Sustainable Masig

Decarbonisation of Great Barrier Reef Islands – Whole of Community Pilot Project

December 2020

EarthCheck

ARUP

Regional Economic Solutions

Queensland Tourism Industry Council
The Voice of Tourism

Acknowledgement

This report acknowledges the Traditional Owners, those people with Historical association and all community members of Masig Island. This report also acknowledges that their customs and traditions have nurtured and managed the land and sea for centuries.

The project team would like to thank all contributors and collaborators who have provided invaluable assistance throughout this project. Special thanks to the Torres Strait Island Regional Shire Council Councillors and staff, the Torres Strait Regional Authority, Tagai State College, as well as the Masig Island My Pathway Program for their continued support and collaboration. The project team acknowledges the Queensland Government for the funding of the project as well as the Department of Environment and Science, the Department of Aboriginal and Torres Strait Partnerships as well as the Department of Housing and Public Works for their ongoing input and support to deliver the project outcomes.

Finally, thank you to all the members of the Masig Island community, who welcomed us into their community, their homes, their country and took the time to have a yarn with us. We are extremely grateful and touched by the community's trust and openness with the whole team.

Disclaimer

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Project Team

EarthCheck
Since 1987, EarthCheck has provided frameworks, tools and standards for the public and private sector to achieve sustainable development outcomes using world leading science, demonstrated methodologies and performance driven approaches to innovation. EarthCheck has three elements of key focus in driving innovative practice in Sustainability: advice and consulting sustainability services, certification of an operation's or destination's sustainability as well as benchmarking and performance tools.

Regional Economic Solutions
Regional Economic Solutions (RES) is a majority owned First Nation Business. RES is dedicated to bridging the economic and social gap between Indigenous Australians and the rest of the community. RES achieve this by partnering with organisations whose projects impact indigenous communities and work to ensure those impacts are positive, delivering social and economic outcomes that are sustainable, ethical and responsible.

Arup
Arup is an independently-owned, multi-disciplinary firm specialising in issues in the built environment. Arup is a global network of engineers, designers, scientists, economists, planners and technical specialists.

Queensland Tourism Industry Council
Queensland Tourism Industry Council (QTIC) is the peak industry body for tourism in Queensland, acting as The Voice of Tourism. QTIC is a not-for-profit, private sector, membership-based organisation representing the interests of Queensland's tourism and hospitality industry.

Document guide

Final Report
This document outlines the overarching project approach and key findings. The Final Report has the following appendices:

Appendix 1: Final Project Options
18 Final Project Options for the Masig Island community across the five project themes of energy, water, waste, transport and resilience.

Appendix 2: Option Recommendations
Options that have not progressed through to the options shortlist, but which have merit and potentially represent areas for future consideration.

Appendix 3: Option Recommendations
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Appendix 4: Stakeholder Register:
List of engaged stakeholders throughout the project lifecycle.

Technical Appendix 1: Sustainability Assessment and Risk Assessment
As a separate document to the Final Report, this appendix is a detailed Sustainability Assessment and Risk Assessment for the Masig Island community. This document contains the detailed project findings and data which are referred to in the Final Report.

Technical Appendix 2: Options Report
As a separate document to the Final Report, this is a detailed report on the process of options from the Long List to determine the final Project Options.

List of Figures and Tables

Executive Summary

To address the risks related to climate change and protect the Great Barrier Reef (GBR), there is a need for the reduction of carbon emissions. The decarbonisation of GBR island communities provides the opportunity to align with Queensland's emission reduction goal as well as learn from the Torres Strait island community's traditional knowledge. The knowledge held by First Nations science practitioners is and will continue to be integral to navigating a path ahead. This report provides an overview of the findings and results of the Decarbonisation of GBR Island – 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.

This project was supported by the Queensland Government, which made a $1.73 million election commitment in 2017 to assist GBR islands transition to a low or zero carbon future and become more resilient to changes in climate. The project team was constituted of EarthCheck, Arup, Regional Economic Solutions (RES) and the Queensland Tourism Industry Council (QTIC).

In order to reach the project objective, a collaborative engagement process with the community was established and maintained, harnessing the RES Moon-Da-Gatta Yarning Framework. This project deeply engaged and connected with the Masig Island community in order to support the community reclaim, revitalise and maintain cultural tradition, which is still very prevalent across the community today through language, stories, song and dance.

Community and stakeholder-led initiatives and ideas were at the heart of this project. It is recognised that it is the community who are best positioned to action sustainable and impactful change towards decarbonisation and building capacity to respond to climate change at a local scale. An options longlist was collated and the ideas most aligned with community needs and project objectives were selected by the community to progress to final project options. It is recognised that community development could incur increased emissions. This project hopes to reduce emissions compared to a business-as-usual approach by proposing carbon conscious solutions.

The extensive research and knowledge development undertaken throughout this project supports the 18 final project options developed for the Masig community. The number of final project options per project theme are presented in Figure 1. The cumulative upper estimates for potential emissions reductions, annual savings, full time equivalent jobs as well as total investments are also identified in this figure. Refer to Appendix 1: Final Project Options for detailed estimates for each final project option.

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Throughout this process, a range of ideas, initiatives and projects were documented for future consideration and are collated as further recommendations in this report. Recommendations can be found in Appendix 2: Option Recommendations of this report. The privileged access to community and perspective gleaned throughout this project enabled the project team to highlight specific policy recommendations aimed at governmental agencies. These are outside the scope of the project options developed in this project and provide tangible opportunities for community development and wellbeing.

Finally, the community on Masig is vibrant, engaged, and a model in sustainability throughout the Torres Strait Region. Through millennia of occupying their land and sea, a deep cultural and traditional understanding of environmental patterns, the community is uniquely positioned to help drive understanding and knowledge around the effects of climate change on island communities as well as pave a way forward. Through ongoing support, including the project options developed through this project, the Masig community and island stakeholders are well equipped to champion decarbonisation and resilience development in the Torres Strait. It is also recognised that a hugely important aspect of this project is the need to improve community living standards. While potentially incurring supplementary emissions due to increased community and economic activity, the final project options propose ways through which emissions could be reduced compared to business as usual models.

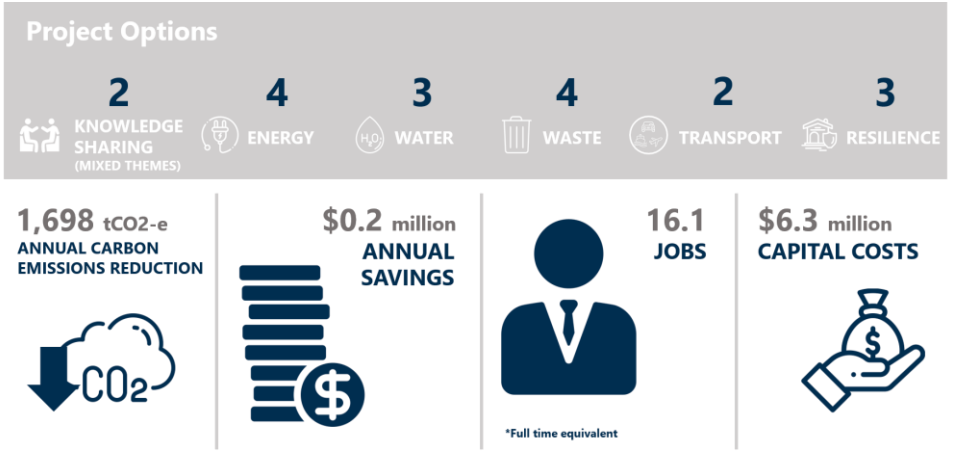

Figure 1: Key Findings and Project Summary*

*Figure totals have been calculated by summing the maximum figure for each final project option aspect. Where final project options do not have an associated figure (e.g. to be determined by a study), there have been no savings or costs included for that final project option.

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The developed final project options provide the potential for significant investment into the Masig Island community, the opportunity for full time equivalent (FTE) positions to be created, as well as important decarbonisation potential presented as carbon reductions. The below Table 1 presents the Final Project Options developed for Masig Island. For the complete final project option documents, please refer to Appendix 1: Final Project Options.

Table 1: Final Project Options for Masig Island

Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
1. Community Market Garden This project seeks funding for a community-led on-island market garden to sell produce to the local community, in conjunction with a green waste composting scheme, which seeks to increase fresh food self-sufficiency on Masig Island.	N/A	100,000	1 – 2	0.5 – 1	• 1000 Jobs Package, National Indigenous Australians Agency • Round 3 - Community Sustainability Actions Grants, Department of Environment and Science • Social Reinvestment fund, DATSIP • Drought Communities Programme, Department of Infrastructure, Transport, Regional Development and Communications • Community Led Grants (Indigenous Communities), Department of Prime Minister and Cabinet • Resource Recovery Industry Development Program, DSDMIP • Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022, Queensland Health • Work with/through TAFE to offer appropriate courses on an ongoing basis • Funding under future round of W4Q
2. Blue Carbon Sequestration Decarbonising the islands of the Great Barrier Reef by implementing measures to enhance blue carbon storage through the conservation and restoration of Masig Island coastal ecosystems such as seagrass and mangroves.	1.38 – 1.74	700,000 (USD)	N/A	5	• Philanthropy and private funds (as an environmental and social cause) • Federal and State government grants/funding, including QLD Community Sustainability Action grants, QLD Attracting Tourism Fund, Land Restoration Fund, Climate Solutions Fund and Emissions Reduction Fund • Partners who might be able to fund their own activities/contributions, e.g. university research might be funded by PHD scholarships, volunteers from organisations like SeagrassWatch, MangroveWatch or Conservation Volunteers Australia
3. Community-led Traditional Knowledge Sharing and Education This project seeks to celebrate cultural knowledge and engage the local community through community-led sustainability and environmental traditional knowledge sharing and education.	N/A	25,000 (capital) 75,000 – 100,000 (ongoing)	1.5	0.5	• Community Sustainability Actions Grants, Department of Environment and Science • Social Reinvestment Fund, Department of Aboriginal and Torres Strait Islander Partnerships • Indigenous Languages and Arts Grant, Department of Infrastructure, Transport, Regional Development and Communications • 1000 Jobs Package (Tranche Two), National Indigenous Australians Agency • Community Led Grants, Department of the Prime Minister and Cabinet • The Container Refund Scheme Small Scale Infrastructure Grants Program (Queensland Government) provides up to $10,000 to establish collection points for the container deposit scheme • DES Grant Program for First Nations Council up to $50,000.

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	Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
	**4. Solar PV Rooftop Systems for Housing** Increasing the number of managed solar panels installed on residential rooftops to reduce dependence on diesel-generated electricity.	102	340,000	1 – 2	0.5 – 1	• Small-scale technology certificates for solar PV systems through Small-scale Renewable Energy Scheme – from the Clean Energy Regulator (Australian Government) • CEFC - Reef Funding Program: funding available for emission reduction projects in Great Barrier Reef catchment area • Regional and Remote Communities Reliability Fund • Climate Solutions Fund – Emissions Reduction Fund
	**5. Low Emission On-Island Shuttlebus** On-island shuttle bus for public transport or direct rapid transport, powered either as an electric vehicle (and associated charging infrastructure) or by alternative low emission fuels.	0.002 – 0.006 /100km	100,000	N/A	0.5 – 1	• Climate Solutions Fund – Emissions Reduction Fund • CEFC - Reef Funding Program • ARENA – potential funding through exploration of innovative EV charging infrastructure • Ergon – potential funding and becoming partner on project due to EV charging infrastructure
	**6. Smart Solar Streetlights** Installation of new smart solar cells in streetlights and solar lighting across the community (including on roads, on the jetty, and at the beach).	0.195	22,000/light	N/A	<1	• CEFC - Reef Funding Program: funding available for emission reduction projects in Great Barrier Reef catchment area • Regional and Remote Communities Reliability Fund • Climate Solutions Fund – Emissions Reduction Fund
	**7. Active Transport Options** Establish planning and infrastructure to promote active transport on Masig Island.	0.35	80,000	1	0.25 – 0.5	• This may be determined as part of the planning process. Potential funding sources may include council budgets, or funding through the activities of the Queensland Walking Strategy and/or the Queensland Cycle Strategy.
	**8. Existing Building Improvements** Improving energy efficiency in buildings through passive cooling measures such as: improving air flow, insulation, glazing, heat reflective paint, gutter guards and other energy saving opportunities	0.257 – 515 (residential) 1.5 – 3 (commercial)	200,000 – 500,000	2 – 3 /year	0.5 – 1	• Ergon Energy should be approached as a key partner as they have an interest in deferring network augmentation

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Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
9. On-island Sustainability Officer An ongoing, paid position for a dedicated on-island sustainability officer to coordinate, oversee and support the successful delivery of sustainability projects on Masig Island.	N/A	80,000	1	<1	• Torres Strait Island Regional Council Community Grants • Community Sustainability Actions Grants, Department of Environment and Science • Social Reinvestment fund, DATSIP • 1000 Jobs Package, National Indigenous Australians Agency • Community Led Grants, Department of Prime Minister and Ca
10. Energy Efficient Appliance Upgrades Improving energy efficiency in buildings through upgrades to energy-efficient appliances.	0.257 – 515 (residential) 1.5 – 3 (commercial)	250,000 – 500,000	1	1 – 2	• Energy Efficient Communities Program, Community Energy Efficiency and Solar Grants 2020, Department of Industry, Science, Energy and Resources • Ergon Energy should be approached as a key partner as they have an interest in deferring investment. • CEFC or an Indigenous Organisation
11. Rainwater Harvesting Improvement Program This project seeks to increase the safety, reliability and (non-potable) utilisation of domestic rainwater harvesting systems, reducing overall demand and increasing the resilience of the community water supply.	0.004 /m3 water harvested	500,000 – 2,000,000	1 – 2	1 – 2	• Round 3 - Community Sustainability Actions Grants, Department of Environment and Science • Drought Communities Programme, Department of Infrastructure, Transport, Regional Development and Communications • Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022, Queensland Health: capacity building for Environmental Health and Animal Management in first nations communities • Funding under future round of W4Q • Northern Australia Infrastructure Fund
12. Solar Panels at Sewage Treatment Plant Solar PV panels on Sewage Treatment Plant, providing decarbonisation benefit through reduced dependence on diesel generators.	11	40,000	0.1	0.5 – 1	• Small-scale technology certificates for solar PV systems through Small-scale Renewable Energy Scheme – from the Clean Energy Regulator (Australian Government) • Reef Funding Program, Clean Energy Finance Corporation: funding available for emission reduction projects in Great Barrier Reef catchment area • Regional and Remote Communities Reliability Fund, Department of Industry, Science, Energy and Resources • Climate Solutions Fund: Emissions Reduction Fund, Department of Environment and Energy
13. Water Supply Energy Efficiency and Solar Project This project seeks to increase the energy efficiency of the Masig Island Water Supply System, and offset power demand with renewable energy - solar PV and potential battery energy storage.	31 – 52	130,000	0.5	1 – 2	• Round 3 - Community Sustainability Actions Grants, Department of Environment and Science • Drought Communities Programme, Department of Infrastructure, Transport, Regional Development and Communications • Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022, Queensland Health: capacity building for Environmental Health and Animal Management in first nations communities • Funding under future round of W4Q • Northern Australia Infrastructure Fund

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Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
14. Waste Management Optimisation Optimisation of landfill practices and removal or recycling of stockpiled waste from the island for reuse.	N/A	250,000 – 300,000	N/A	1 – 2	• The Department of Environment and Science are currently undertaking an Indigenous Waste Strategy and associated infrastructure planning, in line with the Queensland Waste and Resource Management Strategy. The development of this Indigenous Waste Strategy and infrastructure plans may provide opportunity for funding for remote communities such as Masig Island. • Any future round of the Qld Government Regional Recycling Transport Assistance Package
15. Island Composting Scheme Collection of food and garden organics to produce compost, to support on island food production and reduce waste to landfill.	N/A	250,000 – 300,000	1 – 2	1	• The Department of Environment and Science are currently progressing an Indigenous Islands Waste Strategy and associated infrastructure planning, in line with the Queensland Waste and Resource Management Strategy. The development of this Indigenous Waste Strategy and infrastructure plans may provide opportunity for funding for remote communities such as Masig Island.
16. Community-led Housing Design Code Develop and implement a housing design code which is co-developed with the Masig Island community to ensure housing is sustainable, suited to the climate and meets the needs of residents.	3 – 5 /dwelling	80,000 – 130,000	N/A	1 – 3	• Federal and local governments are likely to be the key funding partner • Commonwealth Close the Gap funding
17. Minimise Single-use Plastics and Packaging Modify procurement practices to reduce single use items and packaging from the supply chain to reduce waste disposal and litter on the island.	N/A	20,000 – 50,000	N/A	1 – 2	• It is understood that there is no longer funding through DES in support of the 'Plastic free places' initiatives however future rounds of the Community Sustainability Action Grants may be a potential funding opportunity. • DES are currently developing the Indigenous Waste Strategy and undertaking associated infrastructure planning in line with the Queensland Waste and Resource Management Strategy. The development of the Indigenous Waste Strategy and infrastructure plans may provide opportunity for funding for remote communities such as Masig Island.
18. Community-based Water Demand Management Implement community-based water demand management approaches across Masig Island to assist in achieving TSIRC's ambitious demand reduction targets and evaluate the viability of options for wider roll-out across the Torres Strait.	<5	<25,000	N/A	1 – 3	• Round 3 - Community Sustainability Actions Grants, Department of Environment and Science • Drought Communities Programme, Department of Infrastructure, Transport, Regional Development and Communications • Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022, Queensland Health: capacity building for Environmental Health and Animal Management in first nations communities • Funding under future round of W4Q

Project Phases

This section presents the project phases undertaken.

Project Phases and Engagement Framework

The RES Moon-Da-Gatta Yarning Framework was employed to appropriately engage and connect with the community and is illustrated in Figure 2. This Framework is a strength-based cultural yarning process emphasising revitalising, restoring and reclaiming culture and tradition. This project addressed the first three phases of this engagement framework. There is an understanding that this project constitutes one piece of a process, is supported by past work, and that more remains to be done.

Listening to Hear aimed to identify the best of the current situation as well as community strengths. This phase aligned with the **Sustainability Assessment** of the project. Individuals, stories, places, ways of being as well as practice are the pillars of this phase and set the tone for conversations to come.

Dreaming Big identified the dreams and the goals of the community. Conversations around what might be as well as ideas fostering and developing hope in the community are central to this phase. For this project, this phase aligned with the development of the **Options Longlist**.

Finally, **Whichway Now** is a phase focusing on grouping themes, consolidating ideas and deciding on which actions to take forward. For this project, this phase manifested in the development of the **Project Options**.

This process is critical in developing common understanding around projects and driving community-led change. The next phase in the Moon-Da-Gatta Yarning Framework is the *What*. As mentioned above, this phase is the continuation of this work beyond this project. The Whichway Now section in this report also tackles how community may chose to employ these next steps.

The next pages describe the project approach through the lens of the Moon-Da-Gatta Yarning Framework phases and how they were carried out throughout this project.

Figure 2: Moon-Da-Gatta Yarning Framework (RES)

Phase 1 Listening to Hear (Sustainability Assessment)

The *Listening to Hear* phase focused on two main elements, strengthening relationships within community and data collection, to inform the Sustainability Assessment.

Firstly, utilising established relationships to best understand the cultural context were critical success factors. Establishing relationships and a mutual trust while on the first trip to the island was a key consideration at this stage. This was achieved through conversation and connecting with community leaders. Important elements identified by the community on Masig Island were caring for land and sea, caring for family, as well as reclaiming, revitalising and maintaining culture through language, song and dance. Caring for land and sea manifested through ideas like protecting the island from erosion and sand loss, implementing a community garden, as well as caring for the reef and the mangroves. Caring for family as well as reclaiming, revitalising and maintaining culture and community came through ideas like elders transferring knowledge to younger community members, cultivating cultural identity for next generations, as well as connecting youth and elders to land and sea.

Secondly, data and information was captured through stories and conversations with community and stakeholders. This was on the themes of energy, water, waste, transport and resilience were key parts of the conversations with community and stakeholders. Combined with consultation with council and the various community organisations and service providers on the island, a wide range of information was collected in order to inform the subsequent project phases.

Over 30 community members and stakeholders provided input into the Sustainability Assessment through three drop-in sessions at the community hall and a number of one-on-one meetings. The sustainability assessment data collection process was led by EarthCheck (supported by RES and QTIC) and targeted the five key areas of energy (generation and efficiency), waste, water (supply and treatment), transport (inter and intra-island), and self-sufficiency/resilience in relation to climate change adaptation.

Phase 1 was conducted from 24th of June 2019 to 23th of September 2019. The first island visit was conducted on the 10th, 11th and 12th of September 2019.

Refer to Technical Appendix 1: Sustainability Assessment and Risk Assessment for the full methodology community and stakeholder consultation approach, and project findings.

Phase 2
Dreaming Big
(Options Longlist)

This *Dreaming Big* phase involved thinking about what might be, discussing what may contribute to happiness and getting community members excited about the future, as well as understanding how to increase community well-being under future climatic conditions.

With the community and engaged stakeholders, including council, service providers, the school as well as different subject matter experts, a longlist of options was developed. This list included 44 distinct options across the project themes of energy, waste, water, transport and resilience. The options stemmed from discussions with the community, Torres Strait Island Regional Council (TSIRC), service provider input, Queensland government input, as well as project team expertise.

Community consultations during the second on-island visit sought community and stakeholder input into each of the options, guidance around island context and opportunities, as well as the identification of potential barriers.

Trust-based relationships that were established were the foundation of this second phase. Over 50 community members provided input on the options through individual discussions as well as three drop-in sessions at the community hall. Many of the community members and stakeholders who contributed to this phase had been engaged in the previous phase.

The ideas most aligned with community needs as well as the decarbonisation and resilience-building objectives were selected by the community to progress to project options. This process is further detailed in Appendix 2: Option Recommendations.

The second phase highlighted the eagerness of the community to see change enacted on Masig Island as well as the importance of addressing loss of land due to erosion, community health, self-sufficiency as well as resilience to the effects of climate change.

Phase 2 was conducted from 2nd of September 2019 to 3rd of February 2020. The second island visit was conducted on the 7th, 8th, 9th, 10th and 11th of December 2019.

Refer to Technical Appendix 2: Options Report for the options longlist methodology, full options long list and gateway results.

Project Phases and Engagement Framework

Phase 3
Whichway Now?
(Project Options)

Following *Dreaming Big*, the *Whichway Now?* Phase of engagement aimed to narrow down the long list of ideas to a shorter list of options and develop detailed final project options for each. The most important ideas were identified based on discussed community needs and preferences, project objectives and feasibility for implementation on Masig island.

Initially it was planned to be conducted on-island, this round of consultation had to be conducted remotely given the COVID-19 pandemic and associated health risks related to travel. The Masig community was engaged remotely through the relationships established from the previous island visits, working to consolidate links between the project team and community. Members of the project team reached out to key community members and stakeholders to discuss the proposed projects, measure community support and obtain clarifications on outstanding data gaps.

Informed by the detailed information and data generated through the two previous phases, final project options were developed for 18 distinct projects on Masig Island. These final project options identify how options can be implemented in an impactful and sustainable manner, the different benefits each provides to community as well as how each project may be funded. The final project options also provide an estimate of costs, potential carbon emissions reductions as well as local employment opportunities. Where appropriate, potential for cultural and community development is also highlighted.

This phase was conducted from 3rd of February 2020 to 27th of April 2020. The remote consultation was conducted with three community members and other stakeholders on the 25th of June 2020.

Refer to the Final Project Options Summary section of this report for a list of the final project options and Appendix 1: Final Project Options for the full final project options.

Handing the knowledge and findings back to the community

The fourth and final project phase focused on handing the project knowledge and findings back to the community, PIASC and local stakeholders in a targeted and appropriate manner aligned with the RES Moon-da-gatta Yarning Framework. This phase sits outside the RES Moon-da-gatta Yarning Framework, as it represents the end of this project and the passing on of the knowledge and results for future work. It is recommended that the continuing work resulting from this process follow the RES yarning framework.

With the travel restrictions related to the COVID-19 pandemic still in place at time of finalising this report, the final handover was conducted remotely. With this in mind, the established community and stakeholder network was harnessed to distribute the project deliverables throughout the Masig Island community.

Community members and stakeholders were engaged in this final phase through email communications and one-on-one phone calls with engaged community members. To ensure the appropriateness and reach of the project outcomes, a socialisation document, presenting the project process and final project option summaries, was translated into the local language and distributed throughout the community.

This handover was conducted throughout December 2020.

Masig Island Background

This section presents background information about Masig Island and its community which helps contextualise the project and its outcomes.

Location

Masig Island, also known as Yorke Island, is a coral cay located in the central island group of the Torres Strait. The island is located 150km northeast of Thursday Island, which is situated just off the tip of Cape York. It is approximately 2.7km in length and 800m at its widest point with a total area of 1.62km^2. Masig Island's location and key infrastructure is presented in Figure 3.

Environment

Masig Island has 0.96km^2 of undisturbed vegetation including dense trees on the eastern and western parts of the island. This stands in contrast with 0.71km^2 of area occupied by infrastructure and residential developments[1]. Important plant species include the Piner vine and Chalmers Aristolochia, otherwise referred to as the Dutchmans Pipe. The Rose-crowned Fruit-dove and Macleay's Rainbow Skink are important animal species found on the island[3].

In terms of topography, Masig Island is flat with ground level generally less than three metres above average sea level[3]. This exposes the island to significant risk of sea level rise and increased intensity of severe weather events. Sand loss, erosion and flooding are already an issue for the island.

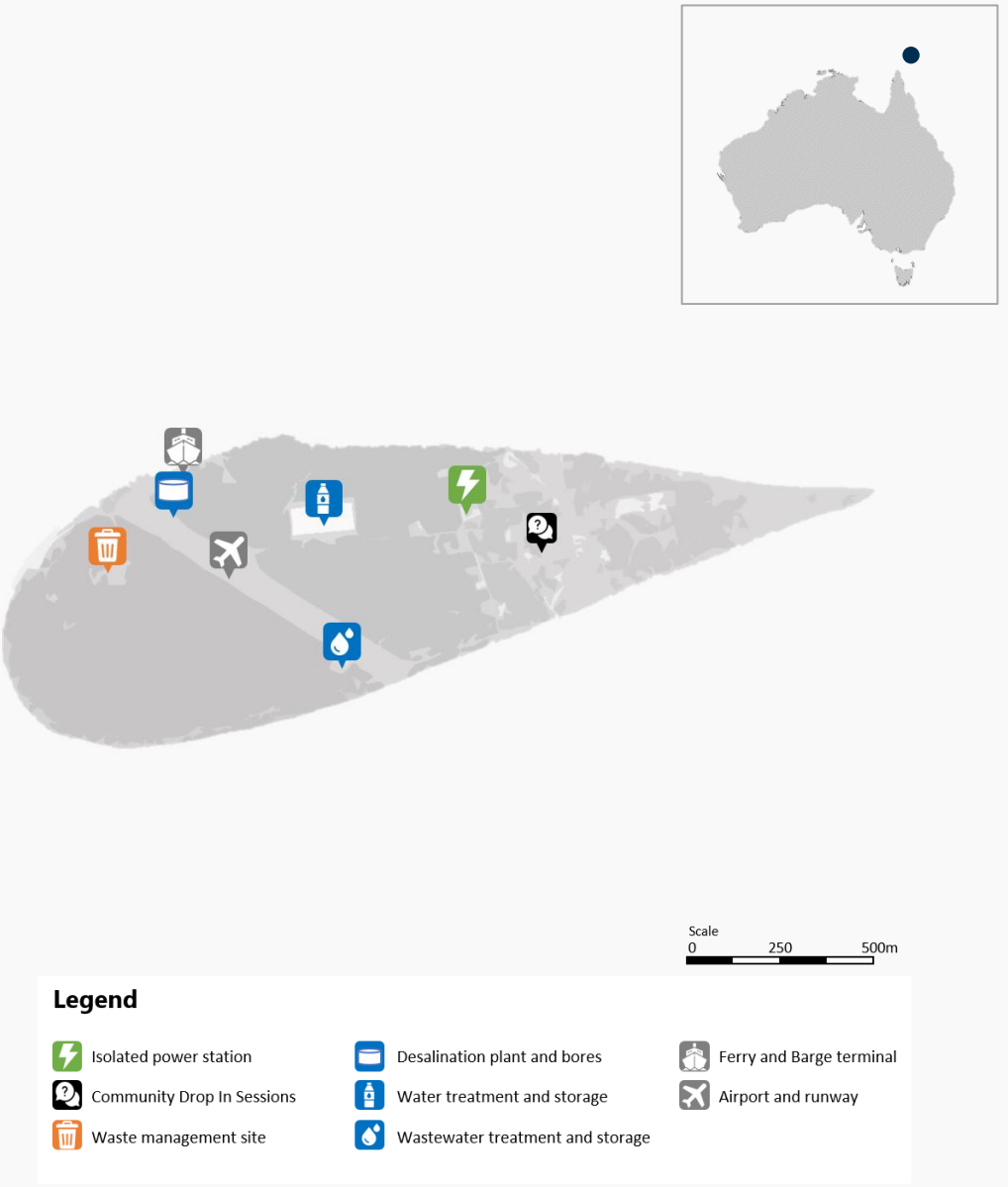


Figure 3: Masig Island Location and Key Infrastructure

Climate

The Masig seasonal calendar defines four overlapping seasons. Masig's Kuki (wet and stormy) seasons occurs from December to April with rainfall reaching 1750mm during some events. Woerr/Sagerr (windy season) spans from March to September and is characterized by a south-easterly wind. Naigai (hot and dry) follows with calm winds from September to November. During the dry season, the region receives only about 90mm of rain. Finally, Zei (windy season), from November to January is characterised by south-westerly winds[2].

The average temperature in the region is approximately 26.8 degrees with December being the warmest month at 28.1 degrees on average. August is the coolest month of the year with an average of 25.3 degrees[3].

Climate Change Projections

The Torres Strait region is highly vulnerable to the effects of climate change. Projected climate change risks include increased temperatures, increased average annual rainfall, increases in sea level, increases in the wind speed of tropical cyclones and a decrease in ocean acidification.

The projections from the Queensland Future Climates Dashboard indicate an increase in mean temperature by 0.67 degrees by 2030 and 1.22 degrees by 2050, as well as an increase in the number of hot days by 0.43 day per annum by 2030 and 6.51 days per annum by 2050[4]. As high interior temperatures are already an issue on Masig (exacerbated during power blackouts), the projected increase in temperatures and number of hot days poses a significant risk for the community's health and well-being.

Precipitation patterns are projected to change in the Torres Strait region with less annual precipitations on average, particularly during the traditional wet season.

In line with the annual precipitation decrease, the frequency and duration of floods (caused by rainfall) is projected to moderately decrease by 2050. These projections do not include the effects of king tides and storm surges on flood events. The drought events are also projected to decrease moderately both in frequency and duration. This will put a strain on water supply levels.

Coastal hazards such as erosion and storm tide inundation are already experienced and affecting the community. These impacts will likely be exacerbated by climate change, sea level rise and the flat topography of the island, limiting the options to relocate to safer areas on the island.

Traditional Owners

The Traditional Owners of Masig, the Masigalgal people, are traditionally skilled navigators with detailed knowledge of the area and occupy a central position in the Strait's trading network[5].

The people of Masig Island value their families, land, culture and take pride in their work, education and religion. Cultural knowledge and tradition has been and continues to be passed on to following generations through language, song and dance. The traditional language of Masig is the Kulkalgau Ya language[5].

During consultation, key members of the community raised concerns that critical knowledge will not be passed on to younger generations as people begin to rely more on modern technologies and tools.

Governance

Native Title is recognised over Masig and is held in trust by the Masigalgal (Torres Strait Islander) Corporation

Registered Native Title Body Corporate (RNTBC)[1]. As outlined in the Native Title Act, the people of Masig uphold fundamental traditions including continuing to observe the traditional authority of the elders in relation to land matters and the integrity, principles, laws and customs determining and regulating land ownership, management and use.

In 2007, the Local Government Reform Commission recommended that the 15 Torres Strait Island Councils, including Masig, be abolished and the Torres Strait Island Regional Council (TSIRC) be established to govern an area of 42,000km2[6]. Today, each island has an elected councillor who represents the island within council. TSIRC works collaboratively with the Torres Strait Regional Authority (TSRA), an Australian Government Statutory Authority that formulates and implements programs in the region.

Housing

There are 98 residential buildings on Masig as well as 26 non-residential buildings[7]. The homes on Masig Island are public housing homes that are rented out to the community with the remaining portion of houses being for government and other workers. There is a long wait list for housing on the island, with people having to wait for a house on the island, sharing homes or living on the mainland for many years.

Based on community consultations, housing on the island complies with standardised Queensland Government housing codes but does not seem to consider sustainable design concepts such as natural shading, ventilation, window glazing or insulation. The roofs of the homes are mostly dark-coloured metal sheeting, which can contribute to higher interior temperatures. The community report that older homes are more comfortable and better adapted to the tropical climate than newer homes.

Additionally, there are several family camps by the water spread across the island. These are semi-permanent to permanent installations by the shoreline used by the community to be close to the water and practice culture and tradition.

Tourism

There is considerable potential for the development of tourism on the island as well as throughout the Torres Straits. Based on community consultation, there are currently a few dozen visitors annually on Masig, who visit for fishing and kitesurfing.
Gubaou Mari, a local tourism provider, has partnered with Zephyr Tours to offer catering services as well as a few organised visits per year allowing groups of tourists to visit the island, practice sport, fish and partake in local culture. The business is eager to grow and develop this operation while working with Traditional Owners to ensure this is culturally appropriate. Lowatta Lodge is the only accommodation option for visitors which is operated by Kailag Enterprises Limited (KEL).

KEL consists of residents as well as descendants of Masig Island. This organisation has the purpose of benefitting future generations and supporting the community's social and economic wellbeing.

The island's isolated power supply has just enough capacity for the current population and residents have limitations on consumption. This has been identified by community as a barrier for community and local tourism development.

Socio-economic

Over 50 percent of the island's population is under 24 years of age with children under 14 years old forming the largest age group and elders aged over 65 forming a very small segment of the population[8].

The key industry sectors and employers on Masig Island are public administration and safety, followed by education and training[8]. The fishing industry is also a major economic driver for the community. It is a hub for many of the east coast fishing and prawn boats and it also plays a large part in the livelihood and culture on Masig[8]. In Queensland, the unemployment rate for Aboriginal and Torres Strait Islanders aged 15-64 is 20.1 percent[10]. On Masig, the unemployment rate reaches 16.2 percent[8]. Median household weekly income on Masig Island is almost half of the Queensland average[8].

The Masig Island Community and Business Profile is summarised in Figure 4.

