer 2016/17, as well as decommissioning of Hazelwood power station in March 2017 has resulted in renewed interest in Tasmania providing an increased level of renewable energy into the national market. Similarly, the extended Basslink outage in 2016 and resulting energy security enquiry recommended an increased level of on-island generation to manage shortfalls in hydro in-flows during droughts. This is driving a change to the mix of generation in Tasmania with new large scale and wind projects with at least 300MW of new wind connection applications received. An additional 300MW of solar and wind energy projects are being investigated, as well as Hydro Tasmania studying increased capacity from existing generators and significant investments in pumped storage. Additional interconnectors to Victoria are also being considered.

These increases and changes to generation mix will result in system security challenges that must be managed to ensure lowest sustainable costs to the market.

5 Network Innovation Objectives

Network innovation objectives have been revised for 2017 to focus the innovation activities at TasNetworks. The objectives align to the TasNetworks Strategic objectives, key business risks and current strategic initiatives. The innovation objectives are:

1. Facilitate Network Transformation;
2. Increase network utilisation and efficiency for planning, asset management and operation; and
3. Demonstrate innovative outcomes for customers.

5.1 Facilitate Network Transformation

The services offered by the network to customers must continue to transform and respond to changing customer needs. The Network Innovation strategy focusses effort into core innovation activities that progress TasNetworks along its transformation journey. Specifically, increasing the technical hosting capacity of renewable generation in the network will allow a transition to a customer centred energy system. Similarly, the pricing reform required to ensure this transition is economically sustainable must also be progressed.

5.2 Increase Network Utilisation and Efficiency

A cost effective and technically efficient network is essential to ensure sustainable pricing of network services. Many new and innovative technologies can address existing and emerging issues. The key network issues facing TasNetworks are:

- localised peak demand and voltage issues;
- asset management, fault and emergency costs;
- the risk of asset stranding from uncertain load growth;
- expensive to maintain edge-of-grid assets (such as SWER networks);
- availability of accurate and timely distribution network data for decision making purposes;
- network constraints; and
- localised lower reliability performance.

5.3 Demonstrate innovative outcomes for customers

Demonstrating TasNetworks is providing innovative solutions to customers is vitally important in buying a social licence to operate and prosecute the strategy. Tariff reform is a key activity required to achieve sustainable and predictable pricing, and closely linked to DER adoption for residential and small business customers. For tariff reform to succeed, customers must see value in the network, and innovative solutions must be demonstrated in concert with pricing reform.

6 Network Innovation Implementation

6.1 Network Innovation Priority Areas

Network Innovation Priority Areas have been defined to prioritise network innovation activities, ensuring resources are utilised efficiently and the problems of the business are solved.

The priority areas are a combination of current business strategic initiatives and top business risks:

- 1) Bushfire mitigation;
- 2) Increasing DER hosting capability of distribution network;
- 3) Increasing large scale renewable energy hosting capability of transmission network;
- 4) Works Service Delivery operational capability increase;
- 5) Vegetation management; and
- 6) STPIS/ Reliability improvement.

6.2 Innovation Implementation approach

Network innovation is structured as three distinct streams to address innovation across different business areas and drivers, and the progression of innovation from research through to adoption. The three innovation streams are:

