# Renewable Energy Transition Plan

*for*

# *Torres Strait Regional Authority*

2021–2050

TSRA
www.tsra.gov.au

ener-g

Ener-G Management Group
Suite 1/204-206 McLeod Street, Cairns North QLD 4870
07 4041 0972
info@ener-g.com.au

*Front cover photo: John Rainbird TSRA*

# Contents

# 1 Executive Summary

Ener-G Management Group has investigated the current electricity supply arrangements and potential future opportunities to develop a Renewable Energy Transition Plan for the Torres Strait. This study has explored renewable energy technologies, the regulatory environment, social, cultural, and economic factors, barriers to implementation, and potential funding sources.

The authors have developed a draft implementation plan for consultation with key stakeholders and interested parties to guide and support the transition to a renewable energy future for Torres Strait communities.

At the core of the implementation plan is a recommendation to establish a key stakeholder forum including the Torres Strait Regional Authority, Energy Queensland, Torres Shire Council, Torres Strait Islands Regional Council, and Northern Peninsula Area Regional Council, Prescribed Bodies Corporate and Traditional Owner representatives and other relevant Queensland Government agencies and community leaders to coordinate planning, funding, and delivery of future renewable energy projects, to monitor technology developments, and to publish relevant data and information that will keep local communities informed and engaged. The existing Regional Inter-Agency Forum would be an excellent vehicle to build upon with the inclusion of EQL and Traditional Owner representatives from the community.

The implementation of renewable energy solutions in the Torres Strait must recognise and acknowledge the unique demographic and logistical circumstances and the significant impacts that climate change is currently having, and is forecast to continue having, on Torres Strait communities. It must also consider the important functions of Energy Queensland and the Queensland Government as the current providers of an economical, reliable, efficient, and safe electricity supply system for the people of the Torres Strait.

Solar and wind power are the most reliable and technically suitable renewable energy sources recommended for application in the Torres Strait. Combined with energy storage systems such as batteries, these renewable energy sources can initially be developed alongside diesel-powered base-load generators to meet short- to medium-term future power supply needs whilst reducing Greenhouse Gas emissions. The capacity of renewable energy generation that can be added to the electricity network, or can be used to offset diesel generation, must be carefully planned to avoid undesirable impacts to local energy consumers.

Energy Queensland is currently exploring strategies for renewable energy solutions to reduce Greenhouse Gas emissions at its largest power stations at Thursday Island and Bamaga, and Torres Strait Regional Authority can play an important role by supporting the successful implementation of identified projects, particularly through its advocacy and community engagement capability.

The Torres Strait Renewable Energy Transition Plan proposes potential solutions of different scales that may be applicable across all Torres Strait communities. Subject to available funding, stakeholders will need to assess priorities for supporting and implementing large-scale projects that provide the greatest contribution to Greenhouse Gas reduction, and small-scale renewable energy projects and energy efficiency improvements that are lower cost, have shorter lead times, are not subject to land constraints and are relatively easy to implement across a greater number of the Torres Strait Island communities. In addition, the plan addresses the benefits to be gained and challenges that may be posed by the change in transport infrastructure from fossil-fuelled to predominantly electric-powered vehicles in the future.

**Recommendation Summary**

This report focuses on actions that could be implemented during the first ten years to optimise the renewable energy contribution to Torres Strait energy supply. It is anticipated that the following ten-year period would then focus on activities to retire diesel power generators or replacement with renewable or low-carbon fuel options.

**Key activities during the initial 10-year period are:**

1. Establish a Torres Strait inter-agency Renewable Energy Forum and community engagement program to elevate the renewable energy focus and energy efficiency priority in the Torres Strait
2. Implement large-scale centralised solutions at Thursday Island and Bamaga where the greatest potential Greenhouse Gas reductions can be achieved
3. Implement centralised renewable energy systems at the next largest sites including Badu Island and Horn Island, and other sites where a centralised solution is feasible
4. Implement behind-the-meter solutions such as rooftop solar PV, micro wind turbines and battery storage systems utilising bulk installation arrangements to achieve economies of scale
5. Assess and prepare for the impacts of e-mobility anticipated to replace traditional transport solutions in the Torres Strait during the life of the RETP
6. Monitor and review the RETP implementation program on a regular basis to ensure currency with technology developments, policy and legislation changes, and to ensure that preferred project delivery outcomes are achieved and promote successes to build engagement.

**Specific actions identified and recommended in this report include:**

- Through the TSRA Inter-Agency forum establish a Renewable Energy focus group including representatives from Energy Queensland and relevant government agencies and Torres Strait communities to:
  - » Seek endorsement of the RETP and in-principle agreement to adopt the plan – incorporate relevant feedback from forum members.
  - » Support and facilitate the implementation of identified EQL renewable energy projects especially at Thursday Island and Bamaga where there is greater opportunity to reduce Greenhouse Gas emissions
  - » Coordinate agency efforts to optimise future investment in renewable energy infrastructure and facilitate the replacement, over time, of current diesel generation plant
  - » Develop a future renewable energy funding strategy
  - » Agree priority activities and sites for renewable energy infrastructure and develop feasibility studies
  - » Implement wind monitoring program for identified future wind generation sites
  - » Develop a set of Key Performance Indicators (KPIs) and prepare and publish progress reports and monitor performance
  - » Monitor and review the RETP
- Establish a community engagement program to
  - » promote energy efficiency,
  - » identify potential sites for renewable energy infrastructure
  - » identify and address potential land tenure issues and initiate action to reserve land for future renewable energy infrastructure development
  - » celebrate success and keep the community informed of progress towards the 100% renewable energy target.
  - » seek feedback on the priorities for roll-out of renewables at local communities
  - » prepare community members for potential employment opportunities in a renewable energy future
- Monitor and influence regulation and policy that may support outcomes that encourage local ownership of renewable energy infrastructure in Torres Strait communities where it is economic and sensible to do so.
- Investigate the impacts of e-mobility on the capacity of a renewable energy system, and its contribution to Greenhouse Gas reduction, health, education, and other social benefits.
- Liaise with EQL, councils, government agencies and business owners to promote the uptake of behind-the-meter renewable energy solutions such as rooftop solar, micro-wind turbines and battery storage systems
  - » implement a trial or demonstration project at a whole-of-community level
  - » explore opportunities for bulk-installation arrangements for cost-efficiencies
  - » collaborate on energy-efficient house design and integration of renewable energy systems and energy-efficient appliances such as split system air-conditioners into public housing.
- Investigate other off-grid or Standalone Power system opportunities including solar lighting and the use of renewable energy sources for water, wastewater and sewerage processing.

# 2 Introduction

The Torres Strait Regional Authority (TSRA) engaged Ener-G Management Group (Ener-G) to develop a Renewable Energy Transition Plan (RETP) for the Torres Strait. The Plan will assist the region to clarify the viable pathways to transform the regional energy supply in a manner that addresses energy reliability and security as well as meeting regional aspirations related to autonomy, sustainability, employment and reducing cost of living pressures. The RETP will also help to identify the investment required to progress this transition.

Ener-G has reviewed the current operating arrangements and challenges associated with providing a reliable, affordable and sustainable electricity supply to Torres Strait residents, and evaluated potential renewable energy technology solutions against a range of criteria to determine the most appropriate options for the Torres Strait region.

Energy Queensland (EQL) is presently accountable for the provision of electricity services to the Torres Strait and has significant investments in plant and personnel in the region to ensure that a safe, reliable, efficient and cost-effective electricity supply network is available.

Further, the Queensland Government subsidises the costs of providing electricity services in the region to ensure equitable access to electricity supply under standard retail tariff charges.

With a renewed focus on Greenhouse Gas (GHG) emissions and the impacts of Climate

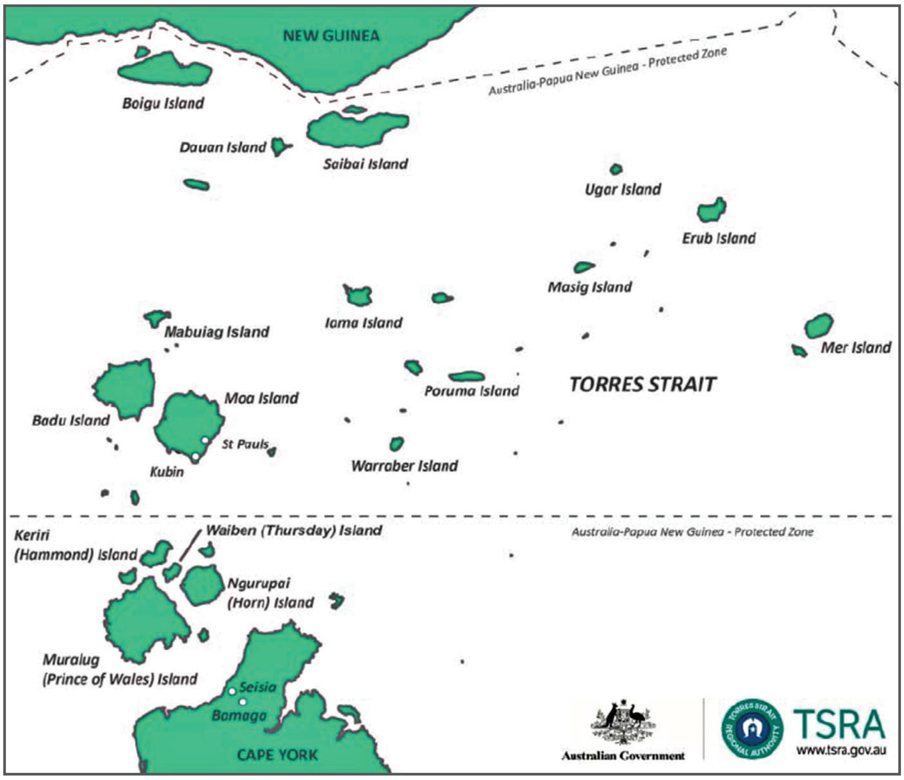



*Figure 1 - Map of Torres Strait Region*

Change on the island communities of the Torres Strait we trust that this report will assist the TSRA and its partner organisations in the region to navigate the path towards a 100% renewable energy future.

# 3 Future Plan

### 3.1 Opportunities and potential solutions

The Torres Strait leaders have been proactive in planning for the future of their island communities in anticipation of significant impacts to their way of life due to the impacts of climate change. The vision of a sustainable future powered by 100% renewable energy demonstrates a desire and commitment to lead the response in a meaningful and measurable way.

This RETP seeks to align the TSRA's desire for a Renewable Energy future for the Torres Strait with Queensland Government Climate Change Commitments[1]:

- Powering Queensland with 50% renewable energy by 2050
- Doing our fair share in the global effort to arrest damaging climate change by achieving zero net emissions by 2050
- Demonstrating our commitment to reducing carbon pollution by setting an interim emissions reduction target of at least 30% below 2005 levels by 2030

The vision of 100% renewables by 2050 is aspirational. The RETP focusses on the initial ten-year transition period. Given the current technological, economic and regulatory framework, potential achievements within the next decade are based on adopting practical and workable renewable energy solutions as a platform to transition to 100% renewables over the subsequent decades. Prior to 2030, would see a limited roll-out of large-scale renewables, small-scale behind-the-meter systems, and an implementation of demand management and community engagement programs whilst lobbying government and their agencies to implement renewable energy technology as they develop or upgrade their service delivery infrastructure.

The subsequent decades of the plan could see the gradual replacement of existing diesel generators, as their lifecycle ends, with alternative fuelled generators, as hydrogen and biofuels technologies mature, to provide baseload power. The installation of appropriate scale and combinations of wind, solar and batteries at locations where community tenure, ownership and operations can be effectively resolved and funded, is envisaged.

As outlined throughout this report, the development of renewable energy infrastructure in the Torres Strait will face several barriers including technical, regulatory, economic, and socio-cultural constraints. The remote location inhibits affordable and ready access to technical resources and there are additional costs incurred in undertaking infrastructure projects of any kind due to logistical factors. Mitigation strategies for identified barriers are included throughout the report.

Given the current rate of change of renewable energy technology and pricing, and expected changes to regulatory and policy frameworks, the RETP focusses on what could be achieved in the next ten years with proven technology and in the current regulatory environment, whilst monitoring the development of new and emerging technologies. Engaging with State and Federal governments, during this time to influence policies and programs, whilst exploring and consolidating future funding opportunities for carbon reduction projects will maintain momentum and focus on Torres Strait community issues.

To be successfully implemented, the RETP requires the co-operation and alignment of the planning and resources of a number of agencies. The key stakeholders are Energy Queensland (EQL) which is currently responsible for the safe, reliable and cost-effective electricity supply generation and distribution and the provision of electricity retailing services, and the Torres Shire Council, Torres Strait Island Regional Council, and Northern Peninsula Area Regional Council, who are responsible for planning and development controls in the Torres Strait region. Traditional owners and Prescribed Bodies Corporate will also be key stakeholders in the facilitation of solutions within their communities.

EQL has a stated policy[2] to "Actively seek opportunities to reduce our controllable GHG emissions across our network operations (e.g. power station diesel usage, fleet & property efficiency, streetlight upgrades) with a target of 17% reduction in emissions by 2030."

EQL has previously investigated opportunities to replace the existing wind turbines at Thursday Island and establish additional renewable energy systems

1 Queensland Department of Environment and Heritage – Pathways to a clean growth economy – Queensland Climate Transition Strategy

2 Energy Queensland Low Carbon Future Statement Ver. 2 (4 February 2021)

to reduce diesel consumption and GHG emissions at Thursday Island, Horn Island and Bamaga. However, the high costs and issues associated with acquiring suitable land for renewable energy development sites has impeded the progress of earlier proposals. In April 2021, EQL invited formal Expressions of Interest for the provision of low carbon, renewable energy generation services for its two largest power stations (Thursday Island and Bamaga) in the Torres Strait region, including the potential application of hydrogen as a fuel source.

Whilst off-grid options are a possibility, it is recommended that the regional stakeholders partner with Energy Queensland to progress grid-connected[3] solutions for these sites to ensure quality and reliability of supply, and the efficient delivery of energy services, at least for the next decade.

Alternative energy supply ownership models have not been explored in significant detail in this report due to the need to address technical and economic requirements that ensure that impacts to CSO subsidies are considered, and performance and operational standards are maintained over the longer term for the benefit of all local communities. Future proponents of privately-owned electricity generation and distribution assets would need to address regulatory matters with the Queensland Government and other stakeholders.

The TSRA can coordinate the implementation of a Renewable Energy Transition Plan for the Torres Strait by establishing strong relationships and open communication between partner agencies that develop, operate, and maintain infrastructure in the Torres Strait, and the local communities, residents, and leaders that live in the region.

Having reviewed previous assessments undertaken by CAT Projects in 2012[4] and considering the advancement of renewable energy and energy storage technologies since that time, Ener-G undertook to examine potential renewable energy solutions and shortlisted the most applicable technologies for Torres Strait in line with the Technology Evaluation Matrix in Appendix 2.

It is concluded that wind turbines, solar PV systems and energy storage devices (e.g. Battery Energy Storage Systems) are currently the most viable options. Costs of solar panels have reduced substantially in the past ten years, and they can be packaged and transported to the Torres Strait using standard barge services. Additionally, there are numerous qualified installers with remote area experience that could efficiently undertake installation work. Locals could be employed to assist with installation works and to provide support services for contractors undertaking works in the region.

There may also be contracted opportunities for locals to undertake routine inspection and maintenance services to ensure optimum performance of any solar PV systems installed.

Wind turbines have been proven to reduce diesel consumption at Thursday Island power station for more than 20 years. The wind resource in the Torres Strait is very good for most of the year however there are periods during the summer months when there is insufficient wind (the doldrums) to ensure continuous operation of wind turbines. Large wind turbines are generally more difficult to establish and maintain in the remote island communities due their physical size and the requirement for heavy machinery to load, unload, carry and lift equipment into place. Small wind turbines may be more suitable for installation at some locations subject to site and access restrictions.

Wind monitoring data will be required for at least two to three years to confirm site suitability and design parameters for turbine capacity and mounting height. Wind turbines also need to be installed away from residential areas and airstrips, and this may be a challenge on some smaller islands. Micro wind turbines may be an option for behind-the-meter solutions at a domestic or commercial level.

The limited scope of this investigation has not permitted Ener-G to undertake a detailed analysis of the future energy requirements or renewable energy capacity of the individual Torres Strait communities. For the purposes of this study, communities have been grouped according to maximum annual energy demand[5] in classifications of Large (>2000kW), Medium (500kW – 2000kW) or Small (<500kW).

The following table identifies individual communities according to these groupings.

| Energy Consumption Group | Community | Local Government Area |
|---|---|---|
| Large | Thursday Island | TSC |
| Large | Bamaga / Seisia | NPARC |
| Medium | Badu Island | TSIRC |
| Medium | Horn Island | TSC |
| Small | Moa, Mer, Saibai, Darnley, Iama, Masig, Boigu, Poruma, Warraber, Mabuiag, Dauan, Hammond, Ugar | TSIRC |
| Small | Muralug[6] | TSC |

*Figure 2 – Classification of Torres Strait Communities by Power Station Annual Maximum Energy Demand*

For the foreseeable future (at least the next ten

3 Refers to local distribution networks at isolated communities
4 Torres Strait – Options to Reduce Regional Carbon Footprint – January 2012 – CAT Projects
5 EQL supplied data for the 2016 period
6 Muralug is not connected to the EQL electricity network

years) it is expected that a diminishing but significant proportion of energy generation in the Torres Strait will remain as diesel generation owned and operated by Energy Queensland to ensure a continuous, reliable, and cost-effective base load energy supply for Torres Strait residents. EQL has developed efficient systems and processes based on the existing mini-grid model, has significant resources to operate and maintain the power supply systems and employs and trains local people who live and work in the local communities.

With the assistance of Government subsidies under the Community Service Obligation (CSO), Torres Strait residents that are connected to the EQL electricity networks benefit from subsidised energy costs through regulated retail tariff charges that also apply in other regional Queensland locations, despite the higher costs of generating and reticulating electricity in the Torres Strait.

The cost of establishing renewable energy power supply systems in the Torres Strait is currently likely to exceed the cost of upgrading and maintaining the existing conventional power supply systems due to additional control systems needed to maintain a consistent power supply during periods of low wind or cloudy days which may result in wind turbines and solar panels not providing sufficient output to meet community demands. It may also be necessary to provide energy storage capacity to cater for periods when there is excess renewable energy produced so it can be stored and used later when required. As the cost of renewable energy and storage systems reduce in the future they will become more cost-effective and may be cheaper than traditional options. The cost of renewables should be monitored as part of the RETP review process.

Demand management is a recognised strategy for ensuring the economic and efficient design of energy systems by reducing peak load and shifting energy use to other periods of the day when it may be cheaper to produce or more plentiful. Managing energy demand ensures that plant is correctly sized and sufficient to meet user requirements. Community education on demand management principles would provide the foundation for optimising the renewable energy generation and storage system capacity and maximise benefits to community members through reduced electricity costs.

It is essential to consider renewable energy strategies that can defer or offset power station or electricity network augmentation costs whilst reducing operating costs such as engine servicing and diesel fuel consumption. The timing of renewable energy system implementation should also consider when routine power station plant replacement or upgrades are scheduled, noting that diesel generator replacement generally occurs on a six- to seven-year cycle for most of the remote EQL power stations. This may vary depending on the plant usage, environmental conditions, and budget availability.

In the absence of a carbon price for a quantitative analysis of carbon reduction benefits, future business cases for substitution of diesel power station plant with alternative renewable energy solutions should also incorporate a qualitative assessment of the GHG reduction benefits.

To realise the vision of 100% renewable energy for the Torres Strait, a strategy to target replacement of diesel generation with renewables would need to be developed with EQL. This may take the form of fuel substitution program, as identified above for hydrogen fuel cells or biofuels for baseload generation; or multiple site alternative renewable energy generation using small scale wind and solar with batteries combinations, where most appropriate. Exploration of the replacement strategy should be undertaken in years seven to ten, with the view to roll out throughout the second and third decade of the RETP strategy.

### 3.2 Large and Medium Energy Demand Sites

Based on existing power station capacity and other technical considerations, there is potentially greater scope for customised renewable energy solutions directly connected into the electricity network or at the power station (beyond-the-meter solutions) for large and medium-sized locations than for the small-sized sites. For example, a solar farm or wind farm (or other larger scale renewable energy generation system) with energy storage and associated control systems may be more efficient for these locations.

It is noted that there is limited land available for large scale renewable energy systems at Thursday Island and previous investigations have considered establishment of a wind farm at Horn Island with undersea cables between Horn and Thursday Islands.

Given the scope and potential impact on the operation of existing power station infrastructure and the need to carefully coordinate and manage the interaction between future renewable energy devices and the existing power stations, along with the required technical skills to operate and maintain this type and scale of equipment, EQL would be the most appropriate entity to own and operate this infrastructure into the foreseeable future.

As the isolated systems are not connected to the National Electricity Grid, any potential private owners of solar farms or wind farms would need to negotiate power purchase agreements directly with EQL in isolated communities. The requirement to meet rigorous technical compliance requirements and the current CSO subsidies may make this option a high risk for potential investors in the short-term. However, changes to government policy and community and social equity expectations, and particularly the implementation of climate change mitigation strategies and/or carbon pricing at national or international levels may change the privately funded economic model rapidly.

Distributed Energy Resources (DER) which are small-scale behind-the-meter solutions could be implemented at large and medium sites up to the available “hosting capacity” specified by EQL at each specific location.

Careful monitoring and control of the installation of all renewable energy systems is required to be undertaken by EQL to avoid detrimental impacts to the operation of power station control systems that can affect the reliability and quality of electricity supply and to avoid unnecessary and costly augmentation works to accommodate any excess renewable energy that is being exported to the grid by electricity customers.

### 3.3 Small Energy Demand Sites

Previous analysis by CAT Projects (2012) indicated that solar PV systems with capacity in the range of 10kW (Ugar Island) to 100kW (Moa Island) could be connected to the network at these small sites. The current available renewable energy hosting capacity at each site would need to be confirmed with EQL given the passage of time since the previous report was prepared. Individual island site information was not available to Ener-G for inclusion in this report.

The hosting capacity can change over time depending on the level of customer interest for behind-the-meter renewable energy systems such as rooftop solar PV. EQL monitors applications and connection approvals to determine the amount of available hosting capacity at any point in time.

Where feasible to do so, small centralised renewable energy systems should be considered as the first preference for small sites. These systems can be designed for optimal performance and customised to integrate seamlessly into the existing electricity supply networks without detriment to the quality and reliability of supply to the community.

It is noted that EQL have previously installed a 36kW centralised solar system at Poruma Island.

