Magnetic Island

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 as the traditional custodians of the land. This report also acknowledges that their customs and traditions have nurtured and managed the land for centuries.

The project team would like to thank all contributors and collaborators who have provided invaluable assistance throughout this project. Special thanks goes to the Townsville City Council (TCC) Councillors and staff, Magnetic Island Community Development Association (MICDA), Magnetic Island Residents and Ratepayers Association (MIRRA), Magnetic Island Nature Care Association (MINCA), Tourism Magnetic Island (TMI), Zero Waste Magnetic Island and Energy Queensland 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 and the Department of Aboriginal and Torres Strait Partnerships for their ongoing input and support to deliver the project outcomes.

Finally, thank you to all the members of the Magnetic Island community, who welcomed us into their community and took the time to discuss and connect with us. We are extremely grateful and touched by the community's trust and openness with the whole team.

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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 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 Magnetic 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: Discounted Options:
Other options put forward by the community and stakeholders that were assessed, but ultimately not determined to constitute a viable project option or option recommendation.

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 Magnetic 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.

Technical Appendix 3: Project Survey Results
As a separate document to the Final Report, this appendix consolidates the responses from the Magnetic Island project survey.

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Executive Summary

This pilot project was supported by the Queensland Government, which made a $1.73 million election commitment in 2017 to assist Great Barrier Reef islands transition to a low or zero carbon future and become more resilient to changes in climate. The Queensland Government aims to assist these communities to take advantage of new technologies, innovations and best practices which not only reduce greenhouse gas emissions but can also provide additional benefits such as increased resilience, reduced energy costs for the community and increased self-sufficiency. This project focused on five key areas at a whole of community level; energy (generation and efficiency), water (supply and treatment), waste, transport (inter and intra-island), and resilience to the effects of climate change.

Through this program of work, 18 final project options to decarbonise have been developed. These were guided by the Magnetic Island community and key stakeholders, in order to achieve outcomes which are appropriate, pertinent, as well as carried forth by the community and other key stakeholders.

These final project options stem from a comprehensive consultation process via a Stakeholder Engagement Plan, over four project phases, through which the community and key stakeholders have provided substantial and maintained input. The project phases included an on-island sustainability assessment (phase 1) which resulted in a long list of decarbonisation options presented to the community and key stakeholders (phase 2). These options were then narrowed down through a multi-criteria assessment and presented back to community for input before being developed into the final project options (phase 3). The resulting final project options represent the community and key stakeholder priorities, needs and future vision, which were handed over in the final phase. More information can be found regarding the stakeholder engagement process by viewing the **Technical Appendix 1: Sustainability Assessment and Risk Assessment**.

Executive Summary

The final project options developed through this program of work include expected upfront and ongoing costs and environmental, economic and social benefits. These will help stakeholders and communities seek funding opportunities. If all final project options are implemented, they will provide community benefits, including a reduction in energy use providing a 22,130 tCO_2-e reduction in emissions, resilience building, opportunities for sustainable economic and community development including an estimated $2.87million annual savings, as well as an estimated 11.5 full time equivalent (FTE) jobs (Figure 1).

The largest challenge on Magnetic Island is a heavy reliance on the mainland to supply essential goods and services, such as electricity, water, waste removal and food supplies. There is a strong sentiment from the community to maintain a sustainable image of the island and they are supportive of projects that work towards promoting and protecting the natural environment. Energy cables that provide electricity to the island are nearing end of life which presents opportunities for decarbonisation as Ergon are interested in alternative solutions to replacement.

The main barriers for implementation of projects on the island reported during consultation, are funding avenues and the lack of useable space, as the majority of the island is designated National Park.

Finally, sustainability and resilience are inherent to the community on Magnetic Island, which are intimately linked to the previous work done on the island, such as the Solar Cities Project.

This program of work has sought to deeply engage and connect with the Magnetic Island community in order to collaboratively trace a path forward towards community decarbonisation as well as building resilience to climate change and promoting self-sufficiency.

Community and local stakeholder led initiatives are at the heart of this project, as it is recognised that communities are the best positioned to action sustainable and impactful change.

The final project options are summarised on the following page.

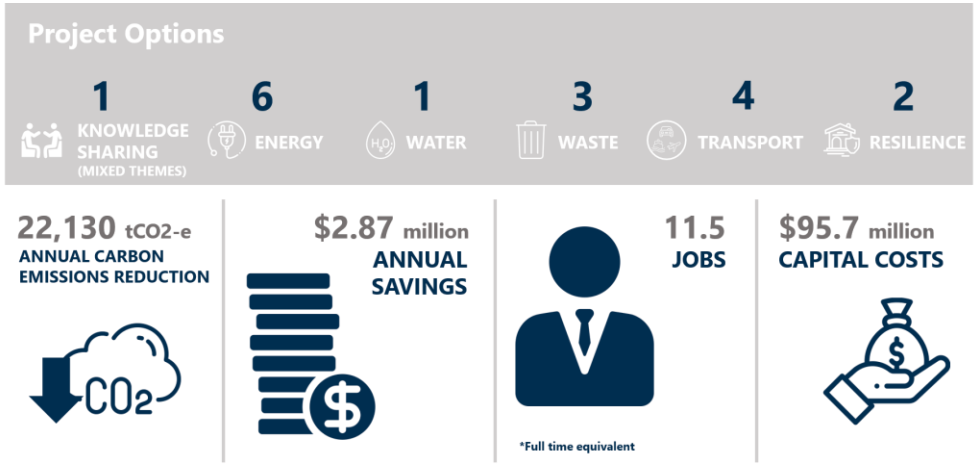


Figure 1: Final Project Options Estimates*

*Figure totals for carbon reductions, annual savings, jobs and capital costs have been calculated by summing the maximum figure possible for each project option aspect. Note that 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 project option. Annual savings do not consider the replacement of undersea cables.

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

	Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
	**1. Electric Bicycle Rental Service** Solar powered – electric bicycle rental scheme for the community of Magnetic Island to support active travel	0 - 6	800,000	2.5	0.5 - 1	• There is the potential to partner with Ergon Energy to integrate the charging infrastructure (both solar powered and grid backup depending on the scale of the scheme) required into the Magnetic Island Network. The location of charging hubs will be critical to the success of the scheme, and planning will require Ergon's input.
	**2. Low Emission On-Island Shuttlebus** On-island shuttle bus for public transport, powered either as an electric vehicle (and associated charging infrastructure) or by alternative low emission fuels.	14	200,000	2	0.5	• Climate Solutions Fund – Emissions Reduction Fund • Clean Energy Finance Corp - Reef Funding Program • Australian Renewable Energy Agency – potential funding through exploration of innovative EV charging infrastructure • Ergon – potential funding and becoming partner on project due to EV charging infrastructure
	**3. Establishment of a Native Plant Nursery** A nursery and associated infrastructure to support establishment of a new Indigenous owned business to supply native plants to the Magnetic Island community.	1 – 10	300,000	1 - 3	1 - 3	• Advance Queensland Deadly Deals fund • Australian Government's Indigenous Procurement Policy • Australian Government's Indigenous Entrepreneurs Fund • Australian Government's Community Development Program Business Incubator Pilot • QLD Business Growth Fund Program • Indigenous Business Sector Strategy - pilot Indigenous Entrepreneurs Capital Scheme • Relevant concessions for growers: QLD Department of Environment and Science Fee Concession for Protected Plant Growing Licence
	**4. Path Networks to Support Active Transport** Establish appropriate path network infrastructure and associated facilities to promote active transport on Magnetic Island.	12	5,000,000 – 10,000,000	N/A	1 – 2	• Infra+, ATIP under the Cycle Network Local Government Grants (CNLGG) program, Department of Transport and Main Roads on identified principal routes. • Funding through the Queensland Action Plan for Walking, Department of Transport and Main Roads • Queensland Health (e.g. Healthier, Happier) and Department of Housing and Public Works (e.g. Active Community Infrastructure Initiative).

Table 1: Final Project Options for Magnetic Island

Executive Summary

	Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
	**5. Sustainability and Environmental Education** This project seeks to engage the local community through community led sustainability and environmental knowledge sharing and education	N/A	200,000 – 300,000	N/A	1 - 3	• Round 3 - Community Sustainability Actions Grants1 • Social reinvestment2 • 1000 Jobs Package (Tranche Two)3 • Community Led Grants4 • The Container Refund Scheme Small Scale Infrastructure Grants Program (Queensland Government.) provides up to $10,000 in infrastructure and equipment to set up collection points for the newly introduced container deposit scheme
	**6. Energy Efficiency Retrofits** Improving energy efficiency in residential and commercial buildings through passive cooling measures such as: improving air flow, insulation, glazing, heat reflective paint, gutter guards and other energy saving opportunities	400 – 800 (households) 450 – 900 (commercial)	1,000,000 – 1,500,000	2 - 4	1 - 2	• Discussions with Ergon Energy confirmed that they are supportive of opportunities to reduce peak energy demand on the island. Ergon also have audit capability which could be employed for the project.
	**7. Green Hydrogen Transport Demonstration Project** A feasibility study for the development of a green hydrogen generation and refueling demonstration scheme	TBD by the study*	150,000 – 200,000 (for the study)	TBD by the study*	0.5 (study)	• There are potential funding opportunities through ARENA, Queensland Hydrogen Industry Development Fund, Clean Energy Finance Corporation.
	**8. Aquaculture Production Feasibility Study** This project will develop a feasibility study to assess the potential for on island aquaculture production using local species.	0	80,000 (feasibility study) TBD by the study (farm)*	TBD by the study*	0.5	• Round 3 - Community Sustainability Actions Grants, Queensland Department of Environment and Science • Drought Communities Programme – Extension, Department of Infrastructure, Transport, Regional Development and Communications • Community Led Grants, Department of the Prime Minister and Cabinet

*To be determined (TBD) by the study indicates that a feasibility study is needed for this project option in order to ascertain the figure.