1. Research and Development
2. Specific technology trials
3. Adoption

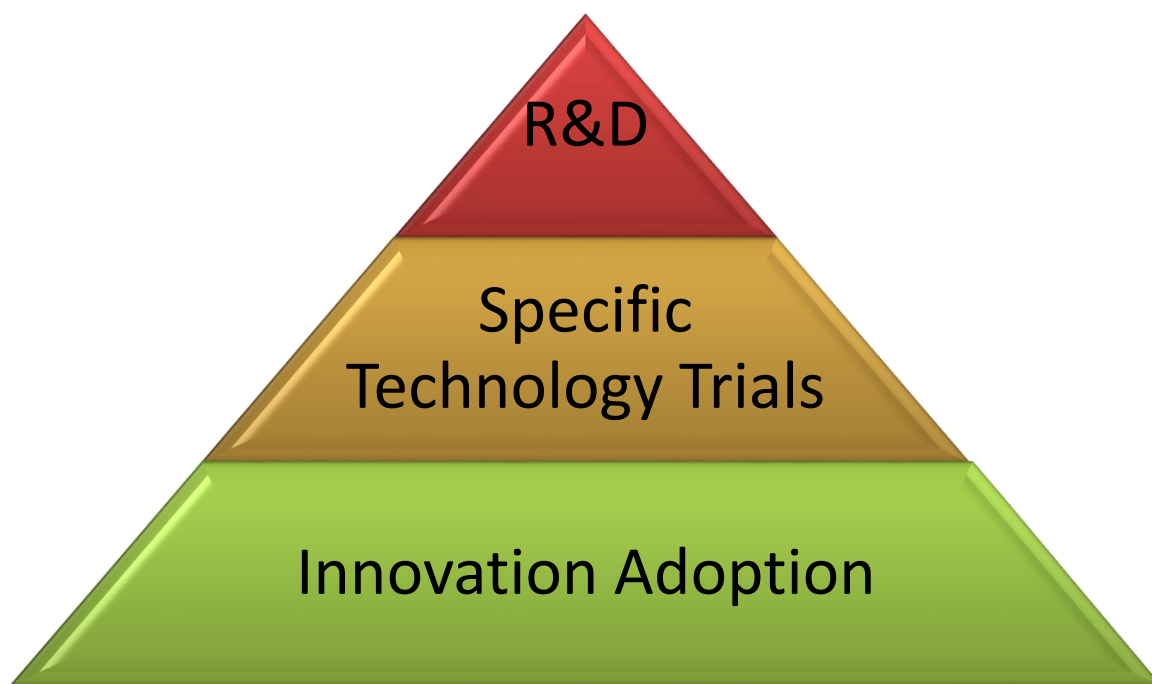


Figure 1- Innovation Approach

The innovation approach triangle represents the focussed R&D efforts on a small set of issues, through to the vast innovation adoption activities underway at present and into the future.

6.2.1 Research and Development

The research and development stream recognises the importance of research and development for progressing TasNetworks towards its vision. At present the industry is progressing significant research projects focussed on integrating renewables, both large and distributed in the network. Collaboration is important and TasNetworks is collaborating with ARENA, ENA and API through multiple streams of research. TasNetworks is an active contributor to this critically important work.

The Demand Management Innovation Allowance is often utilised for research and development as well as Specific Technology trial projects.

6.2.2 Specific technology trials

Where research identifies suitable technologies for broader trials, TasNetworks will undertake specific larger scale trials to test the real world application. An example of this is the CONSORT Bruny Island battery trial project, which combines research and real world application. The path outlined by the ENA's Network Transformation Roadmap outlines many areas that will require larger scale trials to further develop the concepts.

6.2.3 Adoption

The adoption stream recognises the multiple technology opportunities available to TasNetworks that may have been tested elsewhere and can be introduced into TasNetworks easily to achieve asset and works management efficiencies. Examples of this include the introduction of composite poles, as an alternative to wood poles. Adoption innovation usually has less risk, and moves towards faster rollout of technology to business as usual. Adoption innovation is self-funded through lower whole of life costs in existing programs.

Innovation adoption is implemented as a business as usual function across all asset streams and detailed in individual asset management plans.

6.3 Network Innovation Framework

The Network Innovation Framework outlines a common model for network innovation at TasNetworks. The framework allows anyone to innovate by providing a framework with processes, documentation and governance to streamline outcomes.