Any operating cost savings realised through the installation of centralised renewable energy systems owned and operated by EQL, such as reduced diesel consumption, would be returned to EQL. EQL customers are unlikely to see these savings reflected in reduced electricity bills as electricity supply in the Torres Strait is heavily subsidised via Community Service Obligation payments that ensure equitable access to regulated standard tariff charges in regional Queensland. However, the carbon footprint of the Torres Strait would be reduced, bringing the area closer to net-zero emissions.

If there are no suitable sites available for the development of centralised renewable energy systems, or centralised systems cannot be implemented for other technical, social or cultural reasons, the communities may pursue an alternative option with rooftop solar PV systems and domestic batteries.

These DER systems are installed behind-the-meter, and, under current arrangements, the electricity customer would receive the financial benefit of reduced electricity bills. If a landlord funds the renewable energy system installation, they may wish to recover costs over time via increased rent. Only residents that have renewable energy systems installed would receive the benefit and this may result in equity concerns within communities. There may be other options for local councils to consider how these systems are funded and how the benefits may be shared equitably amongst community members.

If DER systems are pursued, a plan could be developed in conjunction with the local council or government agency for each small community to implement rooftop solar PV systems and batteries (if required) up to the available EQL hosting capacity, utilising bulk purchasing arrangements to achieve economies of scale.

The available renewable energy hosting capacity for each community would be specified by EQL. Some small communities may already have reached or exceeded the currently available hosting capacity and there may be no scope to install additional renewable energy systems without further controls that allow EQL to manage or restrict the export capacity of the systems. Ongoing liaison with EQL would identify new opportunities including affordable behind-the-meter control system technology that may provide additional DER capacity and open up further opportunities.

The positive and negative aspects of a DER system deployment at small sites are summarised in the following table (Figure 3).

| Positive Factors | Negative Factors |
| --- | --- |
| Rooftop solar PV is a mature technology and there are many examples of island communities throughout the Pacific, SE Asia, and Indian Ocean islands of successful solar PV minigrid integration.<br><br>(Budget price ~AU$5,000 per residence for a 4-5kW system in Cairns) | Domestic batteries may be required to store excess generated energy to minimise the risk of detrimental impacts to the EQL power network. Battery technology is still developing, and batteries are relatively expensive. (Budget price ~AU$15,000 per residence in Cairns). In the case of dynamic solar PV connections that have control integration in TI and Bamaga, batteries are not likely to be required, however control systems can add some cost per installation for gateway equipment. |
| Each community could be responsible for purchase and installation of the systems and control the timing of the installation, subject to allowable EQL hosting capacity | EQL will need to be consulted to confirm available hosting capacity at each community and may have special requirements for the operation of the systems to avoid interference with power station operation. |
| Local people may be employed as trade assistants for the installation of systems and future maintenance, such as cleaning solar panels, and rust prevention on associated metalwork. | The scope of employment opportunities may be limited and will be dependent on the number of systems installed, the capability of local people and access to training and other resources. |
| No land is required for rooftop Solar PV systems which may be a significant benefit in smaller island communities where land is a premium, particularly with the impacts of rising sea levels. | A higher specification may be required for solar panels, metalwork, and battery systems for the Torres Strait to accommodate the harsh, salty environment and lifespan may be reduced resulting in increased costs. |
| Solar panels can be easily transported via barge to site. | Battery systems are heavier and more expensive to purchase and transport to island communities. |
| Solar panels and batteries could be purchased in bulk via council tendering procedures. A bulk tender could be let for installation services.<br><br>Opportunity to investigate recycling of solar panels and batteries, providing local employment opportunities. | Systems required to be implemented to manage replacement of failed units and disposal of equipment at end of life. Costs of recycling or removal could be significant. |
| Council or Government agencies own most residences throughout the Torres Strait, so only need to deal with a small number of home "owners" for the installation. | Need to resolve who receives the benefit from the installation – tenant or landlord, and how the benefits are best shared within the community – systems are installed behind-the-meter. |

*Figure 3 – Pros and Cons of Distributed Energy Resources in the Torres Strait*

Should the behind-the-meter systems approach be adopted, it is recommended that a trial site be selected initially to roll-out the solutions and review the performance and operation of the PV systems and batteries and how cost-sharing protocols are managed.

### 3.4 Timeframes

The RETP Implementation Plan (Figure 30 – Appendix 1) provides a suggested timeline for the deployment of Renewable Energy systems in the Torres Strait over the next decade. This timeline is aspirational, though challenging, given the high level of consultation and inter-agency coordination and co-operation that will be required to achieve the desired outcomes and will also be dependent on successfully securing the required funding.

The Implementation Plan is intended to provide guidance to the TSRA on key tasks that should be undertaken to maintain focus on the goal of transition to a 100% renewable energy future in the Torres Strait in a timely manner. It should be used as the basis for discussion with other agencies and, as a 'living document' should be modified as appropriate in line with stakeholder consultation and future review outcomes.

The initial period of the plan focusses on establishment of a suitable Inter-Agency forum that engages regularly with relevant agencies and communities to achieve a common view of the desired outcomes, confirm accountabilities and to ensure the efficient deployment of resources to achieve optimal outcomes for the Torres Strait communities.

Ener-G has consulted with representatives from the TSRA, TSIRC, Queensland Department of Energy and Public Works, and EQL to provide input into this report. It has not circulated the proposed Project Plan for discussion or review to a broader range of interested stakeholders to seek their input or feedback at this time.

### 3.5 RETP Implementation Plan

The RETP Implementation Plan is summarised in tabular form in Appendix 1 (Figure 30). The timeframes outlined in the plan are indicative and assume that the TSRA, EQL and other partners agree in principle to the plan and adopt a project-management approach to coordinating its delivery. The various components of the Implementation Plan are expected to be rolled out concurrently, as resources permit. However, each section of the Implementation Plan can also be considered discretely.

It is assumed that technical solutions are developed, and other barriers addressed in a timely manner, and that project funding is available when required.

A summary description of the key elements of the plan is presented below.

#### 3.5.1 Milestone Dates

In line with Queensland Government Climate Change Strategy, we have included the following key milestones for reference: -

- By 2030 – Greenhouse Gas emissions 30% below 2005 levels and 50% of energy is produced by renewables
- By 2050 – Net zero Greenhouse Gas emissions

#### 3.5.2 Stakeholder coordination and community engagement

The first component of the RETP focusses on establishing the appropriate membership of an Inter-Agency forum, establishing reporting on Greenhouse Gas emissions associated with power generation and usage, and establishing renewable energy project tracking processes. It is reliant upon engaging with communities, and particularly their representative bodies, the Prescribed Bodies Corporate and Traditional Owners, and all interested parties to raise awareness, promote energy efficiency principles, keep residents informed and seek feedback on local issues and opportunities.

A range of agreed **Key Performance Indicators (KPIs)** and targets should be developed by the Regional Inter-Agency Forum participants at the initial renewable energy focus meeting with the intention of providing an annual report of progress against the approved project plan, as well as production measures that give a summary of the status of renewable energy production and year-on-year trends in the Torres Strait.

Suggested measures include: -

- Volume of diesel consumed per kWh of energy produced/consumed
- Volume of diesel per head of population
- kWh of energy produced by renewable energy systems
- Percentage of total energy produced by renewable energy sources
- kWh of energy produced per head of population – an energy efficiency measure

It is noted that EQL provides annual data to the National Greenhouse and Energy Reporting Scheme (NGERS) which may be utilised for this purpose.

It is suggested that implementing an energy auditing program, using local people, throughout the Torres Strait islands may be a means of building community engagement via one-on-one communication. The energy audits may feed into energy-efficiency implementation programs and provide background data for designing behind-the-meter renewable energy systems.

The TSRA may take a lead role in coordinating this program in liaison with other partner agencies.

This element of the plan, including intensive community engagement, may span three to six years from commencement. Ongoing community engagement and information sharing should be undertaken for the duration of the RETP.

### 3.5.3 Implement solutions for Large Demand sites

***Candidate sites are Thursday Island, Bamaga and Seisia.***

The RETP proposes that TSRA and partner agencies liaise with EQL to support and promote grid-scale renewable energy opportunities for large-demand communities such as Thursday Island and Bamaga.

This may comprise community engagement and information programs, development applications, property acquisition, funding application support and other activities that may assist in reducing barriers and streamlining the implementation of identified renewable energy projects due to familiarity with local conditions and established relationships across the region.

TSRA and other agencies may work with local communities at these sites to evaluate the potential impacts and benefits of the projects, implement energy efficiency strategies and practices, including energy efficient design of new infrastructure, and to advance the implementation of small-scale behind-the meter renewable energy systems up to the available hosting capacity permitted by EQL. This may also entail raising awareness and managing community expectations regarding the timelines and approvals required, and the available network hosting capacity for connecting new private renewable energy generators.

This phase of the project is expected to take up to ten years to complete.

### 3.5.4 Implement solutions for Medium Demand Sites

***Candidate sites are Badu and Horn Island (and other specified small sites).***

For medium-demand sites such as Badu and Horn Islands, similar strategies may be pursued as for large-demand sites, working closely with EQL and partner agencies to identify and progress grid-scale projects.

The TSRA and local councils may be able to assist with renewable energy resource analysis at identified sites where there is potential to develop wind and solar farms. This could include establishment of wind-monitoring equipment at strategic locations to ensure that adequate data is available for input to business cases and preliminary designs when required. Site selection will require input from local people who will also be able to contribute local knowledge on potential development sites, and particularly the resolution of cultural and tenure constraints.

The TSRA and Councils, through their community engagement activities, could capture this local information and establish a database of potential renewable energy development sites for future reference.

The TSRA and other agencies should also partner with EQL to develop a future funding strategy for renewable energy projects and to seek funding streams that can efficiently support community engagement activities, site identification, acquisition, resource studies etc. as well as the project funds necessary to design, build, maintain and operate renewable energy infrastructure in the Torres Strait communities.

The implementation plan for these activities is expected to be delivered over a six- to ten-year timeframe.

### 3.5.5 Implement Solutions for Small Demand Sites

***Candidate sites are Moa, Mer, Saibai, Darnley, Iama, Masig, Boigu, Poruma, Warraber, Mabuiag, Dauan, Hammond, Ugar and Muralug islands.***

The initial focus for smaller sites is to determine those sites where a centralised renewable energy system may be appropriate, before progressing implementation of behind-the-meter solutions. Centralised systems would be investigated and developed in line with the plan for medium-sized sites. In small island communities, the capacity for centralised renewable energy systems may be very limited.

The TSRA would liaise with councils and key government departments to identify properties that could host rooftop solar PV, micro wind turbines, battery energy storage systems etc.

A trial site would be established, and equipment would be purchased and installed on a project-managed basis to trial approved systems at small sites, with the view to roll-out similar solutions across multiple sites. This would facilitate procurement that provided the benefit of economies of scale. Project funding would be sourced for the demonstration site initially, with a view to expanding the program on successful delivery of the trial site, to successfully implement similar systems at other eligible communities throughout the Torres Strait.

In the RETP it is anticipated that this section of the plan could be completed over a five- to eight-year timeframe.

### 3.5.6 Low emission and e-Mobility Transport Solutions

In anticipation of transport strategies being reviewed throughout the Torres Strait communities to reduce Greenhouse Gas emissions and address the issues associated with management of redundant vehicle bodies, the impact of a future low-emission and electric transport scenario has been incorporated into the RETP.

The key aspects of this section of the plan include understanding the potential benefits and scope of the transition to low emission and electric transport across the Torres Strait communities and the impact of the need for battery charging facilities, the potential for vehicle-to-grid discharging possibilities, and how these new technologies are integrated into existing mini-grid structures in different communities.

A feasibility study is proposed which would then form the basis of business case development and identification of funding for implementation.

A suggested timeframe of two years to undertake the preliminary studies is provided in the plan, with an implementation period of two to five years, following feasibility assessment, to outwork the identified and agreed solutions.

The implementation of low emissions and electric transport solutions throughout the Torres Straits, and elsewhere, is expected to evolve quickly, driven by global trends towards the elimination of internal combustion engines, refinements to technology, development of political and community will, and the increased recognition of the synergies between e-Mobility and health, education and mitigating the impacts of climate change.

### 3.5.7 Monitoring and Review

To ensure that the RETP is effectively managed, it is recommended that the plan be frequently reviewed and amended, as necessary. It is also suggested that strategic reviews be undertaken to reassess available technologies, funding opportunities and government policy etc. pertaining to the implementation of renewable energy and that these changes also be reflected in an amended RETP.

The plan allows for an annual operational review and a five-yearly strategic review.

Whilst the RETP focusses on the next decade, we acknowledge the Queensland Government's stated target, and the Federal Government's desired position, and global commitments for net zero carbon emissions by 2050.

At each strategic review, the TSRA should consider developing a five-year rolling operational forecast that extends beyond the initial ten-year planning period and reflects achievements to date and revised project goals in the future.

### 3.5.8 Actions to support the implementation of the RETP

Throughout this report, the authors have identified suggested actions that could be undertaken to prepare the Torres Strait community for a renewable energy future and to progress the implementation of the RETP.

For convenience, these actions have been collated and summarised in Table 1 located in Appendix 3 of this report.

*Figure 12 - Poruma Solar Farm (photo courtesy of Ergon Energy)*

# 4 A Regional Vision for Renewable Energy in the Torres Strait

**4.1 Why is a Renewable Energy Transition Plan needed?**

Electricity supply in the Torres Strait is currently dependent on diesel powered generators, which are expensive to operate and are high contributors to GHG Emissions. Whilst the Queensland Government ***(Queensland Climate Transition Strategy (2017))*** has set targets for reduction of GHG's and adoption of renewable energy, there is no targeted plan for the Torres Strait.

The Torres Strait Regional Authority (TSRA) has recognised the need to develop a plan specifically for the Torres Strait that supports and aligns with Queensland Government objectives and local desired sustainability outcomes. TSRA engaged Ener-G to develop a Renewable Energy Transition Plan (RETP) to guide future planning and aid in attaining appropriate and timely funding and resources to implement renewable energy solutions in Torres Strait communities.

The ***TSRA Annual Report 2019–20*** identified a Strategic Framework (Figure 4) to adapt, which includes the recognition that transitioning to sourcing power from renewable energy is an essential component of the successful TSRA Adaptation to Climate Change program and for ongoing sustainable management of the region.

A Renewable Energy Transition Plan (RETP) will aid in:

- Clarifying the most viable pathways to transform the regional energy supply while addressing energy reliability and security
- Meeting regional aspirations related to autonomy, sustainability, employment and reducing cost of living pressures.
- Prioritising effort – for the community and for infrastructure delivery agencies.
- Sourcing funding from investors and Government to deliver identified projects.
- Ensuring maximum return on investment of time and resources to improve the liveability and resilience of Torres Strait communities in the shortest possible timeframe.
- Delivering Resilience Outcomes of the *TSRA Adaptation and Resilience Plan 2016–2021*.
- Helping to unlock the potential for sustainable transport options and broader deployment of air-conditioners to address heat stress via sustainable clean energy.

*Figure 4 Extract from TSRA Annual Report 2019–20 p13*

**Strategic Framework**

All community management plans developed by the TSRA are underpinned by the *Land and Sea Management Strategy for Torres Strait 2016–2036*.

Developed by critical stakeholders and Traditional Owners across the Torres Strait, the strategy provides a framework to support communities to continue to sustainably manage and benefit from their land, sea and cultural resources into the future. It sets out the vision and guiding principles for land and sea management in the region and identifies 16 key values and associated management directions.

An excerpt of the strategy, *Management Directions: Land and Sea Management Strategy for Torres Strait 2016–2020* will be reviewed and updated in 2020–2021, in order to report on progress against the guiding principles.

*Figure 5 – Torres Strait Islands – tidal impact.*
*Photo: John Rainbird*

### 4.2 Potential Climate Change Impacts

The TSRA has recognised and documented the potential significance of climate change on the islands and communities within their regional influence, and the necessity to plan to adapt to potential impacts.

The identified risks of climate change are expected to significantly impact on lifestyles and liveability of Torres Strait communities:

- Rising sea levels leading to more frequent and higher flooding and coastal erosion – currently 6-8mm rise annually,
- Warmer, more acidic oceans due to higher $CO_2$ concentrations,
- Variability in weather and seasons to increase,
- Hotter days – more hot days and higher temperatures overall
- More intense rainfall – over shorter periods in the Wet, resulting in more localised flooding
- Longer dry seasons

The ***Torres Strait Regional Adaptation and Resilience Plan 2016–2021***, defines the following foreseeable and specific social and economic impacts directly attributable to Climate Change across the region, that also have implications for a RETP.

- Increasing oil prices – impacts on both electricity and fuel prices
- Neighbouring PNG – there will be similar economic and health impacts, with many shared natural resources with Torres Strait communities
- Demographic and social changes that result from increased education, access to technology and better communications.
- Increasing demand on State and Commonwealth budgets – implications for maintaining key services and capacity to adapt especially for low-lying settlements, water security, community and ecosystem health,
- Lifestyle changes that will be required due to increasing heat stress of being outside during the day, and
- Social and equity impacts of additional costs associated with adapting households and lifestyles, by procuring assets such as air-conditioning to make housing more liveable.

**Climate Adaptation and Resilience**

Local climate adaptation and resilience plans for outer island communities, to align with and complement the *Torres Strait Regional Adaptation and Resilience Plan 2016–2021*, have been in development over several years. These plans are designed to help communities to identify local actions that can be undertaken to prepare for possible climate change impacts and to assist in building greater community strength and resilience.

*Figure 6 - Extract - TSRA Annual Report 2019–20 p14*

# 5 History of electricity supply in the Torres Strait

## 5.1 Legal & Regulatory considerations

The Torres Strait Island communities form part of the Remote and Isolated communities serviced by EQL. EQL and its predecessor organisations have been responsible for managing the power supply infrastructure throughout the Torres Strait since the early 1990s.

Remote and Isolated communities are not connected to the National Electricity Grid and therefore do not fall under the Australian Energy Regulator's (AER) jurisdiction. The AER sets standards for network reliability and the allowable capital and operating expenditure for Distribution Network Service Providers on the National Grid.

The Queensland Government and the Queensland Competition Authority provide the regulatory framework for the Remote and Isolated communities and monitor all aspects of safety, reliability, customer service standards and economic performance for these communities.

As part of its commitment to keep regional Queensland power prices on par with the south-east, the Queensland Government provides a subsidy to meet the additional costs involved in supplying electricity to regional Queensland. This subsidy is called the Community Service Obligation (CSO) payment. The budget estimate for the CSO in 2020–21 is $454 million[7] which includes $66 million for Remote and Isolated Systems. EQL operates 33 remote and isolated power stations located in western Queensland, the Gulf of Carpentaria, Cape York Peninsula, and on Mornington Island and Palm Island.


*Figure 7 - Energy Queensland Isolated Power Stations*

The development of renewable energy solutions and operating systems in the Torres Strait must consider economic impacts to the CSO to ensure that residents are not disadvantaged by higher energy prices.

## 5.2 Torres Strait electricity supply background

### 5.2.1 Power Generation and Distribution

EQL, through its subsidiary companies Ergon Energy Network and Ergon Energy Retail, provides generation, distribution network services and electricity retailing services to residents and businesses in the Torres Strait communities.

Electricity supply at each of the Torres Strait communities is provided by "mini grids" consisting of a central power station and overhead and underground powerline networks which distribute the electricity throughout the communities.

7 Queensland Government – Queensland Budget 2020–21 - Budget Strategy and Outlook – Budget Paper No. 2 Table A.2.9 (p200)

Each power station consists of multiple fuel-efficient diesel generators, on-site fuel storage tanks, protection devices and other automatic control equipment to ensure there is adequate capacity and redundancy to meet the electricity demands for the various communities and ensure the safe, efficient and reliable delivery of power to the communities they service. The power stations are fully automated and remotely monitored.

Power station capacity ranges from 260kW (Stephen Island) to 9.55MW (Thursday Island) with the majority in the range of 300kW to 1MW installed capacity.[8]

EQL has permanently staffed depots at Thursday Island and Bamaga with trained and qualified staff that operate and service the power station equipment, and powerline maintenance crews that are responsible for the distribution networks throughout the Torres Strait. Power Station Attendants (PSAs) are located at most of the island communities. The PSAs are trained to undertake routine maintenance and inspection works at the power stations.

Technical, engineering, administrative, and other general support services for the Torres Strait Island communities are provided by the EQL Isolated Systems and Asset Management teams based in Cairns, the Atherton Tablelands and other regional Queensland locations. These teams operate remotely and fly in and out of the Torres Strait when required and are engaged in a broad range of activities including design and installation of power station upgrades, contract management activities and providing supplementary resources for emergency response in the event of equipment breakdowns beyond the capacity of the local crews or in response to a major weather event, or to assist with significant construction works programs.

EQL also coordinates contract works throughout the Torres Strait for vegetation management, pole inspection and treatment, annual meter check readings and specialist services for maintaining power station or wind turbine equipment.

8 Ergon Energy Network Web Site (May 2021)

## Functioning Power Generation

All islands except Prince of Wales (Muralug), an inner island situated next to Thursday Island, are currently served by diesel generators for electricity. Thursday Island has two wind turbines, and a number of the buildings have grid-connected solar PV systems. The cost of provision of electricity is very high per household due primarily to the diesel supply costs. Without further investments in upgrading the generators and grids, there are likely to be increased interruptions to power supply, particularly during times of peak demand such as when the network is stressed to cope with air-conditioning and refrigeration on very hot days. As global oil reserves continue to decline, the cost of diesel-based power is likely to continue to increase.

Increased storm risk can disrupt supply through damage to power lines and other infrastructure. Sea-level rise will eventually inundate low lying power generation infrastructure. Periods of excessive heat can cause grid failures.

Increased deployment of renewable energy technologies is a more logical fit for island communities over continued reliance on imported diesel. The region has very good wind, solar and tidal resources which are currently barely used. Stronger winds will increase the available wind resources for power generation.

*Figure 8 – Extract –TSRA Regional Adaptation & Resilience Plan p46*

*Figure 9 – Extract – TSRA Regional Adaptation & Resilience Plan p46*

| | 2030 | 2050 | 2070 | Adaptive capacity |
|---|---|---|---|---|
| Extreme weather impacts on infrastructure | | | | M |
| Temperature and chemistry change impacts on infrastructure | | | | M |
| Sea-level impacts on services and infrastructure | | | | M |
| Impacts on fire risks to infrastructure | | | | M |

**Approximate timing of severity of impacts and indication of adaptive capacity**

The electricity network is exposed to seasonal weather impacts, the effects of a harsh salty environment, and vegetation regrowth. EQL undertakes routine maintenance programs on its power stations and distribution systems and provides emergency response services to meet established reliability and safety performance standards.