Executive Summary

Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
 **9. Waste Transfer Station Installation of Solar PV** The installation of solar panels at the existing waste transfer station with possible future battery integration, reducing dependence on grid power and cutting emissions.	3.2	5,100	1 – 2 days	1 month	• 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
 **10. Tourism Master Plan** This project seeks to develop a Tourism Master Plan to provide a sustainability accreditation pathway for Magnetic Island.	TBD during accreditation^	65,000 plus certification costs to be determined	N/A	1 – 3	• Round 3 - Community Sustainability Actions Grants, Queensland Department of Environment and Science • Community Led Grants, Department of the Prime Minister and Cabinet • Attracting Tourism Fund, Department of Innovation and Tourism Industry Development • Townsville City Council may also consider the possibility of providing support as part of their overall certification budget
 **11. Energy Demand Management Incentive Scheme** Energy efficient appliances and tools to enable residents and businesses to actively monitor and manage their energy use.	0 - 740	20,000 – 1,500,000	N/A	1	• 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 • Ergon Demand Management Plan 2021
 **12. Solar Hot Water Systems** Upgrade of residential electric hot water systems to solar hot water systems, providing decarbonisation benefits and power cost reductions to residents.	1,200 (for 1,000 residences)	4,500 per household	N/A	1 - 2	• Department of Housing and Public Works funding to subsidise purchase and maintenance of SHW systems, have similar arrangement on nearby islands, however different demographic of residencies of each island • Small-scale technology certificates (STC) for SHW systems through Small-scale Renewable Energy Scheme (SRES) – 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

Executive Summary

	Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
	**13. Organic Waste Recycling Feasibility Study** Feasibility study to undertake collection and composting of organic waste on the island to reduce transport and landfill emissions and provide a product for soil conditioning on the island.	TBD by the study*	100,000 – 200,000	TBD by the study*	0.5	• Resource recovery industry development program • Business grants
	**14. Solar PV Rooftop Systems** Increasing the amount of managed solar PV installed on rooftops with potential battery integration, reducing dependence on grid power and emissions, while providing cost benefits to residents.	1.5 (per residence)	5,100 per 3kW system	1 - 2 days per installation	1 - 2	• Small-scale technology certificates through the Small-scale Renewable Energy Scheme (SRES) – from the Clean Energy Regulator • Reef Funding Program: funding available for emission reduction projects in Great Barrier Reef catchment, Clean Energy Finance Corporation • Regional and Remote Communities Reliability Fund • Climate Solutions Fund – Emissions Reduction Fund • Energy Efficient Communities Program, Community Energy Efficiency and Solar Grants 2020, Department of Industry, Science, Energy and Resources • Interest-free loans offered for solar and storage by Queensland Government (not currently running)
	**15. Glass Recycling Feasibility Study** Feasibility study to investigate initiatives to increase the volume of glass recycled and reused on Magnetic Island.	TBD by the study*	5,000 – 30,000	TBD by the study*	0.25 - 0.5	• Small scale business loans • Resource recovery grants
	**16. Low Emission Marine Transport** Current technology and market assessment of alternative low emission technology and fuel solutions for ferry services between Townsville and Magnetic Island, potentially including electricity, hydrogen and biofuels.	813 – 2,700	50,000 – 100,000	TBD by the study*	TBD by the study*	• Climate Solutions Fund – Emissions Reduction Fund • Clean Energy Finance Program - Reef Funding Program • Australian Renewable Energy Agency – potential funding through exploration of innovative emission reduction measures • Ergon – potential partner on project due to EV charging infrastructure • Benchmarking against global funding schemes for ferries to be conducted in review.

*To be determined (TBD) by the study indicates that a feasibility study is needed for this project option in order to ascertain the figure.

Executive Summary

	Project Option	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
	17. Microgrid Feasibility Study A feasibility study for the development of a renewable energy microgrid on Magnetic Island, exploring a combination of renewable energy generation, energy storage, microgrid control systems and supplementary fossil fuel generation i.e. diesel generator.	0 – 13,000	200,000 – 300,000 (feasibility study) 20,000,000 – 70,000,000 (microgrid)	TBD by the study*	0.5 (study) 1 – 3 (microgrid)	• Reef Funding Program - funding available for emission reduction projects in Great Barrier Reef catchment area, Clean Energy Finance Corporation • Regional and Remote Communities Reliability Fund - Department of Industry, Science, Energy and Resources • Climate Solutions Fund – Emissions Reduction Fund • ARENA funding – project has similarities to previously supported King Island project
	18. Water Smart Demonstration Community This project proposes implementation of sustainable water management solutions, to reduce water use, improve amenity, cost of living and environmental outcomes. positioning the island as a Water Smart demonstration community.	2.7 – 13.7	500,000 – 2,000,000	N/A	1 – 3	• No specific funding opportunities have been identified. It is likely that this will need to be funded by TCC.

*To be determined (TBD) by the study indicates that a feasibility study is needed for this project option in order to ascertain the figure.

Project Phases

This section presents the project phases undertaken and the methodology behind each phase.

Project Phases and Engagement Framework

Phase 1
Sustainability Assessment

The first step of Phase 1 was **Preparation and Planning – Stakeholder Mapping**, whereby the project team identified the data required for the five themes of the project (Figure 2). Next, to commence the sustainability assessment, **Desktop Research** was undertaken on the history, culture, demographics, infrastructure, facilities and future development of Magnetic Island. To kickstart **Stakeholder Engagement**, the project team was introduced to local government contacts from the Townsville City Council (TCC) and other key on and off island contacts such as SeakLink, Ergon and community association leaders. The project team visited Magnetic Island on 29 to 31 August 2019 and undertook **Site Visits** and conducted an **online survey** with residents and businesses to collect quantitative and qualitative data. Of the 214 survey respondents (approximately 9% of the population), 186 were residents and the remaining 28 represented businesses.

The sustainability assessment data collection process was led by EarthCheck (supported by Regional Economic Solutions (RES) and Queensland Tourism Industry Council (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 23rd of September 2019. The first island visit was conducted on the 29th, 30th and 31st of August 2019.

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

Phase 2
Options Longlist

During phase 2, a long list of 70 decarbonisation options were identified under the key themes of energy, water, waste, transport and resilience to reduce carbon emissions and increase resilience for Magnetic Island (Figure 2). The list of options was narrowed down to 24 through a multi-criteria analysis and Gateway assessment developed by Arup, and on-island workshops with island residents, key stakeholders, TCC and Ergon. The shortlisting process can be found in Technical Appendix 2: Options Report for Magnetic Island.

Phase 2 was conducted from 2nd of September 2019 to 3rd of February 2020. The second island visit was conducted on the 31st (of October), 1st and 2nd of November 2019.

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

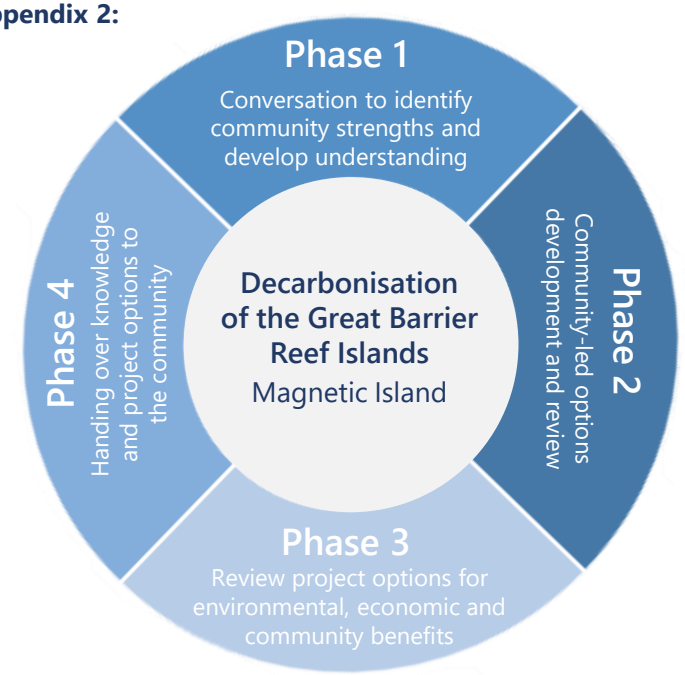


Figure 2: Project Phases

Phase 3
Project Options

The third phase took the top weighted options identified by the community and performed a multi-criteria analysis to establish the most appropriate **final project options** to be developed (Figure 2). Each final project option identifies potential carbon abatement, simple payback, cost savings, full time equivalent (FTE) jobs, opportunities, risks and identifies potential funding sources. Options that were highly weighted by the community but did not fit within the aims of the project, have been included as **recommendations** for future consideration.

Phase 3 was conducted from 3rd of February 2020 to 27th of April 2020. The third island visit was conducted on the 5th, 6th and 7th of March 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.

Phase 4
Handing over knowledge and findings back to the community

The fourth and final phase focused on handing the project knowledge and findings back to the community in a targeted and appropriate manner, aligned with the engagement framework (Figure 2). Appropriate and effective transference of knowledge was a key consideration throughout this project and is of particular importance at this point in order to ensure project success.

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

Community members and stakeholders were engaged in the final phase through conference calls and remote workshops with key stakeholders involved throughout the project.