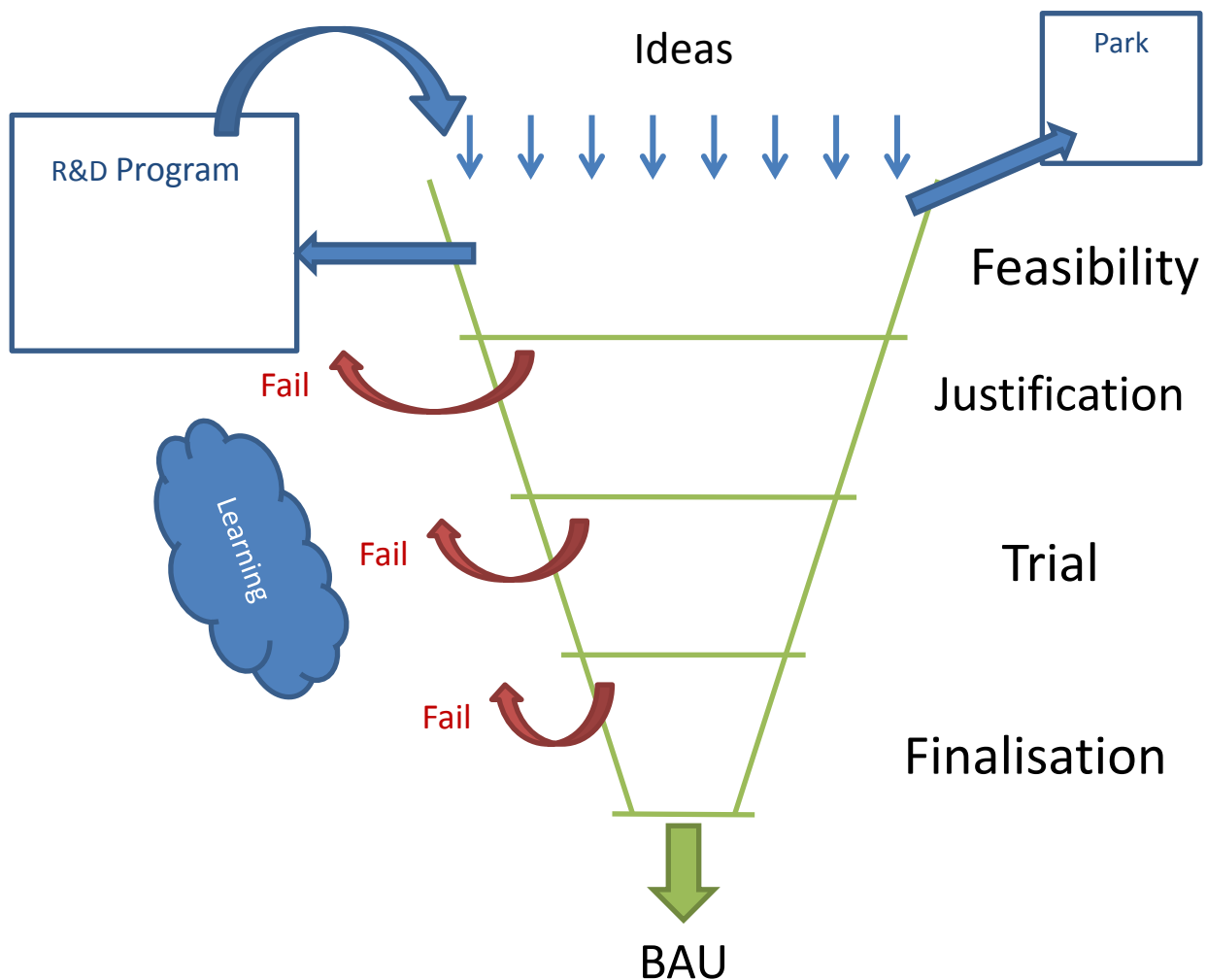


Figure 2 Network Innovation Framework

The objectives of the network innovation framework are:

Ensure efficient and aligned innovation

The network innovation framework is owned by Network Innovation Team Leader and operates across Strategic Asset Management and Works and Service Delivery. All innovation projects follow the framework to ensure that innovation is as efficient and effective as possible by coordinating, prioritising and learning from innovation projects.

7 Network Innovation Initiatives

TasNetworks has selected the following initiatives to achieve the Network Innovation objectives. Each initiative has alignment with one or more of the objectives. The following program has been designed to be concise, achievable and flexible in response to technology and market changes.

7.1 Research and development

Research and development tasks focus on addressing longer term trends and issues affecting the electricity network and customers. The research activities are always a collaborative effort, leveraging external expertise, resources and funding where appropriate.

Further detail of the research and development projects can be found in Appendix A

- ARENA/industry collaboration research projects
- ENA Network Transformation Roadmap (ENTR)
- Peer-peer energy trading
- Irrigation customer demand management
- Wooden pole soft rot detection
- Threatened bird studies

TasNetworks is also a member of ENA's Australian Strategic Technical Program research funding organisation, contributing and benefitting from broad research across the industry.