As identified in the TSRA Regional Adaptation & Resilience Plan 2016-2021 (p46) the reliability and maintenance status of existing electricity supply infrastructure and any future renewable energy systems are expected to be affected by more extreme weather events associated with climate change. Transition to a more renewable energy grid will still require significant focus on infrastructure maintenance once operational. Planning for transition should include provision for maintenance requirements and foreseeable changes to maintenance regimes. Refer to Figure 9.

### 5.2.2 Diesel Supplies

Fuel supplies for the power stations are managed under bulk supply contract arrangements to ensure reliable, cost-effective and efficient supply chains to minimise risk to continuity of power station operations. Approximately 16 megalitres of diesel fuel is consumed annually[9] for the generation of power in the Torres Strait. The fuel supply contract includes barging services to transport the diesel from Cairns to the Torres Strait islands and mainland communities.

Diesel is held in bulk storage tanks at each of the island communities to ensure that power stations

9 Estimate based on annual energy production (reported in NGER) and 0.25 l/kWh diesel

*Figure 10 – Twin Vestas 225kW wind turbines on Thursday Island. Photo: John Rainbird*

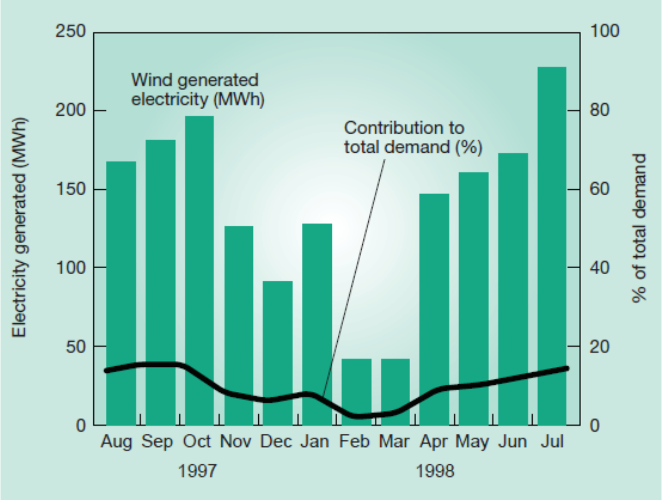



*Figure 11 Thursday Island wind generation and contribution to total demand 1997–1998*

have sufficient fuel to remain operational in the event of interruptions to barge services due to weather conditions, breakdowns or temporary interruptions to supply chains. The average holding capacity is 30 to 60 days' supply.

### 5.2.3 Existing Renewable Energy Generation

The data used in this assessment is from publicly available sources and from general data available from EQL and other sources. Site-specific data is not currently available for inclusion in this report. Available data is considered sufficient to assess potential options to develop the RETP. Site-specific data will be required prior to implementation.

There are two 225kW wind turbines located at Thursday Island which are estimated to save up to 600,000 litres of diesel per annum.[10] These wind turbines were originally installed in 1997 with a life-expectancy of twenty years and are currently operating beyond design life. EQL is investigating options to replace the wind turbines. Further details are included in Section 9.9.

Although dated,[11] the graph in Figure 11 indicates the contribution to total demand, but more relevant, the variability of the wind resource, due to the doldrums in the summer months, which highlight the limitations of exclusive reliance upon wind power in this area.

It is estimated that there is currently 1,800 kW of rooftop solar PV generation installed at Torres Strait communities, mostly on the commercial buildings and schools. EQL considers connection applications from its customers for additional rooftop solar PV systems on a case-by-case basis in line with the available renewable energy hosting capacity at each Torres Strait community.

Residents of Muralug (Prince of Wales Island) do not have a community electricity service and rely on

10 Ergon Energy Network web site (May 2021) Renewable energy sources - Ergon Energy

11 http://euanmearns.com/wind-and-solar-on-thursday-island/

*Figure 12 - Poruma Solar Farm (photo courtesy of Ergon Energy)*

privately-owned Standalone Power Systems (SAPS) to meet their energy needs. These systems typically consist of a combination of small solar PV systems, battery storage and diesel or petrol generators. Gas cooking and refrigeration are also utilised.

Privately owned and operated SAPS may be applicable at other isolated locations where it is uneconomical to provide reticulated power supply networks.

EQL has a small (36kW) solar farm located at Poruma (Coconut) Island as shown in Figure 12. This system was installed at the community's water supply reservoir site and demonstrates the potential for multi-purpose use of property for energy and water (or other services) infrastructure at Torres Strait Islands where access to land for developing renewable energy infrastructure may be limited.

#### 5.2.4 Greenhouse Gas Emissions Reporting

EQL reports GHG emissions from the Torres Strait power stations to comply with the National Greenhouse and Energy Reporting Scheme (NGERS) requirements.

The following table summarises the 2019-20 NGER report data for all TSRA sites.

This report indicates that approximately two thirds of total Greenhouse Gas emissions from power stations in the Torres Strait are contributed by diesel

*Figure 13: 2019–20 NGER data for Energy Queensland power stations in the Torres Strait*

| Facility name | Electricity production (GJ) | Electricity production (MWh) | Total emissions (t CO2-e) | Primary fuel |
|---|---|---|---|---|
| Badu Island | 11,735 | 3,260 | 2,291 | Diesel |
| Bamaga | 52,160 | 14,489 | 10,005 | Diesel |
| Boigu Island | 4,246 | 1,179 | 898 | Diesel |
| Coconut Island | 3,597 | 999 | 761 | Diesel |
| Darnley Island | 5,041 | 1,400 | 1,122 | Diesel |
| Dauan Island | 3,076 | 854 | 668 | Diesel |
| Hammond Island | 2,736 | 760 | 646 | Diesel |
| Kubin | 8,084 | 2,245 | 1,625 | Diesel |
| Mabuiag | 3,859 | 1,072 | 827 | Diesel |
| Murray Island | 7,109 | 1,975 | 1,411 | Diesel |
| Saibai Island | 5,696 | 1,582 | 1,165 | Diesel |
| Stephen Island | 1,628 | 452 | 344 | Diesel |
| Thursday Island | 96,473 | 26,798 | 16,070 | Diesel |
| Warraber Island | 4,906 | 1,363 | 1,002 | Diesel |
| Wasaga | 15,905 | 4,418 | 3,131 | Diesel |
| Yam Island | 6,040 | 1,678 | 1,197 | Diesel |
| York Island | 4,923 | 1,367 | 1,017 | Diesel |
| **TOTAL** | **237,214** | **65,891** | **44,180** | |

generators at Thursday Island, Bamaga and Horn Island, which aligns with the focus on prioritising transition to renewable energy solutions at these higher emitting sites in the initial phase of the RETP.

#### 5.2.5 Previous Studies & Reports

Many reports have been produced over the past ten years pertaining to sustainability, climate change and renewable energy in the Torres Strait that support the conclusions and recommendations of this RETP.

The key reports that are relevant to the RETP are:

- 2020 – Sustainable Masig – Decarbonisation of Great Barrier Reef Islands – Whole of Community Pilot Project (Earthcheck et. al.)

This report provides an overview of the findings and results of the Decarbonisation of Great Barrier Reef Islands – Whole of Community Pilot project for the Masig Island community. The project aimed to collaboratively develop project options for a range of community benefits including decarbonisation and resilience-building community and stakeholder-led initiatives spanning the project areas of energy (generation and efficiency), water (supply and treatment), waste, transport (inter and intra-island), and resilience to the effects of climate change.

- 2016 – Torres Strait Regional Adaptation and Resilience Plan 2016–2021. Report prepared by the Environmental Management Program, Torres Strait Regional Authority.

The core proposition of the Torres Strait Regional Adaptation and Resilience Plan 2016–2021 states that:

> "Torres Strait is the ancestral homeland of our people and is inseparable from our culture. Therefore, we strive to remain here, to retain the achievements of the present and regain the good ways of the past for a future that is resilient to change, in particular to the effects of climate change. The ability to be responsive and adaptable is important in attaining the goals of individual and community happiness and well-being.
>
> Adapting to climate change is an ongoing learning process. It will require a different way of thinking that better appreciates how all parts of the Torres Strait are inter-connected. It will require bold thinking and decision-making to choose a path that is in the best long-term interests of the region. Fast tracking community sustainability and resilience will need to be high level strategic priorities for communities and governments alike."

Our assessment confirms the necessity for the TSRA to liaise with the three local councils, EQL and all relevant State and Federal Government agencies to coordinate infrastructure requirements and develop a shared understanding of future energy needs and renewable energy generation and energy storage opportunities. The role of TSRA could be to help hold each agency to their commitments, and facilitate shared decision-making that reduces inefficiencies or duplication, resulting in more effective implementation of all Plans and Strategies.

- 2014 – Torres Strait Climate Change Strategy 2014-2018 Building Community Adaptive Capacity and Resilience (TSRA et.al.)

This action plan defines the risk assessment methodology utilised to develop the Strategy and provides the second five-year systematic pathway for responding to climate change in the Torres Strait region. Identifying both adaptation to, and mitigation of, climate change impacts under five key themes: Culture and Traditional Knowledge, Environment and Ecosystems, Settlements and Infrastructure, People and Communities, with suggested monitoring actions; including communication and capacity building tasks for engagement with communities and stakeholders that can inform decision-making.

The Plan supported existing adaptation and mitigation efforts by the TSRA, Councils, Queensland Government, and other partners under the previous 2010–2013 Strategy. It captured progress on previous actions and identified information gaps to inform decision-making.

- 2012 – Torres Strait – Options to Reduce Regional Carbon Footprint January 2012 (CAT Projects)

This comprehensive and thorough identification of technical options was commissioned in 2012 to define options to reduce the regional carbon footprint of all activities in the Torres Strait, and in doing so, provides an overview of renewable energy options for the region. It details Indicative Grid-connect Solar System parameters for each island in the region, including potential array size, site requirements, cost (in 2012), energy produced and potential GHG emissions. The observations of site requirements remain relevant in 2021.

Due to factors beyond the TSRA's control, few of the recommendations have been implemented to date. We discuss the barriers to implementation that have contributed to this lack of progress in Section 7.

These reports confirm that climate change is having and will continue to have a significant impact on Torres Strait communities. Key impact areas identified include:

- The health and well-being of Torres Strait residents
- Economy
- Environment
- Infrastructure and services
- Social impacts

The Torres Strait RETP will contribute to meeting the objectives and targeted outcomes of these reports by prioritising renewable energy solutions and strategies based on more current information.

### 5.3 Community awareness and readiness

*powersavvy* was an initiative funded by the Queensland Government through the Office of Clean Energy that commenced in late 2009 and concluded by 2014. The aim of the program was to reduce electricity consumption and diesel usage to lower the overall cost of electricity supply in Queensland's isolated communities serviced by EQL's diesel-fuelled power stations.

According to Ergon Energy's Annual Stakeholder Report 2014-2015 (P19), *powersavvy* was established to aid remote communities facing hardship in paying their bills and facing disconnection, by providing advice and education on energy usage behaviour and by incentivising the installation of new, energy efficient technologies and equipment. It encouraged savings to be used for the take up of solar energy systems which is cheaper than the diesel generation used in isolated communities. In 2015, Ergon showcased savings during the *powersavvy* program of 21GWh of electricity use, and $4.6 million in savings for customers, which helped reduce the Queensland Government's CSO payment contribution. It was estimated to have reduced GHG emissions by 15,300 tonnes in 2015.

The program included working with local residents struggling to pay their bills and avoid disconnection. The residents participated in training on energy efficiency, safety, understanding electricity bills and the hardship program. These people were encouraged to become 'local champions' sharing their knowledge and experience with their community to help them 'better manage their electricity costs and reduce the number of disconnections'. *powersavvy* also included helping with card-operated meters in isolated communities, access to rebates and concessions, and ensuring those using life support equipment had the support they needed.

The *powersavvy* program was credited for achieving significant energy savings for isolated communities by undertaking energy audits, providing financial support for the installation of energy-efficient appliances and rooftop solar PV systems, and providing community education regarding the efficient use of electricity.

In conjunction with Education Queensland, a comprehensive program was also conducted by *powersavvy* which encompassed all schools throughout the EQL Isolated Systems area.

Numerous community awareness forums were conducted where information about energy efficiency and best practice was presented.

Knowledge sharing of the successful elements and learnings from *powersavvy* and experience in other sites should be implemented to enhance the effectiveness of the Renewable Energy Transition Plan as part of the community engagement component. Energy Audits and individual support for those struggling with paying bills would complement the installation of appropriate technology during upgrades at an individual and community level. Examples include the Homesmart program – where EQL staff worked with real-estate developers to integrate energy efficient building design guidelines into their developments, and this could work with the Queensland Department of Communities, Housing and Digital Economy, other government departments and Councils supplying housing across the region, to integrate energy efficiency into the design of all new housing and to retro-fit existing houses.

This aligns with Ergon Energy's (now EQL) 2015 commitment[12] to rollout renewable energy into isolated communities across Queensland.

> "We (EQL) are also actively engaged in implementing renewable energy generation in our other isolated systems including solar, wind and geothermal, increasing the use of renewable energy technologies in off-grid communities will reduce the financial risk associated with long-term diesel price escalation and volatility, and reduce carbon emission."

Reducing reliance upon diesel to zero supports the Queensland Government Target to be at net zero GHG emissions by 2050. The program has already commenced, including the Doomadgee Aboriginal Community solar farm (560kW).

As illustrated above, an effective communication strategy can significantly enhance the likelihood of successful implementation of any strategy, particularly one which aims to reduce costs and increase energy efficiency uptake amongst a community group. The benefits are shared between the entities trying to achieve change and the communities where the strategy is being implemented. If participants understand the 'why', 'how' and 'when' as well as the 'what's in it for me' components, in language that is easily understood, and the benefits are timely, visible and achieve the commitments made, then expectations are managed, and uptake of initiatives and behaviour change is more likely to be sustained. To aid the implementation of the RETP, key elements on the rationale and suggested elements of a Communication Strategy are defined at Section 9.6 of this report.

12 Ergon Energy Annual Stakeholder Report 2015 – accessed June 17, 2021

# 6 Factors influencing the future energy requirements in the Torres Strait (Planning)

Developing a Plan for Renewable Energy Transition in the Torres Strait requires an evaluation of the social context that exists and foreseeable changes to those parameters into the future timeline of the Plan Horizon to 2050. 2016 Census and other community data is used to define the 'now' and the likely future social influence factors. The 2016 Australian Census for Torres Strait Islands has the latest verifiable figures which are used to describe the demographic factors which impact on energy demand and likely uptake of renewable energy during the proposed transition strategy timeline.

## 6.1 Demographics – age, health, income summary, population distribution forecasts

This is a small and relatively young population, which continues to grow at a rate higher than the general Australian population. The remoteness of these communities impacts on health, education and cost-of-living.

The official population of the Torres Strait region was 9548 in 2016 according to Census data, see Figure 14 below.

Approximately 50% of the population is in the TSIRC local government area. Given how data is logged by the ABS, we have focussed the data review on 2016 Census data for the TSIRC.

**TABLE 3-1: TOTAL POPULATION OF THE TORRES STRAIT INCLUDING BAMAGA AND SEISIA, 2011 AND 2016**

| Torres Shire Local Government Area | | Torres Strait Island Regional Council Local Government Area | | Bamaga | | Seisia | | REGION TOTAL | |
|---|---|---|---|---|---|---|---|---|---|
| 2011 | 2016 | 2011 | 2016 | 2011 | 2016 | 2011 | 2016 | 2011 | 2016 |
| 3,256 | 3,610 | 4,248 | 4,514 | 1,046 | 1,164 | 203 | 260 | **8,753** | **9,548** |

*Figure 14 Extract – TSRA Annual Report 2019–2020 p61*

Key summary points from the Census of the Torres Strait Island Regional Council communities (Statistical Area Level 2):

### 6.1.1 Population

- In the 2016 Census, there were 4,514 people in Torres Strait Island Regional Council communities. Of these 50.8% were male and 49.2% were female. Aboriginal and/or Torres Strait Islander people made up 91.8% of the population.
- The median age of people in Torres Strait Island Regional Council communities was 24 years.

| | |
|---|---|
| Median age (years) | 24 |
| Families | 967 |
| Average children per family | |
| For families with children | 2.2 |
| For all families | 1.4 |
| All private dwellings | 1221 |
| Average people per household | 3.8 |
| Median weekly household income | $929 |
| Median monthly mortgage repayments | $0 |
| Median weekly rent | $115 |
| Average motor vehicles per dwelling | 0.5 |

*Figure 15 – Key TSIRC demographic data – Census 2016*

Children aged 0–14 years made up 34.6% of the population and people aged 65 years and over made up 4.9% of the population.

The implication for the RETP is that this is a young population that has grown between 1 and 8 percent between 2011 and 2016 whilst the rest of Australia's growth is on average less than 3 percent in this period. Planning will need to consider increases in population, although it will be limited in future by island capacity for accommodating them, employment opportunities, ability to provide community services like health and education, and climate change factors.

### 6.1.2 People — cultural & language diversity

The most common ancestries in Torres Strait Islands were Torres Strait Islander 64.6%, Australian Aboriginal 8.3%, Papua New Guinean 6.5%, Australian 3.6% and Maritime South-East Asian.

- Respondents had the option of reporting up to two ancestries on the Census form.
- In Torres Strait Islands 94.0% of people were born in Australia. The only other responses for country of birth were Papua New Guinea 3.3%, New Zealand 0.3%, Netherlands 0.1% and Finland 0.1%.
- In Torres Strait Islands, 5.4% of people only spoke English at home. Other languages spoken at home included Yumplatok (Torres Strait Creole) 56.0%, Kalaw Kawaw Ya/Kalaw Lagaw Ya 11.2%, Meriam Mir 2.7%, Kiwai 0.4% and Motu (HiriMotu) 0.2%.

To maximise the effectiveness of any community education program, it is essential that programs are in local 'language'. Programs in Yumplatok (Torres Strait Creole) would likely be much more acceptable to the local community, presented by local speakers, if possible.

### 6.1.3 People — employment

- Of the 4,515 people in the Census, there were 1,153 people who reported being in the labour force in the week before Census night in Torres Strait Islands. Of these 46.6% were employed full time, 31.6% were employed part-time and 15.9% were unemployed. The ABS Labour Force Survey provides the official estimates of Australia's unemployment rate.
- Of employed people in Torres Strait Islands, 13.4% worked 1 to 15 hours, 8.6% worked 16 to 24 hours and 35.0% worked 40 hours or more.
- The most common occupations included Professionals 21.3%, Community and Personal Service Workers 17.5%, Labourers 16.4%, Clerical and Administrative Workers 13.2%, and Technicians and Trades Workers 11.6%.
- Of the employed people, 26.8% worked in Local Government administration. Other industries included Primary Education 11.4%, Combined Primary and Secondary Education 6.5%, Supermarket and Grocery Stores 6.1% and Hospitals 6.0%.

The median weekly income for people aged 15 years and over in Torres Strait was $373, which is notably lower than the Australian average. Considering the higher costs of living, that has significant implications in relation to individual capacity to purchase and install renewable energy technology and implement energy efficiency opportunities without financial assistance.

### 6.1.4 Families — family composition

- Of the families in Torres Strait Islands, 46.8% were couple families with children, 12.9% were couple families without children and 37.0% were one parent families. 19.7% of single parents were male and 80.3% were female.

Census employment and family data highlights the potential for employment in jobs that are likely to be created in the Renewable Energy Transition Plan. These could include roles in community engagement and assistance with planning and approval processes, particularly in land tenure negotiations and preliminary site investigation and assessment activities, as well as energy efficiency auditing or training, construction, operations and maintenance of new infrastructure.

**MEDIAN WEEKLY INCOMES**

| People aged 15 years and over | Torres Strait Islands | % | Queensland | % | Australia | % |
|---|---|---|---|---|---|---|
| Personal | 373 | – | 660 | – | 662 | – |
| Family | 856 | – | 1,661 | – | 1,734 | – |
| Household | 929 | – | 1,402 | – | 1,438 | – |

*Figure 16 – Median Income data Torres Strait Islands – Census 2016*

Income data, which suggests that 34% of households earn significantly less ($373 compared to $662) than Australian average income, has implications for private individuals' capacity to implement renewable energy technology or energy efficiency opportunities, due to high costs, without subsidies or other financial assistance. Implementation of similar programs to the previous *powersavvy* program will be recommended as part of this Plan, to maximise benefits at an individual level.

### 6.2 Infrastructure — Education, housing, health, border security, tourism, etc.

**Education:**

> "The [13]impact of climate on education was rated as less significant. The number of hotter days and increased inundation will affect educational facilities. These effects could be managed with minimal disruption within existing resources. Classroom outdoor activities can be rescheduled to avoid the hottest periods over summer. There can also be greater reliance on internet-based learning. Adaptions such as renewable energy sources potentially could be employed to drive responses such as cooling technologies."

- 35.6% of people were attending an educational institution. Of these, 48.7% were in primary school, 13.6% in secondary school and 5.7% in a tertiary or technical institution.
- Of people aged 15 and over, 20.6% reported having completed Year 12 as their highest level of educational attainment, 19.5% had completed a Certificate III or IV and 4.5% had completed an Advanced Diploma or Diploma. 2011 benchmarks are not available for this data item.

Implications are that educational programs should be devised across a range of educational options and age groups. The level of educational attainment suggests capacity for employment in the renewable energy sector. Recommendations of key elements are presented in Section 9.7.

13 TSRA Regional Adaptation and Resilience Plan p32

#### 6.2.1. Housing — ownership and dwelling structure

The majority of housing in the Torres Strait is publicly owned social housing[14] rather than privately owned. Torres Strait Island Regional Council is Queensland's second largest provider of social housing and manages housing on 15 of 16 communities in the TSIRC region.

In Torres Strait Islands, 87.9% of private dwellings were occupied and 12.1% were unoccupied.

Of occupied private dwellings, 93.9% were separate houses, 5.3% were semi-detached, row or terrace houses, townhouses etc, 0.8% were flat or apartments and 0.0% were other dwellings.

In Torres Strait Islands, 67.2% of households had at least one person access the internet from the dwelling. This could have been through a desktop/ laptop computer, mobile or smart phone, tablet, music or video player, gaming console, smart TV or any other device. It is foreseeable that the electricity demand will increase as 'smart' technology becomes more integrated into the day-to-day lives of individuals as has been the pattern of the last 10 years.