This handover was conducted throughout December 2020.

Magnetic Island Background

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

Location

Magnetic Island, traditionally known as Yunbenun, is located north-east of Townsville in the Cumberland Islands group. Located just 8km north-east of Townsville, it is the seventh largest and fourth highest island in the Great Barrier Reef World Heritage Area, with a total land area of 51km^2. Its highest point is the summit of Mount Cook at 497m. Magnetic Island hosts four small settlements at Horseshoe Bay, Arcadia, Nelly Bay and Picnic Bay. Magnetic Island's location and key infrastructure is presented in Figure 3.

Environment

Magnetic Island is the largest island in the Brigalow Belt bioregion which extends from the mid-Queensland coast to central-western New South Wales. Almost half of the island is protected under the Queensland Nature Conservation Act 1992, including the Magnetic Island National Park and two smaller areas designated as Conservation Parks.

It is likely that Magnetic Island represents the largest, most diverse assemblage of island flora in the dry tropics region of the Great Barrier Reef (GBR) and contributes to the processes of dispersal, colonization, and establishment of flora communities within the GBR World Heritage Area as a whole. The island is recognised for its terrestrial and marine ecological diversity which is valued by both the residents and tourists. Most of the island is covered by eucalypt and acacia woodlands with small areas of vine thicket occurring in sheltered gullies and on rock screen[1]. Characteristic of Magnetic Island are the hoop pines and native kapok. Marine environments include mangrove forests, salt marshes, fringing coral reefs and seagrasses. Endemic terrestrial species include skipper butterflies and the Sadlier's skink whereas some marine species include sea snakes, turtles, dugongs and dolphins. It is also home to northern Australia's largest habitat of wild koalas[1].

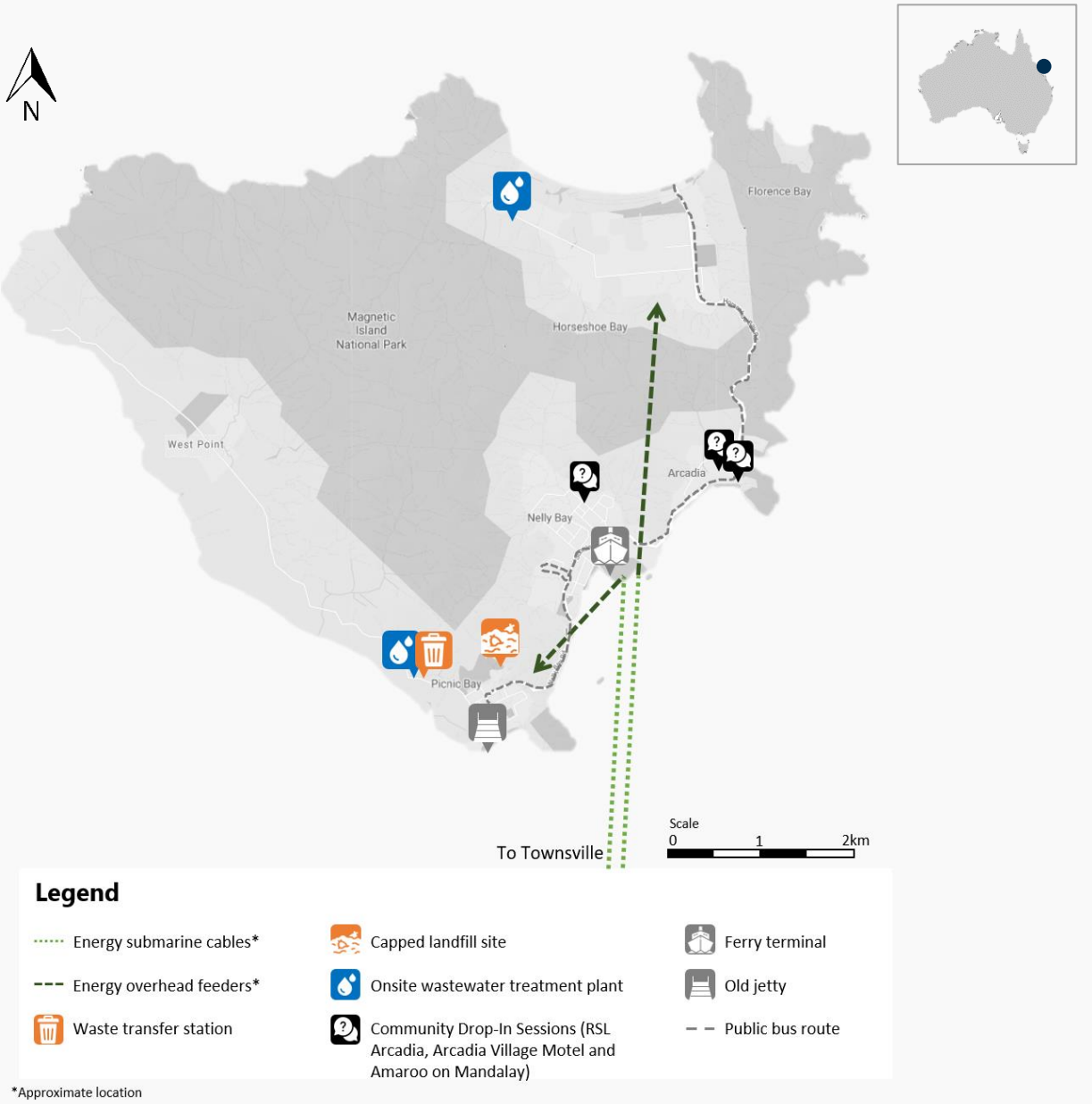


Figure 3: Magnetic Island Location and Key Infrastructure

Current Climate

Magnetic Island has a tropical and humid climate. Wet season is generally from December to April and the dry season runs from May to November. It receives less rainfall than the Wet Tropics to the north and the Whitsunday Islands to the south, which makes the island quite dry with a dense shrub type vegetation. Magnetic Island is located within the dry tropics of Queensland, with humidity present almost all year round and has a dry season with minimal rain and days with long hours of sun. Average temperatures range between 25°C and 32°C throughout the year with approximately 1136mm of rainfall each year[2].

The Townsville region is prone to heavy precipitation events and cyclones which cause overland flow, flash flooding and damaging winds. Recent events impacting Magnetic Island over the last 10 years include storm surges, floods, bushfires and cyclones.

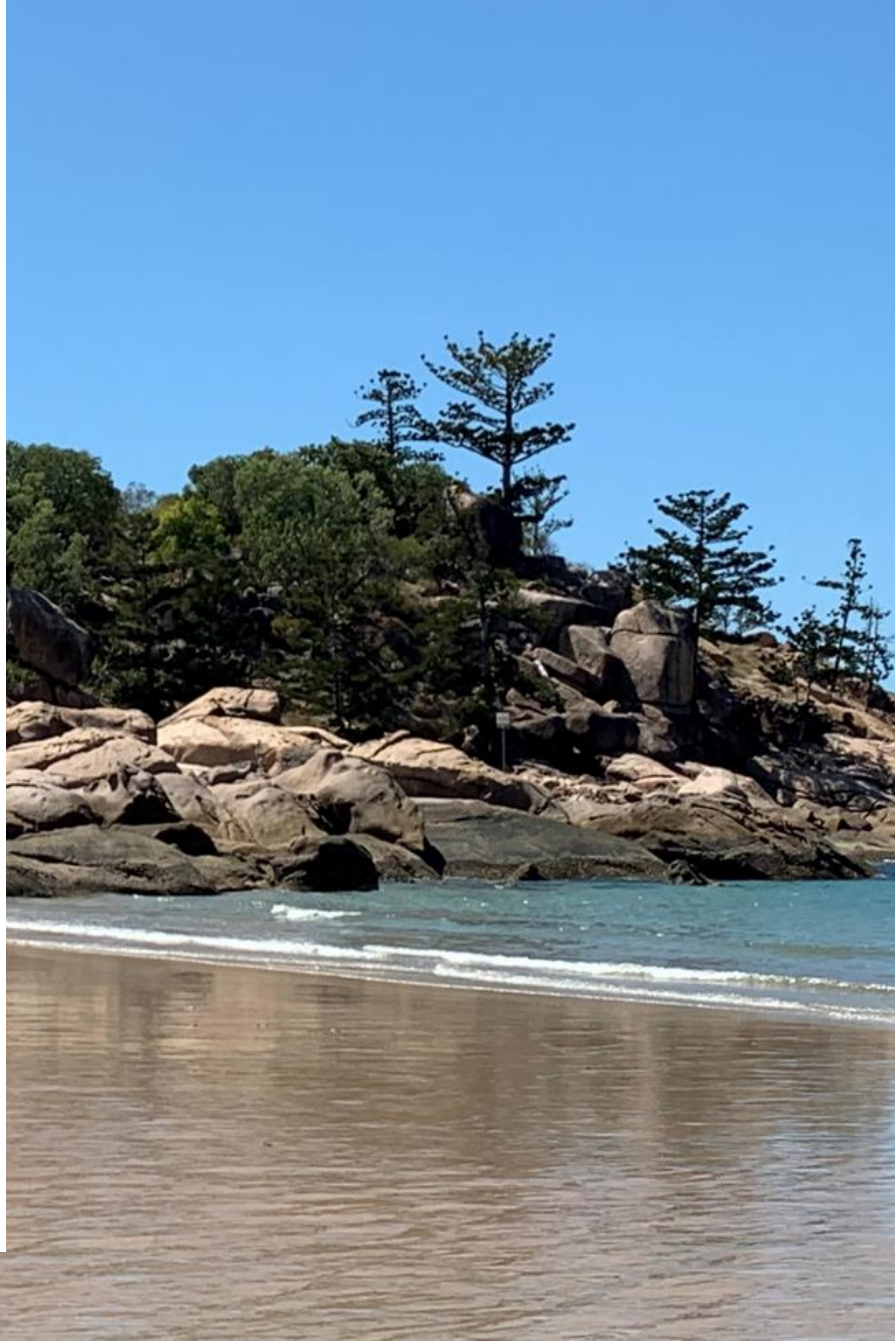
Climate Change Projections

The Queensland Future Climates Dashboard shows climate change projections for the Townsville City region for 2030 and 2050 and is based on long-term regional changes over the reference period of 1986-2005[3].