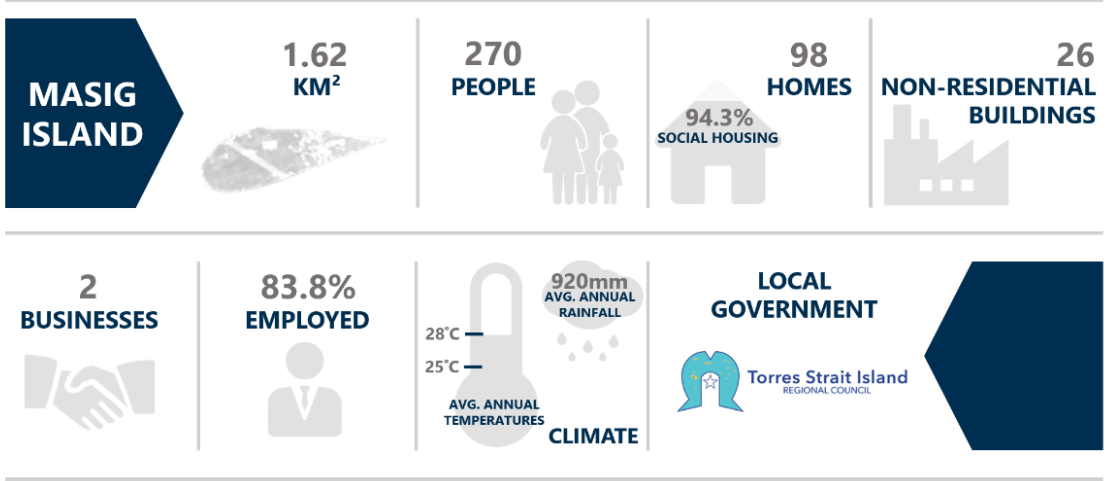


Figure 4: Masig Island Community and Business Profile

Listening To Hear

Sustainability Assessment Report Findings

The Sustainability Assessment studied the Masig Island community through the lens of five key areas: energy, waste, water, transport, and resilience. This enabled the project team to develop an emissions profile for the community, conduct a community-wide risk assessment, as well as lay a solid foundation for the development of the project options. The Sustainability Assessment also includes the project methodology as well as the community engagement approach.

The Sustainability Assessment findings are presented in the following pages of this report. For the full assessment, please refer to the Technical Appendix 1: Sustainability Assessment and Risk Assessment.

Total Carbon Emissions

Total carbon emissions for the whole Masig community were calculated at **2,848t CO2-e** per annum (for an average year)[11]. The emissions related to each emission category closely aligns with the island's energy profile.

As Masig Island is located over 800km from Cairns and 150km from Horn Island, transportation to and from the island constitutes most of the emissions related to the overall carbon footprint of the island (84%) (Figure 5). This category includes the barge, flights as well as commercial fishing activities.

The third most important emitter is electricity (12%). Ergon Energy provides electricity generated by a diesel power plant on the island. This plant releases significant greenhouse gas emissions but is relatively low cost and reliable.

The next most important source of emissions is waste management (3.52%). Almost all the island's general waste is burnt in the island landfill. On-island transport represents 0.42% of the community's emissions and the emissions associated with water treatment are 0.05%.

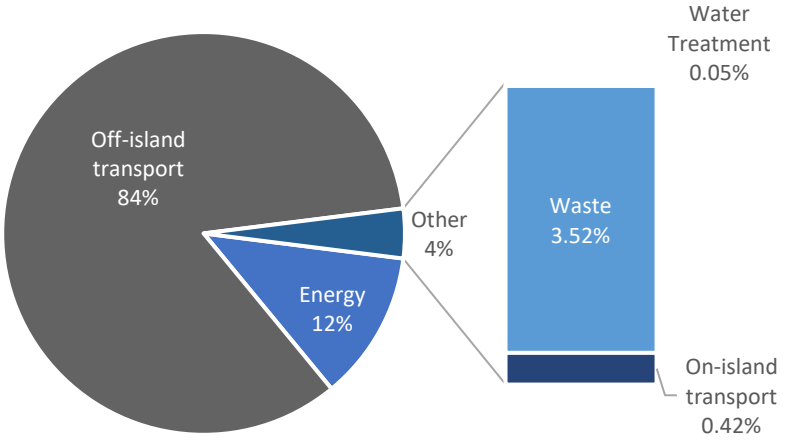


Figure 5: Carbon emissions profile of Masig Island[11]

Island Energy Profile

The island's energy profile for the whole community was estimated at **39,876GJ** per annum or **147.7GJ** per capita per year (for an average year)[11]. The energy profile represents the sum of all energy produced and consumed on the island as well as transport to and from the island (Figure 6).

Marine transport is the majority of energy consumption. This category accounts for 64% of the island's energy profile. Air transport is the next most important category responsible for 23% of energy use. As detailed in the transport section, marine as well as air transport providers operate in loops which service other nearby islands. These whole loops have been considered in Masig's transport related energy consumption profile, as they are integral to the existing service. It is recognized that they greatly increase transport's share in the island's energy profile.

Diesel-generated electricity for residential and non-residential uses accounts for 12% of total energy profile. Liquefied petroleum gas (LPG) is used for cooking and represents 0.6% of the island's energy profile. On-island transport represents a very small portion of the community's energy usage with 0.4%, as the need for vehicles is low. Finally, there is very little solar power (energy) on the island, accounting for 0.3% of the island's energy profile.

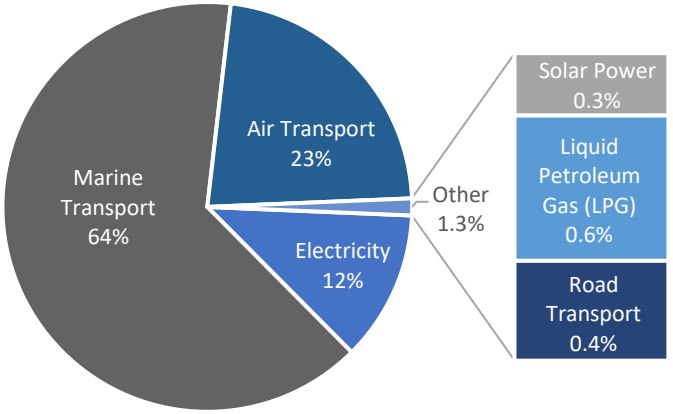


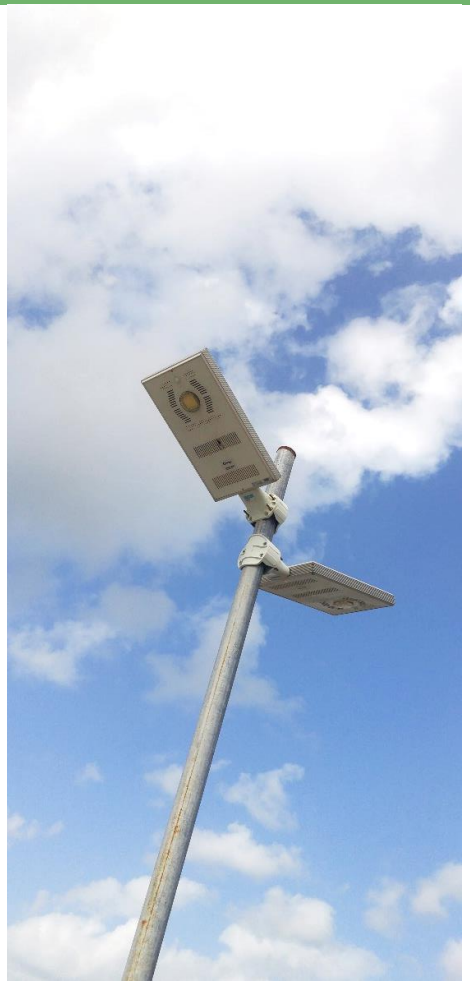
Figure 6: Energy profile of Masig Island[11]

Energy

Energy plays a central role in the lives of local people, as it is used for water desalination and distribution, cooling, lighting, communications and many other essential uses. Access to reliable and cost-effective energy to meet community development is critical.

Electrical energy is supplied by Ergon Energy on behalf of the Queensland State Government. It is sourced from an isolated power station by four diesel generator sets[7]. The plant runs 24 hours per day and is reportedly operating at full capacity to meet the current island needs[7]. For this reason, residents are currently limited in the type and number of electrical devices they can run.

There are two 10kWh photovoltaic systems (PV) on the island, one at the Islander Business, Service and Industry (IBIS) shop and one at the desalination plant[6]. The majority of homes (81%) have solar hot water systems[12]. It was noted that only the airstrip light system, the pilot's house and the health-care centre have backup generators. The rest of the community are left without alternative energy sources during blackouts.



In terms of residential energy consumption, the average household on Masig Island uses less energy than the Queensland average. The average Queensland home uses 24% more energy than the average Masig home[13], even though the average household size on Masig is over 40% larger (Figure 7)[14].

Consequently, Masig Island's per capita residential energy consumption is also lower than the state average. The annual energy consumption of the average Queenslander is almost 70% higher than the average Masig Islander consumption[13].

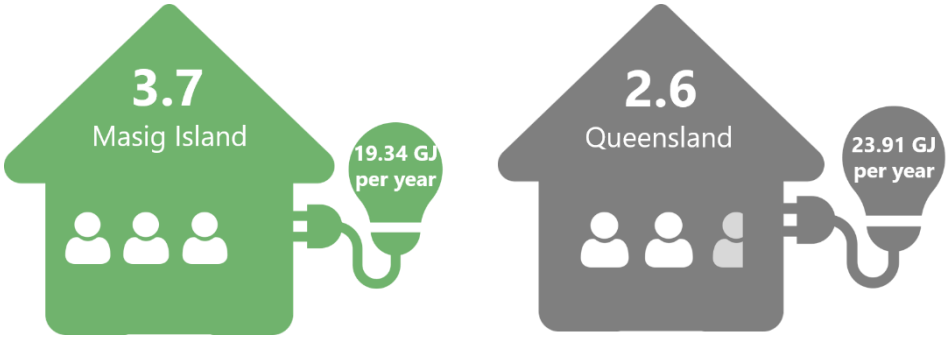


Figure 7: Annual electricity consumption for an average Masig Island household compared with an average Queensland household

What was said:

The community highlighted the need for more diversified power sources such as solar to improve reliability during times of uncertain weather events, which would in turn increase resilience.

Energy

Total daily energy demand fluctuates over the year (Figure 8)[7]. This consumption profile aligns with annual temperature variation, as the annual (2019) peak demand aligns with the hotter months (November to January). The average daily energy demand is 148.62kW[7].

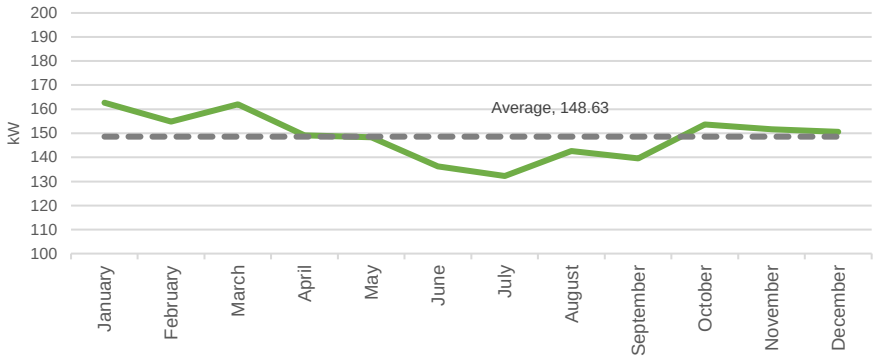


Figure 8: Average daily energy demand per month

Non-residential energy consumption is 50% higher than residential usage (Figure 9)[7]. This is mainly due to the desalination plant, which is energy intensive. Most non-residential buildings have air-conditioning running throughout the day. Energy prices may be less of a constraint for organisations than for residents, contributing to this difference in usage.

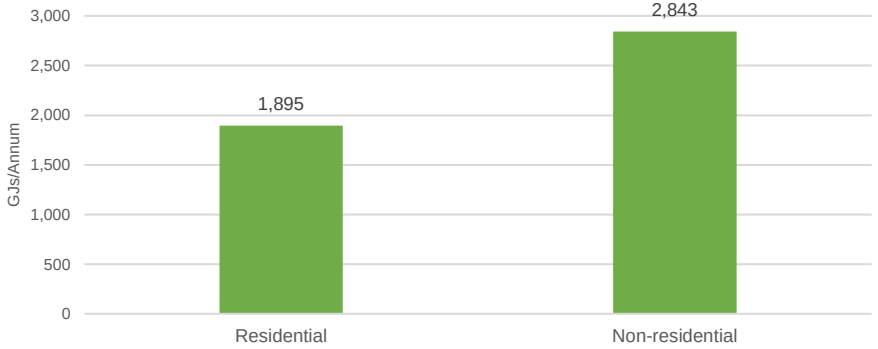


Figure 9: Electricity consumption for residential buildings compared with non-residential buildings

Key findings

- ***Energy generation:*** Energy is generated by four diesel generators providing a total of 500kW. This isolated power supply has just enough capacity for the current population and residents have limitations on consumption.
- ***Power cards:*** Community members pay for energy with a power card on a "pay-as-you-use" basis.
- ***Cost of energy:*** The cost of energy is a burden for the community, even though the Community Service Obligation (CSO) ensures similar pricing as the rest of state, as average wages on the island are lower than the rest of the state. Different community organisations provide power card top ups to people in need.
- ***Energy upskilling:*** Based on community testimony, there is limited technical knowledge within the community to manage or upgrade existing solar assets due to qualified workforce moving to the mainland for work.
- ***Solar hot water:*** Solar hot water panels are found on approximately 81% of houses in the community. About half of these are covered by protective grates.
- ***Solar PV:*** Limited solar PV installation on the island, only the IBIS shop and desalination plant each have 10kWh photovoltaic systems. There is some solar lighting near the jetty.
- ***Energy efficient practices***: There is significant community support for building improvements, education and job opportunities around energy efficiency practices.
- ***Building types and design***: Housing is compliant with Queensland Government construction codes but does not consider sustainable design and are reported being very hot in summer. Older homes are reported being more adapted to Torres Strait conditions and more comfortable to live in.

Water

As every litre of potable water produced has an associated carbon emission, any potential gain in water efficiency or decrease in water consumption correlates to an important decarbonisation opportunity for the island.

Potable water is generated through a desalination plant (50kL and 70kL per day systems) combined with rainwater collected from the lagoon[15]. Some homes also have rainwater tanks, which are often used for drinking water. Multiple wells are dispersed around the island providing non-potable brackish water for irrigation and other uses to some residents.

Households in non-urban, remote and isolated indigenous communities typically have elevated water consumption[16]. Masig Island households use approximately 814L per day compared with the Queensland average of 556L per day (Figure 10)[17]. It is important to consider that homes on Masig house 40% more residents than the state average, which can explain the higher water usage per household even though per capita usage is below state average.

The wastewater treatment plant has a designated capacity of 120kL/day. Masig Island's community only requires 50% of the plant's capacity, corresponding to 60kL of wastewater being treated daily[17]. The quantities of sludge produced are not measured by the council. Sludge is dried and disposed of in the designated area at the disposal site.

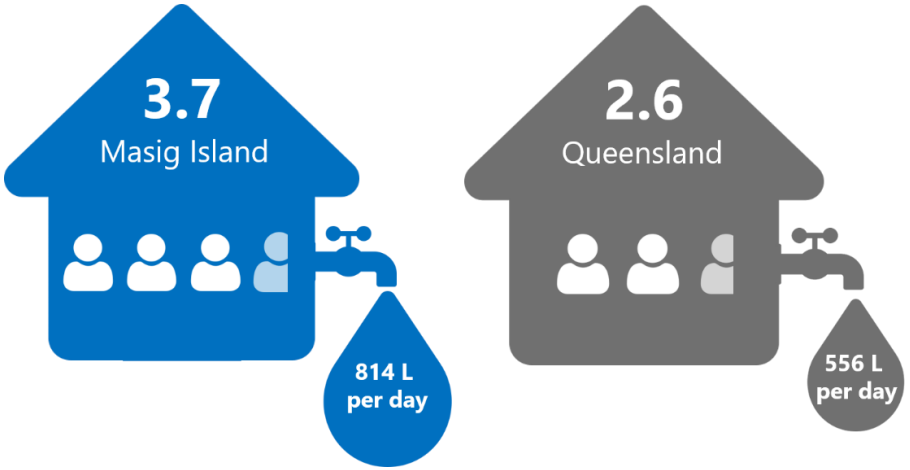


Figure 10: Annual water consumption for an average Masig Island household compared with an average Queensland household

What was said:

Water is a constant issue for the community due to limited t reatment capacity and reserves. For this reason, Masig has been and continues to be part of water-metering and efficiency projects.

Water

The production limits of the desalination plant coupled with reduced rainfall and increased water demand (Figure 11)[18] during hotter months result in water restrictions being imposed. During water restriction periods, the water supply is cut-off from 9:00am to 12:00pm and from 1:00pm to 5:00pm.

Maximum daily water demand is **0.27ML** per day

=

Average **296 L per person** per day

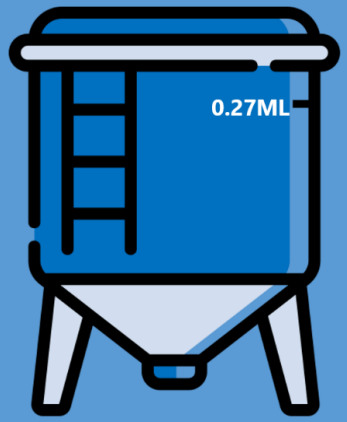


Figure 11: Maximum daily water demand and average daily per person water demand for Masig Island

Key findings

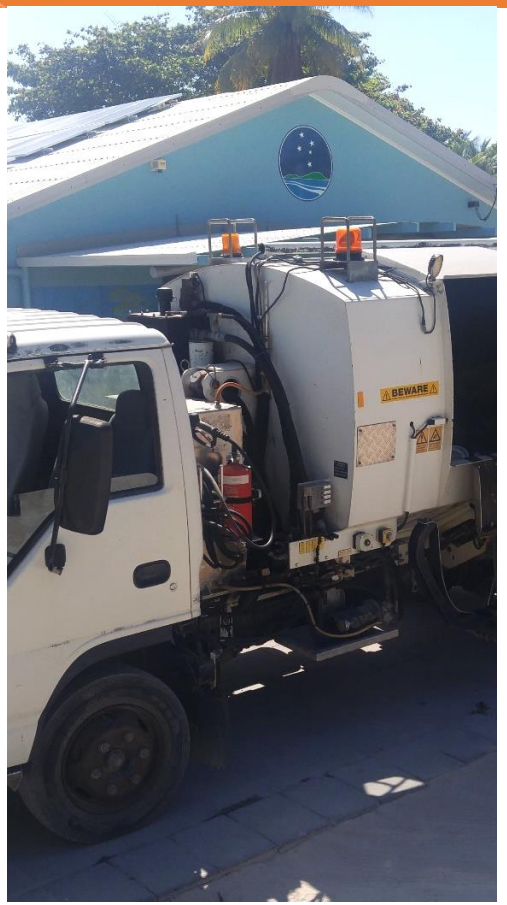
- ***Water supply***: Potable water supply is almost exclusively provided by the desalination plant, supplemented by rainwater as well as barged-in bottled water.
- ***Water restrictions:*** During restriction periods, residents have access to water for 9 hours a day on weekdays and 16 hours a day on weekends.
- ***Water efficiency***: The Masig community have been exposed to water efficiency and education through multiple programs. Smart water meters have helped the community reduce their water consumption by up to 39% over 12 months ending in 2019[19].
- ***Well water:*** Based on community consultation, Masig has 33 wells throughout the island. This water is not potable, as it is brackish and contains sediments. Some wells are outfitted with pumps to provide irrigation water.
- ***Rainwater:*** 81% of homes have a rainwater tank, which is often used for drinking due to reasonable taste (no chlorine)[12]. Some homes even have two tanks or a dual-purpose tank which are filled with mains water during non-restricted hours, enabling residents to have a "24 hour" water supply.
- ***Wastewater treatment:*** The current wastewater treatment plant can support 535 persons[18], only 270 residents currently on Masig[8]. Plant currently processing 60kL daily.

Waste

Waste management is an important issue on Masig, as it is for most island communities, due to limited space and the high cost associated with management and removal. Masig's disposal site is well organised, clean and managed. The site has an estimated 5-10 more years before capacity is reached.

Biosecurity restrictions are applied in the Torres Strait Region and include various goods such as fresh produce, live animals, meat or dairy products as well as waste. Any of these goods crossing one of the zone boundaries requires a permit and compliance with regulations. As general waste is included in these categories, waste transportation between islands or to the mainland is prohibitively complicated and expensive.

A DES-funded project is currently working on a state-wide Indigenous waste management strategy which will address many of these issues.



What was said:

Waste management is an important issue for the community, due to space limitations and the high costs associated with waste removal (transport and biosecurity). The waste management site is rapidly reaching maximum capacity.

Comingled waste is collected twice a week by TSIRC using a small-sized garbage collection truck. At the disposal site, three waste streams are collected: household general waste, green waste and other bulky items. The general waste as well as the green waste is disposed of at the landfill site (Figure 12)[20]. Bulky items and scrap metal is accumulated at the disposal site.

Though there is no official council-run recycling scheme on Masig, there are many ways in which the community reduce, re-use and recycle. In collaboration with SeaSwift, the school has implemented a container collection program, providing a small income stream to the school. Furthermore, community members use wooden pallets from the barge to make all types of furniture for the community. The community also re-use materials for crayfish crates, which are typically made from a variety of materials such as buckets, old nets and buoys.

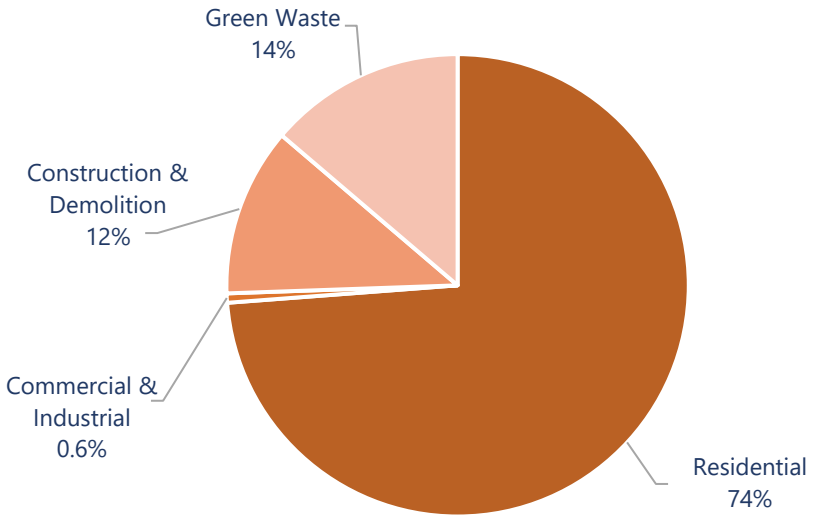


Figure 12: Breakdown of waste types disposed to landfill for Masig Island

Waste

The difference in waste per capita production between Masig and Queensland aligns with the correlation between community socioeconomic profile and their waste production (Figure 13)[21]. Lower socioeconomic communities like Masig typically produce less waste than higher socioeconomic regions. This difference is also exacerbated by the remoteness of the community, likely making the supply of goods and potential waste more expensive and less accessible, resulting in less materials sent to landfill.

Residential waste per person per year

Figure 13: Residential waste disposed to landfill per person per year for Masig Island compared with the Queensland average

Key findings

- ***Waste management:*** Waste is separated into general waste, green waste, white goods, scrap metal and electronics at the waste management site. General waste and green waste are disposed of in the landfill sites.
- ***Car bodies:*** A significant number of old car bodies are strewn across the island (up to 90, as most houses have at least 1 old car body). Biosecurity restrictions and extremely high costs of removal has been an obstacle for removal.
- ***Recycling and reuse:*** No council recycling, but the school has implemented a container recycling program, in collaboration with SeaSwift.

Transport

As Masig Island is located approximately 150km from the mainland and the nearest regional airport (Horn Island), movement to and from the island is generally by plane. Charter flight operators mainly service government workers and contractors throughout the Torres Strait region on a sporadic basis. Islanders also move between islands on their dinghies, although distances travelled are unknown. All supplies are barged from the mainland.

Residents get around the island by walking, car (including ridesharing) and bicycle (Figure 14)[8]. Multiple dinghies are used for fishing and inter-island movement.

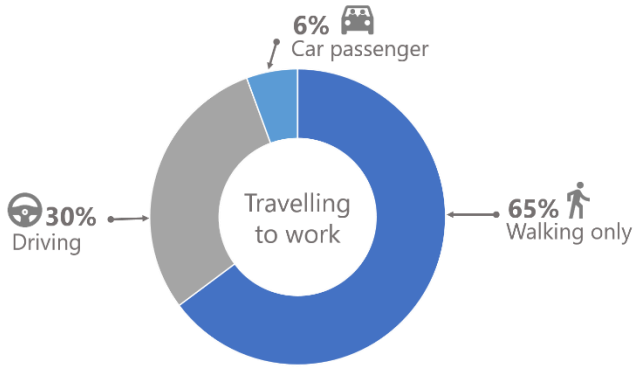


Figure 14: Methods of transport for travelling to work for Masig Island residents

What was said:

Transport to and from the mainland is expensive for the community. A Local Airfare Scheme (fixed discount) is offered to all Torres Strait residents, but due to Masig being one of the furthest islands in the region, prices remain high for the community.

There is a total of approximately 40 road vehicles in use on Masig Island (owned by council and residents), corresponding to an average of 0.6 vehicles per dwelling (Figure 15)[8]. These are not used for long distances, due to the island's size, but are used on a variety of surfaces such as tarmac and sand tracks around the island.

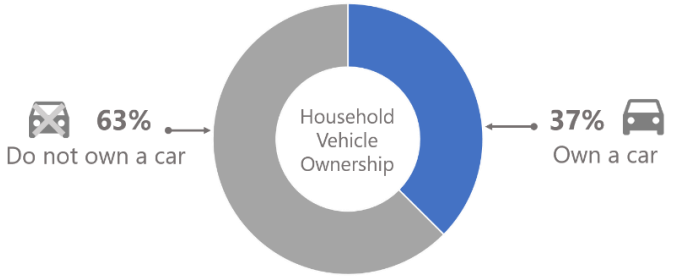


Figure 15: Household vehicle ownership on Masig Island

A key issue facing vehicles on Masig Island is the extremely high cost of getting them on and off the island. Based on anecdotal evidence from the community, it costs between $3,000 and $5,000 to get a vehicle to Masig Island and up to $10,000 to get it off the island. These high costs are due to transport, but for old car bodies, biosecurity restrictions significantly increase removal costs.

Transport

All goods, materials and fuels (unleaded and diesel) are shipped by barge. SeaSwift is the sole barge operator in the region servicing Masig Island, delivering goods to Masig Island twice a week, typically on Wednesdays and Thursdays[22].
Small single propeller or propeller planes are used for transporting people on and off the island. Skytrans operates flights two to three times a day to Masig Island, except for Sundays and public holidays[23].

From the mainland, passengers must initially fly to Horn Island and then change flights to the Skytrans service to travel to Masig Island (Figure 16).

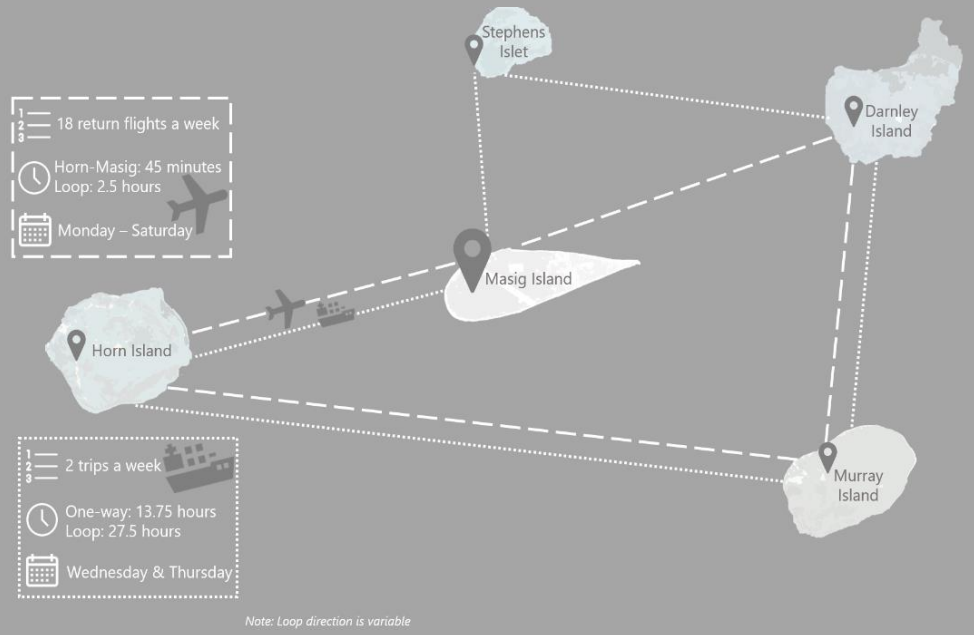


Figure 16: Transport modes for travelling to Masig Island including frequency and travel time

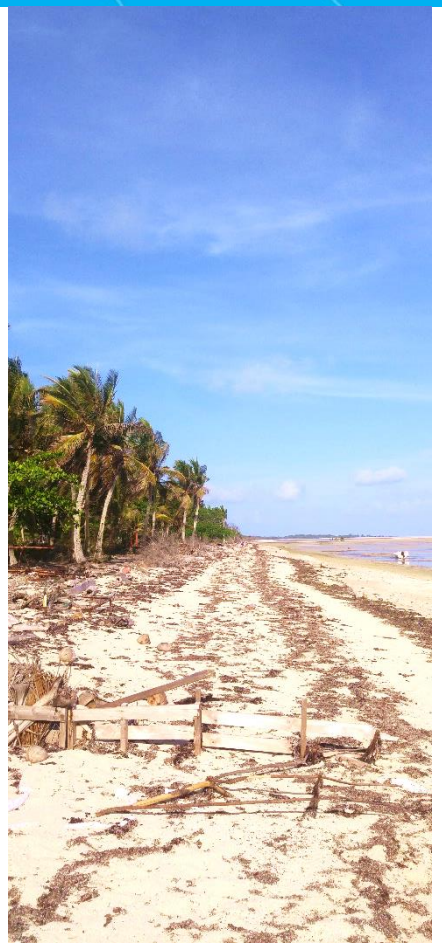
Key findings

- **On-island transportation:** Residents travel by foot, bicycle and car and there is no public transport on Masig. It is estimated that there are up to a total of 40 vehicles on Masig and that 62.5% of households do not own a vehicle.
- **Transport costs:** Transportation costs of freight (marine and air) are high due to the island's remote location. Sometimes these services are stopped during high winds which present isolation and supply issues for the community.
- **Air transport:** Air transport is the only way to get to Masig Island, with both scheduled and chartered flights used (45-minute flight between Masig and Thursday Island). The island is home to one of two CASA approved airstrips in the Torres Strait.
- **Marine transport:** Residents travel between nearby islands using small boats and dinghies (75 hp on average). Almost all goods are barged to Masig on a bi-weekly schedule.
- **Services:** The health and social services available to the community are often located on the mainland or neighbouring islands such as Thursday Island.

Resilience

Cultural and traditional knowledge is very prevalent throughout the Masig community today. Torres Strait Island communities have been studying and observing the natural environment for millennia and have developed a deep understanding around their land and seas. This ancient cultural and traditional knowledge is very much alive today throughout the community. Initiatives such as the seasons calendar developed by the community elders and the Prescribed Body Corporate (PBC) are capturing and sharing of thousands of years of knowledge around seasons, patterns, winds, tides, rain and fauna movements - knowledge that has underpinned self-sufficiency on the island in the past, and now into the future[2].

Cultural and traditional knowledge, developed through millennia of occupying and fostering the region's land and sea, is finding that changes to the environment and the climate are occurring at an increasingly rapid pace and have a profound impact on the flora, fauna and the communities that depend on them. The community's capacity to read the climate, understand patterns and adapt accordingly using a range of bioindicators underlines the community's self-sufficiency capabilities.



What was said:

The community identified reducing erosion, sand loss as well as developing strategies to manage king tides and storm surges as critical issues. There is a strong desire throughout the community to be given the means to maintain the island themselves, based on traditional knowledge of the land and the sea.

The Masig community's main concerns relating to resilience is the sea level rise related to climate change. For millennia, the community have been observing and studying the climate and the natural weather patterns. They have long been observing rising sea levels combined with intensified storms and severe weather events (Figure 17), as well as actively involved at the political and governmental level on these issues. These more frequent and disruptive events have caused increased island erosion, endangering key infrastructure and the loss of land, threatening culturally significant landmarks.

Community resilience for Masig is closely tied to energy security, water reserves and fuel supply. The island is almost completely dependent on energy for its fresh water supply due to the use of a desalination plant and electrical pumps for water circulation. Refrigeration and air conditioning are also critically important in Masig's tropical environment, both highly dependent on the diesel generation of energy.

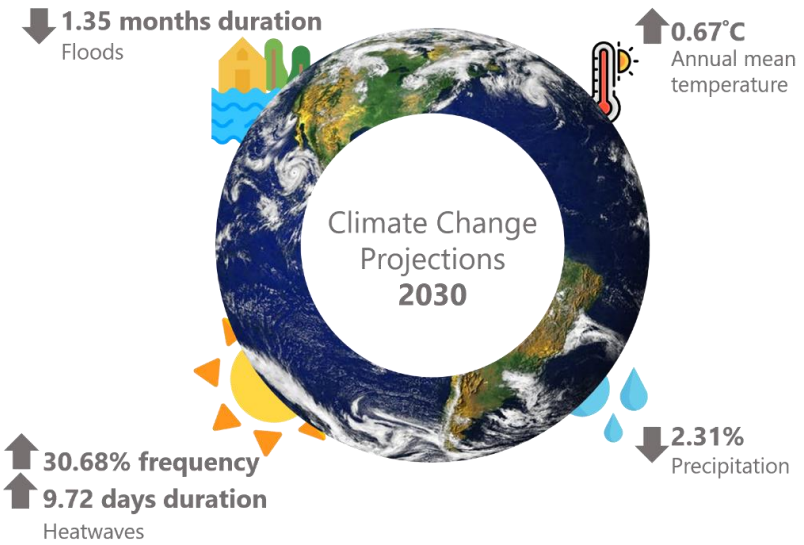


Figure 17: Climate change projections for 2030, Masig Island[4]

Resilience

Community resilience concerns

Altered patterns & seasons from cultural & traditional knowledge

Dependence on energy for fresh water supply

Sea level rise

Erosion & loss of land

Infrastructure damage & loss

Key findings

- **Culture and tradition:** The survival and continuing use of traditional and cultural knowledge and practices are critically important to the community. The TSRA and the PBC are currently involved in projects on this front (seasons calendar and knowledge-sharing).
- **Fossil fuel dependence:** Community resilience is closely tied to energy security and fuel supply, as electricity is generated on-island with diesel generators.
    - The community is dependent on energy for its fresh water supply which is provided from a desalination plant and circulated around the island via electric pumps.
    - The community relies on energy for communication and banking services (EFTPOS and cash withdrawal).
- **Climate change and severe weather events:** The island is extremely vulnerable to the impacts of climate change, with sea level rise predicted to have the most significant impacts. Due to its northerly latitude, the Torres Strait region is less likely to be impacted by tropical cyclones, though the island has been affected by cyclones in the past. During storms, the community can be isolated for up to four weeks.
- **Funding and projects:** Masig is involved in the QCoast2100 project through TSIRC and $20 million of funding was recently approved for erosion control projects with TSRA.
- **Food and fishing:** The community heavily rely on the fishing industry for food and income. Agriculture has mostly been replaced by the more convenient IBIS shop.