In Torres Strait Islands, for dwellings occupied by Aboriginal and/or Torres Strait Islander people, the median weekly rent was $120, and the median monthly mortgage repayment was $0. This confirms limited individual home ownership, and therefore limited options for private installation of renewable energy technology on existing housing. A benefit may be that Local Government and Queensland State Government owned assets are sufficient to allow for economies of scale through bulk purchase and installation of (particularly) rooftop solar PV infrastructure.

14 http://www.tsirc.qld.gov.au/our-work/housing

**NUMBER OF BEDROOMS**

| Occupied private dwellings | Torres Strait Islands | % |
|---|---|---|
| None (includes bedsitters) | 8 | 0.8 |
| 1 bedroom | 23 | 2.3 |
| 2 bedrooms | 130 | 13.1 |
| 3 bedrooms | 309 | 31.1 |
| 4 or more bedrooms | 490 | 49.3 |
| Number of bedrooms not stated | 34 | 3.4 |
| Average number of bedrooms per dwelling | 3.6 | – |
| Average number of people per household | 3.8 | – |

*Figure 17 - Australian Census 2016 Housing Data*

This has many implications for the successful implementation of the RETP, to overcome the major barrier that lack of private housing presents:

- The need to engage with those who construct and own the houses in this region – the local Councils, Queensland Department of Communities, Housing and Digital Economy, and QBuild – to ensure that energy efficient design applies to Torres Strait housing, and to ensure the installation of energy efficient appliances. Much of the current stock of housing is not designed to maximise 'tropical living' while minimising energy use or adapting to foreseeable climate change impacts.

Collaboration of the TSRA with other Government agencies to integrate renewable energy technology and energy efficiency principles into the design and construction or procurement of the next generation of housing provided to Torres Strait communities will be essential to ensure that options identified in this Renewable Energy Transition Plan, and the previous CAT Torres Strait – Options to Reduce Regional Carbon Footprint (2012) report are implemented in a timely manner.

- Limits to income in households, and lack of access to a range of low-cost appliance options means individuals have less capacity to make active choices regarding the appliances that they install and use in their houses. A program of education for the community, and access to potential bulk purchase of appliances, including solar panels, could aid in the greater roll out of the RETP. This could be coordinated by the TSRA facilitated inter agency forum.

One of the key limits of access to private housing is the need to resolve complex tenure issues associated with native title, and the lack of freehold land. The high cost of building and maintaining homes in the Torres Strait is also a significant barrier.

#### 6.2.2. Health

According to Australian Indigenous Health Infonet,

> "Between 2011 and 2015, cardiovascular disease was responsible for nearly a quarter (24%) of Aboriginal and Torres Strait Islander deaths. In 2017, coronary heart disease (CHD), diabetes, chronic lower respiratory diseases, suicide and lung and related cancers were the leading causes of death for Aboriginal and Torres Strait Islander people, with the age-adjusted death rate due to CHD occurring at 1.8 times the rate of non-Indigenous Australians."

This is likely to be exacerbated by predicted impacts of climate change, with increased heat and humidity and likely exposure to additional environmental threats. Access to reliable and affordable energy would make the lifestyles of Torres Strait islander peoples who are having health issues more comfortable, and more likely to be able to remain in their homes or communities, than having to be moved to Cairns or other areas for hospitalisation should their conditions deteriorate. Queensland Health will be a key stakeholder in planning future energy requirements for locally based and operated health infrastructure and how this will impact on renewable energy demand.

#### 6.2.3. Border security

According to Torres Strait Island Regional Council,

> "The Torres Strait region is arguably Australia's most critical location for border protection; Geographical positioning, complex reef systems and international border proximity provide an ideal pathway for illegal immigration, drug trafficking, and biosecurity risk. The global pandemic has also highlighted the potential for introduced disease and cross-border transmission risk. Inadequate public lighting and lack of marine surveillance makes night-time access and vessel landings easily achievable, raising concerns for public safety."

Access to reliable and affordable energy supply is essential for powering regional security and monitoring infrastructure, and to facilitate access to technology that improves the ability to survey activities that increase biosecurity risks. Increased border security may increase demand for energy through additional resourcing and infrastructure support commitments.

#### 6.2.4. Tourism

The tourism industry provides goods and services to visitors to the area. There are a range of entities that provide these services, across various industries:

- Accommodation providers
- Travel and tour services – to the islands and between them, tour guides etc
- Transport services – ferry, flight, car and boat hire
- Retail, particularly souvenirs and craft, food services – restaurants and cafes
- Cultural facilities and other associated activities.

All of these would benefit from access to more reliable and cost-effective energy provision. Many tourism entities promote their sustainable eco-footprint as part of their marketing and are aware of the benefits of electric vehicles and renewable sourced energy to reduce their emissions, costs and operational regimes.

Greater rates of visitation to the area will place increased pressure on existing electricity infrastructure and drive energy demand, which must be considered in development of renewable energy capacity.

### 6.3 Environmental factors including climate change

The anticipated impacts of climate change will require that future energy supply infrastructure and technology be resilient and have sufficient capacity to meet increased demand for air-conditioning and refrigeration, and the development of more extensive health-related facilities due to population increase and increased demand for measures to sustain a more 'liveable' environment.

The Torres Strait Regional Adaptation and Resilience Plan (2016–2021) p4 defined climate change impacts that are relevant to the Renewable Energy Transition Plan. These include:

- Human Capital – the outlook for health and well being
  - » Increased heat stress from more hotter days
  - » Increased transmission of diseases, such as mosquito borne diseases and increased reliance on better hygiene standards
- Financial Capital – the outlook for enterprise and the economy
  - » Storm and sea level impacts on infrastructure that underpins economic activities
  - » Increased cost burden for replacement, repair and maintenance of infrastructure
- Natural Capital – the outlook for land and sea
  - » Changes in rainfall and seasons, hotter days and increased risk of bushfires will negatively impact terrestrial plants and animals and human communities
- Physical Capital – the outlook for infrastructure and services
  - » Extreme weather is likely to disrupt services and damage infrastructure
  - » Changing temperatures, increased variability and changes in air and ocean chemistry will decrease the lifespan of infrastructure
  - » Sea level rise and storm surge threatens some key maritime, aviation and road transport infrastructure
  - » Warmer temperatures and mosquito borne disease pose a risk to water security
  - » Increased fire risk is also a threat to some infrastructure
- Social Capital – the outlook for community and Ailan Kastom.
  - » Outdoor activities will become increasingly restricted to cooler times or cooler locations
  - » The number of people experiencing financial stress will increase without substantial efforts to reduce cost of living and expand local economies
  - » Demand for emergency services will continue to increase in response to direct and indirect impacts of climate change.

As identified in the TSRA Regional Adaptation & Resilience Plan, p44, there will be implications for construction, operation and maintenance of existing and future Infrastructure and services as a result of predicted climate change impacts. Damage could be caused due to:

- likely increased heat and problems operating equipment in an increasingly hot and humid environment, leading to more frequent equipment failure
- extreme weather events, like cyclones and floods, impacting on the electricity generation and distribution network
- inundation from sea-level rise and coastal erosion impacting electricity supply infrastructure and access roads
- reduced lifespan of materials due to temperature and chemical changes in the atmosphere and oceans causing acidification e.g. powerline hardware and power station infrastructure.

In relation to the existing generation options, there is potential for increased cost of diesel due to reduced availability, changes in regulatory frameworks, and costs to produce and transport.

The tropical environment, both now and into the future, will be factored into decisions regarding renewable energy technologies that are suitable for installation in Torres Strait communities, particularly in relation to their ability to withstand saline, humid environments, with high rainfall and temperatures. Implications for the life cycle of equipment, and the frequency and extent of maintenance will determine the choice of technology, the location and operational regimes associated with each piece of infrastructure.

The additional costs and benefits of building energy infrastructure to meet future changes to environmental conditions should be factored into business cases and investment decisions. For example, energy storage capacity may become more important as traditional weather patterns vary – i.e. wind patterns and solar intensity.

> "Adapting to more frequent damage to infrastructure in general will require budgetary provision for more frequent maintenance, repair and replacement." Moran, Turton & Hill, 2014 [15]

15 https://researchonline.jcu.edu.au/38292/1/Adaptation_pathways_opportunities_V1_Moran%20et%20al

# 7 Technology overview

This section provides a brief overview of renewable energy technologies and provides a high-level qualitative assessment on the feasibility of the application of these technologies in the Torres Strait communities.

## 7.1 Overview renewable energy technologies (current and emerging)

Electricity generation using renewable generation technology such as solar and wind have been installed at communities throughout the Torres Strait. The application for these technologies includes centralised wind and solar generation and decentralised rooftop solar. The largest concentration of the renewable energy generation is on Thursday Island which includes approximately 700kW of solar and 450kW of wind.

Solar and wind generation technologies are very mature and hold low technical risk. There are however other technologies that are in various stages of maturity and may be suitable for use in the Torres Strait communities. A summary of the technologies and their suitability for use in the Torres Strait communities is provided below.

### 7.1.1 Solar

There are two main types of solar power generation technologies, solar photovoltaic (PV) and solar thermal.

Solar PV converts sunlight directly into electricity using a technology known as a semiconductor cell or solar PV cell. The application of solar PV is common in centralised solar farms (typically large scale) and installation on rooftops typically behind-the-meter and adjacent to the energy consumption point. Solar PV is a well-established technology, and the cost of the equipment (solar PV panels and inverters) is continuing to reduce as the technology is refined.

Solar thermal generation converts sunlight into heat (also known as thermal energy), which can be used to create steam to drive an electricity generator. It is also used to produce hot water for domestic and commercial premises. Solar thermal water heating technology is well developed and is efficient and cost effective in providing this service.

Solar PV in both centralised and distributed forms are suitable for installation in the Torres Strait.

Centralised Solar PV installations are typically only viable in locations where there is suitable land available (Typically larger islands with flat land (1MW = 2HA approx.) e.g. Bamaga, Horn Island or Badu Island). Distributed or rooftop mounted Solar PV is viable at all locations throughout the Torres Strait. The 2012 CAT Report on Torres Strait – Options to Reduce Regional Carbon Footprint also identified the requirement for and potential location of Solar PV/ Renewable Energy across all Torres Strait Islands. The limited area for installations and tenure issues are significant barriers to progressing centralised Solar PV installations. Installation of further distributed solar PV in locations with already considerable solar PV penetration (where unmanaged hosting capacity has been maximised – see EQL Hosting Capacity definition), such as Thursday Island, will require integration with the power system via a behind-the-meter inverter interface / gateway device so that EQL can monitor and control Solar PV generation according to network circumstances.

### 7.1.2 Wind

Wind generation is electricity generated by harnessing the wind. The wind energy is converted to electricity via an electric generator (alternator). Wind generation is a well-developed technology and is the one of the largest sources of renewable generation in Australia. Wind generation can be broken down into large-scale – greater than 1MW; and small-scale – less than 100kW. Large-scale wind generation is one of the least-cost ($/MWh) renewable energy technologies however it is typically not suited to small microgrids (some opportunities exist on Thursday / Horn Island group and Bamaga). Small-scale wind is more suited to microgrids, but the cost is higher than competing technologies such as solar. The development approvals & community acceptance for wind farms in the Torres Strait islands has been and remains a challenging process.

### 7.1.3 Biodiesel

Biodiesel is manufactured from processing organic oils e.g. vegetable oils derived from canola grain, soy, coconuts, palm oil and animal fats derived from tallow from cattle. These fuels are called first generation biofuels and compete for the raw product with human consumption.

Second generation biofuels are not derived from edible food stocks but come from alternative sources e.g. algae, pongamia trees and are currently not commercially viable. Since the source feedstock material can be replenished readily, biodiesel is considered a source of renewable energy. Biodiesel can be blended with normal automotive diesel at various percentages and can typically be used as a direct replacement for diesel fuel with little or no modification to the diesel generator. Although coconut oil fuels are more common in the Pacific, the biodiesel market from all fuel sources is not well established in Australia and thus the availability and cost can vary significantly. Furthermore, the supply chain is generally separate to the automotive diesel supply chain resulting in high transportation costs.

### 7.1.4 Waste to Energy / Biomass

Waste-to-Energy (WtE) technology also referred to as Energy-from-Waste (EfW) and Energy Recovery (ER) refers to a range of technologies that convert waste that would otherwise go to landfill into energy sources such as electricity, heat and fuel. Waste-to-energy technologies vary according to the type of waste used, how it is processed and the type of energy it generates. There are two main waste sources that would be available in the Torres Strait region, general residential and commercial waste, and waste vegetation. Typically, large quantities of waste are required to enable this technology to be commercially viable and thus represents a challenge for implementation within Torres Strait communities. The commercial viability of WtE can be improved when taking into consideration the cost of waste disposal but volume still represents a key issue.

### 7.1.5 Tidal

Tidal energy refers to technologies that use the tidal flow or change in tides to drive a generator to then produce electricity.

Tidal energy comes in two forms, both of which generate electricity:

- Tidal range technologies harvest the potential energy created by the height difference between high and low tides. Barrages (dams) harvest tidal energy from different ranges.
- Tidal stream (or current) technologies capture the kinetic energy of currents flowing in and out of tidal areas (such as seashores). Tidal stream devices typically operate in arrays, similar to wind turbines.

The application of tidal generation around the world is limited compared with other renewable energy and the technology is relatively immature especially when being applied in areas with low tidal flow.

The Torres Strait is well known for having large tidal flows especially in the vicinity of Thursday Island. However, the areas with the high tidal flows are relatively shallow thus limiting the application of tidal flow generation. Previous testing undertaken around Thursday Island has not been positive with regard to identifying suitable locations with sufficient tidal flow. The use of tidal barrages requires large areas that can 'store' the water which is typically done in rivers or large lagoons. The use of barrages can have a significant impact on the local environment and can be costly to implement.

### 7.1.6 Hydropower

Hydropower converts the energy of moving water into electricity. It includes a number of generation and storage technologies, predominantly hydroelectricity and pumped hydro energy storage (PHES). Hydropower is one of the oldest and most mature energy technologies and has been used in various forms for thousands of years. Hydropower typically uses the natural change in elevation of rivers or dams to enable enough flow to generate electricity.

Pumped hydropower is also used as an energy storage mechanism. It requires two water storages with one being elevated above the other. Water is pumped from the lower dam to the higher dam at times of excess (or low cost) energy production and is then released down through turbines when energy is required. Pumped hydropower requires relatively large water storage areas and significant water quantities.

As detailed above, hydropower is a mature technology, but the application is limited by the availability of suitable water and land resources to install. The cost of installing this technology is typically very high as it requires a lot of head works (e.g. dam construction).

### 7.1.7 Hydrogen

Hydrogen has many uses such as fuel for transport or heating, a way to store electricity, or a raw material in industrial processes. Electricity can be generated from hydrogen in several different ways including fuel cells or in internal combustion engines.

Hydrogen can be produced by electrolysis of water or separation of methane stored as a gas or liquid. For hydrogen to be considered renewable, it must be produced from a renewable energy source such as solar, wind or other. Hydrogen could be produced locally using excess renewable generation or it could be produced remotely and transported to site.

Specialist equipment is required to produce, transport and store hydrogen safely and this currently makes it cost prohibitive. Federal and State Governments are now focussing on the hydrogen economy, and it is likely that hydrogen may become a significant part of a future low-cost renewable energy / fuel source option.

Recommendations will include monitoring progress on this evolving technology and looking for opportunities to apply it for electricity generation, energy storage, transport and other applications in the Torres Strait environment.

### 7.1.8 Summary

Ener-G has collated procurement and operational characteristics of each of the identified technologies to create a technology evaluation matrix for likely application in the Torres Strait Region.

A range of criteria have been considered in the Technology Evaluation Matrix including:

- Site applicability
- Grid-connected or behind-the-meter
- Primary responsibility to own/operate
- Indicative installation cost
- Relative operating costs – low/medium/high
- Equipment life expectancy
- Plant and equipment availability
- Energy resource availability
- Risks
- Environmental considerations
- Ease of implementation
- Timeframe to implement if approved
- Economic Benefits
- Property and land tenure considerations
- Regulatory considerations
- Employment opportunities and local service capacity

***The full technology evaluation matrix is attached as Appendix 2.***

A consolidated summary of the matrix is presented below (Figure 18) to highlight the results of the detailed evaluation. This table highlights technologies considered viable for use in Torres Strait in the foreseeable future.

The implementation of the above renewable energy technologies into microgrids typically requires the use of supporting technologies to ensure there is no impact on the stability of the electricity network. This includes energy storage and adoption of advanced control systems. Some of these storage mechanisms (hydrogen and pumped hydropower) are discussed above and others are listed in Appendix 2. Energy Storage systems are also discussed in more detail in Section 9.

The available renewable generation solutions are a blend of mature and immature (under development) technologies. Some of the technologies are very effective in reducing the reliance on fossil fuels. However, the implementation of the renewable technologies especially into small microgrids presents significant challenges. While many of these challenges can be met and resolved, it does often come at significant cost. Further details on the barriers to wide scale implementation of renewable generation in the Torres Strait are discussed in Section 8.

Based on the technology assessment undertaken, solar and wind are currently the most viable renewable energy generation options available in the Torres Strait.

The other technologies reviewed should be monitored to determine if they will become viable at a future time.

| Technology | Solar | Wind | Biofuel | W2E / Biomass | Hydrogen | Tidal | Hydro-power |
|---|---|---|---|---|---|---|---|
| Technically Viable | Yes | Yes | Yes | Yes | Yes | No | Yes |
| Currently Economically Viable | Yes | Yes | No | No | No | No | No |
| Implementation difficulty | Low | Medium | Low | High | High | High | High |
| Summary – Currently Viable | Yes | Yes | No | No | No | No | No |

*Figure 18 - Renewable Energy Technology Evaluation Summary - Torres Strait*

# 8 Barriers to the uptake of Renewable Energy in the Torres Strait

In assessing barriers to the uptake of Renewable Energy in the Torres Strait, we have also considered the Barriers to Climate Change Adaptation that the TSRA have previously identified in their TSRA Regional Adaptation & Resilience Plan because there is significant alignment between these two issues.

TSRA identified the following barriers in relation to Climate Change:

- Lack of community support
- Existing institutional and legislative frameworks
- Capacity and resource constraints
- Lack of adequate external funding
- Lack of system understanding
- Lack of access to good quality projections
- Inadequate assessment of adaptation options and poor prioritisation processes
- Physiological, economic and social thresholds

Specifically, the following barriers must be considered to successfully implement a Renewable Energy Transition Plan in the Torres Strait. TSRA Regional Adaption and Resilience Plan p27.

### 8.1 Community Expectations

Community expectation, generally, is that:

- Reliable energy is a right and will be supplied at the lowest possible price.
- Renewable energy is cheaper than energy supplied by traditional diesel generation.

However, the cost of establishing renewable energy in the Torres Strait islands may be significant. The energy supply is currently subsidised by the Queensland government to ensure an equitable price, rather than the actual 'cost to supply'.

An engagement program is required to clarify community expectations and desired outcomes, and to educate the community on renewable energy options, and to manage their expectations of:

- the cost, timeframes and technical solutions that may be feasible across the Torres Strait based on population, location, construction, operation and maintenance considerations; ownership and other criteria defined below.
- Whether solutions of future energy supply will be acceptable at similar, less or higher costs than currently, and at the same or better levels of reliability and safety, as currently supplied by Energy Queensland Limited under the CSO.
- Acceptable reliability and availability of electricity supply using renewable energy technologies compared to existing diesel power supply.
- The importance of demand management, and individual responsibility to reduce costs – with practical examples like turn off appliances when not in use; procure energy efficient and site appropriate items.
- The obligation to maintain assets and determine who will be responsible for that maintenance – e.g., clean solar panels so that they function effectively.
- Whether investment in renewable energy may be based on climate related factors only rather than economic or operational requirements.
- That EQL will respond to outages and provide upgrades in a timely manner, similar to other regional Queensland locations.

### 8.2 Regulatory considerations

- Electricity generation and distribution are regulated services and operators must be licenced and accredited to provide these services to appropriate quality, safety, and reliability standards. This applies to all generation entities across Australia and has a significant resource and financial implication.
- As the Torres Strait communities are not connected to the National Electricity Grid, there is no facility for the sale of energy produced from independent generators into the National Electricity Market. This limits the potential

Torres Strait community. Photo: John Rainbird

'return on investment' for a generation entity, whether they be private or Council.

- Additionally, the Queensland Government provides a CSO payment to EQL to subsidise the high costs of providing electricity to the Torres Strait communities. It would be an expectation for any alternative generator to provide energy at a similar (subsidised) cost to the rest of Queensland whilst the generator may not be able to access the CSO subsidy from the Queensland government, which is a 'market entry' barrier to other generators.

Developers will be required to comply with a range of Legislation and its reporting requirements. Particularly relevant is the Environmental legislation including the Environmental Protection and Biodiversity Conservation Act 1999 which applies to development on currently unoccupied land, adjacent to oceans and areas of biological significance. It may require a project to undertake an Environmental and Social Impact Assessment at significant cost, resource and time commitment and report on its impacts and commitments over time.

- Government and community agencies will have obligations to show compliance with, and progress to achieving regional, state, national and international commitments on climate change.

### 8.3 Technology-based

Technological barriers are based around:

- Suitability of technology to be implemented in either a tropical or saline environment.
- Lack of site-specific data across the Torres Strait on the renewable energy resources, particularly wind and solar and associated seasonal variations. This would need to be addressed prior to location of any infrastructure at a particular site, as part of the overall assessment and approval process.
- Scale of technology available for implementation in remote and island environments, in relation to appropriateness, ability to install and maintain.
- Technical integration with existing technology, that risk interruption in supply, or inefficient operation of, or increase wear on assets, particularly diesel generators.
- EQL renewable energy hosting capacity – the maximum renewable energy capacity that can be installed with or without specialised control equipment to switch devices on and off the network. EQL advise that the integration equipment is less specialised now than it used to be (behind-the-meter interface device provided by a third party vendor). The interface

enables the power system to operate in an integrated manner to maintain reliability of supply. Customer owned PV systems may be curtailed when local conditions require this via a defined control strategy.

### 8.4 Infrastructure Costs

The cost to establish Renewable Energy Infrastructure in the Torres Strait is a significant barrier. Whilst the costs of some technologies such as solar panels and battery systems are reducing with broader community uptake, the additional costs to freight plant, equipment, materials, and contractors to site are a significant burden.

Plant items such as wind turbines and large support towers require specialised heavy plant and equipment and cranes to erect and install. This equipment would be sourced from Cairns or further afield and transported to site during the construction phase. Current barges and landing facilities at island communities may restrict the size and type of equipment that could be accommodated.