Climate change projections indicate an increase in mean temperature by 0.82˚C by 2030 and 1.55˚C by 2050. There will also be an increase in the number of hot days by 21 days per annum by 2050. Relevant to temperature increases, heatwaves are also predicted to occur 10% more frequently by 2030 and 33% more frequently by 2050, and last for longer periods of time. Increasing temperatures may lead to an increase in electricity consumption and further strain on an already constrained energy network as a result of cooling homes and businesses.

Precipitation patterns are projected to change with less rain projected on average, particularly during the traditional wet season. Less rainfall may require more frequent drawing from the water network for irrigation and tighter water restrictions to ensure water security. Drought events are projected to increase moderately both in frequency and duration which may put further strain on the water supply. Subsequently, the frequency and duration of floods is projected to moderately decrease by 2050.

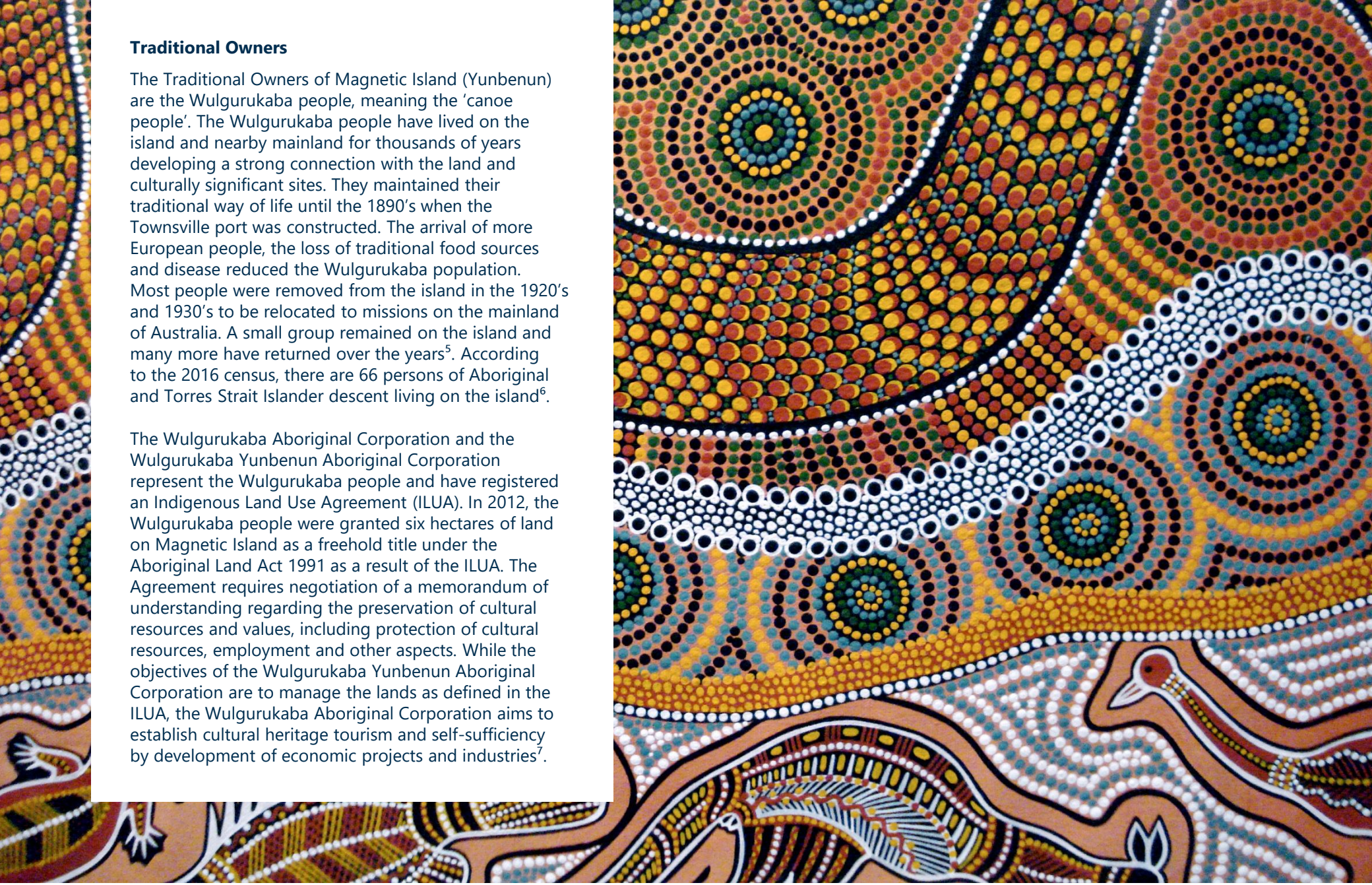
Relevant to precipitation patterns, sea level rise projections for 2100 extend on the current day highest tide which is especially prominent around Cockle Bay Reef along the west coast of the island. It is estimated there will be a median sea level rise of 0.74 metres by 2100[4].

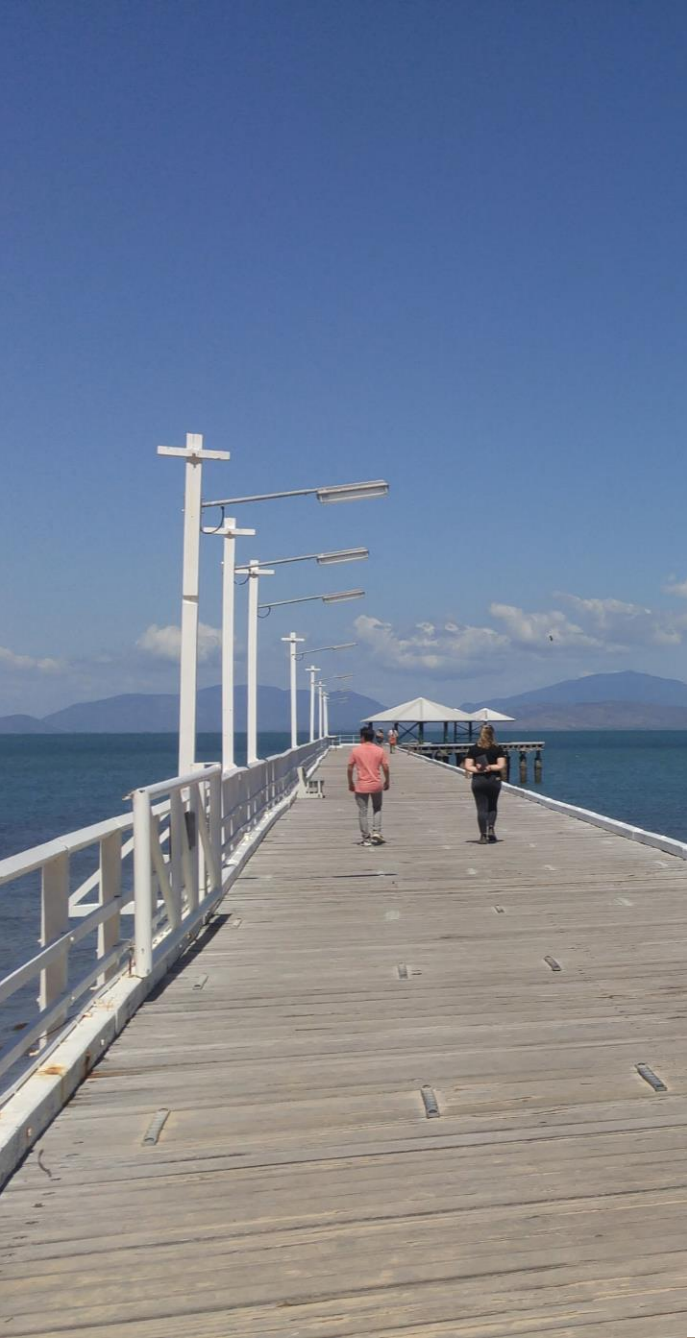


Traditional Owners

The Traditional Owners of Magnetic Island (Yunbenun) are the Wulgurukaba people, meaning the 'canoe people'. The Wulgurukaba people have lived on the island and nearby mainland for thousands of years developing a strong connection with the land and culturally significant sites. They maintained their traditional way of life until the 1890's when the Townsville port was constructed. The arrival of more European people, the loss of traditional food sources and disease reduced the Wulgurukaba population. Most people were removed from the island in the 1920's and 1930's to be relocated to missions on the mainland of Australia. A small group remained on the island and many more have returned over the years[5]. According to the 2016 census, there are 66 persons of Aboriginal and Torres Strait Islander descent living on the island[6].