The risk assessment, carried out alongside the sustainability assessment, provides overview of Masig Island's climate and environment-related risks, based on The EarthCheck Destination Standard which identifies 13 Key Performance Areas for a region which were used as a base to identify risk aspects. High, severe, and extreme risks which have little to no minimisation or mitigation strategies are identified in Table 2. The risks identified in the risk assessment were utilised as guidelines for the development of the options longlist and during the options shortlisting process. For the full risk assessment, including the key risk aspects as well as the risk assessment methodology, please refer to section 8 of Technical Appendix 1: Sustainability Assessment and Risk Assessment.

Risk Evaluation	Potential Impact(s)	Current Minimisation / Mitigation Strategy Observed
High	Renewable energy accounts for a small proportion of total energy generated.	Some solar photovoltaic and solar hot water systems. No current mitigating strategies observed.
	Lack of auxiliary power supply at plant leading to risk of failure should the primary power supply fail.	No current mitigation strategies observed beyond Ergon contingency plans.
	High costs associated with removing waste off the island as there is no on-island waste treatment facility.	No current mitigation strategies observed.

Table 2: High, Severe and Extreme Risks

Severe	Use of non-renewable fuel consumption in transportation to and from the island contributing to climate change.	No current mitigating strategies observed.
	Potential for ozone depleting substances to release gases harmful to human health (e.g. from fridges, air conditioning equipment etc.).	No current mitigating strategies observed.
	Onsite storage and incineration of sludge due to the high cost of transporting this to the mainland which could impact local ecosystems and the community.	No current mitigating strategies observed.
	Reliance on external transport providers to bring visitors, workers and residents on and off the island, including evacuations during extreme weather events.	Some residents may use personal boats to travel from Masig to surrounding Islands. No other current mitigating strategies observed.
	Contamination of land and sea ecosystems from disused and abandoned vehicles across the island.	No current mitigating strategies observed.
	Greenhouse gas emissions from waste buried and incinerated on-island.	No current mitigating strategies observed.
	Long waitlist for social housing.	No current mitigating strategies observed.
	Power outages cut cellular reception and payment services (except for satellite phones) isolating the community.	No current mitigating strategies observed.
	High reliance on food delivered from the mainland as limited food grown on Masig Island.	Although there are a small number of backyard gardens as well as fishing, there are no current mitigation strategies in place.
Extreme	Extreme weather events leading to the island being cut-off from the mainland. This leads to a range of issues including evacuations for health reasons, reduced access to power, water, roads cut to critical infrastructure, telecommunications etc.	No current mitigating strategies observed.
	Projected climate change risks include increased temperatures, increased average annual rainfall, increases in the wind speed of tropical cyclones and a decrease in ocean PH (ocean acidification).	Complaint against the Australian Government to the UN Human Rights Commission has increased awareness of their issues.

Dreaming Big

Options Shortlisting

The Dreaming Big phase involved thinking about what might be, discussing what may contribute to happiness and getting community members excited about the future, as well as understanding how to increase community well-being under future climatic conditions.

Final project option summaries are presented in the following pages of this report. For the full final project options, please refer to Appendix 1: Final Project Options.

Options Shortlisting

Phase 2 encapsulates the options longlisting and shortlisting process. The development of the options assessment approach was undertaken by Arup in an interactive and collaborative manner with the wider project team. The assessment has been informed by community and stakeholder consultations, technical workshops, desktop review and the Sustainability Assessment.

Through this process, a longlist of options was developed by the community, the project team, as well as other project stakeholders such as State Government and service providers. With input from the Masig Island community and stakeholders, this options longlist was filtered down to an options shortlist. The options shortlisting process was conducted through the gated approach outlined in Figure 18 on the following page. Gate 3 consisted of a multi-criteria analysis, which is shown in Table 3. This multi-criteria analysis was developed in order to ensure that options filtered through to the options shortlist meet project objectives as well as ensure outcomes are aligned with the community's needs and vision for the island. The outcome of the option analysis process, including the multicriteria analysis is the final shortlist of 18 options which have been progressed into final project options, which enable the community to action and implement the identified initiatives.

The full options report, which provides more detail around the longlisting and shortlisting process, as well as the rationale behind option selection can be found in Technical Appendix 2: Options Report.

Objective Category	#	Criteria	Proposed weighting
Economic development	1	Potential to support economic opportunity	15%
	2	Potential to support local job creation, skills development and/or capacity building (including consideration of NIRA objectives)	15%
		Total (economic development)	***30%***
Social development and culture	3	Promotion of community self-sufficiency and/or resilience (including consideration of NIRA objectives)	15%
	4	Protection of cultural heritage and assets	15%
		Total (social development and culture)	***30%***
Environmental protection	5	Extent of decarbonisation potential	25%
	6	Preservation of environmental, ecological and/or natural resources	15%
		Total (environmental protection)	***40%***
		TOTAL	**100%**

Table 3: Multi-criteria analysis

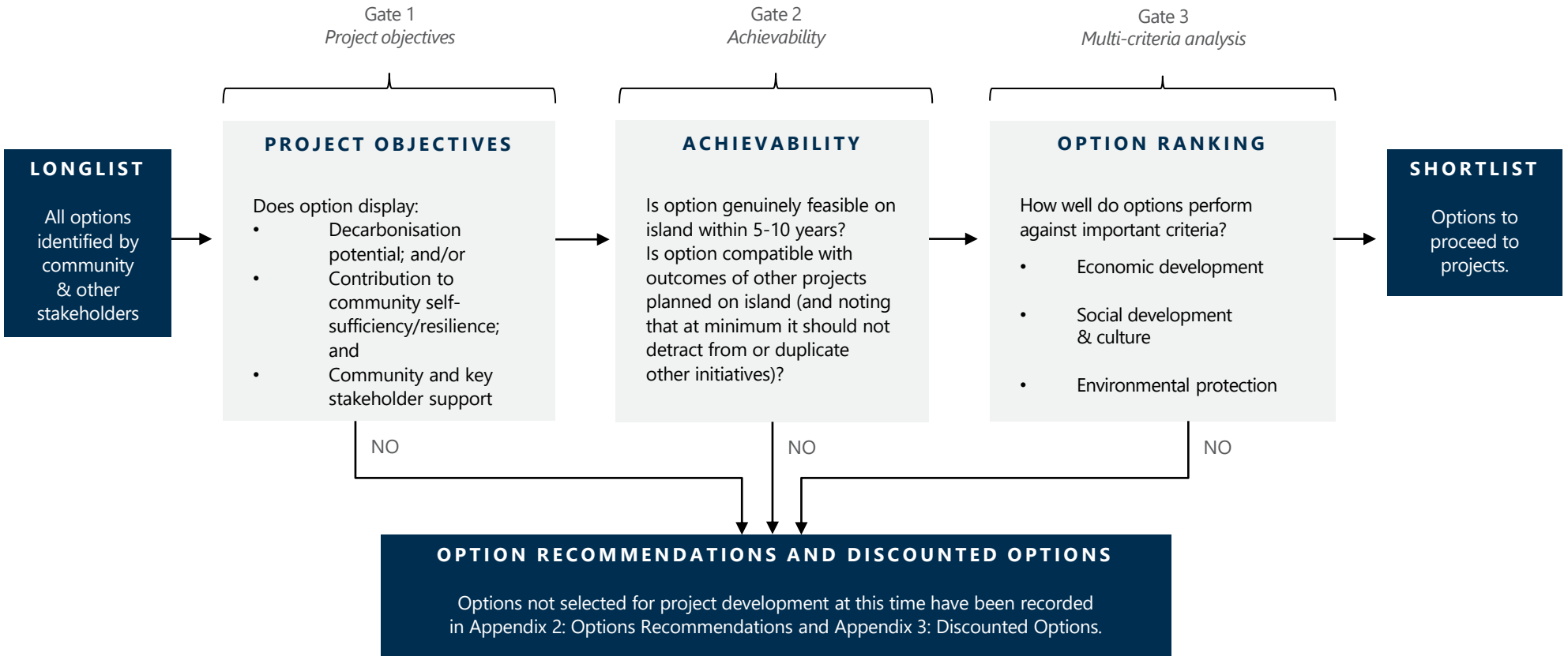


Figure 18: Options analysis process

Whichway Now?

Project Options and Project Outcomes

The most important ideas were identified based on discussed community needs and preferences, project objectives, and feasibility for implementation on Masig island. This section also presents overarching project learnings and policy recommendations, which aim to raise awareness around key issues identified throughout the project.

Final project option summaries are presented in the following pages of this report. For the full final project options, please refer to Appendix 1: Final Project Options.

Project Options and Project Outcomes

Throughout this project, the knowledge collected and used within the various project options, as well as the findings compiled in the Sustainability Assessment, have been shared with the project team by the Masig Island community and local stakeholders. The project team recognises that this knowledge was shared openly by different members of the community with the expectation that tangible and appropriate actions be enacted from the outcomes of the project.

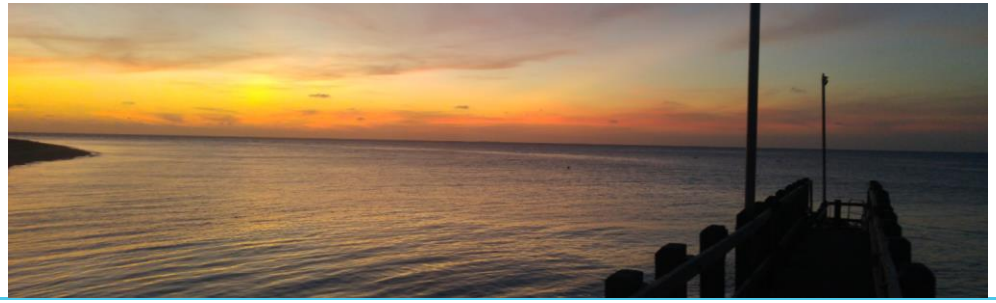
The delivery of this report and accompanying project options is a step towards community-driven action that will aid Masig Island in developing a low carbon, resilient and thriving community.

The outcomes of this project as presented in this report are threefold and encompass the final project options, the options recommendations, the overarching project learnings and policy recommendations, and supporting technical appendices.

Final Project Options

The final shortlisted project options are the culmination of the project, drawing on the different stages of data capture and analysis, and the collaboration between the project team and the community. The following final project options actively provide project information, structure, and funding opportunities for the Masig Island community to pursue the different decarbonisation and resilience projects best suiting the islands' needs. Some final project options have natural owners, such
as council and other government bodies, while others are meant to be community or business-driven and owned.

The final project options are summarised in the next pages and the detailed final project options are provided in Appendix 1: Final Project Options.



Options Recommendations

The option recommendations are options that have not progressed through to the options shortlist, but which have merit and potentially represent areas for future consideration. These do not include options which were not supported by the community or were found to be infeasible. There are a variety of reasons why options from the longlist may not have progressed to final project options, these include:

- Where work was already planned through initiatives external to the project
- Where it was considered to be out of scope of this project
- Where the required technologies are not likely to be market ready in the short- to medium-term
- Where the existence or maturity of required supply chains represent a barrier to option success

The additional project options recommended for future consideration are listed in Appendix 2: Options Recommendations.

Overarching Findings and Policy Recommendations

Finally, the overarching project learnings and policy recommendations form an assembly of observations and learnings generated by the project team throughout the duration of the project and the island visits. These are informed by discussions with members of the community, council, service providers, government agencies as well as observations during the island visits.

These learnings and recommendations are important to address in this report due to the intricacies and complexities of Masig Island and its community. These learnings and recommendations include issues or solutions which must be applied from a government level, project option implementation considerations such as order of execution or other dependencies as well as other learnings.

The Overarching Project Learnings and Policy Recommendations are presented on the following page.

Overarching Project Learnings and Policy Recommendations

Through this project and the RES engagement framework the project team identified a great number of strengths, opportunities, and risks within the Masig Island community. The project options provide an opportunity for the community and stakeholders to collaboratively action change in order to decarbonise and bolster resilience throughout Masig Island.

In order to address key issues which were beyond this project's scope, the following overarching project learnings and policy recommendations complement the project options. They identify key issues which were observed throughout the project and suggest resolution approaches.

Recommendation 1: Community-based governance and ownership framework

Community ownership as well as local community governance structures are key elements for project success as well as sustained community engagement, especially in Indigenous communities who do not traditionally operate with a western governance paradigm. It is proposed that a whole-of-community governance and ownership structure be implemented in the Masig Island community, based on the wants and needs of the Masig community. This involves facilitating and accelerating community engagement, empowerment and involvement in decision-making and future projects across the island in a culturally and traditionally appropriate manner. A key consideration for this recommendation is the protection of community intellectual property as well as traditional governance styles. Implementing a community-based ownership and governance framework will ensure the successful implementation of the projects outlined in the final project options as well as many other community-based initiatives.

Recommendation 2: The importance of pilot projects and leading by example

It was raised by a member of the Masig community that although many residents are enthusiastic about the idea of changes and new projects, they prefer to see things in action before they choose to implement them in their own households or communities. This has manifested through difficulties in getting hydroponic gardens as well as the TSRA biodigester projects up and running. Providing tangible ideas as well as concrete, on-island, examples which demonstrate direct benefits to the members of the community will undoubtedly bolster community motivation for new ideas and sustain long term engagement.

Recommendation 3: Providing more information around energy consumption and card usage

The Masig community have a limited understanding of their power usage as well as limited access to energy usage information. As a governmental entity, it is recommended that Ergon Energy provide more detailed usage data as well as ensuring a community understanding of what the influencers of energy consumption are. This could contribute to electricity consumption literacy across the community and equip Masig residents with the knowledge and data to make more informed energy related decisions.

Recommendation 4: Consider the inflation of the cost of scheduled flights with the rise of government use of charter flights

The Masig community has identified that the scheduled flights, their main mode of transport to the mainland, has seen rising costs over the last years which are estimated to be linked to the increase in use of charter flights. These charter flights are typically used by governmental agencies and contractors, due to increased flexibility in scheduling, the possibility of direct flights, and reduced transit times. Moving forward, it is recommended that this pressure on the local transport system be considered by governmental agencies and contractors, as transport is already an expensive commodity for the Torres Strait community. This is especially true for the residents of Masig and other communities further away from Horn Island, as the community rebates are a flat rate, which does not account for the variable cost of fares.

Recommendation 5: "One on, One off" policy for motor vehicles on Masig to reduce car body waste

The Masig community has identified that old car bodies are an important issue, as they are accumulating on the island, contaminating the land and taking up precious space on the small island. Through discussions with community members, It reportedly costs between $10,000 and $11,000 to remove a single car body due to transport and biosecurity restrictions. To counteract the further accumulation of car bodies on the island, it was proposed by community members that, to bring a car onto the island, an old car body must be removed. This could also include boats, as old boat hulls are also accumulating on the island.

The project team recognises that many of the identified final project options stem from the Palm Island community and are not new propositions. Many have been the subject of discussion for some time. The ultimate aim of this project was to collect and package these ideas in a format which will facilitate the connection between the community and various funding opportunities in order to help these ideas to fruition.

Many of the proposed final project options are complementary and deliver on different community aspects which, together, form a cohesive community development pathway. As the structure of funding often requires a more granular approach, synergies between projects may be hindered. This can be due to scheduling or logistical dependencies between final project options. On a larger scale, benefits to island communities can be clustered together, such as the impact of GBR Islands recycling their waste. Please refer to the final project option alignment identified in individual projects.

The 18 final project options developed through this project are an opportunity for the community and stakeholders to collaboratively action change in order to decarbonise and bolster resilience and self-sufficiency throughout Masig Island. The final project options which are summarised on the following pages in Table 4, span the five themes (as well as knowledge sharing options including multiple themes) of this project, as presented below in Figure 19. **Refer to Appendix 1: Final Project Options** for the full detail on the final shortlisted project options.

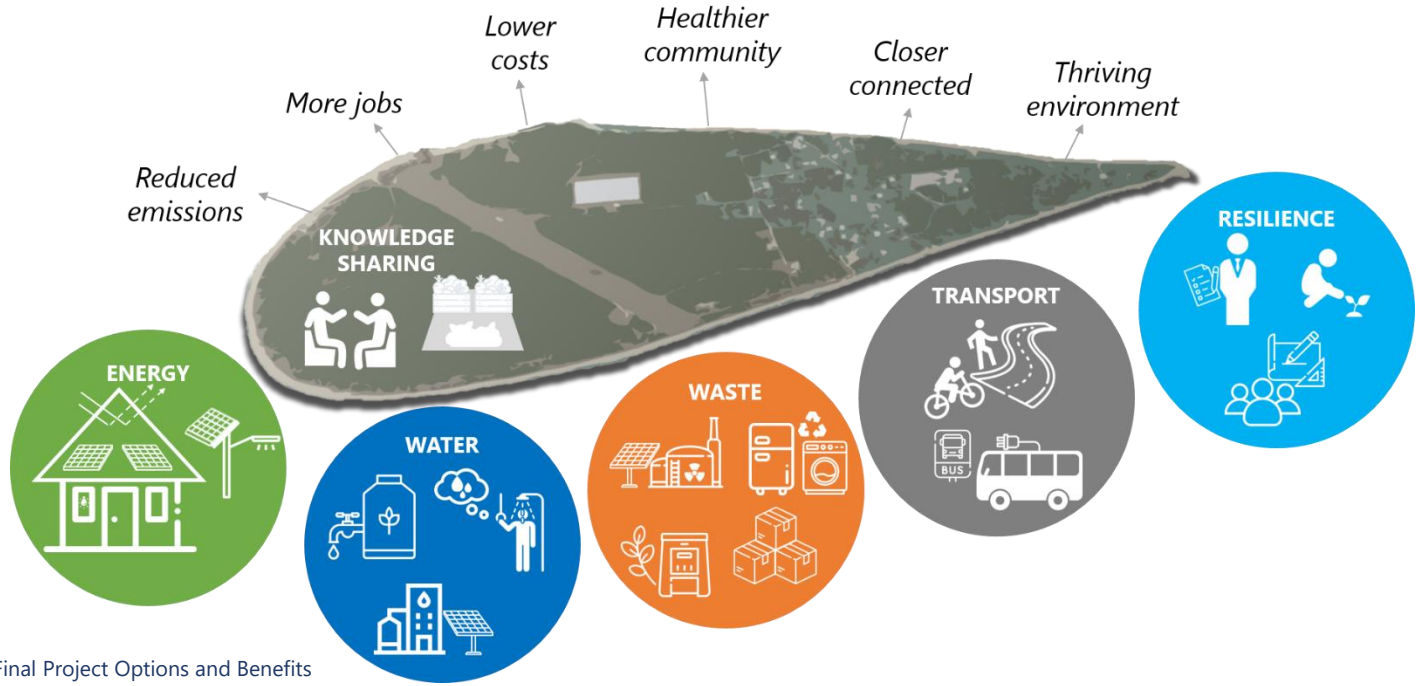


Figure 19: Summary of Final Project Options and Benefits

Final Project Options

Table 4: Final Project Options for Masig Island

Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
1. Community Market Garden This project seeks funding for a community-led on-island market garden to sell produce to the local community, in conjunction with a green waste composting scheme, which seeks to increase fresh food self-sufficiency on Masig Island.	N/A	100,000	1 – 2	0.5 – 1	• 1000 Jobs Package, National Indigenous Australians Agency • Round 3 - Community Sustainability Actions Grants, Department of Environment and Science • Social Reinvestment fund, DATSIP • Drought Communities Programme, Department of Infrastructure, Transport, Regional Development and Communications • Community Led Grants (Indigenous Communities), Department of Prime Minister and Cabinet • Resource Recovery Industry Development Program, DSDMIP • Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022, Queensland Health • Work with/through TAFE to offer appropriate courses on an ongoing basis • Funding under future round of W4Q
2. Blue Carbon Sequestration Decarbonising the islands of the Great Barrier Reef by implementing measures to enhance blue carbon storage through the conservation and restoration of Masig Island coastal ecosystems such as seagrass and mangroves.	1.38 – 1.74	700,000 (USD)	N/A	5	• Philanthropy and private funds (as an environmental and social cause) • Federal and State government grants/funding, including QLD Community Sustainability Action grants, QLD Attracting Tourism Fund, Land Restoration Fund, Climate Solutions Fund and Emissions Reduction Fund • Partners who might be able to fund their own activities/contributions, e.g. university research might be funded by PHD scholarships, volunteers from organisations like SeagrassWatch, MangroveWatch or Conservation Volunteers Australia
3. Community-led Traditional Knowledge Sharing and Education This project seeks to celebrate cultural knowledge and engage the local community through community-led sustainability and environmental traditional knowledge sharing and education.	N/A	25,000 (capital) 75,000 – 100,000 (ongoing)	1.5	0.5	• Community Sustainability Actions Grants, Department of Environment and Science • Social Reinvestment Fund, Department of Aboriginal and Torres Strait Islander Partnerships • Indigenous Languages and Arts Grant, Department of Infrastructure, Transport, Regional Development and Communications • 1000 Jobs Package (Tranche Two), National Indigenous Australians Agency • Community Led Grants, Department of the Prime Minister and Cabinet • The Container Refund Scheme Small Scale Infrastructure Grants Program (Queensland Government) provides up to $10,000 to establish collection points for the container deposit scheme • DES Grant Program for First Nations Council up to $50,000.

Final Project Options

	Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
	**4. Solar PV Rooftop Systems for Housing** Increasing the number of managed solar panels installed on residential rooftops to reduce dependence on diesel-generated electricity.	102	340,000	1 – 2	0.5 – 1	• Small-scale technology certificates for solar PV systems through Small-scale Renewable Energy Scheme – from the Clean Energy Regulator (Australian Government) • CEFC - Reef Funding Program: funding available for emission reduction projects in Great Barrier Reef catchment area • Regional and Remote Communities Reliability Fund • Climate Solutions Fund – Emissions Reduction Fund
	**5. Low Emission On-Island Shuttlebus** On-island shuttle bus for public transport or direct rapid transport, powered either as an electric vehicle (and associated charging infrastructure) or by alternative low emission fuels.	0.002 – 0.006 /100km	100,000	N/A	0.5 – 1	• Climate Solutions Fund – Emissions Reduction Fund • CEFC - Reef Funding Program • ARENA – potential funding through exploration of innovative EV charging infrastructure • Ergon – potential funding and becoming partner on project due to EV charging infrastructure
	**6. Smart Solar Streetlights** Installation of new smart solar cells in streetlights and solar lighting across the community (including on roads, on the jetty, and at the beach).	0.195	22,000/light	N/A	<1	• CEFC - Reef Funding Program: funding available for emission reduction projects in Great Barrier Reef catchment area • Regional and Remote Communities Reliability Fund • Climate Solutions Fund – Emissions Reduction Fund
	**7. Active Transport Options** Establish planning and infrastructure to promote active transport on Masig Island.	0.35	80,000	1	0.25 – 0.5	• This may be determined as part of the planning process. Potential funding sources may include council budgets, or funding through the activities of the Queensland Walking Strategy and/or the Queensland Cycle Strategy.
	**8. Existing Building Improvements** Improving energy efficiency in buildings through passive cooling measures such as: improving air flow, insulation, glazing, heat reflective paint, gutter guards and other energy saving opportunities	0.257 – 515 (residential) 1.5 – 3 (commercial)	200,000 – 500,000	2 – 3 /year	0.5 – 1	• Ergon Energy should be approached as a key partner as they have an interest in deferring network augmentation

Final Project Options

Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
9. On-island Sustainability Officer An ongoing, paid position for a dedicated on-island sustainability officer to coordinate, oversee and support the successful delivery of sustainability projects on Masig Island.	N/A	80,000	1	<1	• Torres Strait Island Regional Council Community Grants • Community Sustainability Actions Grants, Department of Environment and Science • Social Reinvestment fund, DATSIP • 1000 Jobs Package, National Indigenous Australians Agency • Community Led Grants, Department of Prime Minister and Ca
10. Energy Efficient Appliance Upgrades Improving energy efficiency in buildings through upgrades to energy-efficient appliances.	0.257 – 515 (residential) 1.5 – 3 (commercial)	250,000 – 500,000	1	1 – 2	• Energy Efficient Communities Program, Community Energy Efficiency and Solar Grants 2020, Department of Industry, Science, Energy and Resources • Ergon Energy should be approached as a key partner as they have an interest in deferring investment. • CEFC or an Indigenous Organisation
11. Rainwater Harvesting Improvement Program This project seeks to increase the safety, reliability and (non-potable) utilisation of domestic rainwater harvesting systems, reducing overall demand and increasing the resilience of the community water supply.	0.004 /m3 water harvested	500,000 – 2,000,000	1 – 2	1 – 2	• Round 3 - Community Sustainability Actions Grants, Department of Environment and Science • Drought Communities Programme, Department of Infrastructure, Transport, Regional Development and Communications • Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022, Queensland Health: capacity building for Environmental Health and Animal Management in first nations communities • Funding under future round of W4Q • Northern Australia Infrastructure Fund
12. Solar Panels at Sewage Treatment Plant Solar PV panels on Sewage Treatment Plant, providing decarbonisation benefit through reduced dependence on diesel generators.	11	40,000	0.1	0.5 – 1	• Small-scale technology certificates for solar PV systems through Small-scale Renewable Energy Scheme – from the Clean Energy Regulator (Australian Government) • Reef Funding Program, Clean Energy Finance Corporation: funding available for emission reduction projects in Great Barrier Reef catchment area • Regional and Remote Communities Reliability Fund, Department of Industry, Science, Energy and Resources • Climate Solutions Fund: Emissions Reduction Fund, Department of Environment and Energy
13. Water Supply Energy Efficiency and Solar Project This project seeks to increase the energy efficiency of the Masig Island Water Supply System, and offset power demand with renewable energy - solar PV and potential battery energy storage.	31 – 52	130,000	0.5	1 – 2	• Round 3 - Community Sustainability Actions Grants, Department of Environment and Science • Drought Communities Programme, Department of Infrastructure, Transport, Regional Development and Communications • Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022, Queensland Health: capacity building for Environmental Health and Animal Management in first nations communities • Funding under future round of W4Q • Northern Australia Infrastructure Fund

Final Project Options

Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
14. Waste Management Optimisation Optimisation of landfill practices and removal or recycling of stockpiled waste from the island for reuse.	N/A	250,000 – 300,000	N/A	1 – 2	• The Department of Environment and Science are currently undertaking an Indigenous Waste Strategy and associated infrastructure planning, in line with the Queensland Waste and Resource Management Strategy. The development of this Indigenous Waste Strategy and infrastructure plans may provide opportunity for funding for remote communities such as Masig Island. • Any future round of the Qld Government Regional Recycling Transport Assistance Package
15. Island Composting Scheme Collection of food and garden organics to produce compost, to support on island food production and reduce waste to landfill.	N/A	250,000 – 300,000	1 – 2	1	• The Department of Environment and Science are currently progressing an Indigenous Islands Waste Strategy and associated infrastructure planning, in line with the Queensland Waste and Resource Management Strategy. The development of this Indigenous Waste Strategy and infrastructure plans may provide opportunity for funding for remote communities such as Masig Island.
16. Community-led Housing Design Code Develop and implement a housing design code which is co-developed with the Masig Island community to ensure housing is sustainable, suited to the climate and meets the needs of residents.	3 – 5 /dwelling	80,000 – 130,000	N/A	1 – 3	• Federal and local governments are likely to be the key funding partner • Commonwealth Close the Gap funding
17. Minimise Single-use Plastics and Packaging Modify procurement practices to reduce single use items and packaging from the supply chain to reduce waste disposal and litter on the island.	N/A	20,000 – 50,000	N/A	1 – 2	• It is understood that there is no longer funding through DES in support of the 'Plastic free places' initiatives however future rounds of the Community Sustainability Action Grants may be a potential funding opportunity. • DES are currently developing the Indigenous Waste Strategy and undertaking associated infrastructure planning in line with the Queensland Waste and Resource Management Strategy. The development of the Indigenous Waste Strategy and infrastructure plans may provide opportunity for funding for remote communities such as Masig Island.
18. Community-based Water Demand Management Implement community-based water demand management approaches across Masig Island to assist in achieving TSIRC's ambitious demand reduction targets and evaluate the viability of options for wider roll-out across the Torres Strait.	<5	<25,000	N/A	1 – 3	• Round 3 - Community Sustainability Actions Grants, Department of Environment and Science • Drought Communities Programme, Department of Infrastructure, Transport, Regional Development and Communications • Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022, Queensland Health: capacity building for Environmental Health and Animal Management in first nations communities • Funding under future round of W4Q

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Appendix 1:
Final Project Options

This section includes the full Final Project Option documents.

Masig Island | Multiple themes

1 Community market garden

This project seeks to develop a community market garden for community members to grow their own food and/or trade or sell excess produce within the local community, to increase fresh food self-sufficiency on Masig Island.

Description and overview

This project seeks to develop a community market garden, for residents to grow their own food and/or trade or sell excess produce within the local community. The project is aligned with the proposed Island Composting Scheme (project 18).

The Masig Island community are reliant on fresh produce and goods barged from the mainland, As in many remote communities, fresh fruit and vegetables are often reported to be of a lesser condition and variety than available on the mainland. Prices for many goods and fresh produce at the Government-operated supermarket are higher than on the mainland, including additional refrigerated storage, transportation and running costs. These pose challenges for the community including a higher cost of living, limited healthy fresh food choice options and reduced food security. The carbon footprint of the food supply chain is also relatively high due to emissions from transportation. The community is somewhat vulnerable to price spikes or supply deficits which may result from adverse weather or changes in transport or economic market factors outside of their control.

Following initial community engagement, the first stage of operations may include the following food streams: chicken, banana, cassava, taro, coconut, mango, yam, wongai and sweet potato. A survey of the most in demand types of foods will need to be conducted for the local population.

Between 500 - 1000m^2 is proposed as an approximate size as either raised garden beds, planter boxes or directly in-soil planting. A detailed guide on potential options was released by Anthea Fawcett as part of the Closing the Gap initiative in 2013 *Food and other gardens in and about remote communities. A guide-planning considerations and project opportunities.*

A green waste composting scheme is also to be included as part of this project, aligned with project 18:Island Composting Scheme to reduce the emissions associated with agricultural waste and produce nutrient rich compost, in line with circular economy principles.

In the longer term, expansion of the market garden and compost scheme would enhance community self-sufficiency and resilience, promote healthy eating, providing skills capacity building opportunities, and community knowledge share and connectivity opportunities. Further phases of the community garden may consider expansion of the garden size and food grown and may include incorporation of other aligned methods such as permiculture or hydroponics. Additionally use of the biodigester for compost could be incorporated with adequate support for training and benefit realisation.

Project summary

Alignment with key project objectives	Low	Med	High
Decarbonisation impact	■		
Community resilience	■	■	
Extent of co-benefits			
Economic development	■		
Social development & cultural	■	■	■
Environmental protection	■		

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	N/A
Estimated payback period	Years	N/A
Estimated annual cost savings	$	N/A
Estimated capital costs	$ mil	0.1
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	0.5 – 1
Estimated FTE	No.	1 – 2

Key project objectives

Carbon assessment

- Importing less produce will reduce the emissions associated with packaging and transporting (food miles) these goods
- Community led emission reduction on island through the green waste composting scheme, avoiding disposal and break down in landfill.

Community and resilience

- Local production of food will improve self-sufficiency and reduce the community's reliance on the mainland
- Increased climate resilience to natural hazards that could impact the supply of food from the mainland
- Increased social resilience to economic market factors which impact upon the cost of food

Alignment with other initiatives

Alignment with other project options

- 3. Community-led Traditional Knowledge Sharing and Education
- 14. Waste Management Optimisation
- 15. Island Composting Scheme
- 18. Community-based Water Demand Management

Alignment with external initiatives or investments

- Masigalgal TSRA Rangers employed as part of market garden
- Mothers Well Nursery to support garden (seeds initial plants)
- Horticulture in Schools Initiative at Tagai College to work in the market garden
- My Pathways Community Development Programme can provide wage subsidies and employees to work in the market garden
- Opportunities with Department of Employment, Small Business and Training (DESBT) to provide certificate training to local people to build capacity
- Utilise resources from Brisbane City Council's 'Master Composter' course
- Qld Dept Health Keeping Queenslander's Healthy Roadmap

Co-benefits

Economic

If the market garden proved viable it could:

- Create a new activity on the island that will provide community benefit in terms of upskilling and reduced cost of buying supermarket food. This assumes that the community market garden costs are met by grant funding, offset by any potential produce sales.
- Initially proposed as May provide employment for 1-2FTE when upscaled in the future, which was identified as a high risk in the project risk assessment.
- Provide horticulture education and upskilling opportunities.
- On-island food production will reduce vulnerability to price spikes for imported fresh produce
- Opportunity to scale up and sell produce to local community and tourists

Social and cultural

- Access to fresh, healthy produce for residents
- Food security which reduces reliance on mainland, which was an extreme risk identified in the project risk assessment.
- Celebration and integration of traditional knowledge into agricultural practices.
- Pathway for elders to connect with and mentor youth
- Supports Qld Dept Health - Keeping Queenslander's Healthy Roadmap Action 21 – 'Ensure the supply of healthy food in remote Aboriginal and Torres Strait Islander communities' of Our Future State

Environmental (General)

- Circular economy principles of composting garden waste for reuse at the garden, as well as avoiding emissions associated with alternatively breaking down organic waste in landfill
- Shortening the supply chain will reduce food waste created through transportation
- Cultural shift to lower processed foods will provide a reduction in waste on the basis of type of food (and packaging) transported to the island

Environmental (impacts to Great Barrier Reef)

- Reduced pollution potential resulting from the transportation of food (e.g. fuel leakage in water, air quality)
- The use of compost will avoid the potential for chemical fertilisers to run off into the ocean

Risks and opportunities

Barriers

- It is understood that the required skills to manage the market garden (both commercial and technical) are available on-island. However, if this is not the case, this would pose a significant barrier.
- Local growing conditions, resources and technical challenges limit produce
- Biodigesters for green waste are expensive, difficult to run and require expertise to operate. It is understood that a biodigester owned by TSRA is currently located on the island but is yet to be made operational.

Risks

- There may existing climate hazards or natural disasters which could affect crop yields and the productivity of soil
- There is a risk that if not subsidised by grant funding and/or volunteer workforce, costs of on-island production may be non-competitive
- A long-term commitment to the effective management of the market garden will be required. There is a risk of being unable to secure sufficient ongoing financing or funding, which would threaten long-term viability.
- Demand for locally-grown produce has not been assessed, and there is a risk this may not be sufficient to meet costs
- There are serious health risks associated with the composting scheme if machinery and materials are not operated correctly
- If land clearing is required for the market garden, erosion may occur. Steps should be taken to mitigate these effects.
- Water availability and water security issues on the island
- Introduction of pests and weeds (biosecurity risks) to the island through imported plant material or fertilizers must be avoided through strict controls in accordance with Biosecurity regulations
- Operations may not be able to meet regulatory standards, they may require a high degree of regulations, require comprehensive standard operating procedures
- Poor operations and/or practices may result in food-borne illness or outbreak

Opportunity

- There is opportunity to link environmental and sustainability education workshops with the market garden (including for volunteer roles to be developed)
- There is an opportunity to collaborate with the local community groups and school to ensure the benefits of the project are more widely realised
- Using native food crops to celebrate traditional knowledge and history
- Rainwater harvesting could combat water security issues
- The production of arrowroot powder from the cassava crop could be undertaken Future phases of the community garden may consider more energy intensive operations e.g. permaculture, increased volume of production. Solar power could be considered for inclusion if deemed feasible and beneficial at that time.