Additional challenges associated with premature degradation of solar panels, wind turbines and support structures in the harsh salty environment would need to be considered in the lifecycle cost assessment for renewable energy infrastructure in the Torres Strait.

### 8.5 Funding priorities and constraints

Local government in the Torres Strait have limited rates base and are therefore reliant upon external funding to provide essential services for their community. At times, supplemental government funding is difficult to raise due to competing priorities at State and Federal levels. The Queensland Government provides subsidies for energy costs via the CSO.

The historic focus on providing affordable housing, and the cross-departmental responsibilities for housing provision, generally hasn't prioritised energy efficient design. Different government departments trying to achieve 'economies of scale' by limiting alternative designs has resulted in the provision of housing that is not adapted specifically to tropical environments or lifestyles.

Funding of rooftop solar panels and domestic batteries would currently be at the discretion of the property owners, predominantly Council/State government, and this may not be a priority for the relevant government agency. State government has previously trialled a 'solar for rentals' program to provide subsidies to landlords for the implementation of rooftop solar PV.

Private investment may be limited by barriers identified in this paper and 'rate of return' capability without other incentives.

In the absence of a carbon price, historically it has been difficult for EQL to develop business cases for renewable energy solutions in the Torres Strait that reduce the CSO. With reducing costs of the renewable technologies, and a wider government recognition of the need to address climate change and equity issues for remote and Indigenous communities, there is potentially a greater opportunity now to source external funding.

### 8.6 Demographic

Census data confirms that the community comprises mostly younger residents with limited employment opportunities and lower than average income. There is a low level of individual home ownership. This could limit individual capacity to purchase and install energy efficient appliances or renewable energy technologies without additional subsidies or financial support.

There should be additional employment and training opportunities associated with the installation and maintenance of renewable infrastructure that could be used to reduce the barrier, if included as a requirement in the procurement process, and informed by community engagement and education programs.

Powercards are currently used throughout the Torres Strait to assist residents to budget for electricity costs. The implementation of behind-the-meter renewable energy solutions such as rooftop solar PV could significantly reduce the impact of electricity bills on household budgets over time, reducing the amount that residents spend on powercards.

### 8.7 Capacity and resource constraints

Current maintenance of existing energy generation facilities is managed by EQL and locals are employed to undertake some of these tasks. Large or complex projects or outages are managed by external EQL specialist labour sources, due to the infrequent nature of the work, reducing the need to maintain permanent, onsite personnel and resources. Installation of renewable energy generation does not create a large number of permanent or full-time positions in a community, due to the nature of the infrastructure and its inherent reliability.

Community members may not currently have the required skills, electrical safety awareness or other requirements associated with workplace health and safety to take up available positions. Training and support of locals is required to prepare and upskill eligible people for roles in the renewable energy economy.

### 8.8 Tenure – DOGIT & Native Title

In almost all indigenous and island communities, land for infrastructure development is in limited supply. Status of the resolution of native title claims can limit the capacity or timeliness of determining whether land can be used for community or other infrastructure. Sufficient lead times need to be allowed for consultation with landowners and Native Title holders to address property issues like ownership, access, and operational requirements associated with the implementing and maintaining renewable energy infrastructure.

It is understood that most vacant land in the Torres Strait is gazetted as Deed of Grant in Trust (DOGIT). Local Government Authorities (TSIRC, TSC, NPARC), Traditional Owners and Prescribed Bodies Corporate will be key stakeholders to engage early in the decision-making process to identify tenure of potential development sites and to assist in addressing access and other tenure issues.

### 8.9 Geographical remoteness, 'tyranny of distance' and 'economies of scale'

The remoteness of this region, and the relatively low energy demand mean the 'tyranny of distance' and 'economies of scale' apply here. It is more costly to transport any item to the Torres Strait, which contributes to the economic burden on all residents, and this would apply to solar panels, wind turbines and battery storage or any infrastructure that may be installed.

Opportunities to reduce the impact arise if the community or project proponent join to procure bulk supplies or services, which has the potential to reduce purchase and delivery costs, as well as installation costs across the community, and potentially ongoing maintenance costs due to similar products and a range of spares.

Ongoing maintenance costs may remain high due to the remote location and costs to transport parts and specialist maintenance personnel to site and around the area, particularly if these skills are not available locally.

### 8.10 Accountability for outcomes

As the TSRA does not have the regulatory authority to develop or operate energy generation infrastructure, it should work closely with appropriate authorities such as EQL, potential private developers, Councils and landowners to facilitate the implementation of the RETP. Its current annual reporting mechanism and the Regional Inter-Agency Forum provides a platform to clarify accountabilities and monitor progress of agreed RETP outcomes.

The costs, locational constraints, and other barriers will have to be considered when determining the best renewable energy solutions for each Torres Strait community. It is noted that these same barriers also currently apply to developing traditional diesel-powered electricity generation technology on greenfield sites.

Small scale renewable generation systems installed at dispersed island locations may provide opportunities for a community ownership and operation model, however the method of achieving that outcome can be very complex. Options such as a BOOT Scheme (Build-Own-Operate-Transfer) or Cooperative similar to the Hepburn Wind Farm or other community owned renewable energy projects could be investigated, if there was a strong desire by Torres Strait communities to pursue this type of strategy.

*Torres Strait Islands sunrise. Photo: Klodien*

# 9 Strategies for the advancement of renewables

In the Torres Strait communities where base load power relies on the operation of (generally) small capacity diesel generators, the intermittency of renewable energy sources connected to the electricity distribution network must be taken into consideration for the safe and reliable performance of the electricity network, maintaining voltage and frequency within the prescribed legal limits and to avoid damaging electrical appliances.

Renewable energy and energy storage devices may be installed within the customers' premises (behind-the-meter - rooftop solar, domestic batteries, solar hot water systems etc.); directly connected to the electricity supply network (beyond the meter – solar farms, wind farms, community batteries, etc.); or without any connection to the electricity distribution network as a Standalone Power System (SAPS). The following sections provide more detail on the implementation of various strategies including renewable generation, storage and energy efficiency initiatives.

The advancement of energy generation from renewable sources is a key element to enhance the application of the Torres Strait Climate Change Adaptation Strategy.

### 9.1 Behind-the-meter (residential / industrial / commercial)

By developing the facilities identified in its capital works programs, the TSRA and its local partners are demonstrating leadership and commitment to a renewable energy future in the Torres Strait. Having a policy within that capital works program (TSRA Annual Report 2019–20, p89) of integration of renewables becomes part of the Best Practice requirements that could be integrated into Council and other Agency planning and procurement policies, for all tendering, construction, and operations within the Torres Strait.

Rooftop solar PV systems are the most common form of behind-the-meter renewable energy systems currently in use. Australia has the highest uptake of solar globally, with more than 21% of homes with rooftop solar PV. As of 31 March 2021, more than 2.76 million rooftop solar power systems have been installed across Australia. The process of converting sunlight into electricity using PV systems produces zero Greenhouse Gas emissions.[16]

*Figure 19 – TSRA 70kW Rooftop Solar PV System, Thursday Island. Photo courtesy of TSRA.*

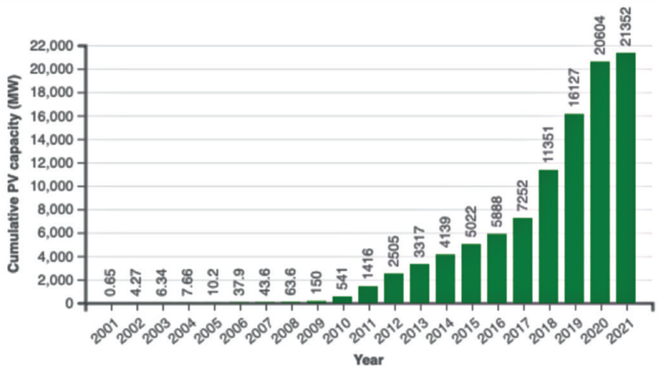



*Figure 20 Growth in rooftop solar PV capacity - Australia*

Efficiency of rooftop PV systems has substantially increased (Figure 20), and the costs have significantly reduced, over the past 10 years with the average cost of a 5kW residential system being $5,250 (based

16 Clean Energy Regulator - Australia

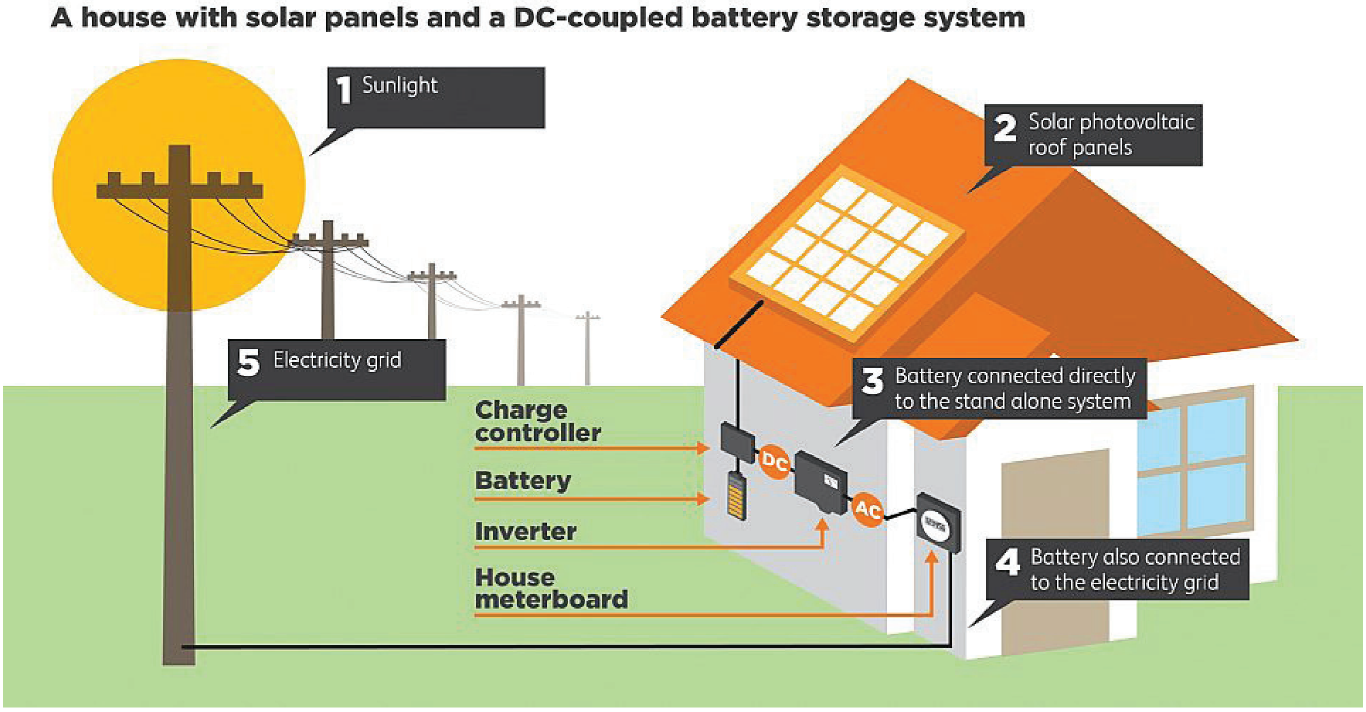



*Figure 21 - Residential Renewable Energy System Configuration*

on average price across Australian capital cities).[17]Excess electricity can be directed into the grid (delivering a feed-in payment), or it can be stored in a rechargeable battery for later use. Batteries can also provide back-up power in the event of blackouts.

In the Torres Strait homes are owned either by the Council or the Queensland Government, so installation of domestic renewable energy would require an agreement with these agencies as well as the homeowners.

A solar PV and battery system offers the potential of off-grid energy self-sufficiency. Domestic battery systems are considered relatively expensive compared to rooftop solar PV, however costs are expected to decrease over time as demand grows and technology matures.

Domestic solar water heating is the most common solar thermal technology currently available, and it could reduce a household's $CO_2$ emissions by up to 3 tonnes per year while saving up to 80% of the energy costs for water heating.

Due to the operational limitations of the local power stations, there are constraints on the amount of renewable energy that can currently be connected to the networks, including rooftop solar PV systems, without costly augmentation works being undertaken or control systems being installed.

Excluding Thursday Island and Bamaga, EQL data indicates that there is currently available capacity to connect approximately 300 to 350kW of rooftop solar throughout all remaining communities (available capacity will vary from island to island) without additional control devices and augmentation works.

17 Choice Magazine (online – accessed May 2021)

This is the equivalent of 60 to 70 x 5kW rooftop solar PV systems.

EQL advise that the power station functionality upgrade has recently been delivered in Bamaga to enable additional 850kW of solar PV to be installed when integrated via behind-the-meter gateway devices. EQL also advise that target timing for a similar upgrade on Thursday Island is 2022, which would similarly enable more than 2MW of additional dynamically integrated solar PV to be installed on the island.

### 9.2 Standalone Power Supply (SAPS) systems and Microgrids

Standalone renewable energy generation and energy storage systems may be established for a single installation (such as a desalination plant), or as a microgrid connecting multiple installations (such as a new residential development that is remote from the existing electricity supply infrastructure) using Distributed Energy Resources (DER). A SAPS / microgrid may incorporate a small diesel or petrol generator, rooftop solar, micro wind turbine and battery storage, network cables and a control system designed to meet the energy requirements for the specific circumstances.

SAPS and microgrid systems operate independently of the electricity grid. There are regulatory and legal requirements regarding ownership and operational responsibility for microgrid systems.

### 9.3 Direct connection to EQL network

Wind farms, solar farms, community-scale batteries and other larger-scale renewable energy generation infrastructure or energy storage devices would typically be connected directly into the electricity network. They may be connected as a single renewable energy source to supplement diesel generation capability, or as part of a hybrid system with multiple generation and storage elements, which may also include diesel generation for periods when renewable energy sources and/or energy storage capacity are insufficient to meet customer energy demand.

Thursday Island wind farm (2 x 225kW wind turbines) is a working example of this type of solution currently operating in the Torres Strait. Whilst the Thursday Island wind farm has proven to be an effective means of offsetting diesel consumption (saving up to 600 000l of diesel per year) and subsequently, reducing GHG emissions, the costs of establishing and maintaining wind turbines are considerable, especially in remote locations. There can be additional challenges with identifying suitable locations to site wind turbines away from residential areas and aircraft flight paths and landing strips, and where there is an adequate wind resource. Land tenure is also a potential barrier to developing new wind farms throughout the Torres Strait.

Local knowledge is generally relied upon to identify locations that may potentially be suitable for further detailed assessment. Wind monitoring devices would then be installed for at least 2 to 3 years to confirm the wind resource prior to developing a final business case for implementation.

The existing wind turbines at Thursday Island are now more than 25 years old and have reached the end of their original design life. EQL has undertaken preliminary investigations to establish alternative wind generation at Thursday Island and Horn Island (including options to interconnect Horn Island, Thursday Island and Hammond Island) and at Bamaga.

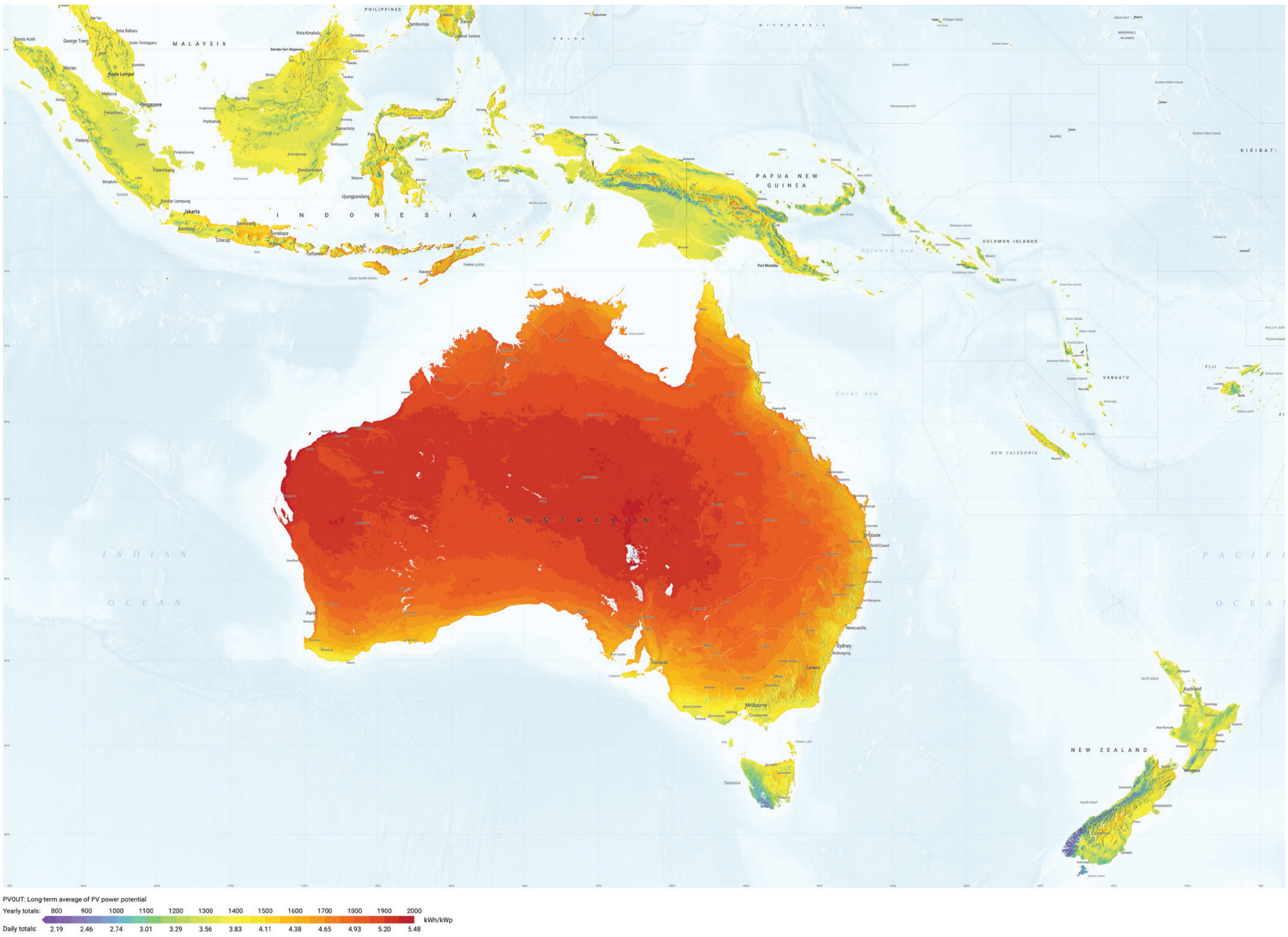
Similar to the requirements for finding suitable locations for wind generation, centralised solar farms also rely on having suitable land available. For example, to develop a 1 MW solar farm would require approximately 2HA of land based on the solar irradiance in the Torres Strait which falls into the mid-range zone (Figure 22).[18]

Wind farms and solar farms are more appropriate for locations with larger capacity power stations with higher demand and where there is suitable land available for potential development such as Horn Island, Badu Island and Bamaga.

Smaller demand sites, with larger land areas, such as Moa, Mer, Erub and Mabuiag may be considered as potential sites depending on an assessment of future need and network hosting capacity.

18 Reference – Solar resource map © 2019 Solargis. https://solargis.com

*Figure 22 Solar Resource Map – Australia and Pacific*



It may be possible to consider small-scale wind, solar and energy storage options suited to smaller power stations located throughout the Torres Strait, subject to assessment of individual site conditions and available network hosting capacity. E.g., Poruma Solar array.

Strategies for connecting directly to the utility network can also include managing community loads to provide services during times of excess renewable generation.

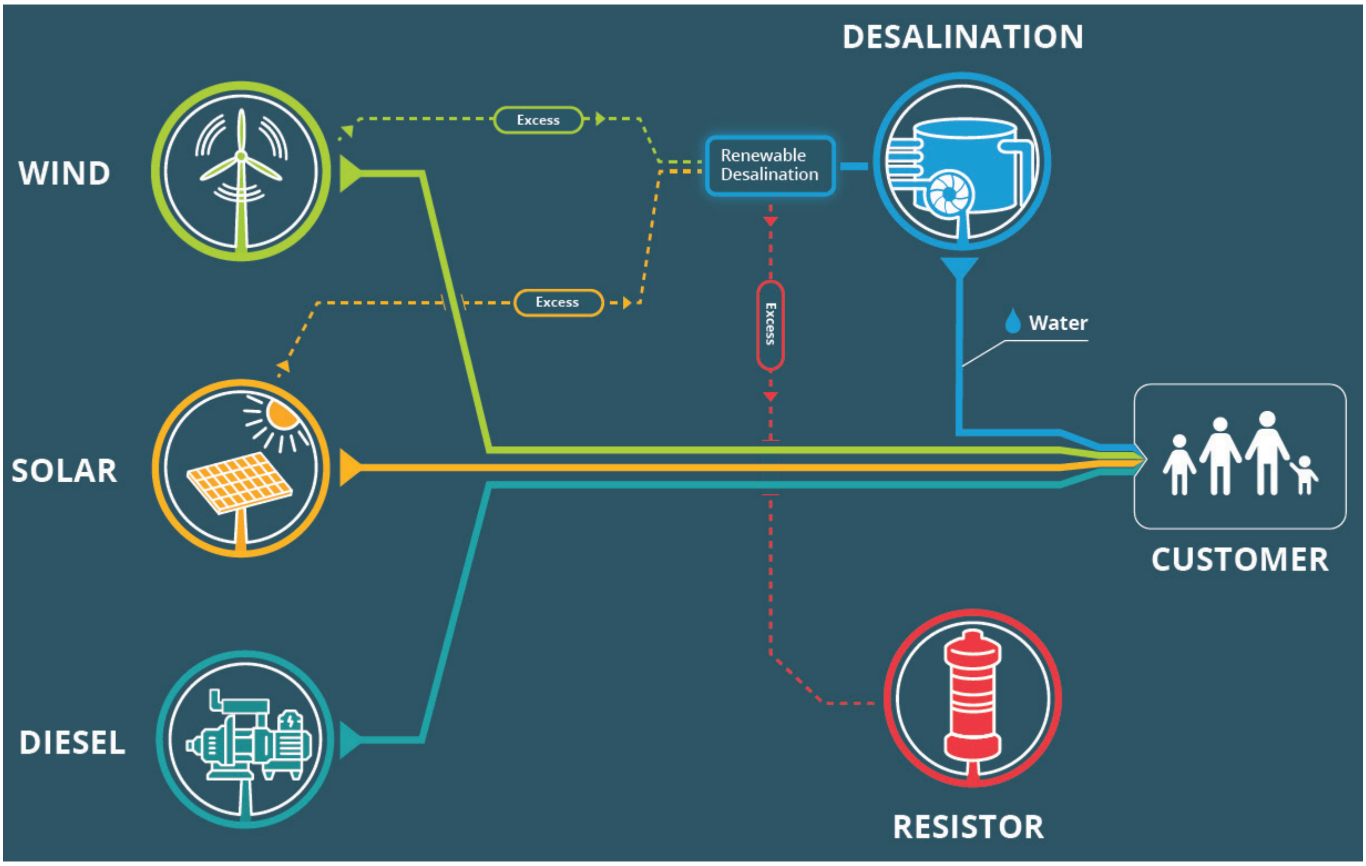
Figure 23 below shows a schematic representation of a working hybrid power and water supply system installed at Rottnest Island[19] (Western Australia). Real-time data on the performance of the system is publicly available via an App that can be installed a mobile device. In this example, excess renewable energy is initially diverted to the desalination plant for water production to reduce the reliance on diesel generation.