7.2 Specific technology trials projects

The specific technology trials are larger scale projects demonstrating or proving concepts as well as testing operational and customer experience.

7.2.1 emPOWERing You Trial

The empowering You trial is an initiative to investigate customer acceptance of demand based tariffs. The initiative is working with 600 TasNetworks customers and testing how they respond to the different pricing frameworks. This project is expected to conclude in 2019.

7.2.2 Distributed Storage aggregation

Distributed storage is an increasingly promising tool to manage the network. TasNetworks is presently implementing the CONSORT Bruny Island Battery trial project to test the use of battery aggregation to manage peak demand issues. Following the early successes of this project, TasNetworks is scoping a broader project to capture all storage to ensure it is "smart" with the future capability to aggregate control to manage future network constraints. This project, known as GridSmart Storage is aimed at capturing the expected influx of storage following the end of the premium feed in tariff from January 2019. TasNetworks envisages further developing this line of innovation in subsequent years to explore the requirements of the Distribution System Operator role, through further trials.

7.2.3 Low voltage network monitoring

Low voltage monitoring is key to enabling the increased hosting of distributed energy resources. Limits will be reached in the distribution network from reverse flows in a difficult to predict fashion, and specific monitoring will be required ensure the system does not breach the technical limits. The most efficient

approach to achieving network visibility is likely to be a balance between advanced metering and monitoring at other points in the network such as at distribution transformers.

7.2.4 Fast Frequency Response

TasNetworks is working with Hydro Tasmania and ARENA to explore the use of super capacitors to stabilise system frequency within the state. The technology can allow increased large scale renewable energy penetration on the Tasmanian network. The super capacitor provides short term real power injection following the loss of other generation, stabilising the system frequency until other generation reserve comes online.

7.2.5 Demand Response North Hobart Transformer deferral

The revised Demand Management Incentive Scheme provides up to 50% bonus for demand management expenditure. TasNetworks has identified a project to defer the 11kV to 110kV transformer augmentation at the North Hobart zone substation. The project has been identified in late 2017 following the review of the revised Demand Management Incentive Scheme (DMIS), and the concept is being explored at present. This project provides an opportunity to test transformer level augmentation deferral.

7.2.6 Sensor Development

Internet of Things (IoT) technology has potential to improve the efficiency of operating the network as well as provide valuable asset management information. TasNetworks is exploring use of IoT technology for managing the network through a pilot project focussing on a limited number of use cases. The project is likely to expand through 2018 with more use cases added into 2019. The communications network options required for enabling IoT is also being considered.

7.3 Innovation Adoption

Innovation Adoption is the adoption of existing technologies applied to the TasNetworks network. Adoption activities are detailed in the relevant asset management plan or defined by the works and services strategic road map (references). The risk and effort required to adopt technology is far less as the technology has achieved a level of maturity elsewhere, and there are learnings from other network businesses that can be leveraged. The network innovation framework assists TasNetworks introduce these technologies as efficiently as possible.

The adoption activities underway and planned equate to approximately \$8M worth of expenditure per annum from 2019 and are listed below:

- Composite pole and cross arms;
- Pole staking and rebutting alternatives;
- Non-destructive pole testing;
- Pole fire-resistant paint;
- Enclosed air-break switches;
- IEC 61850 protection and control standard;
- LiDAR and aerial inspection techniques;
- Distribution Automation (Fault location, isolation, and restoration); and
- Dynamic reactive power support.

Further details of the above innovations are found in the relevant asset management plans.

8 Resourcing

The Network Innovation Strategy will be resourced across TasNetworks within the current business structure and resourcing levels. The increasing complexity of technology impacts on the skills and capability required to manage it. There is an increasing focus on digital control, monitoring and communications in the distribution network requiring a greater level of skills in this area.

The Network Innovation Team focusses on supporting the research and development program as well as implementing technology specific trials. The Network Innovation team has recently increased its technical capability to meet this complexity. The rest of the business supports these programs within the existing resource levels.

Innovation adoption is implemented through the Network Innovation framework and end-end works program and driven by asset experts in each respective area. The innovation adoption activities represent a large value of work, but become less resource intensive as it becomes business as usual.