1. Horticulture Innovation Australia, 2018, "Nursery Industry Statistics and Research Final Report"

Assumptions

- Green waste will be composted and reused in the garden
- Food production is initially as community market garden. Future phases may upscale volumes and intensity of food growing if desired toward commercial outputs
- Produce may require subsidisation to some degree
- Ownership and management of market garden will sit with Torres Strait Regional Authority Rangers and Land and Sea Management Unit. The rangers already operate a small-scale nursery and hydroponic setup which could be expanded or otherwise integrated into this initiative.
- No financial or market analysis has been conducted to assess the commercial viability of the market garden
- No climatic modelling or soil testing has been completed to accurately assess the productivity of suggested crops
- No market study has been completed to determine the community demand for produce

Additional information

- Australia's first sponge farm was established at Masig Island in 2009
- Masig Island has previously had active food producing community gardens however they were not commercial in nature
- Masigalgal Rangers have played a leading role in establishing and maintaining the Mothers Well Nursery

Costs and funding considerations

Capital costs

Approximate total capital cost: $100,000

- Include consultant support for confirming site location and broad layout design and services connection identification. ~$25,000
- gardening equipment, garden beds, shade cloth and structures and direct inputs such as mulch fertiliser and seeds: ~$20,000
- Irrigation systems, rainwater tank ~$10,000

Costs and funding considerations

Capital costs (cont'd)

- Chicken fencing and shed (5 sqm per hen with 23cm perch per hen) to keep them contained and safe from predators, nesting boxes (40cm x 40cm), 8-10 hens (~$40 each) and one rooster ($20 - $100)
- Large bins for storage & composting system – three large compost bins with lids (~$300/bin)
- 4 x community workshops with to plan the garden & subsequently for composting and food growing knowledge sharing Coordinated by sustainability officer (external consultant support, materials preparation) ~$40,000
- Seed stock, hand tools, shade cloth, and stakes ~$2,500

Ongoing costs

- Operations and maintenance expenses
- Supported by On-island Sustainability Officer (BC#9)
- Land lease costs, if required
- Insurance fees (approximately $750 - $2,000)
- Establishing infrastructure connections to electricity and water and ongoing supply and usage costs
- Consistent supply of chicken feed (120g of layers pellets/day/chicken – retail price $24 - $30 /20kg)

Potential cost savings or return on investment

- Community garden not initially aimed at commercial returns however food produced would equate to savings as unlikely to produce revenue beyond ongoing costs to cover salaries and ongoing costs due to economies of scale
- Enterprise would need ongoing financial supplement to cover costs of operation, salaries

Funding opportunities

- 1000 Jobs Package, National Indigenous Australians Agency
- Round 3 - Community Sustainability Actions Grants, Department of Environment and Science
- Social Reinvestment fund, DATSIP
- Drought Communities Programme, Department of Infrastructure, Transport, Regional Development and Communications
- Community Led Grants (Indigenous Communities), Department of Prime Minister and Cabinet
- Resource Recovery Industry Development Program, DSDMIP
- Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022, Queensland Health
- Work with/through TAFE to offer appropriate courses on an ongoing basis
- Funding under future round of W4Q

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Masig Island local community	■	■	■	■
Masigalgal Rangers		■	■	
Torres Strait Regional Authority Rangers and Land and Sea Management Unit	■	■		
Queensland Health			■	
Torres Strait Island Regional Council			■	

Implementation and timeframes

Investment readiness

- There is a strong community desire to establish a market garden on the island
- Mothers Well Nursery is well positioned to support and supply resources for the garden
- Potential land parcels have been identified by community, suitability/availability tbc as part of assessment

Next steps

- Confirm availability of local champion and resources to develop and implement project
- Site feasibility to determine where the site will be located, taking into consideration environmental, planning, technical and community constraints
- Demand assessment to ascertain whether there is sufficient demand to support the market garden

Considerations for implementation

- The garden market model should best suit the interests, skills and capacities of the local community who will be involved
- Lead to champion and carry forward market garden required, including involvement from local people
- Land selection for the market garden to assess climate change risks, including vulnerability to sea level rise, and local growing conditions to maximise crop productivity
- Consultation with PBC (Masigalgal TSRA Corporation) regarding land requirements
- Household food scraps as a feedstock source for chickens and composting system
- Compliance of food production and sale with the Food Act 2006 and responsibilities under the Food Safety Scheme for Eggs and Egg Products (Egg Scheme). Accreditation with Safe Food Queensland to produce, process or transport meat, dairy, eggs, seafood or horticulture.
- Crop selection for reliable, year-round production

Timeframes to deliver solutions

- The total time required to consult, plan, and deliver an operational market garden would range from approximately 6 months to 1 year following a decision to proceed. However, this will also depend on the productivity of the soil and growth cycle of the selected crops.
- Start small and upscale as capacity develops over time

Masig Island | Resilience

2 Blue Carbon Sequestration

Implementing measures to enhance blue carbon storage through the conservation and restoration of Masig Island coastal ecosystems.

Description and overview

Masig Island and surrounding ecosystems of the Great Barrier Reef are part of the land and sea country of the local communities, with high cultural, economic and environmental value, and are increasingly recognised for their value as carbon storages. The reef and coastal ecosystems of Masig Island and the Torres Strait are generally considered to be some of the most pristine in the world.

Blue carbon refers to the carbon stored in marine and coastal ecosystems such as coral reef, mangroves, tidal marshes, and seagrass meadows, which sequester and store more carbon per unit area than terrestrial forests. Conversely, if these ecosystems are degraded or destroyed, their carbon sink capacity is impacted and stored carbon is released, shifting from a carbon sink to a source of emissions.

This project proposes funding for a blue carbon sequestration program to conserve and restore (where required) Masig Island's coastal ecosystems, ensuring that they continue to function as long-term carbon sinks that are also maintained at their highest value for social, economic and environmental purposes. The proposed project phases for this initiative are: planning, implementation, performance assessment, dissemination of results and ongoing adaptive management.

Coastal ecosystems can play a critical role in reducing the unique vulnerabilities of the local community to coastal hazards and climate change, through their natural impacts on the coastal environment such as wave attenuation, erosion reduction and the mitigation of storm surges.

A combination of conserving existing ecosystems and restoring of degraded ecosystems at selected sites may be used. Conserving existing ecosystems may include monitoring programs for adaptive management and environmental management education. Restoration techniques may include plantings, modifying tidal flow or reducing environmental stressors (e.g. water quality, marine debris, shipping accidents, nutrient and sediment runoff).

Fishing and other marine harvesting is at the heart of survival for Masig Island residents; healthy coral reef, seagrass beds and mangroves in the wider archipelago are fundamental ecosystems that support this existence. There are opportunities for employment of the local community to manage and implement program activities, as well as provision of environmental education for local people and visitors.

The project would create benefits for coastal resilience, protection and restoration of coastal habitat (as well as the fisheries/marine harvesting that the habitats support, and which are a significant part of the local culture).

Project summary

Item	Units	Total
Estimated annual emissions reduction[1]	t-CO_2-e	1.38 – 1.74
Estimated payback period	Years	N/A
Estimated annual cost savings	$	N/A
Estimated capital costs	$ mil (US)	0.7[2]
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	5
Estimated FTE	No.	N/A

1. Based on 10,000m2 of restoration
2 Estimate for 1 hectares: $15,017 for mangroves and $699,525 for seagrass

Key project objectives

Carbon assessment
Blue carbon ecosystems can store carbon quicker and much longer (thousands of years) than terrestrial 'green carbon' ecosystems.

Actual carbon storage capacity will ultimately depend on the site and the specific ecosystems targeted:

- On an area-specific basis, mangrove forests store more carbon than other ecosystems like seagrass and salt marsh, with the average carbon sequestration rate estimated to be 174 g C m^2 y^{-1}.
- Carbon sequestration rates in seagrass meadows vary depending on the species, sediment, and depth of the habitats, but on average the carbon burial rate is approximately 138 g C m^2 yr^{-1}.

Masig Island is surrounded by seagrass meadows in the shoal waters on sand flats between the land and coral fringing reefs. Also ecosystems incl. mangroves and freshwater wetlands in the greater archipelago. The area of Masig Island is estimated to be 167Ha (2.7 km in length and 800 m at its widest point).

Based on 10,000m^2 of restoration an annual carbon sequestration amount of 1,380kg – 1,740kg of CO2-e could be expected.

Community and resilience
Coastal communities such as the community of Masig Island are vulnerable to coastal hazards and current/future climate change (especially given the small size of this island). Blue carbon projects to conserve and protect coastal ecological resilience will allow adaptation and mitigation to these threats, as well as promote the wellbeing of the residents (refer to the list of co-benefits of such projects).

Masig Island and surrounding ecosystems of the Great Barrier Reef are part of the land and sea country of the local communities, with high cultural, economic and environmental value, and are increasingly recognised for their value as carbon storages.

Co-benefits

Economic and social
Economic and social benefit in protecting/enhancing fisheries supported by seagrass beds/mangroves, which is a valued income stream to the island.

Blue carbon sequestration markets are also a potential revenue stream (although a relatively young concept).

Opportunities for employment and community development include employment of local workers to manage and implement program activities, as well as provision of environmental education for local people and visitors (which can help to support ecotourism). Conservation and restoration of coastal ecosystems may also support the maintenance of coastal resource dependent livelihoods.

Cultural
The conservation and restoration of coastal ecosystems are measures which align strongly with the values of the local community.

Environmental (general)
Coastal ecosystems provide important or critical habitat for a diversity of wildlife adapted to coastal conditions. Conservation and restoration efforts are likely to support ecosystem resilience and key ecosystem services like fisheries. It would also support policies for environmental conservation and create protected habitat, e.g. fish habitat protected under the Queensland *Fisheries Act 1999* and habitat for nationally protected migratory shorebirds.

The project may also provide protection against erosion, which was identified as an extreme risk in the project risk assessment.

Environmental (impacts to Great Barrier Reef)
The coastal ecosystems on the islands of the Great Barrier Reef are essential parts of the reef itself and have important ecological interactions with the coral ecosystems, including exchange of abiotic materials (sediments and nutrients, influencing water quality) and marine biota (e.g. nursery grounds for many different fish and crustacean species).

Risks and opportunities

Barriers and Risks

- Numerous government and community conservation programs in operation, including Ranger program, however not all joined up, may conflict
- May be a challenge to achieve sustainable ongoing funding. Need long-term management (restoration and conservation are continuous processes), plus difficult to predict costs and timeframes.
- Lack of standardised method/metrics to estimate blue carbon offsets and returns/benefits, uncertainty about financial mechanisms and returns, unclear legal/policy setting including shifting and uncertain policy landscape
- Operational risk – unsuccessful conservation and restoration efforts
- Risk of costs of conservation/restoration being higher than the returns (also benefits like coastal protection or fish nurseries or improved water quality can be hard to quantify)
- Risk of limited or passive engagement from the local community (e.g. lack of incentives in the short and/or long term, failure to address realities of residents now and in the future)
- Risk of climate change and sea level rise to blue carbon sequestration

Opportunities

- Opportunity for blue carbon restoration to be used in existing environmental impact offset frameworks or a blue carbon offsetting scheme
- Opportunity for employment of local people, leverage local knowledge and upskilling. Opportunity to support or align with environmental education and ecotourism initiatives.
- Potential to align/link with Land Restoration Fund/Emissions Reduction Fund/Climate Solutions Fund as market mechanism/driver/framework
- Align with IPA Masigalgal ranger initiatives

Alignment with other initiatives

Alignment with other project options

- 3. Community-led Traditional Knowledge Sharing and Education
- 9. Sustainability Officer

Alignment with external initiatives or investments (to be investigated)

- Torres Strait Ranger Group activities of Masigalgal Rangers for Indigenous Protection Areas
- Seagrass monitoring was conducted at Masig by James Cook University in 2018
- There may be opportunities to build upon and work with Reef & Rainforest Research Centre; SeagrassWatch and MangroveWatch in restoration monitoring and with researchers for pilot ecosystem studies (e.g. from James Cook University). Environmental groups or organisations like Conservation Volunteers Australia may also be able to support restoration activities.
- Potential alignment with government initiatives - GBRMPA, OGBR, Land Restoration Fund, Climate Solutions Fund & Biodiversity Conservation Strategy.
- Blue carbon has been identified in the Carbon Farming Industry Roadmap

Assumptions

- Assumes the coastal ecosystems on Masig Island require dedicated conservation and restoration efforts in the first place, e.g. may already be in healthy condition. Will require baseline ecological data to assess.
- Assumes that there are suitable sites for dedicated conservation and restoration efforts – these sites need to fit the long-term/permanent nature of a blue carbon project
- Assumes availability of reliable methods, metrics and tools for implementing conservation and restoration (and monitoring). Uncertainty may lead to unattractiveness for investment.
- Assumed limited opportunity for salt marsh or coral reef restoration, however these other forms of blue carbon may be investigated during ecological assessments (recommended).
- Detailed analysis of coastal ecosystems on Masig Island not conducted – based on desktop review of known coastal vegetation and aerial imagery.
- It should also be noted that the specific conservation and restoration methods that may apply to Masig Island's coastal ecosystems need to fit social, environmental and economic realities. There are already groups like the Aboriginal Carbon Trust specifically working with indigenous communities to harness traditional knowledge/cultivation and work with established and recognised methodologies for external recognition.

Additional information

- There are examples of mangrove restoration/rehabilitation projects in Queensland, e.g. Coomera Rivers Mangrove and Intertidal Rehabilitation project
- May trigger need for permits/approvals. For example, blue carbon project activities may trigger a permit for activities within the surrounding Great Barrier Reef Marine Park and need approval for works in IPA - Native Title considerations.

Costs and funding considerations

Cost will depend on several factors including the specific conservation and restoration methods used. Some formats in which coastal restoration costs have been analysed include the cost per acre; costs for specific restoration tasks; costs for input (e.g. labour, equipment). The costs of any restoration project is significantly influenced by unique factors (e.g. site).

Costs of coastal ecosystem restoration are difficult to pin down (highly project specific). Restoration works and a feasibility study estimated that the total restoration costs are:

- Median of $2,508 and average of $15,017 per hectare (2020 US$) for mangroves; and
- Median of $383,672 and average of $699,525 per hectare (2020 US$) for seagrass.

Capital costs

- Costs for project planning and restoration design
- Initial costs for training, labour, equipment and materials

Ongoing costs

- Specific ongoing conservation and restoration tasks
- Replacement costs for equipment and materials
- Project management costs

Potential cost savings or return on investment

- Natural coastal protection and climate change adaptation benefits
- Ecosystem services (e.g. more resilient coastal environment and fisheries)

Funding opportunities

- Philanthropy and private funds (as an environmental and social cause)
- Federal and State government grants/funding, including QLD Community Sustainability Action grants, QLD Attracting Tourism Fund, Land Restoration Fund, Climate Solutions Fund and Emissions Reduction Fund
- Partners who might be able to fund their own activities/contributions, e.g. university research might be funded by PHD scholarships, volunteers from organisations like SeagrassWatch, MangroveWatch or Conservation Volunteers Australia

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Local community	■	■		■
Government		■	■	
External partners, e.g. universities and NGOs		■	■	
My Pathway workers			■	
PBC and Traditional Owners	■		■	

Implementation and timeframes

Investment readiness

There are several gaps in available data which must be filled prior to investment:

- Ecological baseline studies of the mangrove and seagrass communities at Masig Island, as well as the habitats that they occupy. Restoration success depends primarily on the ecosystem, site selection, and techniques applied rather than on money spent. Successful restoration projects involve a sound understanding of the site conditions. The studies will support selection of suitable sites and site-specific conservation/restoration methods.
- Further investigation of the risks and barriers described in the Risks and Opportunities section – measuring benefits and returns, lack of legal or policy framework for blue carbon projects, operational risks, and potentially lack of local capacity to implement the project (need external support). Need further investigation into current or upcoming/potential financial markets, voluntary and international markets (including Australian government's move towards inclusion in ERF).

Next Steps

Extensive consultation with the local government and local community to address some of the risk and barriers

Considerations for implementation

It is critical to consider that blue carbon is a relatively new concept, and this issue is related to lack of information/guidance about implementing blue carbon projects, metrics to measure benefits, best practice, costs, etc. (However there is potential for pilot studies to be conducted – this would benefit other/future blue carbon projects in Australia and globally, while improving Masig Island's coastal environment.)

Timeframes to deliver solutions

Benefits to coastal ecosystems could be shown in short timeframes of 3-5 years, e.g. increased area of mangroves and seagrass. However, achieving a successful blue carbon project (with resilient social, environmental and economic systems) is likely to require many more years.

Masig Island | Multiple themes

3 Community-led traditional knowledge sharing and education

This project seeks to celebrate cultural knowledge and engage the local community through community-led sustainability and environmental traditional knowledge sharing and education.

Description and overview

Masig Island's Traditional Owners are linked to their country through their customs, traditions and relationships with the land, sky and sea. Their cultural identity, knowledge and customs are a vital component of Masig Island's community and future developments on the island.

To help promote the continuity of Traditional Owner knowledge, this project seeks to develop and deliver community-led sustainability and environmental traditional knowledge sharing and education. Through this process, the project seeks to integrate modern sustainability practices whilst valuing and protecting traditional knowledge.

This project intends to support existing efforts in this space which are already occurring in the community and with TSRA. Knowledge sharing would include a focus on sustainable and resilient transport and household management to enhance resource management capabilities. The topics for education and knowledge sharing initiatives would include:

- Environmental management, including bushfire, weeds, pests
- Food growing and harvesting
- Energy education around solar PV use (ie using energy when available)
- Energy efficiency improvements and solar panel education
- Energy education around high consumption appliances
- Use of solar hot water systems
- Sustainable transport options including education on vehicle efficiency (marine and land)
- Waste hierarchy principles in improving resource use and reducing waste production
- Improved water usage and management, including increasing rainwater harvesting for homes

Celebrating, sharing and protecting cultural and sustainability knowledge will strengthen community resilience in the face of change and will also promote engagement in important sustainability initiatives based on traditional knowledge. It provides opportunities to support and upskill community members to deliver knowledge sharing and complement other island initiatives.

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	N/A
Estimated payback period	Years	N/A
Estimated annual cost savings	$	N/A
Estimated capital costs	$ mil	0.025
Estimated ongoing costs	$ mil	0.075 – 0.1
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	0.5
Estimated FTE	No.	1.5

Key project objectives

Carbon assessment

- Reducing household consumption of materials will reduce the embodied GHG emissions that goes into producing and transporting goods, as well as avoiding emissions from their subsequent disposal in landfill
- Increasing the community's use of renewables (solar PV) when available and energy efficiency to reduce electricity usage from the grid, which is sourced from carbon intensive diesel generators
- Reduced water consumption by community as well as increased adoption of rainwater harvesting will reduce electricity used at the Water Treatment Plant (WTP) and to transport water to households
- Reduction in individual vehicle usage and increased uptake in shared or active transport will reduce greenhouse gas emission production
- Ecological management to retain terrestrial and marine carbon sinks

Community and resilience

- Optimisation of use of Solar PV when available to increase access to energy and reduction in household bills
- A decrease in resource consumption will reduce the community's vulnerability to supply deficits i.e. water, energy, wasted food
- Adoption of rainwater harvesting will reduce demand on the WTP and increase water security when potable water issues are experienced
- Limiting of waste to the island from both the servicing of the community and future tourism through improved resource consumption
- Education around the safe use and maintenance of water tanks and use of rainwater for non-potable uses to restore a cultural connection and sense of resilience around water, increasing water quality and efficiency

Co-benefits

Economic

- Costs savings for community members from reducing their water and energy consumption and increasing use of Solar PV
- Skills development, capacity building and potential job creation
- Rainwater tank, solar panel maintenance as a job opportunity
- Improved waste separation provides increased opportunities for reuse or recycling of resources and therefore new industries to be established on the island
- Reduced costs associated with waste disposal and transportation from reduced waste production
- Sustainable, 'green' image to use as a marketing advantage for tourism industry
- Separating waste streams would allow the council to sell valuable resources while minimising the amount of waste going to landfill and the costs and associated environmental risks

Social and cultural

- Sharing of cultural knowledge and practices, increasing community knowledge and connectivity in caring for country
- Aligning modern sustainability practices with traditional culture, knowledge and values
- Cost of living benefits from reduced spending and usage of energy, water and other resources
- Protection of Traditional Ecological Knowledge for future generations, allowing community members to access information for their own cultural maintenance, which was identified as a high risk in the project risk assessment
- Integration of modern technology-based sustainability concepts with a cultural narrative commonly unwritten by sustainability

Environmental (General)

- Reduced environmental impact of the community regarding waste production, resource consumption, water usage and energy usage
- Reduced single use plastics
- Reduced litter into the environment in line with Queensland Government's education and awareness around litter
- Traditional knowledge for care of country

Environmental (impacts to Great Barrier Reef)

- Reduced litter and pollution entering oceans and the Great Barrier Reef
- Improved local air quality from efficient vehicle usage and decreasing use of diesel generators from reduced electricity usage
- Traditional ecosystem management for Dugong and Sea Turtle

Other

- Reduced demand on water and electricity use on the island

Risks and opportunities

Barriers

- Communication mediums and infrastructure
- Capacity, availability and interest of the community to develop/deliver the program
- No allocated facility to undertake education and knowledge sharing activities
- Requirements of the National Plumbing Code and the Queensland Plumbing and Wastewater Code for household fittings to be connected to a potable water source

Risks

- Community are not sufficiently consulted or collaborated with, which will jeopardise the longevity of this initiative
- Loss of interest, funding and support over time, restricting its longevity

Opportunity

- Tourism operators to support this initiative as part of corporate social responsibility
- Partner with tourism operators and deliver education activities to visitors
- Partnering with local schools as a platform for education and knowledge sharing
- Creating an education program across multiple indigenous communities that can be tailored and made specific to individual islands, to mutually benefit from the development and delivery of the engagement program. Traditional knowledge and intellectual property ownership needs to be protected for the ongoing benefit of the community

Alignment with other initiatives

Alignment with other project options

- 1. Community Market Garden
- 4. Solar PV Rooftop Systems for Housing
- 8. Existing building improvements
- 9. On-island Sustainability Officer
- 10. Energy efficient appliance upgrade
- 11. Rainwater Harvesting Improvement Program
- 15. Island Composting Scheme
- 16. Community Led Housing Design
- 17. Minimise Single-use Plastics and Packaging
- 18. Community-based Water Demand Management

Alignment with external initiatives or investments

- Potential for collaborative partnerships with NGO's like Keep Australia Beautiful, Community Sustainability Grants. Schools - EcoMarine Warriors
- Masigalgal Ranger Program
- Masigalgal Seasonal Calendar booklet
- Education program segment of the community-based dugong and turtle management plan
- DES education initiatives on Indigenous Waste Strategy/Policy
- The DES Waste Management and Resource Recovery Strategy should be the basis for any waste education initiative. The Litter and Illegal Dumping Program's Team have coordinated behaviour change programs for illegal dumping.

Assumptions

- Strengthening and supporting the transfer of traditional knowledge and culture across the community will directly support skills development, capacity building, and the potential for job creation
- Transfer of traditional knowledge and culture holds resilience, decarbonisation, and other environmental/ecological benefits
- Overall ownership of the program will sit with the Torres Strait Island Regional Council, however responsibility for the programs development and implementation sit with the community members employed to run the program
- The Torres Strait Island Regional Council will have ownership and oversight for the education program. The responsibility for implementing and running the program sits with employees
- The community elders will be sharing the narrative and sustainability knowledge

Additional information

- The education and knowledge sharing program will focus on initiatives that deliver both environmental and liveability outcomes
- Climate change and the impacts of sea level rise are key areas of concern for the community

Costs and funding considerations

Capital costs

- Engage a consultant to provide advice on energy, water, waste and transport impacts and opportunities, as well as upskill and train local community members to deliver the program. In collaboration with the consultant, the trained community members will co-develop and deliver the education materials and program.
- Supporting education materials / brochures
- Approximate total capital cost: $25,000 (consultant engagement)

Ongoing costs

- Salary to employ two local community members (one full time and one part time) to oversee and deliver the traditional knowledge sharing and education as well as update materials and program (approximately $200,000, assuming total overhead margin of approx. 40%). Potential to align with Ranger program initiatives.

Potential cost savings or return on investment

- Potential for household cost of living savings (electricity, water, fuel)
- Container Refund Scheme can return between $75 - $220 per bag of containers
- The role of the On-island Sustainability Officer (project #9) could incorporate oversight of this project
- Financial benefits to the Queensland Government through their Community Service Obligation (CSO) payments as the community moves away from costly diesel-based energy generation to potentially cheaper solar and battery.

Funding opportunities

- Community Sustainability Actions Grants, Department of Environment and Science
- Social Reinvestment Fund, Department of Aboriginal and Torres Strait Islander Partnerships
- Indigenous Languages and Arts Grant, Department of Infrastructure, Transport, Regional Development and Communications
- 1000 Jobs Package (Tranche Two), National Indigenous Australians Agency
- Community Led Grants, Department of the Prime Minister and Cabinet
- The Container Refund Scheme Small Scale Infrastructure Grants Program (Queensland Government) provides up to $10,000 to establish collection points for the container deposit scheme
- DES Grant Program for First Nations Council up to $50,000.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Masig Island local community	■	■		■
Queensland Government		■	■	■
Future tourism operators		■	■	
NGOs		■	■	
Masigalgal (Torres Strait Islanders) Corporation RNTBC		■	■	
Queensland Government	■		■	

Implementation and timeframes

Investment readiness

- This initiative is ready for investment, pending the development of a final scope, as determined by the community and other recognised partners

Next steps

- Formulate appropriate scope, linkages and delivery format
- Establish governance arrangements to ensure delivery is community-led
- Consult with the local community to identify priority areas, ideally those which are 'high impact' and align the program with these issues
- Identify appropriate methods and delivery channels for sharing knowledge (e.g. workshops, signage, letter drops, emails, etc.) in consultation with the community
- Select an appropriate facilities to host knowledge sharing and education activities

Considerations for implementation

- Partnerships with NGOs or community groups who may already be active in this space may enable consolidation of make efforts. Potential partners may include Keep Australia Beautiful, EcoMarines Warriors Program
- Identify suitable individuals to be employed to deliver programs and establish readiness of community for mobilisation.
- Programming must be community-led, contextual and culturally appropriate
- Climate change is a key area of community concern and key focus
- A future project the community could investigate is the feasibility of expanding the range of foods grown locally i.e. aquaponics or broader on-island food production (organic and carbon neutral, of course) given the potential to cater to visitors

Timeframes to deliver solutions

- After securing funding and employing suitable individuals, it is estimated that a period of six months would be required for programming and materials development, collaborating with NGOs. After implementation, re-evaluation in response to the community uptake and feedback should occur every six months.

Masig Island | Energy

4 Solar PV Rooftop Systems for housing

Increasing the number of managed solar panels installed on residential rooftops to reduce dependence on diesel-generated electricity.

Description and overview

Installing additional solar panels on rooftops would increase community energy self-sufficiency and provide a significant decarbonisation benefit through the reduced use of diesel-powered generators. This project seeks funding for the purchase and installation of solar photovoltaic (PV) panels for residential properties. As the cost of these systems can be quite high, they would otherwise be unaffordable for the vast majority of residents on the island.

In the short-term, this project is restricted by the network's solar hosting capacity. The current additional solar PV hosting capacity is 19kW. With the future planned upgrades to the network by Ergon, it is estimated that the additional solar capacity would increase to 94kW, installing 0.9kW systems per residency across the 98 residential dwellings would be under this capacity limit at ~88kW. In addition to cost savings for residents, these residential installations of solar PV would increase renewable energy penetration by ~10% and reduce annual emissions by approximately 102 tonnes of CO_2e.

Future phases may see additional opportunities for solar PV if Ergon hosting capacity is upgraded. Future project phases could also consider battery energy storage as suitable technology evolves, maintenance staff are available and battery costs reduce payback period, however this is not considered value for money at this time.

The installation of solar PV systems could provide additional benefits to the community by upskilling local workers to install and maintain systems. This offers opportunities for capacity building, skills development, and ongoing job creation, however a suitable ownership structure for the solar PV systems still needs to be confirmed.

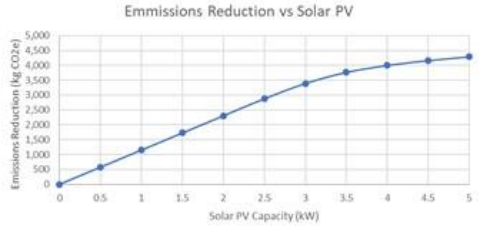
It should be noted that a reduction in cost to deliver power to Ergon will not directly reduce the cost of power for the residents. While installing some solar on rooftops will likely reduce cost of power to the household, if the solar pv systems cannot adequately be sized to match the load of the households they will still be reliant on grid connected power.

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	102
Estimated payback period	Years	10.5
Estimated annual cost savings	$ / residence	335
Estimated capital costs	$ mil	0.34
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	0.5 - 1
Estimated FTE	FTE	1 - 2

Key project objectives

Carbon assessment
Increasing the amount of rooftop solar PV to 88 kW to align with Ergon Energy's predicted hosting capacity, will reduce the island's dependence on diesel generation and cut annual emissions by ~102 tonnes of CO_2.



The above graph shows the emissions reductions achievable from installations of rooftop solar. Ergon's predicted hosting capacity allows for the equivalent of ~0.9kW installations on each residence. Over a 20-year lifespan, and accounting for a two-year payback period for embedded emissions in manufacturing the panels (embodied carbon), these solar PV installations would reduce the island's emissions by ~1,800 tonnes of CO_2.

Community and resilience
Additional benefits to the community could be realised by training residents in the installation and maintenance of the solar PV systems. This presents social and economic co-benefits for capacity building, skills development, and potential job creation, and could reduce the lead time on maintenance of underperforming systems.

Less dependence on diesel generators will mean the existing diesel storage will last the community for a longer duration for each delivery. An increase in renewable generation will also provide more resilience against future carbon taxes, if introduced.

Co-benefits

Economic
Solar-generated electricity would meet most household electricity demand while panels are actively generating power throughout the day. This has the potential to significantly reduce household energy bills.

Upskilling local workers in the maintenance and installation of systems there could reduce operational lead times, whilst also providing opportunities for local job creation.

Any solar generated on the island could have a direct, corresponding reduction in diesel-generated power.

Social and cultural

Increased renewable energy aligns with a shift towards sustainability, resilience, and greater independence for the island community, which was identified as an extreme risk in the project risk assessment.

Reducing cost of household energy bills will improve cost of living pressures for residents.

Environmental (General)

Reduced diesel generation, and therefore natural energy preservation, due to increased solar generation will reduce greenhouse gas emissions, as well as diesel particulates, sulphur oxides and nitrogen oxides. This was identified as a high risk for natural resource depletion and a severe risk for carbon emissions in the project risk assessment.

While it will take some time to fully remove the need for diesel, ultimately this will have an impact on emissions associated with shipping diesel to the islands as well as any risk of spills.

Environmental (impacts to Great Barrier Reef)
No direct impacts identified.

Risks and opportunities

Barriers
- The capacity of the current network will limit the ability to host additional rooftop solar PV in the short term
- Future behind the meter solar PV and battery systems would help mitigate the network limitation barrier, however have much greater capital costs
- Suitable ownership structure of the solar PV systems and any future battery hosting still to be confirmed

Risks
- The structural integrity of buildings to support rooftop installations has not been confirmed
- Adverse weather conditions damaging systems
- Shading conditions may reduce the performance of systems

Opportunity
- Potential to bring forward additional rooftop PV installation and batteries, assuming additional hosting capacity can be provided and with funding support and stakeholder agreement
- In future there may be opportunity to target commercial buildings
- Inclusion of new residential builds in scheme, on condition the solar hosting capacity will not be exceeded.
- Alternative ownership structure of the grid could be investigated to so that cheaper power could be delivered faster than the current proposed upgrades by Ergon.

Alignment with other initiatives

Alignment with other project options
- 3. Community-led Traditional Knowledge Sharing and Education: increased community understanding on how best to maximise return from solar PV systems, conducting power intensive activities during daylight.
- 5. Low Emission On-Island Shuttlebus: EV shuttle bus option for reducing emissions could be supported by increased penetration of renewables into grid
- 12. Solar Panels at Sewage Treatment Plant: Solar hosting capacity limits may be partially reached by solar PV on STP, which could reduce amount of solar PV able to be installed on homes.

Alignment with external initiatives or investments
Aligns with Ergon's proposed network upgrades: the current additional solar PV hosting capacity is 19kW. For the full benefits of residential solar PV to be realised, Ergon's future upgrades allowing for 75kW additional managed solar PV (i.e. total additional 94kW hosting capacity) will need to be complete.

Assumptions

- Ergon's planned network upgrade for occurring before installation of the solar PV is conducted – predicted solar PV hosting capacity is realised
- Seasonal performance of solar PV averaged based on historical GHI (irradiance)
- Modelled on current power consumption – growth rate of island not modelled
- Solar PV all operational and appropriate repairs and replacements made over lifespan
- Solar PV operation is not restricted by Ergon
- Calculations are based on average household power consumption. Using 98 homes, and 40% residential and 60% commercial energy split of total island consumption provided by Ergon
- Solar PV costed on ~$3,885 / kW installation and ~5.3 m^2/kW panel area requirement, including regional mark-up from Rawlinson's
- Detailed analysis of solar PV performance for each home has not been conducted, all emissions and performance parameters based on assumptions and subsequent theoretical calculations
- No structural or orientation analysis has been conducted
- Costing based on Australian industry benchmarking, as opposed to vendor quotes

Additional information

De-centralised (residential) battery systems could reduce the dependence of each household upon grid power consumption providing further financial return, however would not provide Ergon with the same level and ease of control as a centralised solution, which could be implemented at Ergon's power station on the island.

The suitable further levels of solar PV and battery sizing should be conducted in collaboration with Ergon to ensure network reliability and security is maintained or improved.

Costs and funding considerations

Capital costs

- Approximate total capital cost: ~$343,000 (~$3,885 / kW installed)
- Costs include the supply and installation of solar panels for 98 residencies
- Costs could be altered if local members of the community trained in the installation and maintenance of the solar panels instead of / or in combination with external contractors
- This initial installation could provide a suitable foundation for future solar PV extensions, reducing the capital costs and effort required

Ongoing costs

- Maintenance of solar PV systems
- Replacement costs
- Resulting Ergon network modifications
- Distribution of ongoing costs to be confirmed with ownership structure

Potential cost savings or return on investment

- Annual savings of approximately ~$335 per household
- Simple payback period of ~10.5 years, not including any provided subsidy. I.e. if a 50% subsidy on the purchase and installation of solar PV systems were to be offered than the payback period would also be halved to ~5.25 year. Example payback period presented as residential owned systems, however ownership of systems to be confirmed in next steps of project.

Funding opportunities

- Small-scale technology certificates for solar PV systems through Small-scale Renewable Energy Scheme – from the Clean Energy Regulator (Australian Government)
- CEFC - Reef Funding Program: funding available for emission reduction projects in Great Barrier Reef catchment area
- Regional and Remote Communities Reliability Fund
- Climate Solutions Fund – Emissions Reduction Fund

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Residents	■	■		■
TSIRC	■		■	
Energy Qld (Ergon)		■	■	
Solar PV Installers			■	
DHPW	■		■	

Implementation and timeframes

Investment readiness

The project is ready for investment in the planned purchase and installation of the rooftop PV systems, however the actual spending of any funding should be held off until confirmation is made that Ergon's network proposed upgrades can occur in the near future and that the additional solar PV will be able to be connected. Behind the meter solar PV and battery systems could also be considered, which would be ready for investment independent of Ergon's upgrades. The ownership structure of the project is still to be confirmed, whether residents, DHPW, or otherwise owned.