Similar applications of hybrid renewable energy systems are foreseeable in the Torres Strait communities with the integration of energy requirements for the production and treatment of drinking water, and for processing wastewater and sewerage.

19 Reference – Rottnest Island Water and Renewable Energy Nexus Final Report: project results and lessons learnt – Hydro Tasmania / ARENA

## 9.4 Energy Storage

An Energy Storage system allows for the absorption of "surplus" renewable energy when there is abundant wind or solar resource, and the power system demand is not high, to be stored for later use, when demand rises. If the marginal cost of installing more renewable energy conversion




*Water Renewable Energy Nexus Overview, managing surplus renewable energy*

*Figure 23 Rottnest Island (Western Australia) Renewable Energy System Schematic Diagram*

systems at a particular site is low, then often it can be useful to "oversize" the renewable energy production system, to specifically create surplus unused energy for storage and later re-use.

Energy storage systems come in a variety of forms, the most common being a Battery Energy Storage System (BESS) which utilises electrochemical storage medium, which in modern BESS systems is quite straightforward, to store and re-use when required. By careful selection of the BESS chemistry and configuration, a modern BESS can be configured to provide short term energy storage for management of energy or frequency fluctuations, or longer-term energy storage to shift energy production and consumption curves to better match each other.

Other forms of energy storage revolve around either storage of energy as heat, or storage of energy in a chemical or gaseous form, and these energy storage forms require processes to re-convert the stored energy back to useable electricity to supply back into the local grid when needed.

Energy can be converted to heat by employing mirrors and/or heat absorption tubes to transfer the sun's energy into a fluid such as water, molten salt, or refrigeration style working fluids, which can be stored in insulated tanks, and then withdrawn when needed and passed through a heat engine (i.e. Barton engine), or heat exchanger to a conventional steam cycle engine (i.e. Organic Rankine Cycle engine) or steam turbine, to produce electricity as required.

Energy from the sun can also be converted into gaseous energy by utilising surplus solar PV or wind energy to operate an electrolysis process to extract hydrogen and oxygen from water, which can be stored in gas storage cylinders for later re-use by either burning the hydrogen in specifically designed gas reciprocating engine or gas turbine, burning the gas to create steam similar to the conventional steam turbine discussed above, or utilising modern fuel cells which use a conversion process that results in electricity production with only water as the waste by-product. Hydrogen storage can require additional gas safety measures that require additional costs for safe use due to its inherent nature and properties.

Every energy storage system has its own inherent level of round-trip efficiency, and varying costs for conversion and re-conversion into useable electricity, and the method selected can often be influenced by the available energy sources at a particular site, the space available for storage devices, the storage time required – minutes or hours/days, costs of commercially available alternatives, and complexities of installation and maintenance requirements.

During a transition to renewable energy, diesel generation or other alternative storage, would be required for periods when renewable generation is unavailable, such as during the doldrums, when wind speeds drop below wind turbine cut off limits for extended periods of time or during the wet season when clouds and rain may reduce solar generation, and energy storage is insufficient to meet demand. As alternative fuel sources, such as hydrogen or biofuels become viable, then consideration could be given to alternative methods of providing baseload generation instead of diesel.

### 9.5 Power station works (EQL)

Options exist for the conversion of existing power stations to operate using alternative "renewable" fuel sources. It would be cost prohibitive to consider replacing all existing diesel generators throughout the Torres Strait at present. Once they reach the end of their operating life, then replacement with appropriate renewable technology should be considered.

Whilst all power stations are currently diesel-powered, the generators at the Thursday Island power station are suitable for using 100% biofuel and the generators at all other sites throughout the Torres Strait can use B10 – B20 biodiesel (10%-20% biofuel; 90%–80% diesel blend) to reduce GHG emissions and contribute to a renewable energy future.

Although the use of biodiesel appears to be an attractive alternative to fossil diesel generation, there is currently no reliable supply chain for biofuel products in Australia, nor is there a driver or foreseeable supply chain emerging. Total diesel consumption in the Torres Strait communities is in the order of 16 megalitres per annum of which approximately 10 megalitres is consumed at Thursday Island and Bamaga. Total biodiesel production for Australia in 2019 was approximately 40 megalitres[20] demonstrating the lack of availability of biodiesel.

Furthermore, the cost of manufacturing, acquiring and transporting biofuel/biodiesel products to the Torres Strait is significantly more than diesel. B10 is estimated to be approximately 50% more expensive than diesel and 100% biofuel would be more than double the price of diesel landed in the Torres Strait.

Therefore, at this stage, biofuel is not considered a viable alternative in the Torres Strait.

### 9.6 Consultation and engagement strategies

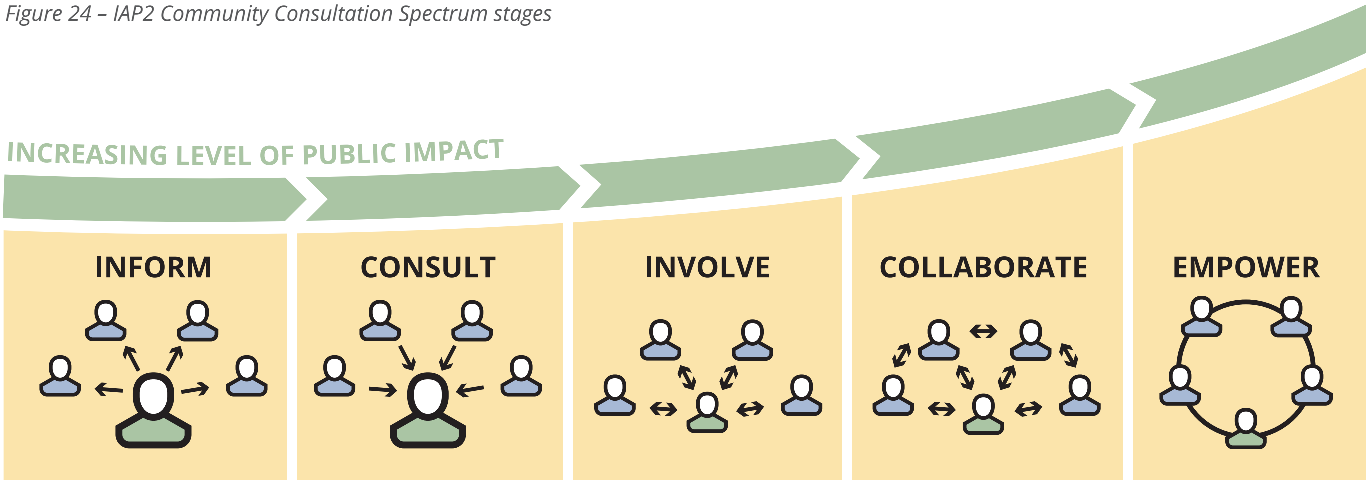
At a high level, a Community Engagement Strategy should have objectives, based on the IAP2 Community Consultation Spectrum[21], (Figure 24) which requires a strategy to:

- INFORM: Provide factual, timely and relevant information to stakeholders at key project milestones to assist them in understanding the challenges, opportunities and solutions.
- INTERACT: Consult – Establish two-way dialogue that provides opportunities to exchange views and information.
- INVOLVE: Ensure that stakeholder concerns and aspirations are considered in decision making processes.
- INFLUENCE: Collaborate – Profile TSRA and renewable energy project proponents as a trusted entities with capability to promote and lead engagement in sustainable practices.
- INDEX: Register and respond to all communications in an appropriate and timely manner.
- INCORPORATE: Use feedback to improve delivery of engagement strategy and report back to shareholders.

These elements are a subset of IAP2 Spectrum of Public Participation. Its describes the Goals at the stages of increasing maturity, and by inference

20 GAIN Report Number AU1829 11/7/2018 – USDA Foreign Agricultural Service
21 https://sustainingcommunity.wordpress.com/2017/02/14/spectrum-of-public-participation/

*Figure 24 – IAP2 Community Consultation Spectrum stages*




effectiveness, of community engagement that an entity should aspire to.

Effective community and stakeholder engagement develops trust relationships based on the following engagement principles:

- **Comprehensive:** Engagement is thorough and covers all aspects of the project including social, environmental, and economic issues. It will give equal time to discussing the potential benefits and potential issues to ensure a well-rounded understanding by stakeholders and community members, as well as a balanced approach to information sharing.
- **All-inclusive:** Engagement that recognises the diversity of backgrounds and interests within the region, such as Indigenous and non-Indigenous residents and businesses, local and non-locals, and a range of organisations with an influence and interest in the future growth and protection of the region. It will also ensure two-way communication is encouraged with all members of the community regardless of project involvement role. Having a local community liaison program (one day/week on-site aspired), even if only part time, shows commitment and care for the local community. Staff on the ground can help communicate key messages and ensure misinformation to be addressed in a timely manner.
- **Equitable:** Engagement that uses a range of communication techniques and tools, including in local language, to promote equitable access to project information for all members of the community. Everyone will have an opportunity to have their say, ask questions and receive answers.
- **Robust:** Engagement is conducted using a disciplined approach ensuring all feedback and consultation outcomes are accurately captured and reported. This is important to ensuring the trusted relationship between the communities and Yarrabah Microgrid project team as a primary source of information is maintained.

A Strategy will outline how stakeholder engagement objectives will be approached and met, including:

- identifying stakeholders and members of the public with a potential to influence the project, who must be informed of the proposed projects. It is essential that Traditional Owners, the Prescribed Body Corporates and individual community members are actively engaged by the engagement process.
- identifying and registering relevant issues that may influence the project achieving desired outcomes
- developing communication methods and tactics that provide factual, timely and relevant information to stakeholders
- recording and analysis of stakeholder interactions
- reporting of stakeholder interaction outcomes
- evaluation of stakeholder engagement effectiveness. Stakeholder consultation and maintaining those stakeholder relationships will be a key element in assessing the potential impacts on and benefit to the community.

Inadequate consultation and engagement with the community is described as a key process contributing to social conflict around any development in Australia. The sense of acceptance and ownership of a local energy generation project can differ according to both the scale but, perhaps more importantly, the depth and involvement allowed in the consultation and engagement process.

A CSIRO study in Australia in 2012[22] found that community engagement and involvement are key factors to successful project delivery and achieving a broad social licence to operate. This describes a level of acceptance or approval continually granted to an organisation's operations or project by the local community. Seeking a social licence to operate means asking the community to accept changes

22 Exploring community acceptance of rural wind farms in Australia: a snapshot Nina Hall, Peta Ashworth and Hylton Shaw CSIRO Science into Society Group • 2012

in their local area because they understand the importance of the project and can see the benefits for the community.

This consultation would allow the Regional Infrastructure Working Group or Inter-Agency Forum to form a well-rounded understanding of community concerns, strengths and opportunities in relation to potential project impacts.

Activities undertaken could include the following:

- identification of stakeholders and their expectations.
- area and site tours of existing renewable energy generation sites
- establishment and maintenance of a dedicated website to share information.
- one-on-one meetings.
- community information sessions, that include culturally appropriate materials.

Activities to be conducted in the future, may include:

- community surveys
- publication and distribution of fact sheets and Frequently Asked Questions
- educational information for local students
- on-site meetings, Q&A sessions, and discussions
- publication and distribution of project newsletters and media releases

Given the number of different agencies operating independently throughout the Torres Strait, each developing plans to potentially meet future targets for carbon reduction, it is imperative that there is a level of inter-agency coordination to ensure that: -

- All agencies and their key staff are educated on the opportunities for and benefits of implementation of appropriate renewable energy technologies and demand management principles across the Torres Strait over time, aspiring to meet state and international targets for net-zero carbon emissions by 2050;
- Current system constraints are not exceeded,
- Sufficient lead times are provided to adequately plan for the implementation of new energy infrastructure, including the development of renewable options,
- Project funding can be coordinated to ensure efficient use of scarce funds for investment in renewable energy projects,
- Stakeholders are aware of the operational arrangements and constraints for power supply and options that could be considered,
- How essential demand management will be in maintaining the reliability of the existing systems and managing the amount and type of renewable energy generation that is required and when, and the operational, maintenance and replacement regimes for future options.

The TSRA should consider expanding the Regional Inter-Agency Forum membership, described in Figure 25, to include Energy Queensland and other relevant

| IAP2 SPECTRUM OF PUBLIC PARTICIPATION | | | | | |
|---|---|---|---|---|---|
| **GOAL** | To provide balanced and objective information to assist in understanding the problem, alternatives, opportunities and/or solutions in a timely manner | To obtain feedback on analysis, alternatives and/or decisions | To work directly with the public to make sure that concerns and aspirations are considered and understood | To partner with the public in each aspect of the decision inlcuding the development of alternatives and the identification of the preferred solution | To place final decision-making in the hands of the public |
| **PROMISE** | “We will keep you informed” | “We will listen to and acknowledge concerns and aspirations, and provide feedback on how input influenced the decision” | “We will work with you to ensure your concerns and aspirations are directly reflect in the alternatives developed and the decisions made” | “We will look to you for advice and innovation and incorporate this into the decision to the maximum extent possible” | “We will implement what you decide” |

*Figure 25 IAP2 Spectrum of Public Participation*

## Integrated Service Delivery

A key element of the Torres Strait and Northern Peninsula Area Regional Plan 2009–2029 is its focus on integrated planning, development and service delivery. The TSRA's Integrated Service Delivery program aims to coordinate the effective delivery of a range of government services to local communities and minimise duplication between agencies.

The project has identified and documented over 1600 gaps in service delivery across 20 communities. The TSRA has published a series of booklets detailing service gaps in each community.

The TSRA Board has requested that local, state and Commonwealth government agencies refocus on relationships to build stronger partnerships for the delivery of services in the Torres Strait.

In September 2019, the TSRA hosted the inaugural Regional Interagency Forum, inviting senior officers from relevant government agencies, TSRA portfolio members and regional mayors and councillors to provide input into the future Integrated Service Delivery framework for the region.

The Interagency forum will be held annually by the TSRA in collaboration with the three regional local government agencies and the Queensland Department of Aboriginal and Torres Strait Islander Partnerships.

*Figure 26 - Extract - TSRA Annual Report 2019-20 p69*

stakeholders that may impact implementation of the RETP. In addition, they should consider adding RETP implementation progress to the agenda of the Regional Inter-Agency Forum.

### 9.7 Education /awareness

There is significant evidence to show the linkage between the community awareness and successful implementation of renewable energy infrastructure in future. The previous Ergon *powersavvy* program in the area aided many members of the community to become more aware of, and take advantage of, energy efficiency measures in relation to their personal energy use.

Implementing renewable energy generation effectively will need to be accompanied by education and awareness programs, as part of an appropriate stakeholder engagement strategy, that identifies how to operate their systems and their existing or future appliances in an energy efficient way; how to maintain them to ensure they function effectively in the Torres Strait's hot and humid tropical environment, and foreseeable changes to climate across the area.

The *powersavvy* program has provided the basis of a broad understanding of the benefits of energy-efficiency to Torres Strait communities. It would be beneficial to build on this knowledge with additional information about renewable energy opportunities and constraints and to ensure that community needs and expectations are taken into consideration with proposed solutions, as part of the planning programs. There is an employment opportunity to develop and deliver a similar renewable energy community awareness program, which builds on previous energy efficiency programs, to prepare communities for changes to energy generation and maximise the benefits of the roll-out of new technologies across the region. Many resources already exist that could aid this community tailored program, including you-tube videos prepared for the Yarrabah Microgrid Feasibility Project – Energy-Connect You-tube Channel, and energy audit apps that define current usage, and potential energy and cost savings. Audits could be undertaken by local teams across the Torres Strait region with minimal training or additional resources.

This information could be part of ongoing Demand Management Programs with strategies that lead to enduring behaviour change in use of energy. Comprising an appropriate mix of education programs, incentives, automation of appropriate components, and changing the timing of usage are all aspects that should lower demand. With lower energy demand, it is more likely that renewable generation could cover baseload as well as supplementary or emergency loads as situations evolve for Torres Strait communities

Expectation management should also be built into future programs, to help define particularly the planning, approval, financing and construction timelines, so that community members and Government Agency staff can understand and plan around the realistic timeframes for delivery of major infrastructure projects.

The TSRA Annual Report provides examples of best practice, which could be applied regionally. (Figure 27) Small incremental steps DO add up by increasing awareness and by slowly changing behaviour as options are 'proven' to work, raising the standard of 'normal'.

**Sustainability Awareness**

The TSRA also contributes to ecological sustainability in the Torres Strait region by:

- Employing Aboriginal and Torres Strait Islander people as trainees, rangers and ranger supervisors
- Partnering with Tagai State college in the Horticulture in Schools programme
- Providing technical assistance to improve food production in the Torres Strait through the Sustainable Horticulture Project
- Producing biodiversity profiles, fauna surveys and fire management plans for all inhabited Torres Strait Islands
- Working with communities for the sustainable management of turtles and dugongs
- Developing and implementing actions to build sustainability and resilience across the region through planning for climate change impacts
- Monitoring environmental change across the region

*Figure 27 Extract - TSRA Annual Report 2019-20 p91*

### 9.8 Location applicability (small, medium, large sites)

There are 17 power stations operated by EQL in the TSRA area as outlined in Figure 28 below. The total energy production across all communities is approximately 65.9 GWh per annum[23].

- 2 large stations (Thursday Island and Bamaga) account for 63% of total energy production
- 2 Medium-sized stations (Wasaga and Badu) - 12% of total energy production
- 13 Small power stations account for 25% of total energy production

The Torres Strait RETP should focus on engaging stakeholders to prioritise renewable energy solutions based on sites where maximum benefit can be achieved most economically. There is greater scope to make significant reductions in the reliance on fossil fuels at the top 4 sites including Thursday Island, Bamaga, Horn Island and Badu Island than at the other 13 smaller sites.

It is noted that EQL has previously explored solutions to develop renewable energy generation at Horn Island with an undersea cable connection between Horn Island, Thursday Island and Hammond Island, as there is more suitable land available at Horn Island for infrastructure development than Thursday Island.

### 9.9 Recent EQL activities for Thursday Island and Bamaga

EQL has sought expressions of interest for renewable energy solutions for Thursday Island and Bamaga. Details were published by the Queensland Government on ***QTenders*** website on 29th April 2021 as follows:

**Expression of Interest**

| | |
|---|---|
| **Status:** | Current |
| **Mega Category:** | General goods and services |
| **Number:** | Doc5486872 |
| **Released:** | Thu, 29 Apr 2021 at 2:11PM Brisbane, Queensland |
| **Closing:** | Mon, 7 Jun 2021 at 1:30PM Brisbane, Queensland |
| **UNSPSC:** | Power Generation and Distribution Machinery and Accessories - (100%) |
| **Region/s:** | Cairns & Far North Queensland |

EQL is seeking expressions of interest for the provision of low carbon / renewable generation services in Ergon Energy Isolated Networks (Thursday Island and Bamaga). EQL is searching for a viable low-carbon, carbon-neutral and / or renewable generation option, which may include, but is not limited to inverter-based renewables, energy storage, hydrogen or biofuels.

23 NGER reporting 2019-20

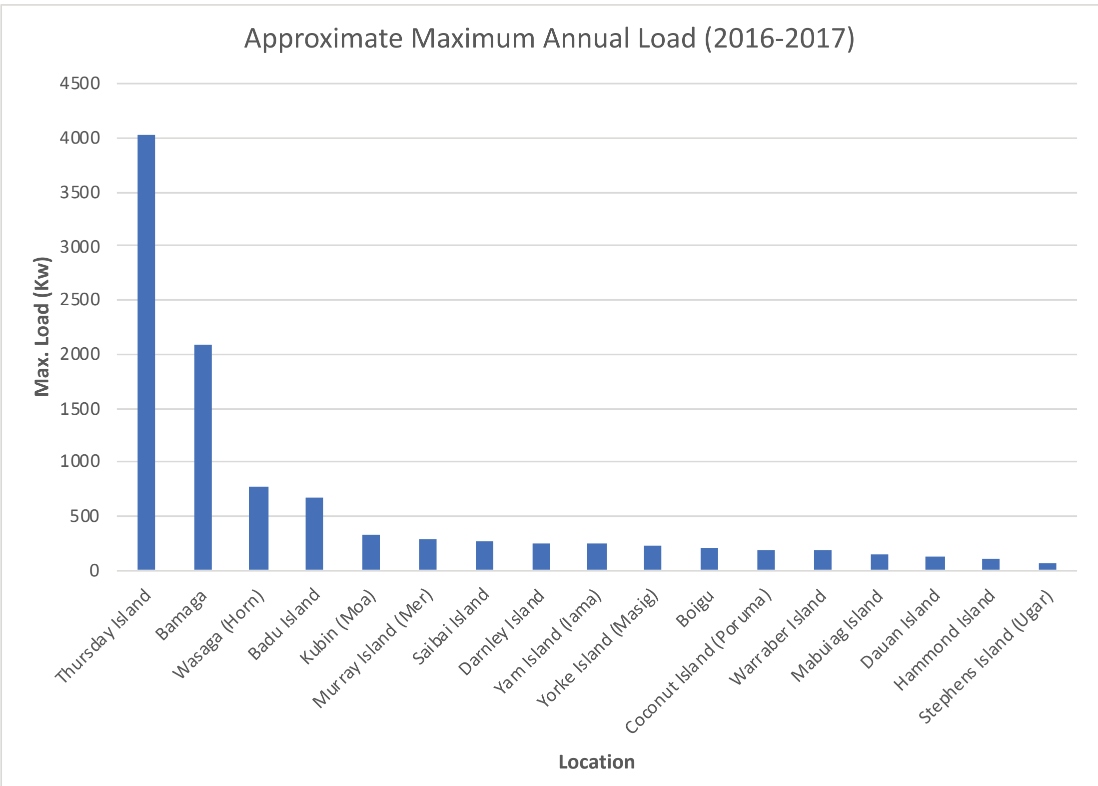



*Figure 28 Power Station Maximum Demand – Torres Strait Communities*

# 10 Impact of e-Mobility trends on the deployment of renewable energy systems

### 10.1 e-Mobility Definitions

The term e-Mobility is taken to define all methods of transport that are powered by electric energy, as opposed to fossil-fuelled internal combustion engines, and is a subset of the overall term of low-emission transport.

e-Mobility based transport includes passenger motor vehicles, electric motor bikes (road and trail), micro-mobility such as e-scooters and e-bikes, electric trucks (mini-vans, delivery vans/trucks and large highway trucks), public transport such as e-buses and shuttles, electric water transport such as passenger ferries – a form of transport very relevant for this report, and the emerging area of electric air transport – also very relevant for Torres Strait communities.