The Wulgurukaba Aboriginal Corporation and the Wulgurukaba Yunbenun Aboriginal Corporation represent the Wulgurukaba people and have registered an Indigenous Land Use Agreement (ILUA). In 2012, the Wulgurukaba people were granted six hectares of land on Magnetic Island as a freehold title under the Aboriginal Land Act 1991 as a result of the ILUA. The Agreement requires negotiation of a memorandum of understanding regarding the preservation of cultural resources and values, including protection of cultural resources, employment and other aspects. While the objectives of the Wulgurukaba Yunbenun Aboriginal Corporation are to manage the lands as defined in the ILUA, the Wulgurukaba Aboriginal Corporation aims to establish cultural heritage tourism and self-sufficiency by development of economic projects and industries[7].





Governance

As well as Traditional Owners, local, state and federal governments have vested interest in the management of the island and the surrounding area. Magnetic Island is part of the Townsville City Council (TCC) area and is considered one of its suburbs with a population of 2,335 people[6]. Community consultation highlighted a disconnect between governance from the mainland and input from the Magnetic Island community.

There are many active and engaged community groups on the island including the Magnetic Island Community Development Association (MICDA), Magnetic Island Nature Care Association (MINCA), Magnetic Island Residents and Rate Payers Association (MIRRA), North Queensland Conservation Council, Tourism Magnetic Island (TMI), Returned Services League (RSL) and Zero Waste Magnetic Island. Due to the large number of community groups on Magnetic Island, competing interests and communications across the entire community were identified as an issue during consultation, leading to a disconnect with working together towards a unified vision. This project successfully initiated discussions and collaboration between the community groups, ensuring that each group have contributed to the project outcomes.

Tourism

Tourism can lead to environmental and social issues such as beach damage, littering and congestion, and also puts the community at risk of overtourism. According to Tourism Research Australia, Magnetic Island received approximately 142,800 visitors in 2018 which were evenly split between day visitors, domestic travelers and international visitors. Magnetic Island is considered as a unique selling point for tourism in the Townsville region and it is key to inducing tourist visitation to the area[8]. With the tourism industry continuing to grow, it is important to plan for growth and development to meet consumer demand, manage negative impacts and ensure benefits are distributed evenly. Therefore, tourism management is important and there are limits to growth of tourism on the island, which is not currently understood. Tourism can bring employment opportunities for local communities.

Community Sentiment

Energy efficiency and water conservation are well understood by community due to a history of Government-led programs on the island.

The community is motivated to achieve further resource reductions such as energy, water and waste and expressed interest in becoming more self-sufficient in energy production and access to potable water. Energy cables that provide electricity to the island are nearing end of life which presents opportunities for decarbonisation as Ergon are interested in alternative solutions to replacement.

Socio-Economic Profile

There is a greater number of retirees and seniors on Magnetic Island than the regional Queensland average, with census data showing an increase in this age group from 2011 to 2016. People aged 65 years and over make up 25% of the population on the island[6]. The majority of the community, including retirees, are dedicated to environmental conservation as the island supports many diverse habitat features. Aside from conservation efforts, the main employment on the island is in accommodation, food services and retail[6]. As of 2015, there are 211 businesses operating on Magnetic Island including accommodation, restaurants, various shops, transport operators and a golf course[9].

Currently, there are no assisted living facilities or palliative care services on the island for retirees and seniors, meaning residents must relocate to the mainland to access these facilities. However, there are home care services for elderly provided by Magnetic Island Community Care (MICC)[10].

The island does not have its own hospital and the nearest is located in Townsville. In the case of emergency, helicopter transport can be used, with the helipad located in Nelly Bay. Three medical centres and an ambulance operate on Magnetic Island running a 24-hour service. This presents difficulties during peak times as minimal staff are available for 24-hour servicing. There are also no radiology options on the island, meaning residents must travel to Townsville for this service. A report identified health service improvement as a major priority for the community despite the professionalism and commitment of the current health workers[11]. Other emergency services include the Rural Fire Services (RFS) and State Emergency Service (SES).

Transport to and from Magnetic Island is predominantly by passenger ferry which is operated by SeaLink, running up to 18 ferry services a day. Each ferry trip takes approximately 20 minutes departing from Townsville[12]. A vehicle barge operated by Magnetic Island Ferries also runs frequently between Magnetic Island and Townsville, taking approximately 45 minutes for the transport of freight and vehicles[13]. The barge service operates Monday to Saturday and residents are eligible for a discount for freight. Once on the island, transport options available include cars, tour buses, bicycle hire and a public bus operated by Translink. The community were interested in alternative transport options to reduce car congestion and remove large public transport buses due to safety concerns.

The Magnetic Island community are passionate and recognise the need for continued environmental sustainability on the island. Community groups are active in the development and preservation of Magnetic Island ensuring that the community dynamic is maintained. The largest challenge on Magnetic Island is a heavy reliance on the mainland to supply essential goods and services, such as electricity, water, waste removal and food supplies.

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

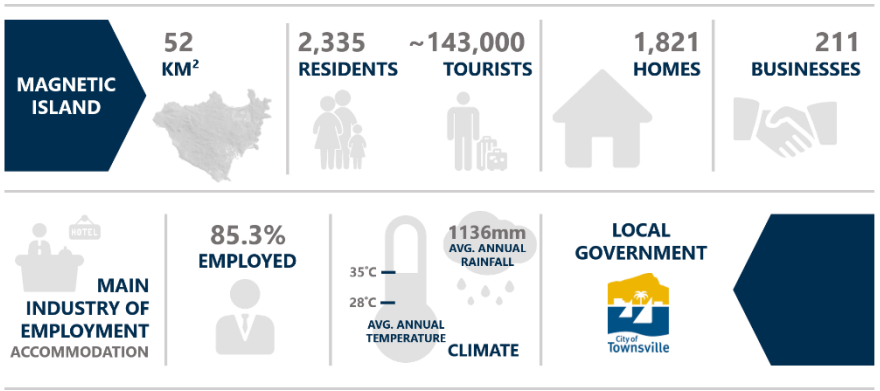


Figure 4: Magnetic Island Community and Business Profile

Sustainability Assessment Report Findings: Phase 1

The Sustainability Assessment conducted, studied the Magnetic Island community and Island operations 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 island, conduct an island-wide risk assessment, as well as lay a solid foundation for the development of the project options.

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 Magnetic Island were calculated at **19,643 tCO_2-e per annum** or 5.5 tCO_2-e per capita* (for an average year)[14].

Magnetic Island sources electricity from the mainland grid operated by Ergon Energy which equates to 76% of the island's total emissions (Figure 5). Marine transport makes up 14% of emissions, leaving 10% for the other emissions categories. These are petrol motor vehicles (3%), waste sent to landfill (3%), diesel motor vehicles (2%) and onsite wastewater treatment (1%). Buses (including public transport and the bus tour company), and diesel generators make up the remainder of emissions.

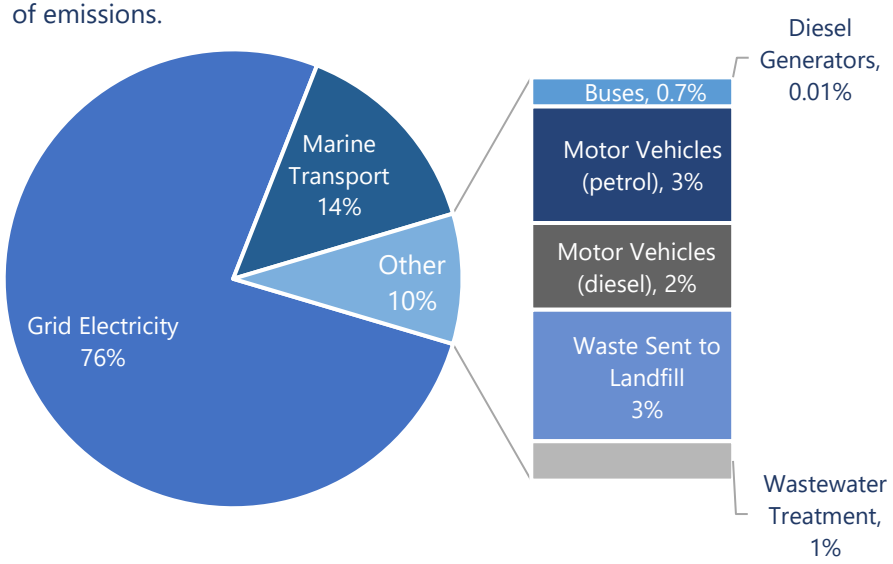


Figure 5: Carbon emissions profile of Magnetic Island

*Per capita is defined as all residents, overnight guests and day visitors to the island.

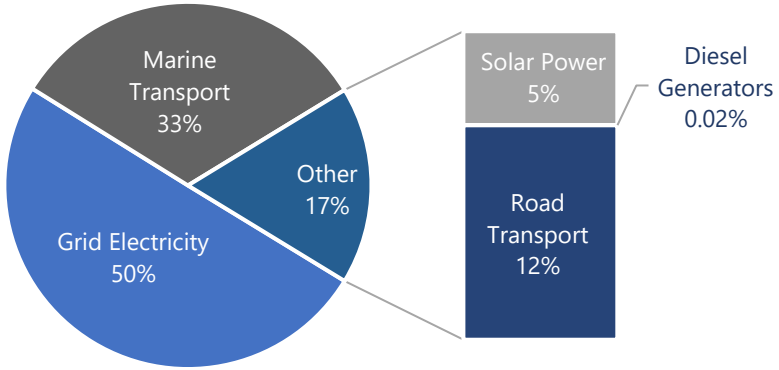
Island Energy Profile

Based on the information gathered during the sustainability assessment, the average annual energy profile for Magnetic Island was calculated at **125,237GJ per annum** or 35.32GJ per capita (for an average year)[14]. The energy profile represents the sum of all energy consumed on the island for residents, businesses and visitors, as well as transport to and from the island (Figure 6).