Next steps

Further analysis of solar PV output taking into consideration the unique losses due to roof orientation, shading, and tropical conditions, in addition to vendor engagement to confirm pricing of systems and ongoing maintenance costs. The ownership structure and funding methodology requires further consideration.

Considerations for implementation

Ability to train locals in the installation of the systems should be considered in combination with considerations regarding minimising overall cost and time taken for each installation. If training is to occur during the installations of the rooftop systems they may take longer in the short term, however the maintenance and future installations of systems could be achieved more efficiently with help from trained local workers. Other ownership structures could be looked at with the outcome targeted at community owned and operated infrastructure to reduce power costs. An example structure could be a co-owned microgrid with government.

Timeframes to deliver solutions

The timeframe to deliver the project is largely dependent on the required upgrade to the Ergon network, supply and installation of the panels. This could take between 6 months to 1 year depending on the availability and efficiency of qualified technician(s) to install the rooftop solar PV systems. The installation of these systems could take from 1 – 2 days each. The timeframe to implement systems independent of Ergon support, with batteries, would be likely at the upper end (or exceeding) the range provided.

Masig Island | Transport

5 Low Emission On-Island Shuttlebus

On island shuttle bus for direct rapid public transport to improve community connectivity. Future opportunity to be powered as an electric vehicle or by alternative low emission fuels.

Description and overview

A community need for a reliable accessible public transport option has been identified to improve accessibility and community connectivity for all island residents. Potential emissions reduction opportunities have been investigated and are discussed further below.

The community currently relies on driving own vehicle or car sharing particularly where active transport is not possible, pleasant or practical (heavy goods, hot weather, distance, ability). This is inefficient from a cost and emissions perspective per trip and does not provide equitable access to services and community connectivity. In addition, the significant car body waste on the island is testament to the prohibitive cost and impracticality of shipping vehicles to/from the island, hence it is expected that a reliable and affordable public transport service could potentially reduce personal car use/need on the island.

Indicative shuttlebus operation could be as follows:

- Capacity of shuttlebus: 12 – 15 passengers
- Route length: ~17 minutes, 4km route around Masig Island including to airport.
- Operating hours: 7:30am to 6:30pm daily

It is proposed that the vehicle be operated with a low carbon fuel alternative (e.g biofuel, renewable diesel) when more commercially market available (~2+years), or alternatively as an EV when charging with renewable energy is feasible on-island.

Low-emission vehicle technology is advancing rapidly, and EV shuttle buses are entering the Australian market. Costs for vehicles and charging infrastructure are expected to decrease over time as EV transport adoption becomes more mainstream. Given the remoteness of the Masig Island community, for maintenance it is recommended that Masig Island not be an early adopter, particularly given it will be some time before renewable electricity on Masig Island is expected to be available to power a shuttle bus as priority of hosting capacity on the grid is likely to be initially for Solar PV Rooftop Systems for Housing (project 4).

An immediate opportunity exists however to operate a diesel combustion vehicle service and replace with alternative low-emissions fuels or EV / hybrid vehicle when market available and deemed feasible. Decarbonisation benefits are outlined for these options and should again be reassessed immediately prior to implementation to ensure latest information is considered.

Project summary

Item	Units	Total
Estimated annual emissions reduction	kg-CO_2-e / 100 km	2 – 6
Estimated payback period	Years	N/A
Estimated annual cost savings	$ / vehicle	5,900
Estimated capital costs	$ mil	0.1+
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	0.5 – 1
Estimated FTE	No.	N/A

Key project objectives

Carbon assessment
Addition of a new diesel public transport service may initially increase carbon emissions on island as it is providing a new service to improve community resilience and wellbeing.

Introducing an EV for a daily shuttlebus service could decrease the overall emissions per year when compared with a diesel equivalent due to the inefficiencies of internal combustion engines, especially with the stop, start nature of a shuttlebus. The specific emissions reduction depends on multiple operational factors, however literature highlights this could be in the order of 10-25% (~2 to 6 kg CO_2e / 100 km) of the current grid and has the potential to be increased with higher penetration of renewables and scheduled recharging.

The emissions from the EV are due to charging from the diesel-powered grid on Masig Island. If the renewable energy penetration of the grid were to be maximised, the emissions from implementing an EV shuttlebus could eventually be effectively zero.

A dedicated solar PV and battery charging system could also ensure low emission operation. Sizing and costing of this charging system is suggested to be explored further after the shuttlebus' operating times and methodology are confirmed, however indicative numbers for two operating philosophies are provided in the capital costs section.

Community and resilience
Increased community connectivity, encouraging more community engagement and freedom of movement for the community, including during weather events when unsafe to travel by foot.

Introducing an EV shuttlebus is an enabler for other EVs and electric modes of transport on the island in future, due to the possibility of sharing EV charging infrastructure and maintenance management.

Co-benefits

Economic
- An EV option provides a lower operational cost compared to that of a diesel shuttlebus, due to expensive diesel prices on the island, relative to electricity cost to appropriately charge EVs
- Depending on funding obtained or whether community members are charged a nominal fare (e.g. $2 - $3) for use, paid positions for driver(s) and maintenance personnel could be available

Social and cultural
- An accessible public transport service could increase community connectivity, encouraging more community engagement, access to essential services and freedom of movement within the island community. The shuttlebus could be used for specific services such as helping transport children to school. Lack of public transport was identified as a high risk.
- The service is currently proposed to run a loop around the main streets of the island, including going to the airport and jetty area to the north of the tarmac
- Further community consultation is required to determine a suitable shuttlebus route, operating hours and operating style; including ownership structure, which satisfies the Masig Island's community needs.

Environmental (General)
- An EV could provide emissions reduction in comparison to diesel counterpart, which was identified as a severe risk in the project risk assessment. The full possible emissions reduction is not quantifiable without further detailed assessment of bus routes and analysis
- Reduced use of personal vehicles may yield additional emissions reductions. Reduced dependence on individual vehicles could also long-term reduce metal waste, a noted problem on regional islands.

Environmental (impacts to Great Barrier Reef)
- A reduction of greenhouse gas emissions through utilisation of EVs could contribute to the global effort to reduce emissions which are impacting the reef through increased temperatures and ocean acidification. Any reduction in the shipping of diesel across the reef will directly benefit the reef through reduced shipping impacts and reduced chance of spillage.

Risks and opportunities

Barriers
- Full decarbonisation benefit requires corresponding increase renewable energy and storage into the grid electricity and installation of charging infrastructure
- Disability / wheelchair access for standard high-floor shuttlebus may be limited. Wheelchair access could be achieved through custom modifications to layout of bus interior; likely increasing capital cost and reducing total passenger seats.

Risks
- Residents and visitors not embracing or utilising service. This risk can be mitigated by effective consultation during the planning phase, and effective promotions.
- Timing of service not properly aligning with plane and/or ferry arrivals
- Wider risk to implementing EVs on grid - may charge at night when solar unavailable
- Servicing and repairs of electric vehicle on Masig Island could be limited depending on skilled labour available
- Project reliant on initial capex and ongoing opex subsidy as on-island demand (270 people) and likely price-point insufficient

Opportunity
- Alternatively could use standard diesel vehicle with a low-emissions diesel fuel when available on market or alternative vehicle type- hybrid (electric & diesel) or hydrogen powered vehicle. These technologies were not detailed due to lack of available vehicles on the local market for the 12-15 passenger capacity size, however they may be available in the next 5-10 years.
- Other alternative opportunities include utilising smaller vehicles, or variations from traditional cars such as golf-carts / tuk-tuks or vehicle types which may be suited to the size of the island

Alignment with other initiatives

Alignment with other project options
- 4. Solar PV Rooftop Systems for Housing: Higher renewable energy penetration in the grid could make charging the EV less emissions intensive.
- 6. Smart Solar Streetlights: greater visibility along the path of travel for the shuttlebus, safer lighting at potential stops along route & storage location.
- 7. Active Transport Options: Electric charging infrastructure / storage area created for the shuttlebus could also potentially be utilised for electric bikes.

Alignment with external initiatives or investments
The installation of charging infrastructure for the electric shuttlebus would need to align with Ergon's planned network upgrades, considerations surrounding increased grid demand are also required to be made.

Assumptions

- Calculations based on a shuttlebus running daily and continuously from 7:30am to 6:30pm. Maximum of ~150km travelled each day
- Shuttlebus utilising Ergon's EV Home Charging Plan (Ergon tariff 33 rates)
- Carbon reduction estimates have been assumed from;
  - VUB university in Brussels for NGO Transport & Environment (T&E). Life Cycle Analysis of the Climate Impact of Electric Vehicles, 2017
  - ACT Government, Alternative Fuel Buses in the Transport Canberra Bus fleet, 2019
  - Life cycle greenhouse gas emissions of Electric Vehicles in China: Combining the vehicle cycle and fuel cycle, 2019
- Project created using the performance specifications and costing estimate of the SEA Electric E4B Commuter Bus (EV) & the Toyota HiAce Commuter (diesel)
- Cost of diesel taken as $2.2/Litre
- Costings of vehicles considered for basic calculations do not include regional mark-up
- No transport or traffic modelling has been conducted
- No vehicle (diesel / electrical power) efficiency analysis has been conducted
- Timeframe to deliver solution an estimate and assumes continuous working towards solution
- Vendor quotes specific to Masig Island not obtained for vehicles or energy systems
- Solar PV costed on $3,900 / kW and 5 m2/kW area requirement, which includes a 85% regional escalation factor based on Rawlinson's 2020
- Battery costed on $2,800/kWh, which includes a 85% regional escalation factor based on Rawlinson's 2020

Costs and funding considerations

Capital costs

- Total capital cost: ~$102.5k
  - Electric Vehicle: ~$100k
  - EV Charging Unit: ~$2,500[1]
- Costs do not include storage location for vehicle, suitable vehicle parking and associated structure costs to be determined in next phase
- Cost of community consultation to refine operational structure, storage location design to be determined.
- Cost of renewable energy charging infrastructure;

Operating Case	Daily Charge	Solar PV, Battery	Capital Cost
150 km / day	56 kWh	15 kW, 60 kWh	~$220k
40 km / day	15 kWh	5 kW, 20 kWh	~$75k

Ongoing costs

- Cost of power to charge the vehicle (based on indicative route): ~$12 / day
- Servicing of electric vehicle: $1,000 - $2,000 / year[2]
- Wages of drivers and training costs to be determined in next steps alongside operating time confirmation

Potential cost savings or return on investment

- Less diesel/petrol required in comparison to power required to charge EV
- Annual savings of ~$5,900 in comparison to equivalent diesel shuttlebus fuel consumption
- If the shuttlebus to be operated with less frequent services, cost savings reduced, i.e. 40km daily trip $1,550 / year savings
- Implementing fee to utilise service could offset driver and power consumption costs for EV charging e.g. ~$1 nominal fee to use service

Funding opportunities

- Climate Solutions Fund – Emissions Reduction Fund
- CEFC - Reef Funding Program
- ARENA – potential funding through exploration of innovative EV charging infrastructure
- Ergon – potential funding and becoming partner on project due to EV charging infrastructure

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
TSIRC				
Shuttlebus driver(s)				
Ergon				
Residents & visitors				

Additional information

- A suitable location for secure undercover storage and further assessment into EV charging infrastructure would need to be explored
- If deemed suitable, solar PV and battery charging system deemed suitable, solar PV could be installed on roof of undercover storage
- Publicly available EV charging infrastructure could help other residents transfer to EV usage

Implementation and timeframes

Investment readiness

- Further consultation with TSIRC and the community is required to determine an ownership and governance structure as well as determining appropriate shuttle bus solutions

Considerations for implementation

- Confirmation of expected patronage will be required prior to investment
- Measures to ensure commercial viability of long-term operations will enable it to operate independently of (potentially inconsistent) funding support
- Appropriate training of drivers
- Publication and promotion of bus route, operating method and operating times
- EV charging duration and strategic infrastructure locations

Next steps

- Analysis of proposed route, potential customer basis, confirmation of sizing of vehicle and design of EV charging station and storage. Community consultation is required to determine appropriate operating times in association with TSIRC and community members.

Timeframes to deliver solutions

- Timeframes for delivering an appropriate vehicle and charging infrastructure will vary but may take between 6 months and a year. A community consultation exercise would be conducted within 3 months from when funding is secured.

1 Ergon, accessed September 2020, 'Charging your electric vehicle', [https://www.ergon.com.au/network/smarter-energy/electric-vehicles/charging-your-electric-vehicle]
2 Canstar Blue, June 2019, 'Electric Car Servicing Explained', [https://www.canstarblue.com.au/vehicles/electric-car-servicing/]

Masig Island | Energy

6 Smart Solar Streetlights

Installation of new smart solar cells in streetlights and solar lighting across the community (including on roads, on the jetty and at the beach).

Description and overview

This project is seeking funding for the installation of new smart solar streetlights at targeted areas such as around the jetty, locations where boats are moored, and on beaches and roads. This aims to improve the lighting of communal areas to improve their safety and usability in the evenings without increasing power demand from the grid.

Whilst it is recognised that there are limited benefits to replacing the existing 25 fully functional grid-connected LED lights on the island and is not deemed appropriate use of resources, solar street lighting provides a favourable solution for any proposed new street lighting. Ergon streetlighting spacing guidelines suggest that up to 50 total streetlights may be suitable for the island, however this would need to be confirmed as part of a community co-design process.

Each solar powered streetlight would contain a 60W LED light, and a battery which is sufficiently sized to sustain lighting throughout night. The cost of each (including a pole and battery) is approximately $22,000, and the decarbonisation benefit in comparison with a grid-connected LED streetlight is equivalent to 195kg of CO_2e per annum. Installation of a nominal 25 solar streetlights instead of traditional grid-connected LED would avoid increasing the power required from the diesel driven network by ~6 MWh/year, freeing grid capacity and increasing network resilience.

Installation of additional smart solar streetlighting will also provide the following benefits to the community:

- As solar lighting does not rely upon the grid, they will enhance resilience by providing safe lighting during blackout events
- Create well-lit safer outdoor communal spaces for fishing, recreation and for families and children to congregate in the evening, promoting social connection and community
- Provide lighting along paths for safer active transport (walking, cycling etc) in the evenings

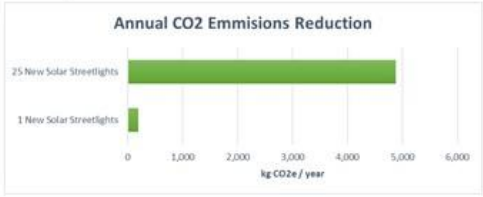
Project summary

Alignment with key project objectives	Low	Med	High
Decarbonisation impact	■		
Community resilience	■	■	
Extent of co-benefits			
Economic development	■		
Social development & cultural	■	■	
Environmental protection	■		

Item (per solar streetlight)	Units	Total
Estimated annual emissions reduction	t-CO_2-e	0.195
Estimated payback period	Years	>20 years
Estimated annual cost savings	$ / light	60
Estimated capital costs	$ / light	22,000
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	< 1
Estimated FTE	No.	N/A

Key project objectives

Carbon assessment
Installing new solar streetlights provides a carbon emissions reduction when compared to new grid-connected streetlighting which is currently powered by diesel generators.



The graph above shows the annual emissions reductions possible from installing each solar streetlight and combined for a total of 25 new solar streetlights. The annual emissions reduction for each light is ~195kg CO_2e. Over a ten-year time period, assuming an embedded emissions payback period of 1 year, a ~1,750kg CO_2e reduction could be seen from each solar streetlight.

Community and resilience
Additional solar streetlighting would improve visibility and safety at night independent of the electricity network improving resilience during blackout events, maintaining a safe environment for the community and transport on the island.

It would also enhance island self-sufficiency by slightly reducing its dependence on delivered diesel to power the grid on the island. If 25 new solar streetlights were installed the network electricity consumption would be reduced by ~6 MWh / year, freeing capacity for other uses and increasing grid resilience.

There is also opportunity for upskilling local workers the in installation and maintenance of lighting. This would provide local jobs and reduce the lead time for maintenance activities. This would significantly reduce the island's reliance upon external contractors, potentially also saving significant cost.

Co-benefits

Economic
- Solar streetlighting could see power consumption cost savings of ~$60 / year compared to new grid connected LED lighting. If 25 streetlights on the island were all converted to solar streetlighting this could see a yearly power consumption saving of ~$1,600 per year. These costs are not accounting for replacement luminaires, other equipment or network maintenance required to keep the grid connected streetlighting operational.
- Better lighting near the jetty and beaches could also provide greater capacity for fishing practices, which could see indirect economic benefits, through more efficient or longer operations.
- There is an indirect economic benefit from greater uptake of active transport options due to improved visibility. Utilising active transport options such as travelling by bikes and by foot, would mean cars are used less, resulting in less fuel consumed and purchased.

Social and cultural
- Safer pathways and roads for bicycles, pedestrians, and cars promote freedom of movement within the community and increased comfort for visitors.
- Better lighting will create safe communal spaces for fishing, and for families and children to congregate
- The support of better fishing practices can also further encourage the supply of fresh and affordable food
- Provide suitable spaces for people to meet and prepare/catch food together
- Enhance relationship building and enabling people to connect

Environmental (General)
- Installing solar streetlighting would lower emissions relative to existing grid-connected lighting, which are powered by the diesel generators. This was identified as a severe risk in the project risk assessment.

Environmental (impacts to Great Barrier Reef)
- No direct impact identified

Risks and opportunities

Barriers
- Ground conditions for the stable installation of the lighting structures is yet to be definitively assessed
- There may be a significant lead time on the development and installation of solar streetlighting. Similarly, there could be delays to ongoing routine maintenance unless local workers are able to be employed for this role.
- On-island worker skills not currently available for maintaining solar and battery in lighting

Risks
- There is a risk that inappropriate design could result in additional lighting spilling into residential properties or impacting wildlife. There is also a risk of excess shading at preferred installation locations reducing the effectiveness of solar panels. Steps must be taken during the design phase to consider these impacts.
- The tropical climate and weather conditions may reduce the lifespan of solar batteries or cause storm damage or soiling of the solar panel due to dried salt.
- There is a risk of vandalism damaging systems

Opportunity
- There may be an opportunity to install motion sensors into the lights. This would limit the effectiveness of lighting for safety and security, although it would reduce light pollution in affected areas. Community consultation would be required to determine if motion sensors are a satisfactory approach. The cost of these sensors are estimated between $400 - $2,000 including allowance for regional mark-up.

Alignment with other initiatives

Alignment with other project options
- 3. Community-led Traditional Knowledge Sharing and Education: Utilising community consultation processes to help determine positioning of new solar streetlights.
- 4. Solar PV Rooftop Systems for Housing: Aligns with reduction of dependence on diesel generators to provide power to the island, however unlike rooftop solar PV systems solar streetlighting will not be constrained by Ergon's solar PV hosting capacity.
- 7. Active Transport Options: Increased visibility on potential paths and tracks for bicycles or individuals travelling by foot – safer paths which are more likely to be used.

Alignment with external initiatives or investments
Aligns with initiatives to provide safe communal areas and roads, a requirement for councils.

Assumptions

- Assuming streetlighting is operational from 8pm – 9am, 11 hours daily operation
- 60 W lights assumed for both solar streetlighting and comparative grid connected LED lighting
- Solar Street lighting costs based on Rawlinson's 2020-unit costs with 85% regional mark-up for Torres Strait Islands, assuming premium batteries are to be installed due to tropical environment
- Council paying $0.26/ kWh from Ergon tariff T11 – daily supply charges assumed not applied for streetlighting
- No vendor quotations obtained for solar streetlighting or comparative grid connected lighting, based on industry benchmarking costings from Rawlinson's 2020 with regional mark-up allowance of 85%
- Specific locations of streetlighting not determined, other than community's requirement for near beach and jetties
- Ground conditions not analysed, and costing of alternate mounting technologies not considered. Cost of decommissioning existing grid-connected streetlighting, where applicable, not included.

Additional information

Installation of additional streetlights could provide a safer community in general. Estimated from streetlighting spacing guidelines provided by Ergon, the community should have over 50 streetlights, however currently have ~25.

Increasing the number of streetlights to satisfy these guidelines could increase community connectivity and safety of the roads and pathways. Options considering lights with less lumens causing less disturbance to nearby residents could also be considered.

Costs and funding considerations

Capital costs

- Approximate total capital cost: ~$22,000 each solar streetlight
  - Standalone – 60 W solar powered light: $20,500
  - Premium batteries: $1,500
  - *Optional* motion sensor (upper end): $2,000

Ongoing costs

- Maintenance of solar streetlighting
- Replacement of batteries every 12 – 24 months. Could be on shorter end of range due to topical environment and temperatures.
- Maintenance, and installation, costs could be reduced if local members of the community are adequately trained

Potential cost savings or return on investment

- Lighting not dependent on mains power consumption, ~$60 / year savings each light. Total savings for 25 solar streetlights ~$1,600 / year
- Direct cost of solar streetlighting similar to that of new grid connected LED streetlighting. However, the benefits from solar streetlighting are generally hard to quantify financially and include; increased grid resilience, safety during blackout events, support of increased fishing practices and active transport.

Funding opportunities

- CEFC - Reef Funding Program: funding available for emission reduction projects in Great Barrier Reef catchment area
- Regional and Remote Communities Reliability Fund
- Climate Solutions Fund – Emissions Reduction Fund

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
TSIRC				
Residents & Visitors				
Ergon				
On-island technicians				

Implementation and timeframes

Investment readiness

- The technology for this investment is currently available however there are prohibitive capital costs associated with implementing that would require further funding or subsidy.

Next steps

- Determine precise, suitable locations for new solar streetlights through community consultation
- The foundations required for lighting column installations are to be determined after a geotechnical assessment
- Develop lighting specifications, mounting structure specifications, and confirm the requirement for additional features such as motion sensor to be included
- Obtain vendor quotations for exact costings and installation times

Considerations for implementation

- Upskilling community members in the installation and maintenance of solar lighting would see long-term social and economic benefits. It would also potentially reduce lead times for future maintenance works. However, training would also increase the initial capital outlay and installation program.

Timeframes to deliver solutions

- This project could be delivered in less than one year
- Approximately 1 month would be required for community consultation to determine suitable locations for new solar streetlighting. Design and installation timeframes are heavily dependent on product and contractor availability.

Masig Island | Transport

7 Active Transport Options

Establish planning and infrastructure to promote active transport on Masig Island.

Description and overview

This business case recommends the funding of a free active transport trial for a community share bike/scooter scheme. This would include the inclusion of push bikes in the first phase and electric bikes/scooters in the second phase that may replace motor vehicle usage for normal daily travel or recreational purposes. It is an efficient, cost effective, sustainable, healthy and accessible form of transport, that provides a range of community and individual benefits. The first phase is intended to be free to encourage community uptake and collect valuable data that could inform a second phase that involves some pay-to-ride scheme.

The first phase of this project would involve up to 50 push bikes to be provided to Masig Island in a community share scheme where residents can use bikes freely around the island. There would be 2 main collection points where bikes would be collected and returned at least every week, providing an employment opportunity. This phase would also involve quantitative and qualitative data collection to monitor the success of the first phase to inform the potential for a second phase that could involve electric bikes and scooters to the island including charging infrastructure with renewables.

Despite Masig Island's small size, 37.5% of households reported the ownership of at least one motor vehicle in the 2016 census[1]. Despite the majority of residents reporting that they walk to work as their usual commute (65%), there is an opportunity to further reduce motor vehicle usage on the island through the provision of bicycles, scooters (or other electric options) to residents. It is anticipated that the reduction in motor vehicle use may eventually lead to a lower rate of vehicle ownership on the island, sparing residents the expensive cost of transit of vehicles to and from the island, as well as reducing the metal waste from vehicles at end of life.

There is an opportunity to provide equipment to facilitate active transport to residents of the island. It is anticipated that this equipment would enable residents to travel using existing roads and footpaths on the island. Additionally, due to the small and flat topography of Masig Island, no auxiliary infrastructure (such as water fountains and shaded rest areas) would be required to enable the investment in equipment. Subsequent work could involve identification of opportunities for business investment in paid active transport. Local maintenance upskilling and education around active transport, in particular bicycle maintenance would be required to increase ongoing utilisation.

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	0.35
Estimated payback period	Years	>20
Estimated annual cost savings	$	900
Estimated capital costs	$ mil	0.08+
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	0.25 – 0.5
Estimated FTE	No.	1

1. Masig Island 2016 Census. Australian Bureau of Statistics

Key project objectives

Carbon assessment

An increase in the uptake of active transport will reduce the number of trips taken in private motor vehicles. Active options will typically replace short car trips (<5km), which produce higher emissions per kilometre relative to longer journeys due to the temperature of engine upon start[1]. Based on the average emissions intensity of passenger vehicles[2], if the initiative results in 50% of current motor vehicle commuters converting to active transport for their daily commute (assumed 1km travel), this will result in an emissions reduction of 0.35t-CO_2-e/year.

Community and climate resilience

The uptake of active transport on Masig Island may have the following impact on community and climate resilience:

- Improved health and fitness of those undertaking active transport regularly, including the potential for reduced risk of cardiovascular disease, type 2 diabetes and all-cause mortality in adults[3].
- Reduction in the community's reliance on fuel shipped to the island from the mainland and increase in the community's resistance to fuel supply chain shocks
- Reduction in waste generated from operation of motor vehicles through local waste facility

Alignment with other initiatives

Alignment with other project options

- 3. Community-led Traditional Knowledge Sharing and Education: Providing platform for community to engage with alternative transport methods and modern sustainable thinking
- 5. Low Emission On-Island Shuttlebus: Demand for active transport options should be considered alongside demand for public transport

Alignment with external initiatives or investments

- Queensland Cycling Strategy (TMR), Queensland Walking Strategy (TMR), Queensland Health Community Health Priorities
- Masig Healthy Lifestyle Officer appointed by TSIRC may lead this initiative

Co-benefits

Economic

- Fewer vehicle trips may reduce maintenance costs for road infrastructure. However, this would be net of maintenance costs for new active transport infrastructure constructed to support the initiative.
- The potential improvement in health outcomes associated with active transport may reduce healthcare costs associated with inactivity.
- Reduced vehicle use may reduce the cost of living for the community through reduced fuel consumption and vehicle maintenance costs. This may also include the reduction vehicle shipping cost to and from the island (anecdotally reported to thousands per vehicle). Fuel savings included as the annual cost savings as additional savings not clear until completion of phase 1.
- Some forms of active transport (including electric powered bicycles or scooters) may provide a range of small business opportunities for the community. Additionally, maintenance of equipment may provide employment opportunities for young members of the community.

Social and cultural

- An increase in pedestrian traffic through the most populous areas of the island may lead to an increase in social cohesion and community engagement
- Active transport equipment will improve mobility for those on the island without access to passenger vehicles
- Consideration of those unable to utilise common bicycles should be considered

Environmental (General)

- The adoption of active transport will reduce Masig Island's greenhouse emissions via associated reductions in car use, which was identified as a severe risk in the project risk assessment
- Reduced vehicle use may reduce air and noise pollution
- A reduction in motor vehicles on the island will lead to a reduction in metal waste caused by the maintenance and decommissioning of vehicles

Environmental (impacts to Great Barrier Reef)

- Potentially reduced fuel transport across reef

Risks and opportunities

Barriers

- Community uptake and care for the phase 1 free bike scheme
- Individuals may be less likely to adopt active transport methods due to increased travel time compared to private vehicles
- Age of participant may dictate whether the community is more likely to adopt walking, cycling or electric bike or scooter options. This is to be confirmed through monitoring of phase 1.
- Masig Island's warm climate may be a barrier for use of active transport, with participants choosing to avoid strenuous walks or cycle journeys in hot weather.
- Ineffective support and ancillary infrastructure such as seating, rest areas, drink fountains, directional signage can be a limiting factor active transport uptake, although this may not prove significant due to the small size of the island.
- Public education and awareness may be a limiting factor in the uptake of active transport. If people are unaware of the availability and advantages of active travel, they may be less likely to partake in it.
- The current level of bicycle ownership on the island is unknown and may mean low demand for additional equipment if the current level of ownership is high

Risks

- Depending on the existing footpaths, carriageways or crossings, there may be an increased risk to active travellers when compared to car transport, including trip hazards, inadequate path width, location of power/lighting, and paths not accessible for wheelchairs, prams and elderly persons[4].
- There is the potential that increased active transport will result in an upswing of crash risk. According to the Australian Transport Assessment and Planning Guidelines[5], crash risk for active travellers is eight times riskier than private motor vehicle transport with pedestrians being higher than cycling. Typically, most fatal cyclists' crashes involve a motor vehicle. This risk can be mitigated through selection of location and design for infrastructure[4].
- Damage or theft of free bikes

Opportunity

- Explore low cost active transport options (including walking and cycling) in the short-term, alongside further work to establish demand for higher cost options (including electric bike and scooters) in the future through an Active Transport Plan. The consideration of short-term infrastructure should not preclude the potential for installation of charging infrastructure for future options.
- Seek to include Masig Island in the next update of the state government Principal Cycle Network (PCN) to align with Queensland Government strategies for Cycling and Walking, including the potential to obtain funding through the mechanisms outlined in the strategies, such as The Cycle Network Local Government Grants Program.
- Investigate options to acquire equipment via Queensland Health (e.g. Healthier Happier) and Department of Housing and Public Works (e.g. Active Community Infrastructure Initiative.)
- Potential for local business to provide maintenance services for bicycle users

1 City of Ipswich, December 2016, 'Active Transport Action Plan: Technical Report', [https://www.ipswich.qld.gov.au/about_council/corporate_publications/igo/igo-active-transport-action-plan]
2 National Transport Commission, June 2019, 'Carbon Dioxide Emissions Intensity for New Australian Light Vehicles 2018: Information Paper', [https://www.ntc.gov.au/sites/default/files/assets/files/Carbon%20dioxide%20emissions%20intensity%20for%20new%20Australian%20light%20vehicles%202018.pdf]
3 The Heart Foundation, 2019,'Blueprint for an Active Australia, Third Edition
4 Transport and Infrastructure Council, August 2016, 'Australian Transport Assessment and Planning Guidelines: M4 Active Travel', [https://www.atap.gov.au/sites/default/files/m4_active_travel.pdf]
5 Australian Transport Assessment and Planning Guidelines https://austroads.com.au/assets/project-delivery/atap-australian-transport-assessment-and-planning

Assumptions

- Average carbon dioxide emission of new passenger vehicle in Australia: 180.9g/km
- The responsibility for cost of maintenance is assumed to fall upon the user of the equipment
- Approximate cost of affordable bicycle: $500
- Approximate cost of shipping to Masig Island (per bicycle): $250 (approx.)
- Approximate cost of electric bike $2,500
- Approximate cost of electric scooter $1,500
- Initially, the scheme will involve the provision of 50 free push bikes bicycle to share. The push bike share system is to be determined through consultation with further community engagement.
- Given the increased capital required for electric bikes and scooters, it is assumed that following the first trial, these will be more justified including the charging infrastructure required.
- Through monitoring of the first scheme, assessment into electric transport options (bikes and scooters) will be determined and depending on the community uptake could provide a long-term option for decarbonising transport sector
- Diesel savings based $2.2/L price of diesel. Additional savings due to reduced usage of vehicles to be confirmed following the data collection of phase 1.

Costs and funding considerations

Capital costs
The cost to develop this scheme will require some further development with community to confirm the bike trial scheme. This is likely to cost approximately $20,000 to $30,000 through the employment of an external consultancy. Residents could be employed to co-design the plan and infrastructure.

The cost of active transport equipment (such as bicycles and stands) may cost up approximately $40,000 including installation. The cost to ship goods and materials may also cost up approximately $15,000. Total costs $55,000.

However, the extent of infrastructure, and the types of bicycles would be determined in conjunction with community needs as part of the planning process.

Ongoing costs
Ongoing costs for 1 FTE (potentially the Masig Healthy Lifestyle Officer) to look after the bikes, provide maintenance, return them to the central pick up locations every week, monitor community engagement with the scheme and assist with developing the next phase. Training may be required depending on the individual's current skill set. This is to be determined as part of the planning process.

Training of the community in maintenance processes must be considered, including the opportunity for small business development.

Potential cost savings or return on investment
This may be determined as part of the planning process.

Funding opportunities
This may be determined as part of the planning process. Potential funding sources may include council budgets, or funding through the activities of the Queensland Walking Strategy and/or the Queensland Cycle Strategy.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Torres Strait Island Regional Council	■	■		
Masig Island Community		■		■
Potential Maintenance Operators			■	
Tourists				■
Queensland Government			■	

Additional information
The selection and procurement of equipment for provision to residents should be conducted by the council to achieve value for money over the whole of life.

There is an opportunity for local business to provide maintenance services for bicycle users.

Implementation and timeframes

Investment readiness
- Planning for the scheme could be implemented following community consultation, and discussions with potential stakeholders regarding funding opportunities
- Funding to be secured for FTE to manage the first phase scheme

Next steps
- Engagement with community to understand current levels of bicycle ownership and appetite for the scheme
- Council to implement procurement process to obtain equipment

Considerations for implementation
- Selection of equipment in line with community needs
- Community education around the benefits of active transport and the availability of the scheme

Timeframes to deliver solutions
- The timeframe to implement a solution may range between 3 to 6 months, following engagement with the community and identification of a funding source. This timeframe assumes the support and cooperation of community stakeholders in the engagement process.
- It is recommended to run the phase 1 trail for minimum 6 months to provide reasonable data collection to inform further investment

Masig Island | Energy

8 Existing Building Improvements

Improving energy efficiency in buildings through passive cooling measures such as: improving air flow, insulation, glazing, heat reflective paint, gutter guards and other energy saving opportunities

Description and overview

This project is for a scheme to provide financial assistance for a fixed amount (e.g. $2000 per home, $4000 per commercial building) to:

1. Fund building audits (including new-builds) to establish the need for building improvements with the intent of enhancing energy efficiency.
2. Fund the highest priority upgrade(s).

There are 98 residential dwellings on Masig Island and 26 commercial premises. This project has the potential to align with the Indigenous Housing Plan 2019 – 2023 for new construction. This option is of particular importance to many residents who feel that existing homes are not well suited to the climate, resulting in uncomfortable living conditions. Effective and feasible retrofitting measures would seek to improve thermal comfort through passive cooling (based on the findings of the audit) and could include:

- Addition of insulation
- Heat reflective roof paint
- Addition or extension of awnings
- Glazing
- Skylights
- Window augmentation (e.g. increase size, use of louvres)
- Appropriate positioning and planting of vegetation to provide shade
- Roof fans

The solution should allow the consumer to determine the best technology option to purchase based on the house design, orientation, etc.