9 Risks

The major risks in delivering this strategy are shown below in Table 1:

Table 1 Network Innovation Risks

Risk	Description	Mitigation
Technology	Unproven technology on Tas. Network may fail, or cause project delays	The approach is to conduct trial phase, including lab testing, and then implement in full if successful. Learn from other utilities and forums. Risk sharing contracts. Business acceptance of appropriate risk.
Resourcing	The appropriate skills and resource availability is essential to success	Limit the breadth of Innovation program to ensure resources are not too thin. Obtain specialist external support as required Collaborate widely across the industry to leverage external capability where gaps exist
Ongoing business buy-in	There is a risk that the technology won't be accepted by the business	Collaborate and engage across the business. Ensure technology champions are identified early in projects, and maintain close relationship throughout. Engender confidence in the rest of business through a high standard of project implementation.

10 Budget

The Innovation Strategy will be funded within the existing capital and operating budgets. In some cases, budgets have already been obtained in the current regulatory periods, or proposed within the coming distribution regulatory period.

The budget for innovation activity is shared across the specific Network Innovation budget and all other areas of investment. The Research and Development work is predominantly operational funding, with the majority coming from the Network Innovation budget. Specific programs such as the threatened bird studies are contained within their own specific programs.

For clarity, the specific Network Innovation funding includes work category codes DMIAL, NNCMO, NNCCMC, NNNOC and NNNOC, and these categories represent the majority of Research and Development and Specific Technology Trial work.

Table 2 Network Innovation Budget (16/17 \$s)

Budget	17/18	18/19	19/20	20/21	21/22	22/23	23/24
Network Innovation Research and Development	267	462	250	250	250	250	250
DMIA	379	379	379	379	379	379	379
Specific Technology Trials	1,253	1,279	555	563	566	573	582
Total	1,899	2,120	1,184	1,192	1,195	1,202	1,211

The funding described in Table 2 does not include the Innovation Adoption activities which total approximately \$8M in expenditure from 2019.

Appendix A- Research and Development projects

ARENA/industry collaboration research projects

TasNetworks is collaborating with industry and research organisations on several projects, focussed on enabling further DER and large scale renewable penetration. This activity is ongoing, and expected to continue in the short to medium term. TasNetworks has key capabilities and experience to assist with these research activities. The current committed projects include research on distribution state estimation, solar and PV output forecasting, and inverter testing and modelling.

ENA Network Transformation Roadmap (ENTR)

The ENTR outlines several research priorities; TasNetworks is committed to collaborating on the ENTR in a coordinated manner with other partner networks. TasNetworks expects to add value to this process by implementing a large project following from the learnings of the CONSORT Bruny Island Battery trial project.

Sensor development

Internet of Things technology has lowered the cost point of sensor technology to allow the proliferation of low cost, low power sensors to monitoring the electricity network. TasNetworks is partnering with a local IoT firm to develop sensors for the Tasmanian electricity network.

Peer-peer energy trading

TasNetworks is working with one its customers to investigate the operation of a peer-peer energy trading platform across the distribution network. The technology raises regulatory, pricings and policy issues, and TasNetworks is current working with several research organisations to develop a scope to progress these aspects of the trial. The trial is anticipated to go for 12 months from March 2018.

Irrigation customer demand management

Irrigation customers represent a significant portion of electricity peak demand in some regions of the network. A research project has been identified to progress the opportunity to reduce the peak demand of irrigators and neighbouring loads. The project will consider pricing structures, network support services and on farm efficiency. The project is being scoped at present and expected to begin post 2019.

Power pole soft rot

TasNetworks is working with biologists at the University of Tasmania to determine the types of fungus that contribute to soft rot in Tasmanian wood poles, as well as test the relative effectiveness of non-destructive pole testing in detecting soft rot. The research is being shared with ENA member organisations to assist the industry broadly.

Threatened bird studies

TasNetworks is working with the University of Tasmania to study the patterns of Wedge-tail Eagles to better understand the particular behaviours of Tasmanian eagles. The outcomes of the research are being used to

Network Innovation Strategy

improve mitigation measures to help protect this endangered species. More details can be found in the TasNetworks Threatened Bird Strategy.