Half of the island's energy consumption (50%) is associated with grid electricity usage. The majority of electricity used, is sourced from the mainland grid which is operated by Ergon Energy.

Energy consumption through road transport, solar generation and electricity from diesel generators make up the remaining 50%. Marine transport includes the passenger ferry and vehicle barge that service Magnetic Island departing from Townsville (33% of energy profile). Road transport includes an on-island public transport service, a bus tour company and personal vehicles (12% of energy profile). Approximately 30% of residences on Magnetic Island have solar panels generating electricity which is fed into the grid (5% of energy profile). Finally, some residents reported having diesel generators which are used as a back-up power supply during emergency situations or severe weather events (0.02% of energy profile).

Figure 6: Energy profile of Magnetic Island



Energy

Energy issues around reduction and efficiency are well understood by Magnetic Island residents due to the long history of energy efficiency projects on-island. There is a strong solar energy culture on the island as well as a high concentration of solar infrastructure throughout the community due to the successful Solar City Program in 2007.

Magnetic Island is supplied with electricity by Ergon Energy via two submarine cables extending from the mainland to Nelly Bay. One of the cables is nearing its end of life and is marked for an upgrade. Upgrades will need to consider potential population growth and peak season loads for tourism.

Annual electricity consumption for Magnetic Island is **62,798GJ** based on the average of previous financial years of data[14] which corresponds to approximately 0.03% of Queensland's total electricity consumption.

In terms of residential energy consumption, the average household on Magnetic Island uses less energy (16.21GJ per year)[14] than the average Queensland household (23.91GJ per year) (Figure 7)[15]. The average household on Magnetic Island is also smaller with 1.3 people per household compared to the state-wide average sitting at 2.6 persons per household[6].

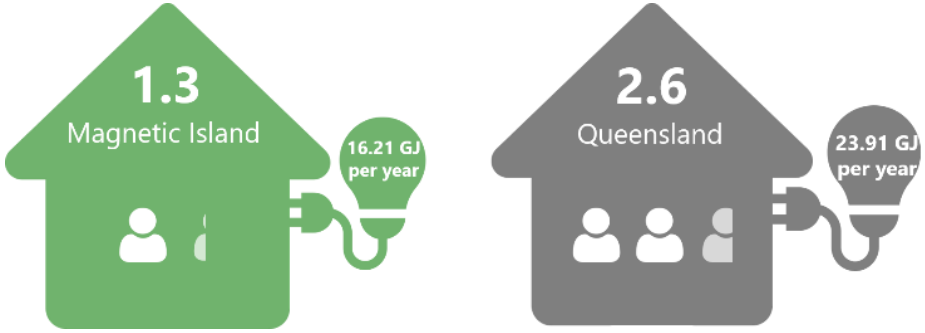


Figure 7: Annual electricity consumption for an average Magnetic Island household compared with an average Queensland household

What was said:

Community would prefer to be more self-reliant regarding energy supply, for example, increasing installation of solar battery arrays at a household level, or having community micro-grids.

Magnetic Island participated in the Australian Government's Solar Cities program from 2007 to 2012. The program's success and corresponding energy savings resulted in deferring the need for replacing a near end-of-life cable. Solar Cities found the maximum available roof space for solar panels at the time of the project was 33% due to shade cover, structural integrity due to older roof ages, asbestos roofs and rental properties where the owner could not be met[16].

Energy

Fluctuation of energy demand peaks during January, February and March, potentially due to increased air conditioning needs during the hotter months (Figure 8)[17]. Demand peaks closely relate to holiday periods due to a surge in visitors. The average daily energy demand is 982.98kW[17].

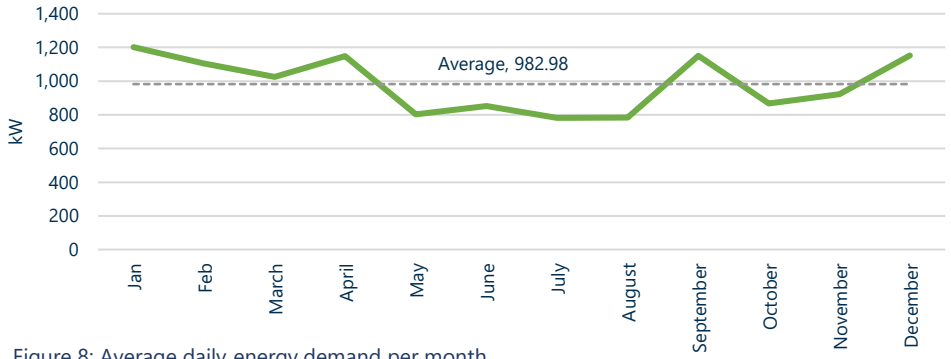


Figure 8: Average daily energy demand per month

Finally, non-residential consumption makes up a higher proportion of the energy consumed on-island (Figure 9)[17]. Non-residential energy consumption includes council offices, buildings and infrastructure (water treatment plants, transfer station, etc.), restaurants, hotels, schools and community organisations.

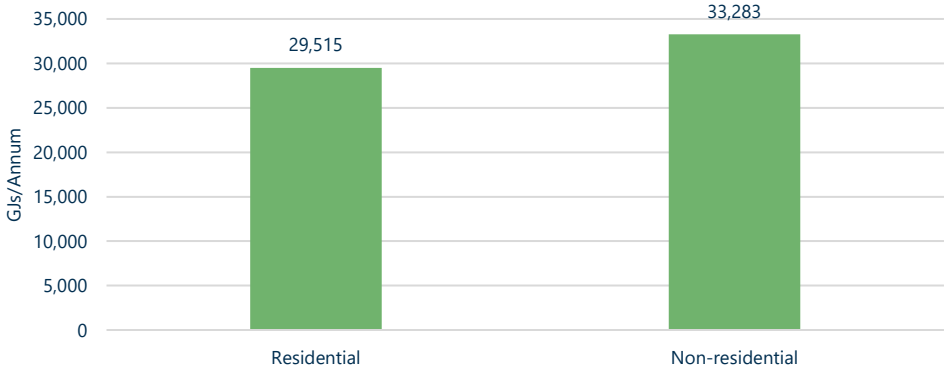


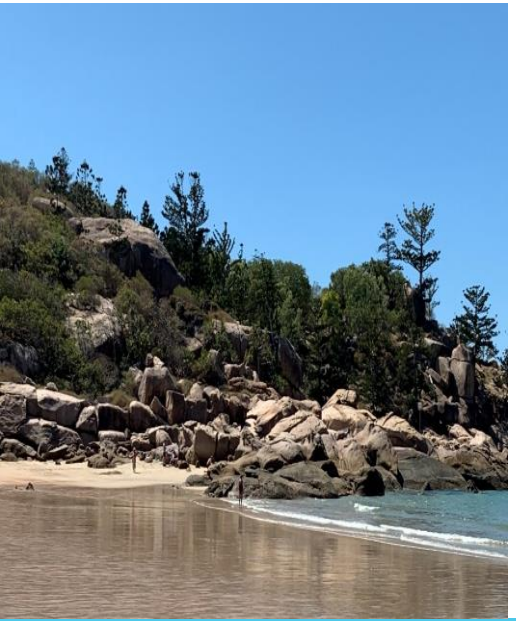
Figure 9: Electricity consumption for residential buildings compared with non-residential buildings

Key findings

- **Energy generation:** Energy is supplied from the mainland grid via two submarine cables (one which is approaching end of life) managed by Ergon Energy. Ergon are interested in investigating alternative solutions to the upgrade or the delay of the submarine cable.
- **Solar profile:** Approximately 33% of residences already have solar PV panels installed and feeding into the grid. The Solar Cities program from 2007 to 2012 found this to be the maximum available roof space due to shade cover, structural integrity due to older roof ages, asbestos roofs and rental properties where the owner could not be reaches; a more recent study has not bee conducted. Ground mounted solar is constrained due to hilly terrain and the majority of the island is designated as National Park.
- **Energy efficient practices:** Energy efficiency and energy reduction is well understood by the Magnetic Island community due to the long history of energy efficiency projects, including Solar Cities, spanning from 2007 to 2012. The survey conducted as part of this project during Phase 1 – Sustainability Assessment, showed that 96% of respondents considered efficiency ratings when making an appliance purchase.
- **Building types and design:** Many new buildings were observed to follow efficiency design principles, such as elevation, orientation, light roof colour and large awnings. Renting and affordability were seen as the largest barriers for improving energy efficiency in rentals on Magnetic Island as efficiency improvements need to be approved by the leasor (approximately 36% of residences are rented on Magnetic Island).

Water

Magnetic Island is dependent on Townsville for its water supply. Potable water is supplied through a high-density polyethylene submarine pipeline that extends for 5.6km from Pallarenda on the mainland to Bolger Bay reservoir[18]. From the reservoir, water is distributed to other reservoirs on the island and finally delivered to the island's properties. Rainwater tanks are installed at some residences. Tanks are not widespread as many did not see the need for one as they are not cost effective on-island; and the island has a predominantly dry tropical climate, rather than wet, hence many residents do not see the need.



Total annual water consumption for Magnetic Island (including residential and non-residential) is **833,360kL** based on the average of 2017/18 FY and 2018/19 FY data provided by TCC (Figure 10). Approximately 238kL of water per year per household equates to 516,012kL of water for residential use. The remainder of water consumption is for non-residential purposes.
The average annual water consumption per year for commercial purposes represents 79,765kL based on the average usage of 378kL per commercial property per year. Other usage represents 237,582kL per year and can be attributed to operations such as council buildings, public spaces and any other non-residential water usage[14].