Project summary

Item	Units	Total
Estimated annual emissions reduction (residential)	t-CO_2 eq	.257 – 515
Estimated annual emissions reduction (commercial)	t-CO_2 eq	1.5 - 3
Estimated payback period (residential)	Years	10 - 30
Estimated payback period (commercial)	Years	5 - 10
Estimated annual cost savings	$ / household	86 - 172
Estimated annual cost savings	$ / commercial structure	485 - 970
Estimated capital costs	$ mil	0.2 – 0.5
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	0.5 – 1
Estimated FTE	FTE / year	2 – 3

Key project objectives

Carbon assessment

- EarthCheck and Ergon energy have reported that the average residential dwelling on Masig Island consumes 5,371 kWh of electricity annually. Around 40% of home energy is expended on heating and/or cooling (national average). Meaning the average residential household on Masig Island consumers 2,148 kWh on heating and/or cooling. The Masig Island Power Plant generates electricity through diesel generators which have an approximate emission factor of 0.8 kg CO_{2eq}/kWh (considering the diesel energy content, the diesel emissions factor and generator efficiency). Therefore, the average Masig Island residential dwelling currently emits ~1,718 kg CO_{2eq} on heating and/or cooling. Typically a residential energy audit will identify measures that reduce energy usage by 15-30%. Meaning the average Masig Island residential dwelling could reduce their annual heating and/or cooling electricity consumption by ~322-644 kWh, abating ~257-515 kg CO_{2eq} annually.
- Following the same logic, the average Masig Island commercial structure could reduce their annual heating and/or cooling electricity consumption by ~1,862-3,725 kWh, abating ~1,507-3,015 kg CO_2-e.

Community and resilience

- Cooling improvements increase climate resilience and adaptation and will allow residents to better manage severe heat events
- Educating residents on energy efficiency benefits the community by increasing understanding and autonomy
- By minimising energy consumption, the community will increase their resilience against supply issues and future carbon taxes, if introduced

Co-benefits

Economic

- Passive cooling measures reduce the need to use mechanical space conditioning (i.e. air-conditioners) which in turn reduces energy bills
- Reducing electricity consumption aids in the deferral of any future upgrades of the Masig Island power station
- Given the number of buildings on Masig Island, it is likely that the project would take between 6 months to 1 year to pass through planning, audit delivery, and implementation of building improvements. This has the potential to support up to 2 to 3 FTE jobs over this period.

Social and cultural

- Increased liveability through improved cooling conditions
- Increased health and wellbeing, particularly for young and elderly individuals
- Increased consumer awareness regarding the way people think about and use energy

Environmental (General)

- Reduction of greenhouse gas emissions through reduced electricity consumption
- Landscaping for energy efficiency reduces absorbed solar heat, air pollution and greenhouse gases

Environmental (impacts to Great Barrier Reef)

- During the installation process of the relevant building improvement materials may enter the waterways which could flow into the Great Barrier Reef and surrounding environments
- Potentially reduced fuel transport across reef

Risks and opportunities

Barriers

- Complications regarding the upgrade of rental properties –likely to be a significant barrier for Masig Island as all houses are rented
- Masig Island is extremely isolated and difficult to get to. This will affect the procurement of skills, services and materials.

Risks

- Each studied building has varying building characteristics meaning the complexity of the energy audit and resulting building improvement varies from building to building. This additionally means benefits from economies of scale are unlikely to be realised (i.e. bulk ordering ceiling fans for a lower supply cost).
- Effective and transparent coordination will be key to reduce the risk of miscommunication between building owners, residents, auditors and installers
- Air conditioners are utilised in the evening after sunlight hours, potentially reducing cost savings realised for homes in the absence of a battery system. Similarly, evening electricity peaks driven by air conditioning may not be diminished and corresponding emissions not reduced.
- Premises are likely to vary and therefore economies of scale mightn't be realised when purchasing the improvements

Opportunity

- Reduction in power consumption, and therefore electricity bills and environmental impact
- Educating residents and business owners on electricity usage and saving measures
- DNRME contracted ICAN to provide energy efficiency education for the community in Mapoon, the re-use of these materials should be explored

Alignment with other initiatives

Alignment with other project options

- 3. Community-led Traditional Knowledge Sharing and Education:
- 4. Solar PV Rooftop Systems for Housing:
- 10. Energy Efficient Appliance Upgrades:

Assumptions

- Capital costs are approximate, for more accurate values further research is required
- The cost listed for the energy audit was precured from a conversation with Tropical Energy Solutions- an organisation that operates out of Townsville
- For insulation the material supply cost was assumed to be \$8-16 per m^2 and the installation cost \$8-10 per m^2 https://enviroshop.com.au/pages/home-insulation
- For heat reflective roof paint the mat was assumed to cost \$13 per m^2
- Average square meter of a residential roof is assumed to equal 160m^2 and 500m^2 for a commercial roof
- The area of the walls was calculated using the perimeter formula (P=4a) and the average height of a wall (2.4m) assuming that the average area of the roof would be the same as the floor
- The potential cost savings purely related to the money saved on space conditioning expenses
- The timeframes are assumptions based on general knowledge
- The quoted energy reduction resulting from an energy audit (15-30%) is reflective of a full energy audit, a more accurate value should be acquired for passive cooling measures
- Remote factor of 85% to all costs has been implemented as per Rawlinson's 2020

Costs and funding considerations

Potential cost savings or return on investment

- Around 40% of home energy is expended on heating and/or cooling. Typically a residential energy audit will identify measures that reduce energy usage and related costs by 15-30%. If these average figures are accepted as a guide, the average Masig Island residential dwelling could reduce their annual heating and/or cooling electricity consumption by ~330-659 kWh. Applying a usage charge of 0.26 \$/kWh, each household could save ~\$86-171 on their electricity bill annually. Equating to a payback period between 12-23 years.
- Following the same logic, the average commercial structure on Masig Island would save ~\$485-970 on their electricity bill annually with a payback period between 4-8 years.

Costs and funding considerations

Capital costs

Approximate total capital cost: ~\$300 k

- Calculated by using the data received from Ergon Energy (98 residential dwellings and 26 commercial structure) where residential dwellings receive \$2,000 and commercial buildings \$4,000 to subsidize building improvements
- The fixed funding amount could subsidize the items listed in the table below, which details the estimated capital cost of each improvement, including a remote factor of 85%

Item	Ave. Residential Building	Ave. Commercial Building
Energy Audit	\$370	\$ 3,700 – 5,550
Roof insulation & installation	\$7,736 – 7,696	\$7,400 – 14,800
Wall insulation & installation	\$2,842 – 4,618	\$8,880 – 14,430
Heat reflective roof paint	\$3,848	\$12,025
Window awnings	\$2,405 – 7,215	\$4,625 – 12,950
Window Glazing	\$1,480 – 2,775 per m2	
Skylights	\$740 – 2,405 per window	
Planting of vegetation	\$28 - 83 per tree (supply only)	

- https://www.homeadvisor.com/cost/outdoor-living/install-an-awning/
- http://www.energysmartstrata.com.au/fact-sheets/energy-audit-fact-sheet/
- https://www.solarquotes.com.au/blog/solar-air-conditioning-vs-heat-reflective-paint

Ongoing costs

- Cost of an additional energy audit (e.g. 1 year after the in initial audit) to measure project success and the costs associated with maintaining each building improvement

Funding opportunities

- Ergon Energy should be approached as a key partner as they have an interest in deferring network augmentation

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Permanent Residents		■		■
State and Federal Government	■			■
Ergon Energy	■	■	■	
Business Owners	■			■

Additional information

About Masig Island:

- There are 98 residential dwellings and 26 commercial premises on Masig Island, and none are privately owned by occupants

Electricity Consumption and Source:

- Electricity is supplied from a central station owned and operated by Ergon Energy
- Electricity is generated through multiple diesel generator sets
- The cost to generate electricity is higher than the income received from consumers (estimated at factor of 5 – 10). State Government Community Service Obligation cover the difference in generation costs and income

Implementation and timeframes

Investment readiness

- The project is currently in concept phase
- The project scheme needs to be planned and funding needs to be secured

Next steps

- Create a scheme structure which details the project priorities key actions
- Contact organisations with energy audit capabilities to develop an optimal approach to undertaking numerous audits of differing structures

Considerations for implementation

- The scheme will fund the energy audit and part of the building improvement
- Whilst the energy audit is a great tool to identify energy savings, energy savings alone should not dictate what is installed, community should be consulted to ensure the elected improvement aligns with community needs

Timeframes to deliver solutions

- It is expected that the process may take up to 2 years to complete. The planning and scheme design, and procurement rollout of audits is likely to take up between 6 months to 1 year. Depending on improvements required, delivery of may occur between 6 months to 1 year following audit finalisation.
- A typical audit takes 1 day to complete for a residential properties and 1-3 days for commercial properties. Installation time varies between 1-3 days.

Masig Island | Resilience

9 On-island sustainability officer

An ongoing, paid position for a dedicated on-island sustainability officer to coordinate, oversee and support the successful delivery of sustainability projects on Masig Island.

Description and overview

Ongoing funding is sought for the creation of a sustainability officer role for Masig Island. The officer would have responsibility for various activities to oversee the development and progression of project initiatives identified through this program. As an ongoing role, the officer would also have responsibility for championing the progression of other sustainability initiatives considered important to the community which are identified through future programs.

This role would embody key aspects of project and program management, including:

- supporting the development and submission of grant funding applications and interfaces with other relevant agencies
- coordination and organisation of project planning and delivery activities, events, and milestones
- interfacing with project delivery personnel to find solutions to issues encountered
- ongoing engagement with community members and external agencies or organisations
- advocating for community interests throughout the planning and delivery of projects to ensure fit for purpose and appropriate outcomes are achieved

This position is not necessarily intended to require technical specialist skills (such as engineering, construction, or other technical skills). It is also not intended to replace a dedicated short-term project or program manager role for large or complex projects. However, the officer will champion initiatives and take responsibility for helping to overcome barriers to enable the delivery of high-quality outcomes in reasonable timeframes, and in line with community expectations. The capacity to successfully write (or learn to write) grant applications is important, as is holding a place in the community that is valued and respected. Interpersonal skills to engage, influence, build trust and advocate effectively are required. The capacity to make connections between projects/opportunities and various members of the community. This role is the lynch pin for multiple streams of economic development on island.

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	N/A
Estimated payback period	Years	N/A
Estimated annual cost savings	$	N/A
Estimated ongoing costs	$ mil p.a.	0.08
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	<1
Estimated FTE (operations)	No.	1

Key project objectives

Carbon assessment

- This role is assumed to be an enabler of wider decarbonisation outcomes which would be achieved through the successful delivery of sustainability projects. This role is a 'catch-all' to support the planning, development, implementation and management of the various projects proposed.
- For instance, the officer's role in encouraging the local community to optimise their electricity and water usage will decrease demand on the island's diesel generators and reduce the emissions produced by their operation
- Their role in changing consumer behaviour (in line with the waste hierarchy) to divert waste from landfill will result in lower emissions from organic materials breaking down in landfill. Upstream emissions from the production of some goods may also be avoided.
- The officer's role in encouraging carpooling, public transport use (when available) and increasing the uptake of active transport will reduce emissions produced by transport
- Conservation efforts to maintain vegetation, protect mangroves and wetlands and reduce erosion will retain significant carbon sinks

Community and resilience

- A dedicated, on-island officer will advocate for and on behalf of the community in the roll out of key sustainability projects. They will provide essential community leadership.
- As a local voice, the officer will intimately understand the desires and needs of the community and will drive solutions that meet their requirements
- Implementing and advocating for projects that generate local economic growth and employment opportunities may also reduce the community's reliance on traditional welfare systems
- These projects will also enhance community self-sufficiency via reduced reliance on the mainland for some goods and services

Co-benefits

Economic

- The implementation of sustainability projects, activities and events provides opportunities for both temporary and permanent employment and capacity building for the local community
- Having a dedicated, paid officer role will ensure important (and often employment-generating) projects and initiatives are championed. Without a local officer promoting these projects their ongoing operation may be challenging.
- The role itself will create an FTE job within the community

Social and cultural

- It is expected that the role will be filled by a Masig Island local, ensuring that local context in the delivery of these projects is retained, and that project outcomes are culturally and socially appropriate. The role will enhance the facilitation of sustainability activities that celebrate the traditional culture and knowledge on Masig Island, which was identified as a high risk. Unemployment rates were also identified as a high risk in the project risk assessment.
- Projects and initiatives are expected to include those that promote social inclusion and civic participation in sustainability activities and events

Environmental (General)

- The initiatives to be championed by the officer include those which promote improved consumptive behaviour of community members, and which will reduce their ecological footprint and waste. Initiatives would also include those which improve water security through decreasing demand and improving infrastructure provision.

Environmental (impacts to Great Barrier Reef)

- Initiatives championed by the officer may also include those which reduce litter and pollution entering the ocean
- Conservation efforts and events led by the sustainability officer will reduce the impact on the local ecosystem from tourism, fishing and recreational activities

Risks and opportunities

Barriers

- Long-term, reliable funding availability to support this role. Other projects could each possibly include a small component cost for this role.
- Access to locally-sourced resources and supporting materials to aid the sustainability officer in delivering their work

Risks

- There is a risk that a suitable candidate with the desired enthusiasm, skillset and character may not be available. The role will need to be incentivised to ensure it is attractive.
- An appropriate governance structure will need to be identified to ensure the role's scope is supported and is as effective and efficient as it can be

Opportunity

- The sustainability officer can work closely with employees running the sustainability education program and the Masigalgal Rangers to more efficiently implement and deliver projects, as well as share resources and effort. A governance framework may be developed where rangers and others report to, and seek approval from, this role.
- Provision of volunteer roles and training to community as part of operations
- Act as a central resource to facilitate project and program efficiencies and to coordinate the activities of organisations and NGOs operating on Masig
- The various sustainability projects, activities and events delivered should consider the appropriate integration of traditional knowledge and culture
- Opportunity to split this role: a younger person who may have outward facing skills (grant writing, interaction with external parties), and an elder brokering/translating for the internal relations within the community

Alignment with other initiatives

Alignment with other project options

The successful implementation of the sustainability officer role will support the delivery of all other initiatives which progress through the Community Pilot program. The officer will have some degree of involvement in the planning, development, implementation and/or management of all projects.

Alignment with external initiatives or investments

- Potential for collaborative partnerships with NGO's like Keep Australia Beautiful, Community Sustainability Grants. Schools - EcoMarine Warriors
- Masigalgal Rangers
- Potential linkages or opportunities to work together with Palm Island may be considered for the delivery for similar projects

Assumptions

- Salary and overhead costs are estimates only
- These costs are inclusive of a mark-up for additional expenses of hiring external consultants or members of the local community to implement projects, activities or events
- Having a committed local will ensure an ROI across all project portfolios
- It is assumed that role establishment costs (estimated to be $20,000) will include the governance and accountability arrangements of this position

Additional information

- The sustainability officer will focus on initiatives that deliver both environmental and liveability outcomes
- This role provides a critical interface for the delivery of larger projects. It is also an important role for identifying the required skills (and opportunities to upskill) within the community, and for enabling on the ground interaction and community support.
- This position is also a key enabler for supporting education and modelling ways to enact positive changes. For example, the officer will need to champion energy efficiency, and practice behavioural change around solar, water efficiency, waste efficiency active transport and resilience.
- Climate change and the impacts of sea level rise are key areas of concern for the community that will need to be actively considered when implementing projects, activities or events

Costs and funding considerations

Implementation and ongoing costs

The following types of costs are anticipated to be incurred in the implementation and ongoing operation of this initiative:

- Initial role establishment costs associated with identifying and securing an appropriate candidate of approx. $20,000, allowing for effort from sponsoring agency over several weeks and associated disbursements. This cost would be borne by the responsible agency (e.g. TSRA).
- Ongoing salary costs of approximately $60,000 per annum, and overheads of approximately $20,000. Some additional discretionary project funds allocated to the role would further incentivise it.

Funding opportunities

- Torres Strait Island Regional Council Community Grants
- Community Sustainability Actions Grants, Department of Environment and Science
- Social Reinvestment fund, DATSIP
- 1000 Jobs Package, National Indigenous Australians Agency
- Community Led Grants, Department of Prime Minister and Cabinet

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
TSRA				
TSIRC				
Masig Island residents				
Funding body				

Implementation and timeframes

Investment readiness

- There are few barriers to progressing this initiative, and it is well-scoped with clear intended outcomes. Determination of appropriate governance and oversight arrangements for the responsible agency will enable this initiative to progress to application for funding.

Next steps

- Determination of governance arrangements including oversight, management and reporting requirements for the position (by responsible agency)
- Scoping of role responsibilities and development of a candidate profile
- Development and submission of funding application to support the role on an ongoing basis
- Identify opportunities for training and/or upskilling officer. This may include identification of a pathway to achieving Certificate II or III.

Considerations for implementation

- Ensuring the candidate application and vetting process is transparent and upholds the ethos of equal opportunity for all qualified candidates. The selection should be purely skills based, should be vetted by community, and should consider any local applicants.
- Ensuring that the selected candidate is an embedded member of the community. They must possess both the required skills and characteristics determined important for the role, as well as local connections and relationships to ensure that community needs are understood.
- The position will need to offer dedicated training (including on-site) and mentoring for the individual selected
- Projects to be managed by the officer need to be prioritised as some have prerequisite conditions. A needs assessment should inform this prioritisation.

Timeframes to deliver solutions

- It is estimated that this initiative could be delivered within 6 months.

Masig Island | Energy

10 Energy efficient appliance upgrades

Improving energy efficiency in buildings through upgrades to energy-efficient appliances.

Description and overview

This business case is for a scheme to provide financial assistance for a fixed amount (e.g. $2000 per home, $4,000 per commercial building) to:

1. Fund building appliance audits (including new-builds) to determine recommendations for purchasing energy efficiency/demand management appliances
2. Fund the highest priority appliance purchase(s)

The funding would cover the cost of a consultant or similar to do an audit of each premise and the highest priority appliances (e.g. a new fridge/freezer). The residents would not be expected to pay for the audit or new appliances. Alternatively, audits could potentially be added on to the regular maintenance inspections by DPWH and notes taken about which appliances would need upgrading.

This scheme would apply to the 98 residential dwellings and 26 commercial premises on Masig Island. The results from building audits would provide recommendations as to which appliances or demand management devices would provide the greatest energy efficiency improvement based on the current use of appliances. This initiative complements and amplifies the work being conducted on Masig Island to date through the Sustainability Assessment.

Appliances and devices to improve energy efficiency/demand side management may include:

- LED lighting
- Higher efficiency appliances (such as fridges or air conditioners)
- Energy management and alert systems to monitor electricity use and display this to the resident (otherwise known as home automation systems)

Diesel-generated electricity is currently the largest direct source of carbon emissions on the island, and residents have also reported high electricity costs; therefore there is a clear value proposition for this scheme. It will also include options for the provision of either solar powered or high efficiency air conditioning for domestic use in recognition of the hot climate and the adverse impacts that this can have upon human health and wellbeing.

Project summary

Item	Units	Total
Estimated annual emissions reduction (residential)	t-CO_2-e	.257 – 515
Estimated annual emissions reduction (commercial)	t-CO_2-e	1.5 - 3
Estimated payback period	Years	N/A
Estimated annual cost savings	$ / residential dwelling	84 - 168
Estimated annual cost savings	$ / commercial structure	485 - 970
Estimated capital costs	$ mil	0.25 – 0.5
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1 – 2
Estimated FTE	FTE	1

Key project objectives

Carbon assessment

- The average residential dwelling on Masig Island consumes 5,371kWh of electricity annually[1]. As approximately 40% of residential energy is expended on appliances and lighting, the average Masig household would consume approximately 2,148kWh on appliances and lighting. The island's power station generates electricity through diesel generators which have an approximate emission factor of 0.8 kg CO_{2eq} /kWh (considering the diesel energy content, the diesel emissions factor and generator efficiency). Therefore, the average Masig dwelling emits approximately 1,718kg CO_{2eq} through electricity consumed by appliances and lighting. A typical energy audit will identify measures to reduce energy usage by 15-30%. Therefore, the average Masig dwelling could reduce annual electricity consumption by between 322 - 644 kWh, abating ~257 - 515 kg of CO_{2eq}.
- Expanding this approach, the average commercial premises on Masig could reduce their annual electricity consumption by 1,862 - 3,725kWh, abating 1 ,507 - 3,015kg CO_{2eq}.
- There are also behavioural measures that residents can employ to reduce appliance energy consumption, such ensuring the air conditioner thermostat is not set too low. This can result in energy savings of approximately 10%.

Current asset	New Asset	Carbon saving
Halogen globe	LED globe	Use 25-80% less energy
Fridge	ENERGY STAR Fridge	Up to 9% less energy
Air Conditioner	ENERGY STAR Air Conditioner	Up to 40% less energy
Manually controlled	Home automation system	Up to 15%

Key project objectives cont.

Community and climate resilience

- By minimising energy consumption the community is slightly less reliant upon the external supply of diesel
- The introduction of solar-powered air conditioning will enhance community resilience during hot periods

Co-benefits

Economic

- Reducing electricity consumption may help to defer future upgrades of the Masig Island power station
- Reducing residents' energy bills, which was identified as a severe risk in the project risk assessment
- Up to the equivalent of one full-time role may be created over the delivery period through provision of planning, design, auditing and installation services

Social and cultural

- Increased consumer awareness of electricity conservation
- Increased liveability, health and wellbeing through improved cooling conditions and up-to-date appliances
- Solar air conditioners reduce the demand on grid electricity, therefore decreasing the likelihood of blackouts in extreme heat events

Environmental (General)

- Reduction of greenhouse gas emissions through reduced electricity consumption
- LED lightbulbs have a longer lifespan relative to halogen, resulting in less disposal to landfill
- Care must be taken to properly dispose of or recycle appliance waste

Environmental (impacts to Great Barrier Reef)

- Potentially reduced fuel transport across reef

Risks and opportunities

Barriers

- Complications regarding the upgrade of rental properties. This will not affect the upgrade of lights and appliances but would affect the installation of an air conditioner and home automation systems.
- Behaviour change takes time and effort, and it is harder to ensure they will be successful
- Appliances are costly to replace and Masig has a higher proportion (40%) of low-income households in comparison to the Australian average (20%)
- Correct appliance size relative to household size is key to improving energy efficiency. This may be a barrier to bulk purchasing.

Risks

- The cost and logistics of removing old appliances will need to be considered as the accumulation of metal waste and white goods is an issue on Masig
- A lack of effective coordination between residents, auditors and installers
- Home automation systems are only effective if the user has correctly programmed the system
- If a solar air conditioner was installed, air conditioners are utilised in the evening after sunlight hours meaning the cost savings might not be realised for homes where residents are not there during the day, unless a battery was included in the system
- The evening electricity peaks driven by air conditioning will not be reduced without the installation of solar battery storage

Opportunity

- There is opportunity for the scheme to be linked to project #3 (Community-led Traditional Knowledge Sharing and Education) regarding measures to save electricity
- Recycling initiatives should be explored for the replaced appliances
- Opportunity to install home automation systems into new builds

Alignment with other initiatives

Alignment with other project options

- 3. Community-led Traditional Knowledge Sharing and Education
- 8. Existing Building Improvements

Alignment with external initiatives or investments

- TSIRC are already operating a small-scale efficient appliances project. TSIRC could benefit from increased funding for this and be a partner to drive this project forward.
- Alignment with Palm Island initiatives to aid in economies of scale

1 Masig Island Technical Appendix: Sustainability Assessment and Risk Assessment

Assumptions

- Capital costs are approximate
- The listed cost of an energy audit was precured from discussions with Tropical Energy Solutions (operating in Townsville). The quote was obtained for Magnetic Island an assumption was made that this would be the same for Masig Island.
- Remote factor of 85% to all costs has been implemented as per Rawlinson's 2020
- The timeframes are based on industry knowledge
- Residential (98) and business (26) premises based off information received from Ergon
- Assumed home automation systems are for new builds only due to large amount of additional infrastructure, wiring, control panels and other electrical equipment to centralise and automate control of existing houses. These are to be determined through planning and design of the scheme.

Additional information

About Masig Island:

- There are 98 residential dwellings on Masig Island and 26 commercial premises.
- The Masig Island Technical Appendix 3 Sustainability Assessment and Risk Assessment outlines that nearly all these houses are rented with no houses being privately owned by occupants.

Electricity Consumption and Source:

- Electricity is supplied from a central power station which is owned and operated by Ergon Energy
- Electricity is generated through multiple diesel generator sets
- The cost to generate electricity is higher than the income received from consumers (estimated at factor of 5 to 10). The *State Government Community Service Obligation* covers the difference in generation costs and income received.

Funding opportunities

- Energy Efficient Communities Program, Community Energy Efficiency and Solar Grants 2020, Department of Industry, Science, Energy and Resources
- Ergon Energy should be approached as a key partner as they have an interest in deferring investment.
- CEFC or an Indigenous Organisation

Costs and funding considerations

Capital costs

Approximate total capital cost: ~$300k

- 98 residential dwellings and 26 commercial premises where residential dwellings receive $2,000 and commercial premises receive $4,000 to subsidise the energy audit and the upgrade of an appliance

Item	Upgrade Cost	Cost saving
Energy Audit	$ 3700 per dwelling	15 – 30% reduction in energy bill
Upgrade to LED globes	$ 685 per dwelling	$ 1,200 – 2,400 over 10 years
ENERGY STAR Fridge	$ 1,150 – 4,500	<9% reduction in energy bill
Home automation systems	> $ 1,500	Up to 15%
Solar Air Conditioning	> $3,500	Up to 40%

Ongoing costs

- Cost of an additional energy audit (1 year after the in initial audit) to measure project success
- Costs associated with maintaining each appliance (assumed to be minimal for household appliances)

Potential cost savings or return on investment

- Appliances account for around approximately 30% of residential energy use and lighting accounts for about 10%. As a typical energy audit will identify measures to reduce energy costs by 15-30%, the average Masig Island dwelling could reduce consumption by ~322-644 kWh annually. Applying a usage charge of 0.26 $/kWh, each household could save $84-168 on their electricity bill annually. This equates to a payback period of 12-23 years.
- Commercial premises could save $485-970 annually, equating to a payback period of 4-8 years.
- Home automation systems are typically expensive, taking a significant time to 'pay back' the savings from reduced energy costs.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Permanent Residents		■		■
State and Federal Government	■			■
Ergon Energy	■	■	■	
Business Owners	■			■
TSIRC			■	

Implementation and timeframes

Investment readiness

- This project will be investment ready following planning and design of the scheme and developing measures to overcome identified barriers and risks

Next steps

- Creating a scheme structure detailing project priorities
- Securing funding for the scheme
- Consultation with energy audit service providers (preferably within the local Torres Strait region) to develop a cost-effective approach for audits
- Consultation with DPHW to determine their funding contribution as the owner of numerous premises

Considerations for implementation

- The installation of home automation systems is better suited to new builds than existing homes
- The complexity of energy audits will vary by building
- The cost and logistics of removing and recycling old appliances must be considered as the accumulation of metal waste and white goods is an issue on Masig
- The remoteness of Masig Island has not been factored into the monetary figures throughout this report, this should be considered in future work

Timeframes to deliver solutions

- It is expected that the scheme could be completed within 1 to 2 years. Whilst there are not many buildings to audit, Masig's remote location may pose logistical challenges for undertaking audits, and for procuring and installing appliances.

Masig Island | Water

11 Rainwater harvesting improvement program

This project seeks to increase the safety, reliability and (non-potable) utilisation of domestic rainwater harvesting systems, reducing overall demand and increasing the resilience of the community water supply.

Description and overview

This project seeks to implement measures to improve the safety, reliability and non-potable utilisation of domestic rainwater harvesting systems on Masig, in order to mitigate risks to consumers and increase the resilience of community water supply infrastructure. The majority of the houses on Masig Island were reported to have rainwater tanks at varied states of repair and use.

Masig Island's Council owned water supply is sourced from a combination of desalination of brackish groundwater and direct harvesting of rainwater from a large (~23ML) lined and covered water storage lagoon. The existing supply is insufficient to meet demand and storage typically reaches critically low levels prior to wet season rainfall. As a result, water restrictions are often implemented to maintain baseline supply. Effective demand management is identified as key to long term water security and domestic rainwater harvesting remains an important part of the demand management strategy. Rainwater is widely used to supplement household water demand for non-potable and potable uses, and it is anecdotally reported that most consumers prefer to drink and cook with rainwater rather than the town supply when rainwater is available (note this is not recommended for health reasons). Whilst domestic systems reduce demand on the water supply system, without adequate maintenance and monitoring, utilisation of rainwater for drinking and other high exposure purposes presents a risk to consumers.

The detailed scope of works for this project will be confirmed through analysis of the site and equipment in consultation with Torres Strait Island Regional Council, Queensland Health, private and public householders and the community, however may include:

- An audit of existing rainwater systems (condition/ performance/ water quality/ ownership);
- Ongoing community engagement and education programs, including in relation to the risks associated with rainwater use, and appropriate management and maintenance of systems;
- Planning and implementation of a formal rainwater tank maintenance program; and/ or
- Capital funding grants for the repair or replacement of existing rainwater systems, household scale plumbing interventions to separate interconnected rainwater and town supplies, and/or installation of new systems and water quality management equipment (e.g. under bench filtration).

Project summary

Item	Units	Total
Estimated annual emissions reduction	kg-CO_2-e/m3 water harvested	4
Estimated payback period	Years	10 - 30
Estimated annual cost savings	$	N/A
Estimated capital costs	$ mil	0.5 - 2
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1 – 2
Estimated FTE	No.	1 – 2

Key project objectives

Carbon assessment

- Increased rainwater utilisation will offset desalination requirement (as this is energy intensive) with some decarbonisation benefit, however this cannot be robustly quantified at this time.
- The existing water supply system consumes approximately 5kWh electricity per $1m^3$ (1000 litres) water produced (refer assumptions). Each m^3 of water saved will result in ~4kg of CO_2-e saved.

Community and resilience

- This project will improve the safety of existing domestic rainwater supplies for non-potable use, reducing risks to consumers.
- It will provide diversification and increased redundancy in the water supply system, enhancing resilience in the face of unforeseen events.
- This will provide increased water supply system resilience (with stored water available to residents in the event of major disruption to water supply)
- The project will reduce overall community non-potable demand on the town supply, and therefore increase its reliability (as raw water storage can be maintained at higher levels throughout the wet season)

Co-benefits

Economic

- Opportunities for capacity building and economic development (installation and maintenance of rainwater harvesting infrastructure)
- This project may be able to support 1 to 2 FTE over the project delivery period
- Additional ongoing employment may be possible for the maintenance of tanks, on a part-time or ad hoc basis

Social and cultural

- Improved water security
- Improved safety, reliability and utilisation of domestic rainwater harvesting systems
- Reduced health risks associated with consumption of water from household rainwater harvesting
- Opportunities to use rainwater for growing own fresh food promoting self sufficiency

Environmental (General)

- Better conservation of water as rainwater is used to offset non-potable household demand
- Reduced reliance on energy for water supply through the desalination plants, which was identified as a severe risk in the project risk assessment

Environmental (impacts to Great Barrier Reef)

- Increased rainwater utilisation will offset demand for desalinated water and associated brine discharge to marine environment

Risks and opportunities

Barriers

- Requires collaboration between multiple stakeholders including TSIRC, Queensland Health, BAS and property owners (Department of Housing and Public Works)

Risks

- All programs must comply with relevant water supply legislation (including Water Supply Safety and Reliability Act 2008, Public Health Act 2005) and associated regulations and guidelines (including Australian Drinking Water Guidelines)
- Without proper maintenance, uncontrolled utilisation of domestic rainwater presents a risk to community health. The program will need to be accompanied by appropriate community education to promote safe utilisation of drinking water supplies. Rainwater tanks should only be used to offset non-potable demands (a large fraction of water consumption on Masig).
- Without proper maintenance, rainwater tanks may increase the risk of mosquito breeding and associated vector borne disease transmission. The maintenance program must take this into consideration.
- Particular risks associated with kidney dialysis patients must be specifically considered.

Opportunity

- Increased rainwater tank utilisation has potential to offset requirements and defer investment in mains water supply, storage and treatment infrastructure
- Reduced desalination production has the potential to reduce energy generation load
- Consideration of additional rainwater tanks for the Community Market Garden (project #1)

Alignment with other initiatives

Alignment with other project options

- 1. Community Market Garden
- 3. Community-led Traditional Knowledge Sharing and Education
- 18. Community-based Water Demand Management

Alignment with external initiatives or investments

- Sustainable Water and Wastewater Management Plan (SW&WWMP) identifies a suite of opportunities to facilitate more sustainable, cost-effective and resilient water and wastewater service provision
- The strategy includes recommendations to engage with residents, householders, and the relevant government departments (e.g. Building and Asset Services) to drive incremental improvements in rainwater tank utilisation and water quality management, as a means of reducing demand on TSIRC's network
- Queensland Health, Tropical Public Health Unit Safe and Healthy Drinking Water Program

Assumptions

- Most houses at Masig have existing rainwater tanks (81%)
- Some of these rainwater tanks are connected to the water supply network and are topped up with town water when levels are low (float controlled)
- The rainwater tanks are owned by the building owners, which on Masig includes both private owners and government (Department of Housing and Public Works)
- Responsibility for management and maintenance of the rainwater tanks does not rest with water service provider TSIRC
- Rainwater tank yields are relatively high throughout the wet season (typically when demands for external/ non-potable water use would be lowest; however, yields are very low throughout the dry season)
- The program would need to be consistent with other community-based demand management initiatives led by TSIRC
- Current power estimates and supply volumes based on power usage and desalination capacity data supplied by TSIRC
- Large-scale (centralised) rainwater harvesting schemes have been investigated separately by TSIRC, and in general are not a preferred water supply augmentation option

Costs and funding considerations

Capital costs

- Project scope could be scaled to meet funding available
- Indicative costing of $500k to $2M has been proposed however more detailed scoping and costing will be required
- Capital cost associated with drinking water fountains anticipated to be negligible in comparison

Ongoing costs

- Ongoing costs will need to be allocated to:
  - Implementation of ongoing community engagement and education program
  - Implementation of ongoing maintenance program

Potential cost savings or return on investment

- Reduced demand, reduced desalination production, and potentially deferred investment in TSIRC water supply infrastructure

Funding opportunities

- Round 3 - Community Sustainability Actions Grants, Department of Environment and Science
- Drought Communities Programme, Department of Infrastructure, Transport, Regional Development and Communications
- Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022, Queensland Health: capacity building for Environmental Health and Animal Management in first nations communities
- Funding under future round of W4Q
- Northern Australia Infrastructure Fund

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
TSIRC				
QLD Health				
Building & Asset Services				
TSRA				
Community				

Additional information
Effective community engagement will be key to ongoing management of risks. Co-designed initiatives will be beneficial.

Implementation and timeframes

Investment readiness

- This initiative is ready for investment, pending the development of a final scope, as determined by the community and other recognised partners

Next steps

- Development of implementation plan for audit
- Community engagement
- Development of education programs (to be designed in conjunction with business case #3 Community-led traditional knowledge sharing and education)
- Detailed rainwater quality risk assessment, to inform suitable uses for rainwater, determine mitigation strategies, and inform scope of maintenance/ upgrade works.
- Development of a post-evaluation and ongoing maintenance program

Considerations for implementation

- Effective community engagement will be key to the design and implementation of the program, and the ongoing management of water quality risks

Timeframes to deliver solutions

- It is expected that the total timeframe required to deliver solutions across the island would be approximately 1 – 2 years. This allows for the requisite consultation, scoping, securing of funding, planning and design, and delivery.

Masig Island | Waste

12 Solar panels at Sewage Treatment Plant

Solar PV panels on Sewage Treatment Plant, providing decarbonisation benefit through reduced dependence on diesel generators.