### 10.2 Transport Preferences

In Torres Strait Islands (Statistical Area Level 2), on the day of the 2016 Census, the most common methods of travel to work for employed people were: Walked only 53.0%, Car, as driver 23.3% and Car, as passenger 9.0%. Other common responses were Other 5.5% and Bicycle 1.3%. On the day, 0.7% of employed people used public transport (train, bus, ferry, tram/light rail) as at least one of their methods of travel to work and 33.9% used car (either as driver or as passenger).

#### Number of motor vehicles

In Torres Strait Islands, 28.8% of occupied private dwellings had one registered motor vehicle garaged or parked at their address, 7.4% had two registered motor vehicles and 2.1% had three or more registered motor vehicles. These are mostly likely to be Thursday Island and Horn Island based vehicles. Costs of fuel, predominantly diesel, for these vehicles, and for those on outer islands will need to be factored into future planning.

### 10.3 Existing Transport and e-Mobility Infrastructure

Most Torres Strait Islands have some form of road network to facilitate transport by vehicle by residents. The mainland communities also have reasonable sealed and unsealed road networks for transport purposes. There are high levels of existing vehicle ownership in most Torres Strait communities, with Thursday Island and the NPA having relatively large vehicle populations, more so than other more isolated islands in the region. The NPA region is serviced by large diesel trucks moving freight up the Peninsula Development Road. The Torres Straits region generally is serviced by diesel powered shipping for bulk freight and for fuel deliveries, by sea going vessels based in either Cairns or Darwin. Inter-island sea-based transport is conducted on medium sized vessels such as ferries and barges for

**TRAVEL TO WORK, TOP RESPONSES**

| Employed people aged 15 years and over | Torres Strait Islands | % | Queensland | % | Australia | % |
|---|---|---|---|---|---|---|
| Walked only | 511 | 53.0 | 70,471 | 3.3 | 370,427 | 3.5 |
| Car, as driver | 225 | 23.3 | 1,368,965 | 64.1 | 6,574,571 | 61.5 |
| Car, as passenger | 87 | 9.0 | 112,508 | 5.3 | 489,922 | 4.6 |
| Other | 53 | 5.5 | 15,689 | 0.7 | 73,512 | 0.7 |
| Bicycle | 13 | 1.3 | 21,679 | 1.0 | 107,756 | 1.0 |
| People who travelled to work by public transport | 7 | 0.7 | 152,230 | 7.1 | 1,225,668 | 11.5 |
| People who travelled to work by car as driver or passenger | 326 | 33.9 | 1,523,756 | 71.3 | 7,305,271 | 68.4 |

*Figure 29 Torres Strait Islands Travel to Work Modes Data – Census 2016*

*Yarrabah e-mobility Day 2021. Photo: G Bowes*

passenger and freight services, and by many smaller boats for personal transport purposes. Air transport is used extensively between the major commercial airport at Horn Island and most Torres Strait islands, both for fixed wing and helicopter transport services.

To the authors knowledge, there are currently no electric vehicles or boats registered in the Torres Strait region, and no existing infrastructure to facilitate electric vehicle or boat charging. Enquiries have not been made as to the presence of smaller electric scooters or bikes in any of the communities, but this may be possible.

It is also not known at this stage what efforts Torres Strait councils have undertaken to investigate the facilitation of local micro-mobility services such as e-scooters and e-bikes, which have certainly grown in popularity in mainland capital cities and some larger regional towns.

The Queensland Government through the Department of Transport and Main Roads (TMR) has developed the Queensland Transport Strategy (QTS) which sets a high-level policy platform for TMR to realise its vision of creating a single integrated transport network accessible to everyone.

Structured around five high-level, customer-focussed strategic outcomes, the QTS is TMR's 30-year vision for the future. The QTS outlines how Queensland can transform the state's transport system by effectively responding to customer preferences, global trends and emerging technologies.

The strategic outcomes are:

1. Accessible, convenient transport
2. Safe journeys for all
3. Seamless, personalised journeys
4. Efficient, reliable and productive transport for people and goods
5. Sustainable, resilient and liveable communities.

The QTS action plan outlines what TMR is doing to deliver the 30-year vision for the transport system. It details the specific initiatives TMR is undertaking over the next two years and beyond to deliver a future-focussed transport system that enhances the future economic prosperity, sustainability, and liveability of Queensland.

TMR is focussed on Queensland's mobility needs beyond the private car through enabling the development of an open mobility ecosystem to support Mobility as a Service (MaaS). In 2019, TMR began executing the MaaS Implementation Roadmap which details 123 actions across key functions needed to transition the department to be an enabler and broker of transport services in Queensland. The roadmap includes the functional areas of strategy, finance and procurement, customer experience, legislation, regulation and policy, infrastructure, data, technology, communications, service delivery, governance and culture.

The Queensland government has also recently produced Queensland's Electric Vehicle Strategy: The Future is Electric[24] which it believes will help the State shift towards a cleaner, greener electric vehicle fleet.

The strategy outlines 16 initiatives that will:

- Empower the community to make informed choices
- Enable the transition to EVs through charging infrastructure

24 https://www.publications.qld.gov.au/dataset/54875c88-0d6c-47ca-8b9d-77ca1ff674ba/resource/7e352dc9-9afa-47ed-acce-2052cecfec8a/download/the-future-is-electric-queenslands-electric-vehicle-strategy-3-october-2017.pdf

- Explore cost-effective programs to support uptake of EVs
- Envisage what future actions may be required.

The Queensland Government undertook to work with local governments and regional tourism groups to develop a series of regional local implementation strategies, to help support the uptake of EVs and associated destination charging infrastructure. It is not known at this stage how the EV strategy is being outworked for the Torres Strait region, and further effort will be required to determine specific action plans to encourage low emission and electric transport adoption in the region.

### 10.4 Estimate of e-Mobility Change in the Torres Strait

It would be reasonable to assume that transport modes in the Torres Strait communities will soon be influenced by trends in mainland communities due to the growing popularity and availability of low emission and electric transport options.

The types of low emission and electric transport options and services that may see development in the Torres Straits includes:

- Electric passenger motor vehicles
- Electric motor bikes (road and trail)
- Micro e-Mobility transport such as e-scooters and e-bikes
- Electric trucks (mini-vans, delivery vans/trucks and large highway trucks)
- Electric public transport options such as electric buses and shuttles
- Electric water transport such as freight shipping, passenger ferries, and smaller personal electric boats
- Electric air transport services – small electric passenger aeroplanes that may use the Horn Island commercial airport, and seaplanes such as the trial being conducted by Harbour Air in Canada[25]

For the ten- to fifteen-year timeframe envisaged by the RETP, the authors believe that the smaller transport modes such as micro-mobility units, passenger vehicles and perhaps some public transport services will include electric driven units as the existing vehicles are retired and require replacement. New electric passenger vehicles are gradually becoming more affordable, and some state governments are introducing a range of incentives to encourage adoption, however these programs are ad-hoc at this stage. There does not appear to be specific Queensland Government incentives in place for Torres Strait residents or communities that would overcome existing cost barriers.

The Queensland Government does appear to be investing funds to support departmental vehicle fleets to convert from fossil fuel to hybrid or fully electric, however this may first be concentrated in Southeast Queensland and major regional cities and towns where supporting infrastructure will be first established. The authors have not discovered any plans to install electric vehicle chargers in any Torres Strait communities.

It is difficult to forecast with any certainty the likely growth of electric transportation and supporting infrastructure in this region, and the what the mix of low emission transport options will be over the next ten to fifteen years. However, it can reasonably be assumed that some private and government owned electric transport will make its way into Torres Strait communities, even without formal government funded charging infrastructure, and planning should commence to support the development of these new transportation options.

### 10.5 Impact of e-Mobility on Electricity / Energy Infrastructure

As stated earlier, the authors believe that there will be a gradual growth in electric transportation of the types listed below, even if the rate of change will be somewhat slower than that occurring in major population centres:

- Electric passenger motor vehicles
- Electric motor bikes (road and trail)
- Micro e-Mobility transport such as e-scooters and e-bikes
- Electric trucks (mini-vans, delivery vans/trucks and large highway trucks)
- Electric public transport options such as electric buses and shuttles
- Electric water transport such as freight shipping, passenger ferries, and smaller personal electric boats

With a growth in electrically driven transport, comes a requirement to re-charge the batteries supporting the vehicles. There are a range of small to medium scale battery chargers currently available on the open market, and they have varying impacts on the electricity grid when the vehicles are charging. The Australian Electric Vehicle Council has published useful reference material for the types of EV chargers most commonly used in Australia[26].

Electricity demand will increase over time to supply the vehicle charging units, and in the Torres Strait mini grid environments, EQL may require charging times to be managed to avoid peak load windows, and grid overload. However, the authors believe that any growth in grid demand caused by a gradual uptake of electric infrastructure, can be met by the deployment of Renewable Energy generation envisaged in the RETP, without impacting on future low emission transport changes.

25 https://www.harbourair.com/harbour-air-magnix-and-h55-partner-for-the-worlds-first-certified-all-electric-commercial-airplane/

26 https://electricvehiclecouncil.com.au/about-ev/charger-map/

# 11 Funding Streams / Opportunities

The potential funding sources for renewable energy projects in the Torres Strait will depend on who is responsible for developing and operating the systems and the nature of the projects.

The costs of proposed works will also depend upon the scope of works. For example, the budget cost to develop a 4MW wind farm and associated plant and equipment at Bamaga is in the order of $30 million whereas the cost to install a 5kW rooftop solar system could be in the order of $5,000 - $10,000 and a domestic battery may be in the order of $15,000 – $20,000.

To undertake an energy-efficiency audit at a house or business using local personnel may be completed for a few hundred dollars, excluding costs to travel to site etc.

Under the current operating model, EQL would be responsible for developing business cases and funding projects from its capital works budget for works that will be directly connected to the grid or at each of the power stations, and each project would compete against other worthy projects for funding. Additionally, each project would need to demonstrate a positive NPV over the project life, typically assessed over a 20–30-year period, and not have a detrimental impact on the CSO. EQL would typically budget on a 5-year cycle for major capital works.

A number of alternative potential funding opportunities and incentives may be available in the future for new renewable energy projects that deliver reductions in Greenhouse Gas emissions, to achieve Queensland Government objectives for net zero carbon emissions by 2050. The current range of funding sources may include:

**1. EQL capital works budget**

- EQL Tender – Bamaga and Thursday Island carbon reduction
- Poruma Island 36kW solar farm (completed
- Cyclic program for diesel generator replacement / upgrade

**2. Federal Government / State Government grants, subsidies or loans. Examples include:**

- Regional and Remote Communities Reliability Fund (Feasibility Studies) Regional and Remote Communities Reliability Fund – Microgrids 2020–21 | business.gov.au
- Building Better Regions Fund Building Better Regions Fund (BBRF) (regional.gov.au)
- Northern Australia Infrastructure Facility Investing for impact across the north – NAIF : NAIF
- Queensland Renewable Energy Fund Queensland Renewable Energy Fund – Queensland Treasury
- Qld Dept Energy & Public Works "Solar for Remote Communities" Solar for remote communities | Department of Energy and Public Works (epw.qld.gov.au)
- Qld Dept Energy & Public Works "Solar for Rentals Trial" Solar for rentals trial | Department of Energy and Public Works (epw.qld.gov.au)

**3. ARENA (Australian Renewable Energy Agency)**

- Future Fuels Fund https://arena.gov.au/funding/future-fuels-fund
- Advancing Renewables Program Advancing Renewables Program
- Industrial Energy Transformation Studies Program Industrial Energy Transformation Studies Program - Australian Renewable Energy Agency (ARENA)

**4. Clean Energy Finance Corporation Home – Clean Energy Finance Corporation (cefc.com.au)**

- Innovation Fund Innovation Fund – Clean Energy Finance Corporation (cefc.com.au)

**5. Private funding – not-for-profit or investment funds**

- Green Collar GreenCollar: Identify the real opportunity on your property
- Social Ventures Australia Social Ventures

Australia | Insights and action to alleviate disadvantage

- Indigenous Business Australia Products and services – Indigenous Business Australia (iba.gov.au)
- Other philanthropic investors / donors

**6. Council funding**

- TSC, TSIRC, NPARC direct investment (behind-the-meter)

**7. Other Government agencies**

- Qld Health, Education Qld, Qld Police Service etc. (behind-the-meter)

**8. TSRA funding**

- Direct investment in small scale trial programs, energy-efficiency education, community engagement, facilitating Regional Inter-Agency forums

**9. Private owner / developer**

- Direct investment (behind-the-meter solutions)
- Potential developer of renewable energy infrastructure for Standalone Systems

Details of specific funding programs and their currency may be obtained by accessing the websites referenced above.

Some background to the relevant funding and support programs and case studies are outlined in Appendix 4.

In summary, there are numerous potential funding opportunities for Renewable Energy projects in the Torres Strait. In liaison with other relevant agencies, the TSRA should seek to raise awareness of various funding streams, gain an understanding of funding streams currently accessed by those agencies and monitor key web sites for future relevant grant funding opportunities.

Funding applications can be prepared in line with agreed project priorities and business cases. Additionally, the TSRA should consider a co-ordinating role for funding applications to ensure that agencies are not competing against each other for the funds.

In some circumstances a joint-agency funding application may be appropriate. Alternatively, a nominated lead agency could apply, with formal support from other agencies.

The TSRA should consider developing a Prospectus of Project Opportunities for Renewable Energy Projects in the Torres Strait on behalf of the various agencies to provide a broad overview of opportunities and to seek Expressions of Interest for project developers, investors etc.

The TSRA could lobby Government representatives on behalf of Torres Strait communities and agencies to establish or identify location-appropriate programs or investment opportunities.

*Rooftop Solar Hot Water System*

# Appendix 1 – Implementation Plan

| | YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | — | — | 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **KEY MILESTONES**<br>**Qld Government Climate Action Strategy** | | | | | | | | | 2030 | | | | | | | | | 2050 |
| | GHG emissions 30% below 2005 levels & 50% of energy is produced by renewables | | | | | | | | | X | | | | | | | | | |
| | Net zero Greenhouse Gas emissions (2050) | | | | | | | | | | | | | | | | | | X |
| 2 | **Planning, engaging, communicating and monitoring** | | | | | | | | | | | | | | | | | | |
| | Establish Renewable Energy Forum & Charter to ensure that there is an agreed plan and clear accountabilities for the deployment of renewable energy solutions throughout the Torres Straits. | X | | | | | | | | | | | | | | | | | |
| | Implement a community information and engagement program (leveraging *powersavvy*) to promote awareness of the Renewable Energy Plan and energy efficiency practices. | | X | X | X | X | X | | | | | | | | | | | | |
| | Establish an energy auditing program to support community education and identify cost saving initiatives for residents. Audit outcomes to inform criteria for rooftop solar PV and battery systems and to assist residents with managing energy costs. | | X | X | | | | | | | | | | | | | | | |
| | Develop a Torres Straits Renewable Energy Report with performance measures and targets. Publish results in TSRA Annual Report or similar. Monitor progress against Qld government targets for carbon reduction and R/E implementation for 2030 & 2050. | X | | | | | | | | | | | | | | | | | |
| 3 | **Implement large scale renewable solutions for Thursday Island and Bamaga / Seisia** | | | | | | | | | | | | | | | | | | |
| | Establish a partnership with EQL (Ergon Energy) to support, promote and implement the identified carbon reduction strategies for Thursday Island and Bamaga. | X | X | | | | | | | | | | | | | | | | |
| | Facilitate engagement with TSC, PBCs, Native Title holders to address barriers to implementation of TI and Bamaga solutions. | | X | X | X | X | | | | | | | | | | | | | |
| | Implement confirmed solutions - TI/Bamaga | | | | | X | X | X | X | X | X | | | | | | | | |

| | YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | — | — | 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | **Solar farm / wind farm / energy storage systems investigation for Badu and Horn Islands (and other identified small energy demand sites)** | | | | | | | | | | | | | | | | | | |
| | Consult with key stakeholders to confirm strategy | X | | | | | | | | | | | | | | | | | |
| | Preliminary community engagement and site identification | | X | X | | | | | | | | | | | | | | | |
| | Develop concept designs and budgets | | | | X | | | | | | | | | | | | | | |
| | Undertake wind resource assessments | | | | | X | X | X | | | | | | | | | | | |
| | Secure funding for solar farm / energy storage sites | | | | X | | | | | | | | | | | | | | |
| | Site Acquisition – solar farms | | | | X | X | X | | | | | | | | | | | | |
| | Detailed design for solar farm/energy storage/diesel | | | | | | X | | | | | | | | | | | | |
| | Build solar/energy storage/diesel projects | | | | | | | X | X | | | | | | | | | | |
| | Site Acquisition – wind farm sites | | | | | | | X | X | X | | | | | | | | | |
| | Secure funding for wind farms | | | | | | | | X | | | | | | | | | | |
| | Detailed design – Wind farm integration | | | | | | | | | X | | | | | | | | | |
| | Build wind farms | | | | | | | | | | X | X | | | | | | | |
| 5 | **Rooftop Solar PV plus battery solutions for small Island communities where centralised solutions are not practical. (Mer, Saibai, Darnley, Iama, Masig, Boigu, Poruma, Warraber, Mabuiag, Dauan, Hammond, Ugar, Muralug)** | | | | | | | | | | | | | | | | | | |
| | Confirm available RE hosting capacity with EQL for target communities | X | X | | | | | | | | | | | | | | | | |
| | Scope suitability of residences for rooftop solar PV and batteries | X | X | X | | | | | | | | | | | | | | | |
| | Confirm funding / ownership model (EQL, TSIRC, TSC, Dept of Communities, Housing & Digital Economy, etc). | X | X | | | | | | | | | | | | | | | | |
| | Undertake a trial installation program of say 10 systems (one small island community – up to 50kW of solar PV + battery) | | | X | | | | | | | | | | | | | | | |
| | Tender for bulk buy solar panels and batteries / installation contracts | | | | X | | | | | | | | | | | | | | |
| | Installation program – rooftop solar PV + batteries | | | | | X | X | X | X | | | | | | | | | | |

| | YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | — | — | 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6** | **e-Mobility Solutions** | | | | | | | | | | | | | | | | | | |
| | Community engagement / opportunity identification | X | | | | | | | | | | | | | | | | | |
| | e-Mobility feasibility study | X | X | | | | | | | | | | | | | | | | |
| | Business case development and implementation plan | | X | | | | | | | | | | | | | | | | |
| | Seek funding and Implement plan | | X | X | X | X | | | | | | | | | | | | | |
| **7** | **Monitor and Review** | | | | | | | | | | | | | | | | | | |
| | Annual review of RETP | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | |
| | Review Strategy, Technology Developments, Climate Impacts, Government Policy, Funding Opportunities etc. | | | | | X | | | | | X | | | | | X | | | |