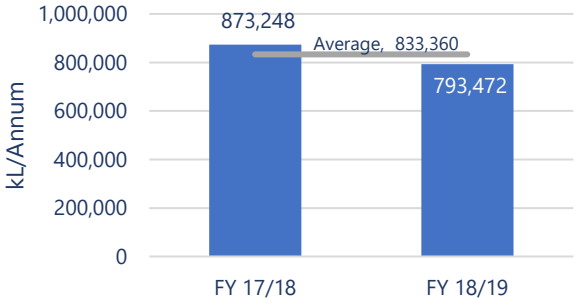


Figure 10: Water consumption for financial years 2017/18 and 2018/19

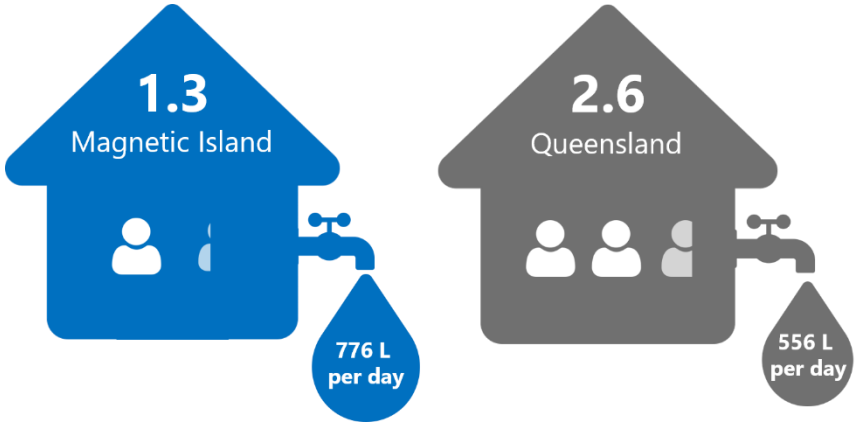


Figure 11: Annual water consumption for an average Magnetic Island household compared with an average Queensland household

What was said:

Community expressed an interest in becoming more self-sufficient in access to potable water and less reliant on mainland supply, however they were unsure how to progress this at a household level.

Magnetic Island households use approximately 776L of potable water per day based on the water consumption data provided by TCC, compared with the Queensland average of 556L per day (Figure 11)[19]. On a per resident basis, Magnetic Islanders use approximately 605L per day (Figure 12), compared to the average Queenslander using only 214L[19]. These numbers reveal that the per capita water consumption on Magnetic Island is almost three times higher than the state average.

Water efficiency is thus an issue on Magnetic Island, which, similar to the Townsville region, is known for high water consumption. Throughout the region, water is used in great quantities to water lawns and gardens. In July 2019, TCC launched the Water Smart Package in collaboration with the Queensland Government, providing rebates to homeowners, renters and body corporates in order to invest in water-saving initiatives[20]. Tourism also contributes to higher water consumption.

Water

Wastewater is treated on the island at two distinct sewage treatment plants, located in Picnic Bay and Horseshoe Bay. Homes located in Arcadia Bay have individual septic systems, as the extreme topography of the island prohibits underground piping between the bays.

The wastewater treatment plant at Picnic Bay is currently running at full capacity for the population it is servicing and TCC has stated it is marked for an upgrade. The bio-solids from both treatment plants are currently barged off the island and disposed of at a council landfill on the mainland.

Maximum daily water demand is **2.3ML** per day

=

Average **605L per resident** per day

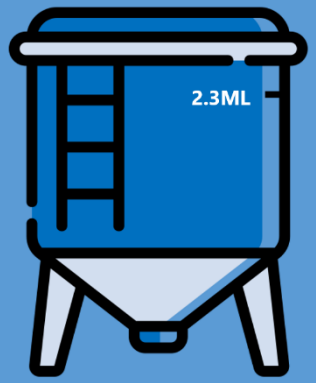


Figure 12: Maximum daily water demand and average daily per resident water demand for Magnetic Island

Key findings

- **Wastewater infrastructure and treatment:** There are wastewater treatment plants located in Picnic Bay and Horseshoe Bay, treating most of the island's effluent. Houses in the suburb of Arcadia are not connected to the wastewater treatment network and have individual septic systems instead. TCC is also looking for additional areas to discharge treated water for irrigation. The wastewater treatment plant at Picnic Bay is at capacity and TCC is looking to upgrade the plant. Some residents have rainwater tanks (18%), some residents have individual septic systems (46%).
- **Water consumption:** Potable water is supplied via an undersea pipeline from Townsville and distributed around the island through feeders. Townsville City Council installed 1,616 smart water meters in November 2020 to help reduce water consumption and cut ongoing costs. This covers almost all homes and businesses on the island[21].
- **Water quality:** There is no groundwater management in place and minimal use of rainwater tanks and bores as per the project survey results due to historical lack of consistent rains and limited water tables.
- **Water usage reduction:** As Magnetic Island uses three times more water on a per capita basis than Queensland averages, water saving measures are important for residents and tourists to understand and implement. This could potentially be linked to the tourism sector on the island. TCC has supplied water consumption monitoring equipment to homes to detect leaks in the Townsville Region on the mainland.

Waste

All waste collected on Magnetic Island is taken to the waste transfer station in Picnic Bay run by TCC, where it is loaded into skips, crushed and transported to the mainland. General waste and co-mingled recycling collections occur bi-weekly. Transport of waste off-island occurs three times a week via a barge to Townsville for landfill or processing. The old on-island landfill site at Picnic Bay was capped and is no longer in use.

Total waste generated on Magnetic Island in the 2018-2019 financial year was **6,243m³** consisting of green waste, recycling and landfill from residential, non-residential and industrial uses as provided by Townsville Water and Waste (Figure 13). Approximately 52% of this waste is recycled, reused and composted equaling a total of **3,296m³** waste diverted from landfill for 2018/19.

What was said:

Community is concerned that the general waste and comingled recycling is disposed of in the same bins once waste reaches the transfer station.

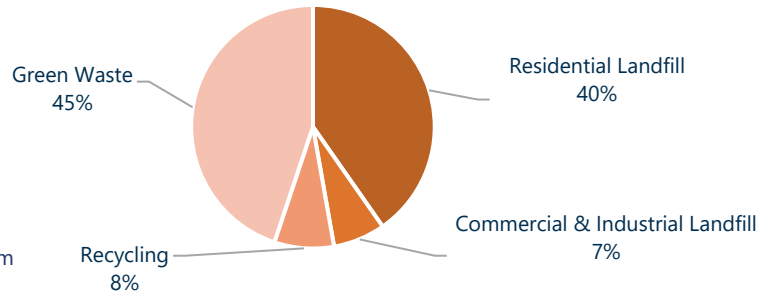


Figure 13: Breakdown of waste types disposed to landfill and sent for recycling from Magnetic Island

Residents can also dispose of white goods, gas bottles, furniture, air conditioning units, tyres, etc. at the transfer station. Fees for disposal are similar to that of other TCC waste stations on the mainland.

Co-mingled recycling is taken to the Materials Recovery Facility (MRF) in Townsville, where it is sorted and cleaned before being recycled. Landfilled waste is taken directly to a landfill site in Townsville.

Most residential waste is diverted from landfill based on the data provided by Townsville Water and Waste (Figure 14). TCC offer free curb-side collection annually for bigger, bulkier items. Residents can also dispose of green waste free of charge at the transfer facility, which is then made into a mulch to re-use on-island. Council has previously run a soil clinic to engage the community in discussion about how waste and wastewater can be utilised in a circular system.

The community group Zero Waste Magnetic Island (ZWMI) are responsible for the management of any funded Zero Waste projects and escalating any risks to the Magnetic Island Community Development Association, whilst also communicating the work and outcomes to island residents and other stakeholders. This includes Townsville City Council approving a trial of a small bio-regen unit for restaurants in Horseshoe Bay to use to reduce food waste. ZWMI have been identified as a key stakeholder group within the community for waste projects. The Townsville Region is also engaged in the Plastic Free Places initiative which is intended to be expanded to Magnetic Island.

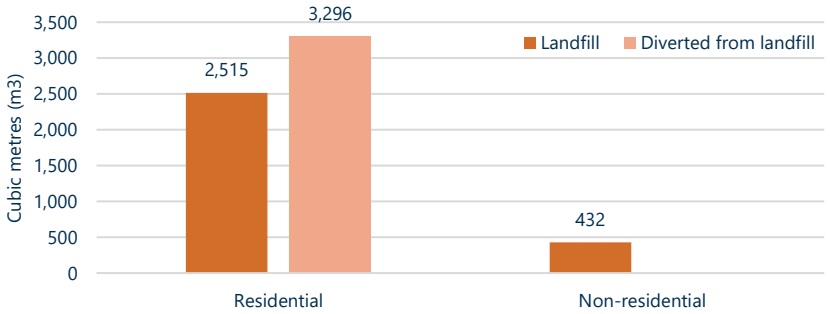


Figure 14: Breakdown of waste types disposed to landfill and diverting from landfill (including green waste) comparing residential and non-residential properties from Magnetic Island

Waste

There is confusion in the community around the use of the same rubbish removal truck for recycling and general waste. The truck is washed out between different waste pick-ups.