Description and overview

The installation of rooftop solar photovoltaic (PV) panels on the sewage treatment plant (STP) will provide a decarbonisation benefit through reduced use of diesel-powered generators for electricity, reduced operational costs and an increase the self-sufficiency of the island from imported fuels. The project seeks funding for the purchase and installation of solar PV panels on STP shed rooftops. The project has been put forward on a basis for saving energy from the central energy plant on the island which will reduce diesel consumption and associated greenhouse gas emissions.

10kW of solar panels has been identified as a suitable installation size, when considering rooftop availability, emissions reduction and capital cost and return on investment. In addition to power cost savings for council, 10kW of rooftop solar PV could lead to renewable energy penetration of approximately 38% of total STP demand. This would lead to an annual reduction in emissions of approximately 11 tonnes of CO_2.

As the power consumption of the STP is diurnal due to peak inflows, it is difficult to manipulate the existing load profile to be more intensive throughout the day when solar resources are available.

Overall, a solar PV installation at the STP would reduce the demand on the island's diesel-powered grid reducing emissions, with the possibility of battery integration further increasing grid and community resilience. The location of the STP provides ease of maintenance access and potential orientational benefits (e.g. roof angle / mounting flexibility and reduced shading).

Future project phases could consider battery energy storage (BESS) as suitable technology evolves, maintenance staff are available and battery costs reduce payback period, however this is not considered value for money at this time. Indicative costs for a 13.5kWh BESS have been considered with the benefit being it may be able to keep some small ancillary equipment operational during times of outage and therefore increase the resilience of the system.

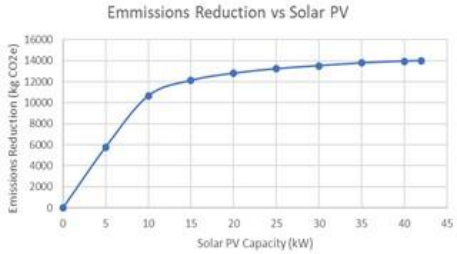
Project summary

Item – 10 kW Solar PV System	Units	Total
Estimated annual emissions reduction	t-CO2-e	11
Estimated payback period	Years	11
Estimated annual cost savings	$	3,500
Estimated capital costs	$ mil	0.04
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	0.5 – 1
Estimated FTE	No.	0.1

Key project objectives

Carbon assessment

A 10kW solar PV installation will reduce the STP's dependence on the diesel-powered grid and could reduce annual operational emissions by ~11 tonnes of CO_2.



Over a 20-year lifespan, and accounting for a two-year payback period for embedded emissions in manufacturing the panels, 10kW of solar PV installations would reduce the STP's emissions from power consumption by ~191 tonnes of CO_2.

Community and resilience

Increased community resilience and employment could be realised by training residents in the installation and maintenance of the solar PV systems, this could reduce lead-time and cost of maintaining the installation, maximising the time the solar PV will be fully operational.

Solar PV panels will reduce the reliance on the diesel-powered grid throughout the day, which could result in less strain on the network providing better reliability for other power consumers. However the intermittency of solar PV can cause reliability issues itself, these issues could be mitigated by the installation of battery systems.

Less dependence on diesel generators will mean the existing diesel storage could last the community for a longer duration. A greater renewable energy penetration on the island could also provide more resilience against future carbon taxes, if introduced.

Co-benefits

Economic

- Much of the STP's operational electricity demand can be met whilst the panels are actively generating power throughout the day, reducing the annual cost of power to TSIRC. This generation will lead to a corresponding reduction in diesel-powered electricity generation. This reduction in diesel use may reduce the frequency of which Ergon has to transport diesel to the island.
- Where possible, residents should be upskilled to maintain solar PV systems, thereby supporting local employment. In the longer-term, this may support up to 0.5 FTE from maintenance of the entire island's solar PV portfolio.
- Ability to gain revenue from selling any additional power back into the grid may be curtailed if Ergon capacity limitations are exceeded on the Island.

Social and cultural

- The introduction of renewables to displace diesel generation is aligned with the community's attitudes towards sustainability and self-sufficiency
- Upskilling locals to maintain panels would potentially reduce lead time to repair any underperforming or non-operational systems

Environmental (General)

- Reduced diesel generation through increased solar generation reduces carbon emissions and emissions of diesel particulates including sulphur oxide and nitrous oxide
- Installation of the panels will also reduce the total volume of diesel required, thereby also reducing emissions from shipping diesel to the island
- Preservation of natural energy resources which was identified as a high risk in the project risk assessment

Environmental (impacts to Great Barrier Reef)

- Less transport of fuel across reef

Risks and opportunities

Barriers

- Compliance with Ergon's network restrictions, assumed increase of solar hosting capacity
- Structural integrity of STP's roof to support solar PV panels has not been assessed
- Ergon capacity limitations on solar PV could reduce ability of the STP's solar installation to supply power back to the grid if conflicting with other renewable installations on the island (e.g. BC4 - future residential solar PV installations)

Risks

- Lead-time on maintenance due to remoteness of the island
- Impacts on grid and on diesel generators having to more significant daily ramping up and down
- Environmental conditions of the island could impact the financial considerations of battery storage. This is to be considered in the next phase of the project.
- Shading conditions and orientation of roof negatively affecting solar PV output.

Opportunity

- STP operations or technology could be reviewed to explore if power consumption could be maximised throughout day when solar PV generation is possible
- There is also an opportunity to install a battery system at the STP in the future when battery technology, maintenance crew and feasibility for remote locations is confirmed. This could enhance the emissions reduction potential and provide backup during a blackout event. However, the cost of a battery system (especially in comparison with the emissions reduction potential) is largely prohibitive. The reliability of battery systems in tropical environments can also be variable.

Alignment with other initiatives

Alignment with other project options

- 4. Solar PV Rooftop Systems for Housing: The available solar hosting capacity of Ergon's proposed upgraded network may be reduced by solar PV installations on homes, reducing the capacity of solar PV possible to install on the STP without battery considerations.
- 13. Water Supply Energy Efficiency and Solar Project: Reduction in demand could reduce sizing of solar PV and capital costs required for this business case.

Alignment with external initiatives or investments

Aligns with Ergon's proposed network upgrades: the current additional solar PV hosting capacity is 19kW. Ergon's future upgrades allowing for 75kW additional managed solar PV will decrease the possibility of the STP's solar PV installation being unable to be connected.

Assumptions

- Ergon's planned network upgrade to occur before installation of the solar PV; i.e. predicted solar PV hosting capacity is realised and installed PV is allowed access to the network in agreement with Ergon.
- Seasonal performance of solar PV averaged based on historical GHI (irradiance)
- Power consumption of STP remaining similar – demand not increasing with population growth
- Solar PV all operational and appropriate repairs and replacements made over lifespan
- Calculations are based on a diurnal load profile of the STP, based on other STP examples instead of hourly measured data for the specific site
- Solar PV costed on $3,900 / kW and 5 m2/kW area requirement, which includes a 185% regional escalation factor based on Rawlinson's 2020
- Load profile of STP created using yearly power consumption and load profile of other STP's from literature
- No structural or orientation analysis of STP roof conducted
- Costing based on Australian industry benchmarking, as opposed to vendor quotes
- EPCO (provider of STP) have not been involved in project development
- Ergon solar feed-in tariff for regional QLD used: https://www.ergon.com.au/retail/residential/tariffs-and-prices/solar-feed-in-tariff

Additional information

- A de-centralised battery system could reduce the dependence of the STP on grid power consumption, providing additional cost and emissions savings. However, a centralised battery system (which could be implemented the island's power station) would provide Ergon a greater degree and ease of control.
- The size of the system should be determined in collaboration with Ergon to ensure network security is improved.

Costs and funding considerations

Capital costs

- Approximate total capital cost of solar PV: ~$39,000 (~$3,900 / kW)
- Costs include the supply and install of solar panels and does not include additional electrical upgrades if required
- Costs could be altered if local members of the community trained in the installation and maintenance of the solar panels instead of / or in combination with external contractors
- Costs could also differ depending on roof or ground mounting requirements
- Approximate Battery Energy Storage System (BESS) costs (if included in future): $2,800 / kWh, i.e. ~ $ 38,000 for a 13.5kWh BESS system

Ongoing costs

- Staff time and materials for the maintenance of solar PV systems
- End of life replacement costs

Potential cost savings or return on investment

- Annual savings of ~$3,500 - inclusive of possible ~$80 / year from solar feed-in tariff
- Simple payback period of ~11 years, not including any provided subsidy. I.e. if a 50% subsidy on the purchase and installation of Solar PV systems were to be obtained than the payback period would also be halved to ~5.5 years

Funding opportunities

- Small-scale technology certificates for solar PV systems through Small-scale Renewable Energy Scheme – from the Clean Energy Regulator (Australian Government)
- Reef Funding Program, Clean Energy Finance Corporation: funding available for emission reduction projects in Great Barrier Reef catchment area
- Regional and Remote Communities Reliability Fund, Department of Industry, Science, Energy and Resources
- Climate Solutions Fund: Emissions Reduction Fund, Department of Environment and Energy

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
TSIRC				
EPCO				
Ergon				
Solar PV Installer				

Implementation and timeframes

Investment readiness

- This project is considered investment ready, following the required consultation and initial planning activities to confirm feasibility and stakeholder buy-in

Next steps

- Confirmation of the daily load profile of the STP must be obtained and consultation with EPCO must occur prior to progressing to planning and funding application
- Decision on whether to include battery integration and suitable sizing to be made
- Analysis of the solar PV output (taking into consideration the tropical climate) should be conducted to understand likely generation rates
- Vendor engagement to confirm pricing of systems and ongoing maintenance costs
- Development of funding submissions and determination of percentage of any potential subsidy

Considerations for implementation

- Identification, engagement and training of suitable local workers in the installation and maintenance of the panels
- If training is to occur during the installations of the solar PV system they may take longer in the short term, however the maintenance and future installations of solar PV systems could be achieved more efficiently with help from trained locals on Masig Island
- A larger, centralised battery energy storage system could be considered in the future as part of a whole-network upgrade that could potentially keep the STP operational during times of outage and drastically increasing the resilience of the system.

Timeframes to deliver solutions

- The timeframe to deliver the project is largely dependent on: consultation with EPCO; confirmation of technical feasibility at the STP; confirmation of the load profile; and structural integrity of the preliminarily selected roofing space.
- This may take between 6 months to 1 year to deliver a solution. However, this also depends on the availability and efficiency of qualified technician(s) for installation.

Masig Island | Water

13 Water supply energy efficiency and solar project

This project seeks to increase the energy efficiency of the Masig Island Water Supply System, and offset power demand with renewable energy- solar PV and potential battery energy storage.

Description and overview

Masig Island's water is sourced from a combination of desalination of brackish groundwater and direct harvesting of rainwater from a large (~23ML) lined and covered water storage lagoon. The water supply system is relatively energy intensive, with three separate pump stations used to draw groundwater from the bores, run the reverse osmosis desalination plant, and treat and deliver desalinated water to a high-level reservoir which gravity feeds the community network. Based on a limited dataset provided by Torres Strait Island Regional Council (TSIRC), the combined energy consumption from the three pump stations is estimated to be in the order of 250-300kWh/day.

This project seeks to increase the energy efficiency of the Masig water supply system by optimising existing pump stations and the desalination plant, and by installing solar PV and/or battery storage to minimise power drawn from the diesel generated power network.

The objectives of this project are generally consistent with TSIRC's Sustainable Water and Wastewater Management Plan 2019. The scope of this project will be further refined in consultation with TSIRC. Options include:

- Optimisation of pump selection and configuration (e.g. replacement of existing progressing cavity pumps with more efficient centrifugal pumps with variable speed control);
- Optimisation of reverse osmosis desalination plant to increase energy efficiency (e.g. feed water pre-treatment/ membrane selection/ flow control optimisation/ maintenance procedures);
- Increased desalination capacity and reduced run time to coincide with peak daylight periods and solar PV generation;
- Installation of small-scale solar PV and/or battery storage on the various pump station and treatment plant buildings (additional to existing); and
- Installation of larger scale ground mounted solar PV and/or battery storage at the existing lagoon site (in the existing cleared perimeter surrounding the lagoon).

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	31 - 52
Estimated payback period	Years	10 - 15
Estimated annual cost savings	$	N/A
Estimated capital costs	$ mil	0.13 +
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1 – 2
Estimated FTE	No.	0.5

Key project objectives

Economic and carbon assessment
A high-level economic and carbon assessment has been undertaken for four potential scenarios:

- **Scenario 1A**: Optimal solar PV arrays based on existing assets site constraints, *without battery storage*. This includes 5.5kW PV installed at the raw water pump shed (constrained by roof size), and an additional 30kW ground-mounted PV at the desalination plant/ lagoon site (additional to the existing 10kW).
- **Scenario 1B**: As per 1A, but with a 40kWh battery installed at the desalination plant site.
- **Scenario 2A**: Desalination plant upgraded to supply daily demand over a 6-8hour window during the day coinciding with PV output (~10kL/hr). This includes 5.5kW PV installed at the raw water pump shed (constrained by roof size), and an additional 50kW ground-mounted PV at the desalination plant/ lagoon site (additional to the existing 10kW).
- **Scenario 2B**: As per option 2A, but with a 12kWh battery installed at the desalination plant site.

The results, summarised below indicate the shortest economic returns and smallest cost of carbon abatement will be achieved through installation of optimally sized PV arrays at each site. The additional costs associated with battery storage and increasing the capacity of the desalination plant are not justified on the basis of power cost or carbon savings, however further investigation may be warranted given behind the meter (battery) solutions would retain available network capacity for other renewable energy (solar PV) installations in the community. Opportunities to further improve pump energy efficiency should also be explored through more detailed engineering analysis.

Co-benefits

Community and climate resilience

- Solar PV would decrease reliance on the electricity grid, and reduce cost to council
- This will reduce the system's vulnerability to power outages and enhance supply continuity following major events such as cyclones
- Reduced vulnerability to fluctuations in future power prices
- While more expensive, battery integrated solutions will retain available network capacity for other PV installations

Economic

- Residents should be upskilled to maintain systems, thereby supporting local employment. In the longer-term, this may support up to 0.5 FTE.

Social and cultural

- Water quality and security are important issues to the people of Masig. This project will support more resilient and reliable water supply, which may improve community confidence in and perception of the system's quality and reliability.

Environmental (General)

- Reduced reliance on energy for water supply, which was identified as a severe risk in the project risk assessment

Environmental (impacts to Great Barrier Reef)

- Potentially reduced fuel transport across reef

Other

- While not justified on the basis of carbon abatement or power cost reduction, increasing the capacity of the desalination plant (as considered in scenarios 2A and 2B) would significantly improve water supply security

Risks and opportunities

Barriers

- Ergon Energy impose restrictions on the total capacity of solar PV which can be connected to the remote isolated grid on Masig Island. It is understood that there is currently around ~19kW unmanaged PV hosting capacity available, with a further 75kW planned upgrade. The project for any significant PV installations may need to be considered in the context of other opportunities for PV in the community. Installation of behind the meter (battery) solutions will mitigate this barrier to some extent.
- Any potential energy efficiency upgrades (e.g. alternative pump types) would only be undertaken following detailed assessment of system operational requirements in consultation with TSIRC. Other operational drivers may be more important, for example familiarity to operational staff, ease of maintenance, and consistency with other assets.

Risks

- Funding for upfront capital expenditure
- Funding for ongoing maintenance
- Payback periods would be impacted if desalination production significantly reduced

Opportunity

- Significant reduction in ongoing power costs

Alignment with other initiatives

Alignment with other project options

- 4. Solar PV Rooftop Systems for Housing: Economies of scale could improve the commercial outcomes of this project
- 11. Masig Rainwater Harvesting Improvement Program: Use of rainwater for non-potable use could reduce overall demand and pumping requirements
- 18. Community-based Water Demand Management: Reduction in peak demand could also reduce pump requirements further reducing carbon emissions

Alignment with external initiatives or investments
TSIRC has recently completed the Sustainable Water and Wastewater Management Plan, which identifies a suite of opportunities to facilitate more sustainable, cost-effective and resilient water and wastewater service provision.

The strategy includes recommendations to increase the capacity of the desalination plant at Masig island, explore opportunities to improve the energy efficiency of water supply assets, and explore opportunities for renewable energy installations (e.g. PV) at TSIRC's sites. This project is strongly aligned with the overall strategy.

Parameter	Scenario			
	1A	1B	2A	2B
Additional Solar PV Capacity (kW)	35.5	35.5	55.5	55.5
Battery Installed Capacity (kWh)	0	40	0	12
Annual Grid Power Reduction (kWh/ annum)	38,878	53,539	59,735	64,648
Annual Emissions Reduction (kg CO2e/ annum)	31,469	43,337	48,352	52,329
Annual Power Cost Reduction to Council ($/ annum)	$10,119	$13,935	$15,547	$16,826
Capital Cost ($) *(inc desal upgrades for options 2A/ 2B)*	$133,875	$244,875	$2,174,825	$2,208,125
Emissions Reduction / Cost ($ / kg CO2e/ annum)	$3.55	$4.24	$86.34	$80.30
Indicative payback period	13	18	140	131

Note: Refer assumptions overleaf

Assumptions

- Current power estimates (base case) based on power usage supplied by TSIRC. No growth has been assumed.
- Estimated optimal PV and battery capacity, and estimated power and emissions reductions based on high-level assessment using existing power data. More detailed analysis is required to confirm prior to implementation.
- Capital and operational costs limited to installation of PV, battery, and desalination upgrades, and reduced power costs (other capex/ opex items have not been considered)
- Capital costs for solar and battery installations based on Arup industry information with 185% regional mark-up for the Torres Straits
- Capital costs for desalination capacity upgrade estimated based on cost data provided by TSIRC
- Indicative payback period excludes discount rate
- Seasonal performance of solar PV averaged historically
- Solar PV installed are restricted by Ergon's managed & unmanaged solar hosting capacity i.e. not fully isolating the system. Option assumes Ergon's planned network upgrades occur before the solar PV is installed. Note network capacity is less of an issue where battery solutions are adopted.
- Solar PV costed on $3,900 / kW and 5 m2/kW area requirement, which includes a 185% regional escalation factor based on Rawlinson's 2020.
- Battery costed on $2,800/kWh, which includes a 185% regional escalation factor based on Rawlinson's 2020.

Costs and funding considerations

Capital costs

- *Refer to the capital cost estimates for four alternative scenarios on previous page.*
- Capital cost will depend on optimised project scope through more detailed engineering analysis.
- Based on the high-level assessment, a capital cost in the order of $150,000-$250,000 (excluding contingency, design and management fees) is expected to deliver a technical solution with a reasonable payback period.
- More detailed feasibility assessment and scope optimisation study recommended ($20-50k)

Ongoing costs

- Ongoing costs associated with operation and maintenance of any new solar PV and batteries have not been considered.
- With appropriate design, pump and desalination operation and maintenance costs are not expected to increase significantly above existing.
- Battery replacement costs at year 11 if implemented.

Potential cost savings or return on investment

- Refer operational (power only) cost savings estimates on previous slides. Depending on the final solution, power savings in the order of $10,000-$15,000/annum may be achieved.

Funding opportunities

- Round 3 - Community Sustainability Actions Grants, Department of Environment and Science
- Drought Communities Programme, Department of Infrastructure, Transport, Regional Development and Communications
- Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022, Queensland Health: capacity building for Environmental Health and Animal Management in first nations communities
- Funding under future round of W4Q
- Northern Australia Infrastructure Fund

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
TSIRC				
Ergon Energy				
Masig Island residents				
Queensland Health, Tropical Public Health Services				
Qld Government DNRME (Water Supply Regulation)				

Implementation and timeframes

Investment readiness

- This project will be investment ready following consultation and confirmation of feasibility

Next steps

- Detailed consultation with TSIRC as the asset owner and operator
- Analysis, in collaboration with TSIRC, of operational considerations and constraints which may impact on technical viability and long-term sustainability
- Detailed options analysis and system design optimisation
- Consultation with Ergon Energy to confirm adequate PV hosting capacity available within grid

Considerations for implementation

- Where grid PV hosting capacity constrained, the project for this project may need to be considered against other projects proposing solar PV installation

Timeframes to deliver solutions

- Following engagement with required stakeholders and securing of funding, it is expected that planning, options analysis, design optimisation and delivery could be completed within 1 to 2 years of project mobilisation

Masig Island | Waste

14 Waste management optimisation

Optimisation of landfill practices and removal or recycling of stockpiled waste from the island for reuse.

Description and overview

This project aims to set up a small-scale transfer station shed alongside the existing landfill (or best available location) to provide a location for sorting and storage of recyclables and potentially a buy back shop to reduce pressure on existing landfill and promote high order materials reuse. The project is aligned with the Indigenous Waste Strategy and subsequent Regional Action Plans being developed by the Queensland Government for the Torres Strait. The island faces many issues with removal of recyclable waste including small material volumes, remoteness, biosecurity zoning, existing shipping routes options and costs, corrosive saline environment. The Masig Island community has a population of approximately 270 people. The Torres Strait Island Regional Council (TSIRC) provide 1-2 bins per household and waste collection of general and green waste undertaken weekly. There is no council-funded recycling on the island, however, there is a container collection program run by the school in partnership with SeaSwift. Note that green and organics waste management is addressed in Project 18 – Community composting Scheme.

Waste is currently burned before being disposed of in the landfill to reduce volume and avoid pest infestations. The landfill is not an engineered facility, does not have operational or environmental management controls, is located within 200m of the coastline and is nearing full capacity. Licencing conditions mean that materials such as metal cannot be disposed to landfill and are stockpiled on-island. Items such as cars and white goods have no ongoing system for waste management and removal. This project aims to seek funding for identified waste management optimisation opportunities on Masig Island aligned with the outcomes of the Indigenous Waste Strategy and would be co-developed with the DES Regional Action plans and the community:

- Develop a strategy for roll out of recycling collection and sorting, including identification of suitable existing infrastructure and equipment and ensure any new infrastructure proposed will be compatible
- Undertake landfill operational and environmental management plans
- Discussions with SeaSwift to identify freight cost saving opportunities for transport of recyclable materials
- Set up of waste storage shed for baling of materials, stockpiling of bulky waste storage area and buy back shop for repair and sale of materials.
- Roll out of recycling bins (note organics collection is part of project 15) to households and educational material

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	N/A
Estimated payback period	Years	N/A
Estimated annual cost savings	$	N/A
Estimated capital costs	$ mil	0.25 – 0.3
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1 – 2
Estimated FTE	No.	N/A

Key project objectives

Carbon assessment
The removal of recyclable materials from the island for processing and reuse on the mainland could be undertaken by backloading of existing barges routinely visiting the island to deliver supplies. This method would not increase carbon emissions, whereas chartering a barge specifically to transport this material would.

Whilst this project is not specifically designed to reduce the carbon footprint of the island, it provides an opportunity to achieve higher-order management of waste materials. Improved waste management practices could also promote the reuse of materials on the island, which would also reduce the requirement for new materials to be shipped from the mainland.

The minimisation of waste disposed to landfill, and better landfill practices would reduce the landfill gas and leachate produced. This would also reduce total emissions.

Community and resilience
The Masig Island community are vulnerable to severe weather events and the impacts of climate change. The community can be cut off from supply routes for extended periods of time during severe weather events. Optimising a waste management system which can be operated by the community during these periods is of great importance.

Implementing waste management optimisation practices would remove waste stockpiles from the island and provide a long-term solution for recycling collection and processing. This project would be in line with the *Queensland Waste and Resource Management Strategy* and the soon to be released *Indigenous Waste Strategy*.

Co-benefits

Economic
- The setup of a small-scale transfer station shed alongside the landfill site (or best available location) would provide a location for sorting and storage of recyclables and potentially a buy back shop
- It is not expected that additional /new staffing will be required to fulfil the requirements of this project
- Reduced cost of removing waste off the island, which was identified as a high risk in the project risk assessment
- It is envisaged that the On-island Sustainability Officer (project option 9) will support the community uptake of the project

Social
- The community are eager to adopt more sustainable initiatives
- If a buy back shop were established this would provide a space for community members to identify materials for reuse
- Aligns with Queensland Waste Avoidance and Resource Productivity Strategy 2014-2024 – in particular:

1. Protecting human health and the environment to secure our future prosperity
2. Sharing responsibility for avoiding unnecessary consumption and improving resource management

Environmental
- Reduced leaching of nutrients and pollutants from waste materials into groundwaters at the landfill site (which is of particular importance as the landfill is not lined), and into the waters of the Great Barrier Reef. This was identified as an extreme risk in the project risk assessment. The landfill at Masig Island is located within 200m of the ocean on this low-lying island. Stockpiled materials at the landfill site pose risk of soil contamination and impact on surrounding groundwater and surface waters. The longer these materials remain in situ the greater the risk is and the harder it will be to remove them without causing further contamination through loss of containment or degradation.

Risks and opportunities

Barriers
- Securing ongoing funding for ongoing success of waste optimisation initiative. This project requires a funding commitment through TSIRC, as the operational, logistic and transport costs of removing recycling material from the island to the mainland for processing is costly.
- Contractual arrangements with SeaSwift the local shipping company and securing a reduced shipping rate for backfilling of recyclables
- Gaining community support for collection and recycling of materials, including uptake of buy back shop
- Community behavioural change
- Contractual arrangements with recyclers on the mainland to accept waste
- Some stockpiled waste materials may be unsuitable for recycling and may need to be disposed to landfill once on the mainland. The landfill levy may pose a financial barrier and consideration should be given to exemptions for this project.
- Biosecurity requirements for treating waste materials moving from outer islands to inner islands or the mainland

Risks
- Funding not available for capital works or ongoing costs making this project cost prohibitive
- Ownership and support of the project must be undertaken by the local community otherwise long-term implementation would be challenging

Opportunity
- Waste management is currently a high priority for the state and federal government and therefore this is an ideal time to seek funding to optimise waste management practices at Masig Island
- Development of operational and environmental management plans for the landfill site would provide long term and best practice guidance for the facility

Alignment with other initiatives

Alignment with other project options:
- 3.Community-led Traditional Knowledge Sharing and Education
- 9. On-island Sustainability Officer
- 15. Island Composting Scheme
- 17. Minimise Single-use Plastics and Packaging

Alignment with other initiatives:
- Indigenous Waste Strategy and subsequent Regional Action Plans being developed by the Qld Government DES Waste team
- Qld Waste Avoidance and Resource Productivity Strategy 2014-2024, DES 2019
- Qld DATSIP Waste Reduction and Recycling Plan: 2017–2020

Assumptions

- It is understood that TSIRC are undertaking a strategy to remove stockpiled metal waste such as whitegoods, vehicles and scrap from the islands and therefore removal and recycling of these materials have not been included in the project costing

Additional information

- In 2011 Warrabar Island was selected to host a waste pilot project showcasing best practice waste management in the Torres Strait Island communities. This showcase included source separation for households, including food waste, green waste, recycling and general waste. Households were provided with a bins for collection of recyclables such as aluminium, mixed plastic (bottles and containers), steel cans and liquid paperboard. Recycling bins were also distributed around public places. Households were also provided food waste caddies and bins.
- The waste management infrastructure on the island included a sorting shed, composting area with BiobiNs and the landfill. Collected recyclable materials were sorted on a sorting table for baling, biosecurity treatment and shipping to the mainland. Collected food waste, shredded cardboard and garden waste was composted through BiobiNs on the island.
- Other materials outlined for potential collection included backloading of motor and cooking oil stored on pallets for recycling on the mainland. For full project report refer to *Project Overview and Review Warraber Waste Pilot Project Torres Strait Island Regional Council* (Aurecon, 2011).

Costs and funding considerations

Capital costs

Capital costs listed below are provided for set up of waste collection infrastructure and a sorting shed with baler. Capital costs include purchasing of the following[1]:

- Wheelie bins and crates
- Wheelie bin lifter
- Trailer
- Multi-material baler
- Sorting table
- Storage shed set up, including buy back shop and bulky recycling collection
- Pallet storage for motor and cooking oils
- Freight and miscellanies
- Project management
- Landfill operational and environmental management plans

Approximate total capital cost: $250,000 to $350,000

Ongoing costs

- Ongoing costs for this project include fuel, operator salaries, replacement of bins, education materials, registration, maintenance and return freight for recyclables
- Based on figures outlined the in Aurecon 2011 report[1] and accounting for inflation, the ongoing costs would be approximately $50,000 to $100,000 per year, depending on the rate of return freight for recyclables secured with SeaSwift. Not this excludes the shipping of metal waste.

Potential funding opportunities

- The Department of Environment and Science are currently undertaking an Indigenous Waste Strategy and associated infrastructure planning, in line with the *Queensland Waste and Resource Management Strategy*. The development of this *Indigenous Waste Strategy* and infrastructure plans may provide opportunity for funding for remote communities such as Masig Island.
- Any future round of the Qld Government Regional Recycling Transport Assistance Package

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Torres Strait Island Regional Council	■	■		
Qld Dept Health			■	
Qld Dept Env & Science			■	
Seaswift - transport			■	
Community			■	■
Recyclers and operators				■

Implementation and timeframes

Investment readiness

This project will be investment ready following consultation with and agreement by stakeholders.

Next steps

- Develop a strategy for roll out of recycling collection and sorting on Masig Island, including identification of suitable existing infrastructure and equipment
- Undertake landfill operational and environmental management plans
- Discussions with SeaSwift to identify freight cost saving opportunities for transport of recyclable materials
- Set up of waste storage shed for baling of materials, bulky waste storage area and buy back shop for repair and sale of materials
- Roll out of recycling bins to households and educational material

Considerations for implementation

The roll out of this project could be staged or delivered as one initiative. It is recommended that this project be undertaken in collaboration with other Masig Island projects such as project 15 (composting) or project 17 (procurement practices to reduce plastic waste). This project could also be undertaken in collaboration with Container Exchange (COEX) as part of the Queensland container deposit scheme, with collection of containers and bottles collected for cash and shipped back to the mainland for recycling.

Timeframes to deliver solutions

- It is expected that this project will take between 1 to 2 years to deliver: Project strategy and management plans (6 months); set up of infrastructure (6 months); roll of equipment and educational materials (3 months)

1 Capital costs have been developed with reference to the Aurecon 2011 report

Masig Island | Waste

15 Island composting scheme

Collection of food and garden organics to produce compost, to support on island food production and reduce waste to landfill.

Description and overview

Introduction of an on-island community composting scheme to promote the recycling of green waste and food waste (i.e. organic waste), for fertile soil conditioner to support the Community Market Garden (project #1), reducing waste to landfill.

The Torres Strait Island Regional Council (TSIRC) currently provide 1-2 bins per household and waste collection is undertaken two times per week for general and green waste. Once collected green waste (garden waste) is stored at the community landfill site and periodically burnt as means of disposal. Approximately 21 tonnes of green waste is generated per year. It is understood that TSIRC own a mulcher/chipper, but this is currently out of operation and there is no large composting or mulching currently undertaken on the island.

Landfill space on the island is limited and ultimately current practices are unsustainable. There is currently no separation of food waste and it is landfilled with all other household waste. Disposal of organics to landfill increases greenhouse gas emissions from the landfill and the potential for nutrient run off from the landfill into the surrounding environment.

The soil on Masig Island is highly alkaline and therefore there is a need for soil improvement when developing local gardens.

The proposed island composting scheme includes:

- Collection of both food and green waste material separated at households;
- Use of mulcher for mulching green waste; and
- Use of a biodigester for community food waste mixed with other compostables.

This material is then windrowed before utilisation within the community. Implementation of this project included extensive community education and engagement.

Project summary

Item	Units	Total
Estimated annual emissions reduction	T CO2e	N/A*
Estimated payback period	Years	N/A
Estimated annual cost savings	$	N/A**
Estimated capital costs	$ mil	0.25 – 0.3
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1
Estimated FTE	No.	1-2

*Implementation of this project would achieve annual emissions reduction however given the lack of organic waste data for the island; the quantity of annual emissions reduction has not been quantified.
**It is possible that the introduction of organic bins could provide cost benefit due to reduced waste to landfill, reduced resource processing or the resale of organic produce, however it has not been possible to quantify this benefit in the context of Masig Island

Key project objectives

Carbon assessment
Degradation of organic waste within a landfill produces landfill gas which contains 40-60% methane, a GHG approximately 30 times more potent than carbon dioxide. In a well-engineered landfill much of this gas can be captured through gas collection systems. However, the local landfill at Masig Island is not engineered i.e. does not have a liner or collection systems, and these landfill gas emissions escape into the atmosphere. The removal of organic waste from the general waste stream would reduce the overall quantity of waste disposed to landfill and the subsequent landfill gas produced. Recyclable organic material such as paper and cardboard could be also collected as part of the organics recycling system, further reducing overall waste to landfill and landfill gas emissions.

Community and resilience
Recycling organic waste for food production would not only promote higher order use of materials on the island, in line with the waste hierarchy and circular economy principles but would also provide resilience for the community during times when access to the mainland is limited. Food is delivered to Masig via barge or aircraft, generally coming from the mainland. Delivery of these items can be cut off for extended periods during extreme weather events such as cyclones. The island also occasionally experiences energy instability through black outs or brown outs which results in an increase of food waste through lack of refrigeration for long periods of time.

This initiative would provide a nutrient rich material source to help improve the local soil and enable residents to establish and sustain gardens to grow their own food. Some residents have fruit, vegetable and medicine gardens however it is understood that the soil is highly alkaline making growing conditions difficult. This initiative complements project #1 for Community Market Garden.

Co-benefits

Economic
Organics recycling to produce mulch and digestate would produce the following economic benefits:

- Employment opportunities for collection, processing of the organic waste material and distribution of product (potentially approx. 1-2 FTE)
- The On-island Sustainability Officer (project #9) would also be able to provide ongoing support to this initiative
- The ability to grow backyard fruits, vegetables and medicines would provide households with a low cost and reliable food source
- Avoided imports of soil conditioning products, which typically cost more than developing local products
- Reduction in the need to transport soil conditioning, compost and fertiliser products to the island
- Community led schemes assist in decoupling from dependence on TSIRC and dependence on one-off funding grants

Social
The community takes great pride in waste management on the island and are eager to adopt more sustainable initiatives. Organics recycling allows for community ownership and participation, benefitting the community through increased skills development both in managing waste recycling processes and in development of community gardens.

Environmental

- The leaching of nutrients from organic waste materials disposed of at the landfill site impacts surrounding surface and groundwaters, natural waterways and the GBR. The reduction of organic waste to landfill will reduce this occurrence which was identified as an extreme risk in the project risk assessment.
- Improvement of soil conditioning via use of mulch and compost rather than artificial fertilisers poses a reduced risk of nutrient run off into waterways and marine areas, including the GBR.

Risks and opportunities

Barriers

- TSIRC currently own the mulching equipment on the island and would be responsible for the purchase of additional plant and infrastructure. Therefore any repairs or ongoing maintenance would rely on ongoing funding. It is understood securing ongoing funding can be challenging, and this could be a barrier to success. It is suggested that residents are trained to undertake routine maintenance and repairs of any equipment purchased for this initiative.
- Gaining community support and buy-in for collection and recycling of organic material, including uptake of food waste separation for recycling.
- Community behavioural change and roll out of an education campaign (in coordination with project #3 Community-led Traditional Knowledge Sharing and Education)

Risks

- Contamination of the organic waste stream making it unsuitable for use in local gardens. Contaminated mulch or compost would need to be disposed to landfill.
- OH&S issues with collection and handling of food waste and composting. Appropriate management will avoid health and safety risks and issues with odour and vermin control. Composting must be managed in a safe and suitable manner to prevent generating a food source or harbourage for vermin. To ensure vermin activity does not create a public health risk as a result of organic waste recycling, appropriate management plans and site selection should be considered.