*Figure 30 – TSRA Renewable Energy Transition Plan – Implementation Plan*

# 13 Appendix 2 – Technology Evaluation Matrix

| Criteria | Rooftop Solar PV | Distributed batteries | Solar Farm(s) | Community Battery | Wind farm |
|---|---|---|---|---|---|
| **Site potential** | All sites – up to EQL hosting capacity limit | All sites – up to EQL hosting capacity limit | Primarily larger sites – Bamaga, Horn Island, Badu. Smaller systems may be suitable at other communities. | All sites | Horn Is, Thursday Island (existing), Bamaga, Badu – subject to wind assessment. |
| **Connection** | Behind-the-meter | Behind-the-meter | Grid-connected | Grid-connected | Grid-connected |
| **Accountability / ownership** | Property owner – Council / Qld govt owns majority of residences.<br>Some private residences / commercial premises | Property owner – Council / Qld govt owns majority of residences.<br>Some private residences / commercial premises | EQL<br>Could be council/private-owned subject to Power Purchase & Connection Agreements | EQL<br>Could be council/private-owned subject to Power Purchase & Connection Agreements | EQL<br>Could be council/private-owned subject to Power Purchase & Connection Agreements |
| **Indicative Installation Cost** | $1000/kW ($5,000/ residence)<br>(Additional cost for Torres Straits – logistics costs and design for harsh environment) | $1,000/kWh<br>($10,000–$15,000/res)<br>(Additional cost for Torres Straits – logistics costs and design for harsh environment)<br>Costs expected to reduce over time. | $3.5m–$4m / MW | TBA | $4m–$4.5m / MW plus additional freight, handling and site establishment costs |
| **Operating Costs** | Low – routine cleaning of solar panels and rust prevention to metal brackets to achieve maximum life expectancy | Low – enclosed unit – no maintenance | Low – routine cleaning of solar panels and rust prevention to metal brackets to achieve maximum life expectancy | Low – enclosed unit – annual maintenance inspections. Rust prevention for metal enclosure (shipping container). | High – routine mechanical maintenance to turbines. Specialist technical resources required. |
| **Equipment life expectancy** | 10–15 years | 10–15 years | 10–15 years | 10–15 years | 15–20 years |
| **Plant / Equipment availability** | Domestic systems readily available – may require higher specification for harsh environment | Domestic systems available – may require higher specification for harsh environment | Commercially available – site-specific design required. May require higher specification for harsh environment | Commercially available – site-specific design required | Commercially available – existing wind turbines at Thursday Is. Site-specific design required. |

| Criteria | Rooftop Solar PV | Distributed batteries | Solar Farm(s) | Community Battery | Wind farm |
|---|---|---|---|---|---|
| **Energy Resource availability** | Good | N/A | Good | N/A | Good. Proven wind resource at TI. Wind monitoring required for other sites. |
| **Risks** | EQL hosting capacity<br>Reduced lifespan in harsh environment<br>Condition of rooftops<br>Ownership / maintenance<br>Equity for tenants | EQL hosting capacity<br>Reduced lifespan in harsh environment<br>High cost<br>Ownership / maintenance<br>Equity for tenants | EQL hosting capacity<br>Reduced lifespan in harsh environment<br>Land availability / tenure<br>High cost | EQL hosting capacity<br>Reduced lifespan in harsh environment<br>Land availability / tenure<br>High cost | EQL hosting capacity<br>Land availability / tenure<br>High cost |
| **Environmental** | Reduces diesel consumption /GHG emissions<br>Process required to manage waste products / recycling at end of life. | Reduces diesel consumption /GHG emissions<br>Process required to manage waste products / recycling at end of life. | Reduces diesel consumption /GHG emissions<br>Environment and Cultural heritage considerations for land requirements.<br>Process required to manage waste products / recycling at end of life. | Reduces diesel consumption /GHG emissions<br>Low impact – small footprint – fully enclosed cubicle. | Reduces diesel consumption /GHG emissions<br>Could be significant environmental constraints requiring EIA studies<br>Cultural Heritage considerations<br>Proximity to residential areas |
| **Ease of implementation** | Relatively simple subject to property owner approvals and logistical issues. | Relatively simple subject to property owner approvals and logistical issues. | Easy to implement subject to land availability. | Easy to implement subject to land availability. | Limited opportunities due to site requirements. Significant logistical issues with transporting and installing large wind towers and turbines at remote sites. |
| **Timeframe** | 0–5 years | 0–5 years | 5–10 years | 5–10 years | 5–10 years |
| **Financial benefits** | Direct financial benefit to household via reduced electricity bills<br>Reduced diesel costs to EQL | Direct financial benefit to household via reduced electricity bills if combined with solar PV<br>Reduced diesel costs to EQL | Reduced diesel consumption – EQL | Reduced diesel consumption – EQL | Reduced diesel consumption – EQL |

| Criteria | Rooftop Solar PV | Distributed batteries | Solar Farm(s) | Community Battery | Wind farm |
|---|---|---|---|---|---|
| **Property / land tenure issues** | Council / government owns most residences – no land tenure issues.<br>Commercial buildings<br>Assessment of roof condition | Attached to existing buildings / residences<br>Could be integrated into design of new energy-efficient building designs. | 1MW solar farm requires 2HA land. Land tenure is an issue and availability of suitable land may be an issue. | Containerised unit – relatively small footprint. Depends on final capacity. | Land tenure and availability of suitable land<br>May require access track construction |
| **Regulatory issues** | EQL hosting capacity limitations | EQL hosting capacity limitations | EQL hosting capacity limitations<br>PPA's / Connection Agreements if privately owned | EQL hosting capacity limitations<br>PPA's / Connection Agreements if privately owned | EQL hosting capacity limitations<br>PPA's / Connection Agreements if privately owned |
| **Employment opportunities and local services.** | Assessing suitability of premises – roof integrity<br>Consulting with residents – public education – energy efficiency<br>Energy audits<br>Supply labour to assist with installation<br>Maintenance contracts – cleaning solar panels / rust treatment<br>Coordinate repairs / contracting services. | Assessing suitability of existing premises<br>Consulting with residents – public education – energy efficiency<br>Energy audits<br>Supply labour to assist with installation<br>Maintenance contracts<br>Coordinate repairs / contracting services. | Consulting with residents – public education<br>Supply labour to assist with installation. Fencing contracts / civil works.<br>Maintenance contracts<br>If council-owned, may directly engage personnel for site management, supervision, contract management etc.<br>Contractor inductions.<br>Service provision for site construction contractors | Consult with residents – public education<br>Supply labour to assist with installation. Civil works.<br>Site maintenance contracts (minor)<br>If council-owned, may directly engage personnel for site management, supervision, contract management etc.<br>Expect low maintenance installation. | Specialised skills required to operate and maintain wind turbines.<br>Opportunities for future site maintenance<br>Environmental and cultural heritage compliance during construction.<br>Supply labour during construction. |

| Criteria | Small wind turbines | Waste to energy (WtE) | Biofuels | LPG turbine | Diesel Generation |
|---|---|---|---|---|---|
| **Site potential** | Small to medium demand sites subject to wind assessment. | Centralised – Horn Island / Bamaga | B10 / B20 – All locations<br>B100 – Thursday Island | All locations | Existing – all sites |
| **Connection** | Grid-connected / Behind-the-meter | Grid-connected / Behind-the-meter | Power Station | Power Station | Power Station |
| **Accountability / ownership** | EQL<br>Could be council/private-owned subject to Power Purchase & Connection Agreements. | EQL (if grid connected)<br>Council / Private (behind-the-meter?) | EQL | EQL | EQL |
| **Indicative Installation Cost** | $4m–$4.5m / MW plus additional freight, handling and site establishment costs | TBA | 50%–150% more than diesel<br>(additional handling and freighting costs and limited supply) | TBA | Current state<br>Baseline cost option |
| **Operating Costs** | High – routine mechanical maintenance to turbines. Specialist technical resources required. | Medium – routine servicing of mechanical plant required<br>High cost of transporting materials between islands | Medium – Similar to diesel generators | Medium – routine servicing of mechanical plant required<br>Additional costs of transporting and handling bulk LPG. | Medium – routine servicing of mechanical plant required. |
| **Equipment life expectancy** | 15–20 years | 5–10 years (engines) | N/A | 5–10 years (engines) | 5–10 years (engines) |
| **Plant / Equipment availability** | Commercially available – existing wind turbines at Thursday Is. Site-specific design required. | Commercially available – site-specific design required | Existing engines | Commercially available – site-specific design required | Readily available. |
| **Energy Resource availability** | Good. Proven wind resource at TI. Wind monitoring required for other sites. | Current waste resource and management process unknown | Limited supply – considered uneconomical at this time. | LPG readily available but would need to be shipped to site from Cairns. | Readily available – proven logistical processes utilising barges out of Cairns. |
| **Risks** | EQL hosting capacity<br>Land availability / tenure<br>High cost | EQL hosting capacity<br>Land availability / tenure<br>Unreliable source of feedstock<br>Transport and logistics costs | High cost<br>Unreliable supply chain | Conversion costs from diesel<br>Storage, handling and distribution of LPG | Low risk – current system.<br>Peak Oil risks – availability and future price (longer term) |

| Criteria | Small wind turbines | Waste to energy (WtE) | Biofuels | LPG turbine | Diesel Generation |
|---|---|---|---|---|---|
| **Environmental** | Reduces diesel consumption /GHG emissions<br>Could be significant environmental constraints requiring EIA studies.<br>Cultural Heritage considerations.<br>Proximity to residential areas. | Reduces diesel consumption /GHG emissions<br>Reduced waste to landfill | Reduced GHG emissions | Reduced GHG emissions | Base case |
| **Ease of implementation** | Limited opportunities due to site requirements. Significant logistical issues with transporting and installing large wind towers and turbines at remote sites. | Relatively easy to implement – could be incorporated into future planning for the waste management and recycling.<br>Considerable logistics issues. | Easy to implement subject to addressing cost and supply risks. | Complex and expensive installation processes requiring conversion of existing power stations to alternative fuel and engines | Easy to implement |
| **Timeframe** | 5–10 years | 5–10 years | > 5 years | > 10 years | Current state |
| **Financial benefits** | Reduced diesel consumption – EQL | Reduced diesel consumption – EQL<br>Potential cost savings for waste management? | More expensive than diesel –not economical | Unknown | Current state |
| **Property / land tenure issues** | Land tenure is an issue and availability of suitable land may be an issue. | Could be developed on a private site / council-controlled land. Potential for land tenure issues. | No land issues | No land issues | No land issues |

| Criteria | Small wind turbines | Waste to energy (WtE) | Biofuels | LPG turbine | Diesel Generation |
|---|---|---|---|---|---|
| **Regulatory issues** | EQL hosting capacity limitations<br>PPA's / Connection Agreements if privately owned | Could be behind-the-meter without significant regulatory constraints.<br>PPA's / Connection Agreements required if privately owned and directly connected to the grid<br>EQL hosting capacity constraint | Nil | Nil | Nil |
| **Employment opportunities and local services.** | Specialised skills to operate and maintain wind turbines.<br>Site maintenance<br>Environmental and cultural heritage compliance during construction.<br>Supply labour during construction. | Collection and processing waste material.<br>Operating and Maintaining the plant.<br>Transporting & handling waste materials | EQL responsibility | EQL responsibility | EQL responsibility |

| Criteria | Hydrogen Generation | Tidal | Micro Hyro | Pumped Storage | Biomass |
|---|---|---|---|---|---|
| **Site potential** | Not identified | Not identified | Not identified | Not identified – expected to be very limited application (if any) | Not identified – possibly centralised (same as WtE) |
| **Connection** | Power Station | Grid-connected | Grid-connected / Behind-the-meter | Grid-connected | Grid-connected / Behind-the-meter |
| **Accountability / ownership** | EQL / Council / Private | EQL /Council / Private | EQL (grid connected)<br>Council/Private (Behind-the-meter) | EQL / Council / Private | EQL (grid connected)<br>Council/Private (Behind-the-meter) |
| **Indicative Installation Cost** | Unknown | Unknown | Unknown | Unknown | |
| **Operating Costs** | Unknown | Unknown | Low | Medium – routine pump, pipeline and reservoir maintenance | Medium – routine servicing of mechanical plant required. |
| **Equipment life expectancy** | Unknown | Unknown | Unknown | Unknown | 5–10 years (engines) |
| **Plant / Equipment availability** | Emerging technology – not commercially available yet | New technology. Not commercially viable at this time. | Commercially available – site-specific design required | Subject to site conditions and site-specific design considerations. | Commercially available – site-specific design required |
| **Energy Resource availability** | Not currently available. | Unproven resource. | Unknown. Site-specific. | Unknown. Site-specific. | Potential vegetation from powerline clearing, road clearance works etc.<br>Volume of feedstock material required / available unknown. No existing agricultural activities that could provide source material. |
| **Risks** | Storage and handling hydrogen | Unknown | Low risk | Unknown | EQL hosting capacity<br>Unreliable source of feedstock<br>Transport and logistics costs |

| Criteria | Hydrogen Generation | Tidal | Micro Hyro | Pumped Storage | Biomass |
|---|---|---|---|---|---|
| **Environmental** | Reduced GHG emissions | Potential impacts to marine environment requiring Environmental Impact Assessment Study. | May require Environmental Impact Assessment Study. | May require Environmental Impact Assessment Study. | Reduces diesel consumption /GHG emissions<br>Positive environmental outcome with re-use of waste products. |
| **Ease of implementation** | Expected to be very complex and subject to further technology developments. | Unknown - dependent on technology developments. | Easy to implement subject to suitable sites being identified. | Installation may be complicated – site dependent. | Relatively easy to implement – could be incorporated into future planning for the waste management and recycling. |
| **Timeframe** | >10 years | >10 years | 1–5 years | >10 years | 5–10 years |
| **Financial benefits** | Unknown | Unknown – offset diesel consumption – EQL | Reduced diesel consumption - EQL<br>Customer savings if installed behind-the-meter. | Reduced diesel consumption – EQL | Reduced diesel consumption – EQL<br>Customer savings if installed behind-the-meter. |
| **Property / land tenure issues** | Land tenure is an issue and availability of suitable land may be an issue. | May require special approvals / licenses | Land tenure is an issue and availability of suitable land may be an issue. | Land tenure is an issue and availability of suitable land may be an issue. | Could be developed on a private site / council-controlled land. Potential for land tenure issues. |
| **Regulatory issues** | Unknown | Unknown | EQL hosting capacity limitations | EQL hosting capacity limitations<br>PPA's / Connection Agreements if privately owned | Could be behind-the-meter without significant regulatory constraints.<br>PPA's / Connection Agreements required if privately owned and directly connected to the grid<br>EQL hosting capacity constraint |

| Criteria | Hydrogen Generation | Tidal | Micro Hyro | Pumped Storage | Biomass |
|---|---|---|---|---|---|
| **Employment opportunities and local services.** | EQL /Private developer – specialist skills | Consulting with residents – public education<br>Supply labour to assist with installation. Civil works.<br>Site maintenance contracts (minor)<br>Expect low maintenance installation. | Specialised skills required to operate and maintain micro hydro turbines.<br>Opportunities for future site maintenance<br>Environmental and cultural heritage compliance during construction.<br>Supply labour during construction. | EQL /Private developer – specialist skills | Collection and processing vegetation material.<br>Operating and Maintaining the plant.<br>Transporting and handling materials to the plant. |

*Figure 31 – Torres Strait – Renewable Energy Options Evaluation Matrix*

# 14 Appendix 3 – Summary of Recommended Actions

| No. | Description | Responsibility | Target Date |
|---|---|---|---|
| 1 | Expand the Regional Inter-Agency Forum to establish a key stakeholder renewable energy working group including TSRA, EQL, TSC, TSIRC, NPARC & Prescribed Bodies Corporate, Traditional Owner reps and other relevant agencies and stakeholders. | | |
| 2 | Present the Torres Strait RETP to Torres Strait stakeholders and seek feedback and develop ownership. Seek formal agreement to adopt the plan. | | |
| 3 | Develop a set of agreed KPIs and performance measures to monitor the progress of the RETP and to communicate key statistics on reduction of Greenhouse Gas emissions as a result of implementing the RETP. | | |
| 4 | Engage with government and regulators to monitor and influence changes in policy and legislation that may apply to the operation and ownership of renewable energy technology in remote and isolated locations that are not part of the National Electricity Market. | | |
| 5 | Through advocacy and community engagement, support the implementation of EQL GHG reduction projects at Thursday Island and Bamaga. | | |
| 6 | Identify training opportunities and provide funding to support training outcomes for local people. May include awareness programs on renewables, energy auditing, and other preparatory courses for the renewable energy future. | | |
| 7 | Liaise with local stakeholders to identify potential solar farm and wind turbine sites throughout the Torres Strait islands, and establish a database for future reference, including access requirements, tenure, key stakeholder contact information etc. | | |
| 8 | Install wind monitoring devices at sites with high wind potential and commence a program of wind measurement to create a database for potential wind turbine installers to reference at the appropriate time. | | |
| 9 | Implement a community education and information program to integrate Demand-Side Management strategies into the Renewable Energy solutions. Include energy-efficiency and cost-saving principles etc. previously delivered via the Ergon Energy *powersavvy* program. | | |
| 10 | Liaise with EQL to assess renewable energy hosting capacity at each community and undertake feasibility studies for establishing centralised renewable energy plant versus Distributed Energy Resources (rooftop solar etc) | | |
| 11 | For sites where behind-the-meter solutions are preferred, establish the available hosting capacity and liaise with local councils and housing owners / businesses to explore potential for a bulk installation program. A trial project or demonstration site may be considered. Funding would need to be secured. | | |

| | | | |
|---|---|---|---|
| **12** | For sites where centralised renewable energy solutions are preferred, liaise with EQL and other stakeholders to prepare feasibility studies for each identified site to scope the required costs, land requirements and approvals necessary to progress the projects. | | |
| **13** | Under TSRA coordination, key agencies work together to develop a future funding strategy for renewable energy projects (to cover costs of community engagement, feasibility studies, site investigation, design, build, operate and maintain, etc.). Implement a funding and investment coordination function or role to seek funding sources, including agency budgets, external investments, government grants, etc. Prepare business cases and applications for funding, lobby government representatives and secure funding for renewable energy projects.<br><br>Develop a summary of renewable energy opportunities in the Torres Strait for potential investors. | | |
| **14** | Prepare a low-emission and e-Mobility feasibility study for the Torres Strait focusing on benefits for Greenhouse Gas reduction and potential health, education, and other benefits that may ensue. | | |
| **15** | Implement a formal process for annual review of the RETP and 5-yearly strategic review. | | |
| **16** | Survey community rooftops to establish solar PV potential – size, condition, orientation, etc. | | |
| **17** | Relevant agencies to collaborate on energy-efficient house design and integration of renewable energy systems and energy-efficient appliances such as split system air-conditioners into the next generation of public housing. Consider retrofit opportunities for existing housing. | | |
| **18** | Investigate opportunities for solar-powered streetlighting for future developments. | | |
| **19** | Identify opportunities for integration of renewable energy applications for potable water and wastewater treatment and management to optimise renewable opportunities. | | |
| **20** | Develop a shared view of the forward program of diesel generator replacement at power stations to identify opportunities for plant or fuel substitution with renewable alternatives. | | |
| **21** | Develop a Community Engagement Strategy for 100% renewable energy future in the Torres Strait, including surveys, fact sheets, FAQs, educational materials, meetings and discussions, newsletters, media, web site etc. | | |

*Table 1 - Summary of Recommended Actions*

# 15 Appendix 4 – Funding and Support Program Case Studies

**SOLAR FOR RENTALS TRIAL[27]**

The solar for rentals trial ran from 5 March 2019 to 30 June 2020, encouraging landlords and tenants in Bundaberg, Gladstone and Townsville to share the value of installing solar systems. As part of the trial, rebates of up to $3,500 were offered to landlords for installing a solar system on their rental property.

**How it worked**

Landlords and tenants both agreed to participate in the trial and entered into a new lease of at least 12 months.

Landlords then installed a solar system at the rental property and received a rebate.

All solar systems were installed by an approved list of Queensland-based solar retailers who had signed up to the Clean Energy Council Approved Solar Retailer Code of Conduct.

In return for full use of the solar system to reduce their power bills, tenants agreed to pay a fair rent increase (not more than the solar savings).

**Trial outcomes**

During the trial, 670 solar systems were installed across the 3 Local Government Areas, including:

- 166 in Bundaberg
- 78 in Gladstone
- 426 in Townsville

In total, 4 megawatts of solar power were installed and more than $2.25 million in rebates was paid to eligible landlords, at an average rebate payment of $3,360.

**Participant benefits**

Tenants participating in the trial are an average of $600 per year better off – accounting for an average rent increase of $11 per week and their electricity bill savings.

The estimated average solar system payback period of out-of-pocket costs after the rebate for participating landlords is expected to be around 9 years.

**Success story: Yumba-Meta Ltd**

Yumba-Meta Ltd is a not-for-profit organisation based in Townsville that provides long, medium and short-term secure and affordable accommodation and services to disadvantaged people, particularly Aboriginal and Torres Strait Islander people.

More than 50 properties in Yumba-Meta Ltd's portfolio installed solar systems during the trial. These systems are now helping some of Townsville's most vulnerable community members' electricity bills to be more affordable.

**Lessons learned**

The trial successfully demonstrated that solar systems can be used in rental properties to create a win-win outcome for both landlords and tenants. However, the rebate played an important part in reducing solar system paybacks for landlords.

Analysis showed that participating landlords and tenants were most likely to benefit in the following circumstances:

- solar system size of 5kW inverter and 6.6kW panels
- rent increase of between $10 to $20 per week

While all customer's circumstances are different, this scenario has the potential to result in savings of around $600 a year for tenants (after the rent increase) and a 7-year payback period for landlords. Without a solar for rentals rebate, the system payback period would be around 18 years.

Tenants tend to benefit more when they use more of the solar power in their rental property (rather than exporting it to the grid) and landlords who purchase and install the solar system at a more competitive price tend to have a shorter payback period.

*Last updated 3 February 2021*

**SOLAR FOR REMOTE COMMUNITIES[28]**

As part of the $3.6 million Decarbonising Remote Communities program, 4 Indigenous communities in Queensland's far north will have new renewable energy systems installed to reduce the use of diesel power. Participating Aboriginal and Torres Strait Islander Councils are key project partners in planning and delivering these projects.

Using renewables such as solar and battery storage directly benefits remote communities that run on diesel by creating jobs and power savings, as well as bringing the environmental benefits of reduced emissions.

**Doomadgee**

Installation of the 304 kilowatt (kW) ground-mounted solar farm extension (adjacent to the existing 264kW solar farm) is now complete and 105kW of rooftop solar has been installed on 4 Doomadgee Shire

27 Qld Department of Energy & Public Works web site (Accessed 29 May 2021)

28 Qld Department of Energy & Public Works web site (Accessed May 2021)

Council buildings. All systems were commissioned on 30 November 2019.

This project provided around 15 construction jobs in the local community and the rooftop solar will help Doomadgee Council save around $30,000 a year on their power bills for years to come.

**Mapoon**

The Mapoon Aboriginal Shire Council installed 65kW of rooftop solar in the community during the second half of 2019. We supported council by covering the cost of network and communication technologies. This included upgrading the power station to allow council's rooftop solar to work together with the diesel generators that power the local grid.

We also engaged the Indigenous Consumer Assistance Network to deliver energy education to residents with the aim of helping families save money on power by being more energy efficient at home.

Further rooftop solar and battery storage is planned for 2021, providing even greater savings for the Council and the community.

**Pormpuraaw**

Around 210kW of rooftop solar was installed on 8 council owned buildings during the second half of 2020. The solar is expected to result in annual power bill savings of around $40,000 for Pormpuraaw Council over the next 20 years.

**Northern Peninsula Area**

Up to 340kW of rooftop solar is planned for installation on 13 buildings across the Northern Peninsula Area (NPA). Each of the communities in the area, including Bamaga, Umagico, Injinoo, Seisia and New Mapoon, will have solar installed.

With construction due to commence in 2021, this project is expected to save the NPA Regional Council around $87,000 per year off their power bills.

*Last updated 3 February 2021*

## GRANTS FOR RENEWABLE ENERGY RESEARCH AND DEVELOPMENT (R&D) [29]

A range of grants exist to help businesses and organisations fund renewable energy projects, energy efficiency and clean technologies. The 2 main funding programs are the Australian Renewable Energy Agency (ARENA) and Clean Energy Finance Corporation (CEFC). Queensland Government opportunities and assistance are also available.

**Advance Queensland**

Through a series of programs to assist businesses in the development of innovative products and technologies, Advance Queensland provides grants to Queensland businesses developing next generation renewable energy technologies.

**Australian Renewable Energy Agency (ARENA)**

ARENA provides long-term financial assistance for renewable energy technology innovation.

ARENA aims to make renewable energy technologies more competitive and increase the supply of renewable energy through a range of funding programs. This includes funding to researchers, developers and businesses that have demonstrated the feasibility and potential commercialisation of a project.

**Clean Energy Finance Corporation (CEFC)**

CEFC provides and develops financing solutions across the clean energy sector spanning renewable energy, low-emissions technologies and energy efficiency. It operates like a traditional financier by working collaboratively with co-financiers and project proponents to seek ways to secure financing solutions for the clean energy sector. CEFC will invest through partnerships, trusts and joint ventures, or through subsidiaries, with a focus on projects that are demonstrably commercial.

29 Business Queensland website (Accessed 28/5/2021)