Opportunity
This initiative could potentially be expanded to processing of biosolids which are currently disposed to landfill. This type of processing facility would need to be managed closely to prevent and health and safety risks and to comply with government regulations. There is also a perception issue with utilisation of biosolids for application to land which would need to be managed closely and the correct testing undertaken on the product.

Alignment with other initiatives

Alignment with other project options

- 1. Community Market Garden
- 3. Community-led Traditional Knowledge Sharing and Education
- 9. On-island Sustainability Officer
- 14. Waste Management Optimisation

Alignment with external initiatives

- QLD Indigenous Waste Strategy
- QLD Waste Management and Resource Recovery Strategy

Assumptions

- The capital costs listed assume a 'worst case' scenario whereby existing equipment on the island is unsuitable for implementation of this project and all equipment must be purchased
- Capital costs have been developed with reference to the report – 'Project overview and review Warraber Waste Pilot Project Torres Strait Island Regional Council', Aurecon 2011
- It is possible that the introduction of organic bins could provide cost benefit due to reduced waste to landfill, reduced resource processing or the resale of organic produce, however it has not been possible to quantify this benefit in the context of Masig Island

Additional information

In 2011 Warrabar Island was selected to host a waste pilot project showcasing best practice waste management in the Torres Strait Island communities. This showcase included source separation for households, including food waste, green waste, recycling and general waste. Compostable food waste was mixed with chipped garden waste and shredded organic recyclables such as cardboard and composted in steel BiobiNs. This material was then windrowed before utilisation within the community. Implementation of this project included extensive community education and engagement. The project was considered successful but key learnings included:

1. Waste management systems need to be integrated with pilot schemes
2. Careful attention must be given to OH&S issues
3. Maintenance assistance must be provided and if one system breaks down the others should continue to function
4. Identify project champions in the community to keep momentum

For full project report refer to *Project Overview and Review Warraber Waste Pilot Project Torres Strait Island Regional Council* (Aurecon, 2011).

Costs and funding considerations

Capital costs

The capital costs listed assume a 'worst case' scenario whereby existing equipment on the island is unsuitable for implementation of this project and all equipment must be purchased. These include purchasing of the following[1]:

- Compostable bags, kitchen caddies and food waste bins
- Vegetation chipper
- Cardboard shredder
- Biodigester or Biobins
- Compost screening
- Freight and miscellanies
- Project management and planning

Approximate total capital cost: $250,000 to $300,000

Ongoing costs

- Ongoing costs for this project include fuel, operator salaries, purchase of biobags, education materials, registration and maintenance. Potentially fuel could be replaced with a solar powered BiobiN. It would be most cost effective and beneficial to train residents to undertake routine maintenance and servicing of equipment.
- The On-island Sustainability Officer (project #9) would also be able to provide ongoing support to this initiative
- Based on figures outlined the in Aurecon 2011 report and applying an inflation value of 2% the ongoing costs would be approximately $50,000 to $100,000 per year

Potential funding opportunities

- The Department of Environment and Science are currently progressing an *Indigenous Islands Waste Strategy* and associated infrastructure planning, in line with the Queensland Waste and Resource Management Strategy. The development of this Indigenous Waste Strategy and infrastructure plans may provide opportunity for funding for remote communities such as Masig Island.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Torres Strait Island Regional Council	■	■	■	■
Community (households and businesses)			■	■
DES ESR /EPP Office Waste and Resource Recovery			■	

Implementation and timeframes

Investment readiness

This project will be investment ready following consultation with and agreement by stakeholders.

Next steps

- TSIRC to confirm condition of on island equipment and identify additional equipment required
- Set up of vegetation chipper, cardboard shredder and biodigester/BiobiN
- Roll out of food waste bins to households and associated education material
- Establish composting facility and platform for distribution of products

Considerations for implementation

The preferred implementation approach will depend on available equipment and community support which could ultimately be rolled out to include - green waste mulching, food waste collection from households, shredded cardboard and biosolids as feed stock to biodigester and composting windrows to produce a nutrient rich product for use on local gardens.

Timeframes to deliver solutions

- Delivery is estimated to take up to 1 year: Project feasibility and planning (6 months); the roll out of education and infrastructure (3 months); Establishment of collection and processing facility (3 months)

Masig Island | Resilience

16 Community Led Housing Design Code

Develop and implement a housing design code which is co-developed with the Masig Island community to ensure housing is sustainable, suited to the climate and meets the needs of residents.

Description and overview

The Masig Island community has voiced concerns that housing on the island is not suited to the climate and does not meet community needs. For example some buildings are not adequately shaded, insulated and ventilated making conditions hot and uncomfortable; dwelling size is often inadequate for household numbers; lack of cool shaded outdoor spaces. This project proposes the development of a community-led housing design code as a resource to guide the future design, construction and maintenance of houses on Masig. A separate project is proposed for Existing Building Improvements (Project #8). It is vitally important that housing provides comfortable and cool conditions for residents to live in. Currently, residents advise that internal daytime temperatures in some buildings can exceed those outside the building.

This project will provide residents with opportunity to positively influence the design of new residential buildings (and renovations). A code would have three overarching objectives:

- Housing design is suited to the local environment and the hot climate;
- Housing design is culturally appropriate and meets the needs of families; and
- Housing design embeds sustainable practices.

This project seeks funding for:

- A review of current housing conditions, including a review of Australian and Indigenous housing standards, contemporary sustainable housing design practices and international benchmarking;
- Developing and implementing the design code in consultation with community; and
- Additional funding for the administration behind implementing this code (i.e. the appointment of an On-island Sustainability Officer to work with community as outlined in Project #9).

Masig Island can act as a pilot study for other islands across the Great Barrier Reef, as many groups of islands face the same housing related difficulties.

Project summary

Item	Units	Total
Estimated annual emissions reduction/dwelling	t-CO_2-e	3-5
Estimated payback period	Years	N/A
Estimated annual cost savings	$ / household	1,000
Estimated capital costs	$ mil	0.08 – 0.13
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1 – 3
Estimated FTE	No.	N/A

Key project objectives

Carbon assessment

- The design code could achieve carbon savings by embedding the following sustainable measures:
  - Renewable energy resources
  - Energy expenditure limitations
  - Passive cooling measures
  - Material selection and constraints
  - Water usage limitations
  - Consideration for waste disposal
- As an example, the design code could choose to draw on Passivhaus design principles[1], which support principles of low-carbon living. These principles promote high energy efficiency dwellings. The average residential dwelling on Masig Island consumes ~5,371kWh/year; by adopting these principles energy demand could be reduced significantly (potentially to as low as to 550kWh/year). Diesel-generated electricity has an approximate emission factor of 0.8 kg CO2eq /kWh therefore, the average dwelling could reduce annual electricity consumption by ~4,850 kWh/year, abating ~3,900 kg CO2eq annually.

Community and resilience

- A community-led housing design code offers a bespoke approach to mitigating the climate challenges the community are facing. Buildings which provide enhanced thermal cooling will increase community resilience, enabling residents to better manage periods of high heat.
- The water saving measures offered by the code will increase resilience and self-sufficiency.
- By minimising energy consumption, the community will increase their resilience in the face of energy supply issues and future carbon taxes, if introduced.
- Larger comfortable spaces suitable for entertaining will improve community connectivity.

Co-benefits

Economic

- New builds would be expected to conserve energy and water and hence lower equivalent household cost of living expenses
- Reducing electricity consumption aids in the deferral any future upgrades of the Masig Island power station

Social and cultural

- A sustained commitment to developing appropriate housing in remote Indigenous communities is essential for 'Closing the gap' per the *National Indigenous Reform Agreement*
- Inadequate housing is linked to poor physical and mental health
- The poor living conditions associated with inadequate housing can negatively impact upon education outcomes and employment prospects
- The community-led development of the code will ensure that the lived experiences and needs of residents are understood

Environmental (General)

- Sustainably designed homes have lower greenhouse gas emissions than the average home, which was identified as a severe risk in the project risk assessment
- Reduced energy use and associated costs as a result of sustainably designed homes, which was identified as a severe risk in the project risk assessment

Environmental (impacts to Great Barrier Reef)

- No direct impacts identified

Risks and opportunities

Barriers

- Delivering and maintaining housing in remote locations presents costs and complexities not experienced in more urban areas

Risks

- The new code must be co-developed with the community for outcomes to be fit for purpose and appropriate
- Development will require engagement with and buy-in from the community
- A potential lack of institutional support in developing and enforcing a new framework would detract from the project's success. This risk could be managed by ensuring the Queensland Government is an open partner throughout the process of developing and implementing this code.

Opportunity

- Community inputs into the development of the code could be championed and coordinated by the On-island Sustainability Officer (Project #9)
- Possibility to replicate this code to other communities across the region
- Audits of existing housing should be undertaken as part of this process to obtain a robust evidence base of existing issues including daytime temperatures. There is opportunity for this to be coordinated with Project #8 Existing Building Improvements.

Alignment with other initiatives

Alignment with other project options

- 8. Existing Building Improvements
- 9. On-island Sustainability Officer
- 10. Energy Efficient Appliance Upgrades

Alignment with external initiatives

- The *National Indigenous Reform Agreement* objectives to 'Close the Gap'
- The *National Indigenous Housing Guide* by the Department of Families, Community Services and Indigenous Affairs

1. Passivhaus Trust, The UK Passive House Organisation, 2011, *Passivhaus and Zero Carbon*, https://www.passivhaustrust.org.uk/UserFiles/File/Technical%20Papers/110705%20Final%20PH%20ZC%20Brief.pdf

Assumptions

- All costs are high-level and order of magnitude estimates
- A well-defined scope of works is required for more robust estimates of cost to be developed as each dwelling will require unique solutions

Costs and funding considerations

Capital costs
- Capital costs include the cost to undertake a review of current housing, and the cost of developing and implementing the design code
- The approximate cost of a review is $30k
- The approximate cost of developing and implementing a design code may range between $50k - $100k. This should include funding for key community members to have input into the design of the code.

Ongoing costs
- Allowance should be made for periodic post-implementation consultation and data collection to ensure new buildings delivered under the code are fit for purpose. This will enable post-evaluation reviews to understand performance and recommend any future updates to the code to ensure project success.
- Wages for the officer who enforces this code and manages the administration behind this code.

Potential cost savings or return on investment
- Residents of newly-constructed homes may realise energy cost savings. As outlined in the Carbon Assessment, the average residential dwelling on Masig Island consumes ~5,400kWh/year. Following Passivhaus principles energy demand could be reduced to only 549kWh/year. Applying a usage charge of 0.26 $/kWh, each household could save ~$1,260 on their electricity bill annually.

Funding opportunities
- Federal and local governments are likely to be the key funding partner
- Commonwealth *Close the Gap* funding

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Residents				
Local planning authorities				
Local repair and maintenance groups				
DHPW				

Implementation and timeframes

Investment readiness
- More work will be required to scope the extent of work required and confirm support from all stakeholders

Next steps
- A scope and strategic brief needs to be developed and a consultancy team needs to be appointed to undertake the review this would be undertaken in conjunction with DHPW and align with previously developed Action Plan and other relevant documents
- Develop and submit funding applications for the review and design and development of the code
- Consultation with the community and key stakeholders, namely local planning authorities, local community members and groups, and local repair and maintenance groups

Considerations for implementation
- An evidence-based approach is essential for developing a robust and sustainable housing design code
- Audits of existing housing should be undertaken as part of this process to obtain a robust evidence base of existing issues including daytime temperatures

Timeframes to deliver solutions
- The timeframe to deliver a new housing code could range between 1 to 3 years. An iterative approach will be required to ensure effective community consultation and community inputs into the design process are achieved.

Masig Island | Waste

17 Minimise single-use plastics and packaging

Modify procurement practices to reduce single use items and packaging from the supply chain to reduce waste disposal and litter on the island.

Description and overview

This project seeks funding to minimise single-use plastics and reduce packaging on the island. It is primarily focused on measures for businesses to modify procurement practices to remove single-use plastics and other disposable waste items from the supply chain. It is proposed to implement an initiative similar to 'Plastic Free Places' (operated by Boomerang Alliance in places such as Cairns and Townsville) to offer support to businesses and council to modify procurement toward more sustainable practices and support for education of the community on recycling of plastic alternatives employed.

The Islander Board of Industry and Service (IBIS) supermarket is the major supplier of goods on the island. Produce is delivered weekly via SeaSwift barge and goods and wrapped in plastic, creating a large volume of waste. The island also has two mini marts which are a source of packaging waste. There is scope for supermarkets and their suppliers to identify and implement initiatives to reduce this packaging. Local businesses offering take away services are also a source of single use items.

Litter generally comprises of single use items and any litter on the could make its way into waterways and ultimately the marine environment, increasing the volume of plastic waste in the ocean and Great Barrier Reef.

With no existing recycling programs, packaging and single use plastic waste that do not end up as litter are disposed of at the local unlined landfill site. This site is located within 200m of the ocean and is nearing full capacity. Reduced packaging and single use plastic waste would significantly enhance the capacity of the local waste management system and minimise the risk of damage to the surrounding environment through windblown litter and pollution of surrounding ground and surface waters.

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	N/A
Estimated payback period	Years	N/A
Estimated annual cost savings	$	N/A
Estimated capital costs	$ mil	.02-.05
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1 – 2
Estimated FTE	No.	N/A

Key project objectives

Environmental
Phasing out the use of single use plastics and plastic packaging would help to reduce the volume of litter on the island, which impacts amenity and enters drainage lines and waterways on the island, ultimately adding to the plastic waste present in our oceans.

Plastic packaging and single use items are also disposed of at the local landfill site, an unlined facility which does not have environmental management systems in place.

The higher order options for management of packaging and single use items on Masig Island, in line with the waste hierarchy, include:

1. Reduction of packaging and single use materials transported to the island
2. Replacement of existing materials with a more sustainable materials such as cardboard or compostable products, which could be shredded and composted on the island
3. Collection and transport of packaging materials back to the mainland for recycling or recovery

It is acknowledged that elimination of all packaging and single use items is not practical. Therefore, where avoidance is not possible promoting the use of more sustainable materials such as cardboard, bioplastics or compostable products is the best option for minimising plastic waste. With effective education, these materials could be recycled or reused on the island as a feedstock for compost production, reducing waste to landfill.

Carbon assessment
Reduction of waste to landfill would have a small reduction in landfill gas, and therefore greenhouse gas emissions.

Co-benefits

Community and climate resilience
The reduction of plastic waste on the island reduces the total volume of waste to landfill and increases the lifespan of the landfill facility. This will contribute to increased capacity for and resilience of waste management.

Economic
Identification of potential areas to eliminate packaging would be the first step to implementation of this project, followed by identification of packaging alternatives which are not cost prohibitive. If non-plastic options are too expensive these will not be attractive to businesses or the community. However, there is the potential for cost saving opportunities through bulk purchase, but this would have to be assessed a on a product case by case basis.

For the phase out of single use items including water bottles, straws, coffee cups, takeaway containers, food wares and bags, funding can be sought through the 'Plastic Free Places initiative'[1]. This has already been implemented in several locations around Australia. The focus of this program is to reduce these six most problematic single use plastic items with identification of sustainable and affordable alternatives.

Uptake of compostable packaging options that can be reprocessed on island would be a cost saving when compared to the shipping cost for transport of waste materials back to the mainland, should landfill capacity be reached and shipping of materials off the island be required to effectively manage waste. This was identified as a high risk in the project risk assessment.

Social
All aspects of this project aim to promote awareness of litter, waste management and sustainable practices, which is strongly aligned with community values.

These practices would also enhance liveability by contributing to reduced litter, whilst also protecting the local environment.

Risks and opportunities

Barriers
- The practicality or perceived practicality of replacing plastic packaging for the transport of goods to the island may be a barrier to the uptake of this initiative
- There is potential for cost for businesses to increase if alternative packaging materials and single-use items are not cost effective
- Some community members may be resistant to this behavioural change. Update and recycling of plastic free alternatives employed is required to achieve project benefits.

Risks
- The replacement of plastic items with compostable items would need to be considered in collaboration with the Island Composting Scheme was established on the island (as recommended in project #15). The packaging replacement materials would only result in a beneficial outcome if compatible with the technology available on the island. Should a composting facility not be established, or if it was not able to process the alternative packaging materials these items would end up in landfill which would not result in a better waste management outcome for the island.
- The buy-in and cooperation of local businesses (IBIS, minimarts and other small business) to adopt new procurement practices will be critical to success

Opportunity
If successful, this project could be expanded to other islands in the Torres Strait. Sustainable procurement terms could be included in transport contracts for all items shipped to the island, including all consumables purchased by residents and council. Buying of materials in bulk may also result in cost savings.

Alignment with other initiatives

Alignment with other project options projects
- 9. On-island Sustainability Officer
- 14. Waste Management Optimisation
- 15. Island Composting Scheme

Alignment with external initiatives
- QLD Indigenous Waste Strategy and Regional Action Plan
- QLD Waste Strategy
- Plastic Free Places Initiative

1. Plastic Free Places - https://www.plasticfreeplaces.org/

Assumptions

Additional information
The 'Plastic Free Places' initiative has been implemented in a number of locations around Australia including Noosa, Byron, Perth, Adelaide, Cairns, Townsville and Elsternwik.

The Boomerang Alliance work directly with communities through this initiative to reduce single use plastic items. The Boomerang Alliance enter a partnership with the community and local stakeholders, such as council to help manage the project.

Collaboration with the Boomerang alliance to help with the phase out of single use plastics would help to achieve practical and sustainable results for Masig Island businesses and the community.

Tangaroa Blue Foundation has partnered with several organisations to deliver ReefClean which delivers the following services:

- Community clean-up events
- Site monitoring
- The Great Barrier Reef Clean-up event annually in October
- Community Source Reduction Plan Workshops
- School and community engagement activities
- Data analysis
- Disaster management clean-ups

Collaboration with ReefClean could provide an excellent source community awareness, data collection and progress tracking for Masig Island in support for this initiative.

Costs and funding considerations

Capital costs
The capital costs of this project are unknown and would need to be established through discussions with TSIRC, local businesses, the Department of Environment and Science (DES) and the Boomerang Alliance.

Costs to commission and undertake a 'plastic packaging reduction strategy' are estimated to be between $20,000 to $50,000.

Ongoing costs
Once established, the ongoing costs of this project are likely to be minimal where plastic reduction practices become commonplace for the community. This project could be supported by the local sustainability officer.

Establishment of an organisation to manage and implement the scheme is highly recommended and therefore would require a part-time role for a scheme champion. This could be championed by the On-island Sustainability Officer role outlined in project #9.

Potential funding opportunities
It is understood that there is no longer funding through DES in support of the 'Plastic free places' initiatives however future rounds of the Community Sustainability Action Grants may be a potential funding opportunity.

DES are currently developing the *Indigenous Waste Strategy* and undertaking associated infrastructure planning in line with the *Queensland Waste and Resource Management Strategy*. The development of the *Indigenous Waste Strategy* and infrastructure plans may provide opportunity for funding for remote communities such as Masig Island.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Torres Strait Island Regional Council	■		■	■
Seaswift			■	■
Local businesses	■	■	■	■
Department of Environment and Science			■	
Boomerang Alliance			■	
ReefClean			■	

Implementation and timeframes

Investment readiness
This project could go ahead immediately if the funding could be sought.

Next steps

- Develop the plastic packaging reduction strategy, including discussions with council and local businesses to identify opportunities to reduce single use plastic waste, including assessment of current contracts and packaging alternatives
- Discussion with Boomerang Alliance and ReefClean regarding roll out of a plastic free places initiative and clean-up operation

Considerations for implementation
This project would require an organisation to drive the plastic packaging reduction strategy and take ownership of its implementation. TSIRC may be well-positioned, however, support from identified parties on the island or within the community would also be beneficial. The plastic reduction strategy could be undertaken as a pilot on Masig Island with potential roll out to other islands in the region, as transport of goods is generally undertaken for several islands at a time.

Timeframes to deliver solutions

- Delivery is estimated to take between 1 to 2 years: Project strategy and management plans (6 months); set up of pilot (6 months); roll out of equipment and educational materials (3 months)

1. Tangaroa Blue Foundation: ReefClean - https://www.tangaroablue.org/amdi-network/reefclean/

Masig Island | Water

18 Community water engagement

Implement community-based water demand management approaches across Masig Island to assist in achieving TSIRC's ambitious demand reduction targets and evaluate the viability of options for wider roll-out across the Torres Strait.

Description and overview

This project seeks to implement the most effective community-based water demand management approaches across all Masig Island, based on the outcomes of the Griffith University studies. The island's water supply is sourced from a combination of desalination of brackish groundwater and direct harvesting of rainwater from a large (~23ML) lined and covered water storage lagoon. The existing supply is insufficient to meet demand, and storage typically reaches critically low levels prior to wet season rainfall, triggering the implementation of severe water restrictions. Effective demand management has been identified as key to long term water security. Between 2017 and 2019, community-based water demand management trials[1] were undertaken by Griffith University with sample community groups from Masig Island and Hammond Island. The studies sought to analyse household water use patterns and trial community-based water demand management approaches, and demonstrated significant reductions in water demand are achievable with investment in appropriate community based strategies.

The broad project needs and scope has been identified by TSIRC in their Sustainable Water and Wastewater Management Plan[2]. Delivered in consultation with TSIRC, the community and other key stakeholders, and in a manner consistent with other existing water efficiency initiatives, the key objectives of this project are to demonstrate the effectiveness of demand management on a community-wide scale, and to develop a demand management program for broader roll-out across all outer islands. Key strategies may include:

- Wider smart water meter roll-out;
- Provision of feedback (on water-use, storage levels, etc.) through community notice boards and other means;
- Supply of water efficient devices;
- Establishment of formal roles within TSIRC to manage demand management programs (regional coordinator) and champion on-island implementation (through feedback, education and information sharing); and
- Community co-development of behavioural change strategies based on specific community water values.

The project may incorporate other related initiatives to engage the community on the value of water, the cost of service provision and promote trust in the council water supply. One such opportunity identified by stakeholders as part of this project is the potential to install solar powered, chilled drinking water fountains in the community to make an un-restricted supply of chilled drinking water available to the community, promote clean drinking water as the beverage of choice and displace plastic bottled drinking water which contributes to waste. Effective community engagement will be key to the design and implementation of the program and the ongoing achievement of demand management objectives.

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO2-e	<5
Estimated payback period	Years	10 - 30
Estimated annual cost savings	$	N/A
Estimated capital costs	$ mil	<0.25
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1 - 3
Estimated FTE	No.	N/A

1 Community-based water demand management trial: Hammond Island. Final report prepared for Torres Strait Island Regional Council by Cities Research Institute, Griffith University, May 2019.
2. Sustainable Water & Wastewater Management Plan. Final report prepared for Torres Strait Island Regional Council by Arup, December 2019

Key project objectives

Carbon assessment
- Reducing water demand will reduce the requirement for extraction, desalination, storage, treatment and distribution of water to the Masig community
- Indirect energy and carbon reductions will be achieved through reduced pumping and desalination, reduced need for supply and transportation of consumables, and reduced need for construction of major water supply infrastructure

Community and resilience
- Increased community water security and resilience through reduced water demand

Alignment with other initiatives

Alignment with other project options
- 3. Community-led Traditional Knowledge Sharing and Education
- 9. On-island Sustainability Officer
- 11. Rainwater Harvesting Improvement Program
- 13. Water Supply Energy Efficiency and Solar Project

Alignment with external initiatives or investments
- TSIRC Sustainable Water and Wastewater Management Plan, 2019; identifies a suite of opportunities to facilitate more sustainable, cost-effective and resilient water and wastewater service provision
- The strategy includes recommendations to expand the piloting and evaluation of community-based water demand management strategies, including the roll-out of smart water meters, to enable development and implementation of effective long-term approaches to achieve demand targets
- It is understood TSIRC is currently rolling out smart water meters across all communities
- Project complements Queensland Health, Tropical Public Health Unit Safe and Healthy Drinking Water Program and Environmental Health Workers Program

Co-benefits

Economic
- The recent TSIRC Sustainable Water and Wastewater Management Plan 2019, determined a strong project for investment in demand management in the Torres Strait
- Compared to the construction, operation and maintenance of new infrastructure, the investment required to achieve the water demand targets is relatively small, with significant cost benefits achieved through avoided infrastructure requirements
- Opportunity for local economic development through employment of a:
    - Regional demand management coordinator position within TSIRC to manage programs (across the Torres Strait regional)
    - Masig Island local to champion water demand management initiatives (likely coupled with other sustainability and resilience responsibilities of the On-island Sustainability Officer – project #9)

Social and cultural
- Initiatives will enhance the resilience of the water supply and this may promote increased community trust in water and wastewater services
- This will promote a better understanding within community of the challenges and costs associated with water and wastewater service provision
- Effective, community-based water demand management initiatives will be tailored to the community's specific values and attitudes toward water
- Increased health outcomes associated with readily available, chilled drinking water, which was identified as a severe risk in the project risk assessment

Environmental (impacts to Great Barrier Reef)
- Reduced desalination production and brine discharge
- Reduced risk of requirement to mobilise emergency mobile desalination
- Reduced need for bottled water would reduce plastic on the island

Risks and opportunities

Barriers
- Resource capacity within TSIRC and stakeholder organisations to drive the initiative are limited, and a regional coordinator position does not yet exist. However, the proposed initiative for an On-island Sustainability Officer (Project #9) would provide critical support for this project.
- Work needs to be undertaken in parallel with other network side leakage management programs
- Chilled water fountains would not be functional if they do not have separate source of water supply.

Risks
- Long-term engagement and investment is required to ensure that successful outcomes are achieved
- All programs must comply with relevant water supply legislation (including Water Supply Safety and Reliability Act 2008, Public Health Act 2005) and associated regulations and guidelines (including Australian Drinking Water Guidelines)
- Without adequate water reservoirs for when the water is unavailable the chilled drinking water fountains will not be functional

Opportunity
- There is a strong platform and community understanding for this project from the recent demand management trials delivered in the community
- Delivering the project soon will capitalise on the momentum and existing engagement from the recent demand management trials
- There is opportunity for this project to be delivered in conjunction with or in support of education and traditional knowledge sharing initiatives relating to water
- Ensure that there is a separate reticulation of water to the chilled drinking fountains that allows water to flow during times when water is cut off or unavailable

Assumptions

- A detailed scope will need to be developed and refined in consultation with key project stakeholders
- The initiative will be most effective when considered in a regional context (e.g. which would be applicable to all TSIRC communities)
- Costs assume smart water meters will be rolled out across community through alternative funded program
- Costs assume TSIRC employment of requisite personnel to deliver ongoing demand management program across the region.
- Project scope and costs could be scaled to meet available budget

Costs and funding considerations cont.

Capital costs

- A nominal budget of ~$250k is proposed to subject to confirmation of project priorities and scope, comprising a nominal:
  - ~$150k consulting fees to design and implement community scale demand management program
  - ~$100k for physical works such as the supply and installation of water efficient fittings, chilled drinking water fountain, and other ancillary measures such as digital notice boards for community feedback.
- Project scope and costs could be scaled to meet available budget

Ongoing costs

- Ongoing costs include:
  - Regional Demand Management Coordinator position (proposed as a Torres Strait region-wide role)
  - An on-island demand management champion (Funding for this is sought through project #9 On-island Sustainability Officer. This would be a part time position shared with broader sustainability and resilience responsibilities)

Costs and funding considerations cont.

- Ongoing maintenance of smart water meters
- Ongoing costs to deliver demand management initiatives, community engagement, training, etc.

Potential cost savings or return on investment

- Avoided investment in upgrading water supply infrastructure (extraction, desalination, storage, treatment, distribution)
- Avoided investment in operating and maintaining water supply infrastructure (pumping, desalination, chemicals, consumables)

Funding opportunities

- Round 3 - Community Sustainability Actions Grants, Department of Environment and Science
- Drought Communities Programme, Department of Infrastructure, Transport, Regional Development and Communications
- Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022, Queensland Health: capacity building for Environmental Health and Animal Management in first nations communities
- Funding under future round of W4Q

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
TSIRC	■	■		
QLD Health			■	
TSRA			■	
Community				■
Qld Government (Water Supply Regulation)			■	■

Implementation and timeframes

Investment readiness

- This project will build on a large body of work previously completed by TSIRC, Griffith University and others
- The project is investment ready and could be commenced within a short timeframe once funding is received

Considerations for implementation

- The project should be led by TSIRC
- To be effective the specific project scope and activities should be co-designed with the community to deliver greatest impact within the available budget

Timeframes to deliver solutions

- The initiatives outlined in this document could be delivered in 1 to 2 years of mobilisation

Next steps

- Confirmation of TSIRC interest and ability to lead project
- Consultation with community and key stakeholders to confirm scope and activities
- Development of a detailed scope and determination of delivery approach
- Consideration of governance arrangements

Appendix 2: Option Recommendations

The project recommendations are options that have not progressed through to the options shortlist, but which have merit and potentially represent areas for future consideration. These exclude options which were not supported by the community or were found to be infeasible.

For further information and descriptions of these Option Recommendations, please refer to Technical Appendix 2: Options Report

Appendix 2: Option Recommendations

ID	Title	Explanation
E8	Wind turbines (large or small) for residential or commercial energy generation	Work is already being conducted under the ARENA program
E9	Tidal or wave energy generators	This technology is considered to be costly to install and maintain and may disrupt marine life. The effectiveness of the technology in this location is also not clear. This option was not supported by the community.
T3	Flight school on Masig to promote indigenous pilots for the Torres Strait region	Captured in the current Master Plan and also unlikely to be feasible within 5 to 10 years
T4	Alternative fuels for vehicles (land, marine and air)	Market readiness of marine / aircraft and medium-term supply chain constraints
T6	Fuel efficient personal vehicles and upgrades (such as electric vehicle (EV), biodiesel or hydrogen – as applicable)	Not likely to represent value for money for personal use, especially given focus to prioritise increased walking and cycling
T7	Community-run barge	There is an existing barge service operated by SeaSwift which would be displaced by a new service. It is also unclear if there is sufficient demand or capacity to maintain an additional service. The addition of a new service would increase carbon emissions.
R5	Additional communication systems (emergency, internet, global positioning system (GPS), mobile communication)	This option is an enabler to others. Digital connectivity can remove barriers to community resilience.
R6	Develop a Masig Island long term vision and plan (resilience, tourism, development planning, fire, land and sea, erosion management)	This recommendation falls somewhat outside project scope and is also reflected in work already underway through the Master Plan.
R8	Jetty design upgrade/replacement to reduce sand accumulation and increase capacity to operate with rising sea levels	Considered out of scope, and action may already be undertaken through other programs.
R9	Rock wall installation and upgrades	Work is already underway through QCoast2100 that will help inform decisions around this recommendation.
R10	Windwall installation	This recommendation is not feasible on the island within 5-10 years but should be considered in future planning.
R11	Establish banking services on the island (office)	This recommendation is outside the scope of this project.

Appendix 3: Discounted Options

The discounted options are other options put forward by the community and stakeholders that were assessed, but ultimately not determined to constitute a viable final project option or option recommendation.

For further information and descriptions of these Discounted Options, please refer to Technical Appendix 2: Options Report

Appendix 3: Discounted Options

ID	Title	Explanation
E10	Heat recovery from compost	This is considered to be a technically complex solution to energy generation for an isolated community which also requires specific capacity, resourcing and expertise. Other energy initiatives would deliver better outcomes.
T5	Increase size and capacity of planes to island to reduce trip frequency	This would require an extended and upgraded runway, which is highly unlikely to be technically feasible given the physical land constraints on the island. Commercial aviation operators run the commercial transport service to/from the Island. Vertical flight technology, electric and/or low emission fuels may be available in the future to enable decarbonisation opportunities in the aviation sector.
WT6	Small scale desalination units for individual wells	This is considered to be a high-cost and complex project which would be both energy and carbon intensive and may pose a risk to public health. The provision of safe and reliable drinking water supply is a complex undertaking, and without proper management can introduce serious human health risks. Further decentralising the water supply in this challenging environment also introduces more operational complexity and cost.
WS8	Sewage plant effluent to create fertiliser	This option is considered to pose potentially serious health risks to the community. It is a complex solution which is not considered suitable in the Masig context.

Appendix 4: Stakeholder Register

The Stakeholder Register lists project stakeholders. Names and contact information are not included in this report for privacy considerations.

Appendix 4: Stakeholder Register

Position	Business/Organisation	Category
	Australian Fisheries Management Authority	Government (Federal)
	Biosecurity and ABF	Government (State) and Government (Federal)
Project Manager	Climate and Coastal Land and Sea Management Unity, Torres Strait Island Regional Authority	Government (Federal)
Chairperson	Community Justice Group	Community Associations
Coordinator	Community Justice Group	Community Associations
	Department of Housing and Public Works	Government (State)
Renewable and Strategy Engineer	Ergon Energy	Utility Provider
	Gabaou Mari	Business and the business community
Senior Lecturer in Environmental Health	Griffith University	Collaborator
	IBIS Grocery Store and Fuel	Business and the business community
Air Charter Consultant	Independent Aviation Charter	Business and the business community
	Islanders Board of Industry and Service	Community Associations
	Kailag Enterprise Limited	Business and the business community
	Kozan Shop	Business and the business community
	Masig Christian Outreach Ministry	Community Provider
	Masig Muysaw Ngurpay Lag Primary School	Community Provider
Chair	Masigalgal Prescribed Body Corporate (PBC)	Traditional Owner representative
Chair	Masigalgal Prescribed Body Corporate (PBC) Corporation RNTBC	Traditional Owner representative
	Primary Health Care Centre	Government (State)
Torres Strait Island Police Support Officer	Queensland Police	Government (State)
Account Manager	SeaSwift	Business and the business community
	SkyTrans	Business and the business community

Appendix 4: Stakeholder Register

Position	Business/Organisation	Category
Head of Campus	Tagai State College	Community Provider
CEO	Torres Strait Islands Regional Council	Local Council
Strategic Sourcing Manager	Torres Strait Islands Regional Council	Local Council
Mayor	Torres Strait Islands Regional Council	Local Council
Manager Engineering Operations	Torres Strait Islands Regional Council	Local Council
Director Engineering and Infrastructure	Torres Strait Islands Regional Council	Local Council
Divisional Manager (Masig)	Torres Strait Islands Regional Council	Local Council
Councillor	Torres Strait Islands Regional Council	Local Council
Acting Executive Manager Engineering Services	Torres Strait Islands Regional Council	Local Council
Senior Project Engineer	Torres Strait Islands Regional Council	Local Council
	Torres Strait Islands Regional Council	Local Council
Engineer Water and Wastewater Compliance	Torres Strait Islands Regional Council	Local Council
Multi Skilled Administration Officer	Torres Strait Islands Regional Council	Local Council
Head of Corporate Affairs and Engagement	Torres Strait Islands Regional Council	Local Council
Director Governance and Planning	Torres Strait Islands Regional Council	Local Council
Campaign and Events Coordinator	Torres Strait Islands Regional Council	Local Council
	Torres Strait Islands Regional Council – Masig Community Tip	Local Council
Board Member (Masig)	Torres Strait Regional Authority	Local Council
Torres Strait Community Tourism Coordinator	Tourism Tropical North Queensland	Business and the business community
	Tourism Tropical North Queensland	Business and the business community