During community consultation, TCC reported a high rate (above 20%) of contamination of the recycling waste by disposing general waste in recycling bins at the household disposal level. Many residents reported suspicion and confusion around the recycling efforts on the island, with many believing that the recycling is mixed in with waste bound for landfill, hampering recycling efforts. This situation has highlighted the need for more effective communication and engagement around this subject. Residents are doing well to divert their green waste from landfill (45% of the total waste reported by Townsville Water and Waste).

Magnetic Island residents generate slightly less waste sent to landfill (1.5m^3 per resident per year) compared to Queenslanders (1.9m^3 per resident per year)[22] (Figure 15).

Figure 15: Residential waste disposed to landfill per resident* per year for Magnetic Island compared with the Queensland average

*Per resident is defined as all residents and does not include island visitors.

Key findings

- **Waste disposal:** General waste pickups are conducted weekly and co-mingled recycling pickups are conducted fortnightly by the council. Waste and comingled recycling is transferred to the waste transfer station for separation and sorting and then transported off the island to be landfilled or recycled in Townsville. There are no waste disposal facilities for tourists in motorhomes which acts to limit stay duration and can lead to illegal disposal of sewage and waste. Beaches on Magnetic Island are often contaminated with plastic waste washed up as debris. Annual beach clean-up days are organised by the community.
- **Waste facilities:** Waste is separated and sorted at the waste transfer station and then transported off the island to be landfilled or recycled in Townsville. Disposal facilities for tourists in motorhomes are not available, limiting stay duration and encouraging illegal disposal of sewage and waste.
- **Community initiatives:** Beaches are often contaminated with plastic waste washed up as debris. Annual beach clean-up days are organised by the community.
- **Reduction, recycling and re-use:** The council conducts best practice green waste management, providing free mulch to residents. Enzymes are added to green waste disposed of (free of charge) by the residents to produce the mulch. A trial of a bio-regen unit has also been approved in Horseshoe Bay. There is one container collection point on the island for collection of bottles.
- **Education:** High contamination rates of non-recyclable materials in comingle recycling bins suggest lack of education, understanding or misconception of the recycling process. TCC is doing work on-island to introduce circular systems with waste management and water reduction.

Transport

Magnetic Island is located just 8km off the coast of Townsville, Queensland. It is well serviced in terms of public transport options, which include regular barge and ferry service, public transport buses and multiple car hire companies, which thrive off the strong tourism market in the region.

On-island, there are a range of transport options including personal vehicles, car hire, bicycle hire (including some electric), bus tours, a public bus and walking trails. There is one privately owned EV charger on island as found by the project survey, however there are no publicly available EV charging stations on-island.

Magnetic Island is characterised by steep topography separating the different bays, in which the different community hubs are located. Narrow and winding roads can make access for bikes and pedestrians difficult.

The emissions associated with transport to, from and on Magnetic Island are estimated at **3,876t CO2-e per annum**[14]. This includes 2,839t CO2-e for marine transport, 906t CO2-e for personal vehicles, and 131t CO2-e for public transport and bus tours[14].

There are approximately 1,300 motor vehicles on Magnetic Island with approximately 88% of residents owning a car (Figure 16)[6]. Driving is also the main method for residents to travel to and from work (Figure 17)[6]. Residents voiced concerns that increased size and use of vehicles is increasing traffic, safety issues and spoiling the green values of the island, which is also linked to tourism and their fears of over-tourism.

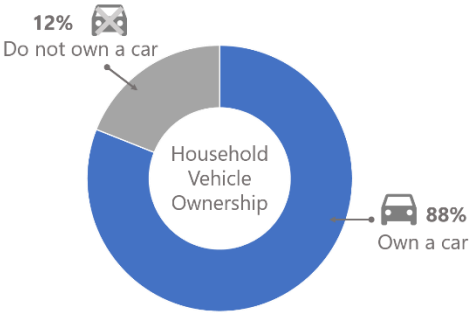


Figure 16: Household vehicle ownership on Magnetic Island

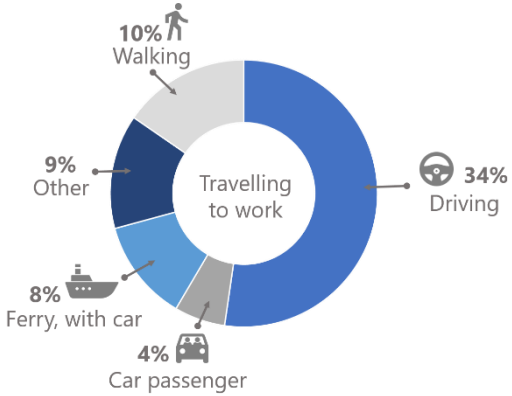


Figure 17: Methods of transport for travelling to work for Magnetic Island residents

What was said:

Transport was the most talked about issue on the island during consultation sessions, with concerns raised about the size and operation of public buses, the condition of walking and bike paths and number of vehicles on the island.

Community members have reported that the council should be promoting the natural beauty of the island as well as the ability to walk or ride everywhere on the island, as reasons to decrease the use of cars. TMI or Townsville Enterprise may also be responsible for promotion.

Transport

Magnetic Island is very accessible with barge and passenger ferries running frequently, departing from Townsville (Figure 18). Passenger ferries transport up to 300 people at a time and operate approximately 118 return trips a week[12]. Barges provide car and passenger services as well as freight delivery running every 2 hours from Townsville, plus an additional 3 trips per fortnight for waste disposal[13]. In addition, there are 100 to 400 recreational boats at any one time anchored around the island based on community consultation.

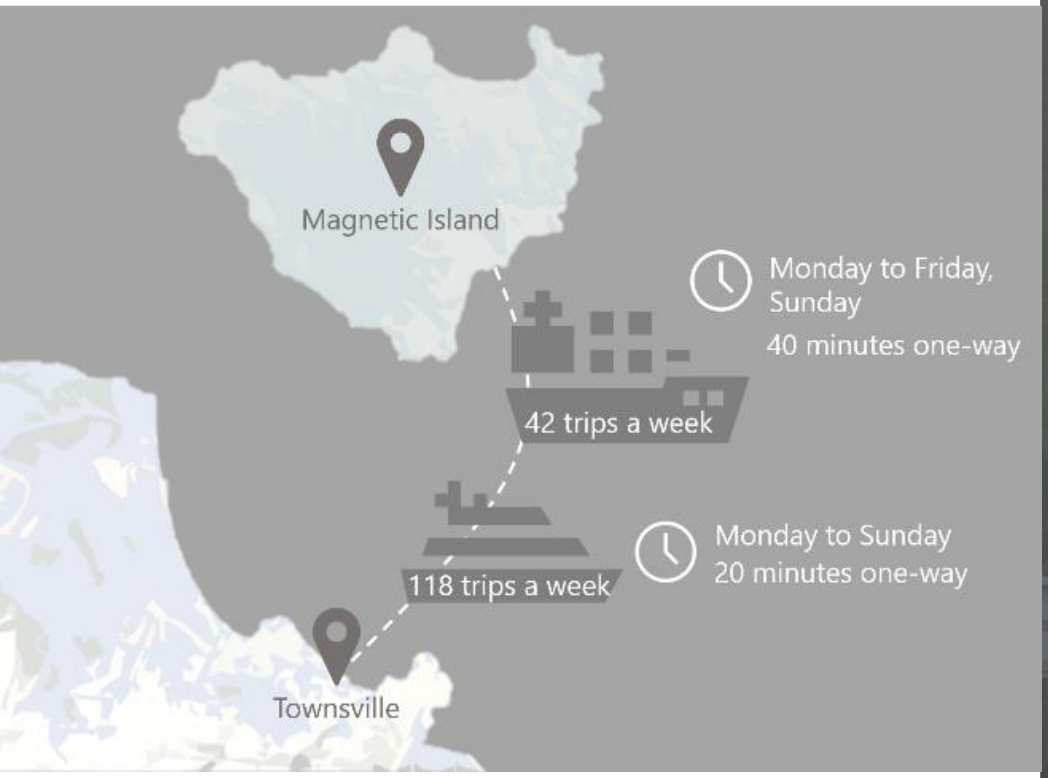


Figure 18: Transport modes for travelling to Magnetic Island including frequency and travel time

Key findings

- **Walking tracks and paths:** Walking paths are available throughout the island. Hire bikes, including some electric bikes, are also available. The community are concerned with pedestrian safety on Magnetic Island due to lack of footpaths in some built-up areas with winding roads between bays.
- **Vehicles:** There are approximately 1,300 motor vehicles on the island – 49% of respondents to the ABS 2016 census had one vehicle, 25% had two, 8% had 3 or more. Approximately 12% of households reported no motor vehicles, which is twice the state average. Visitors can bring their own car or hire car onto the island via the vehicle ferry. There were nine hire car companies identified on the island in 2019 with residents voicing concerns that increased use of vehicles increases traffic, safety issues and spoils the green values of the island.
- **Public transport:** A bus service runs frequently and accommodates the ferry arrivals and departures from Magnetic Island, available for both residents and visitors to the island. There is a small taxi service and one Uber available. The bus route services Picnic Bay, Nelly Bay, Arcadia and Horseshoe Bay. The bus service is widely used and considered to provide a good service to the Magnetic Island community, however, there were concerns raised by residents about the size of buses and potential impacts to road safety. Residents and visitors also reported a lack of service over midday, as the bus service generally aligns with the ferry arrivals and there were no ferry services during this time.
- **Marine transport:** A passenger and a vehicle ferry run multiple and regular services to the island throughout the week and until late at night, with over 100 trips per week. SeaLink have made significant investments in increasing fuel efficiency of their fleet. Residents did raise concerns that prices for both ferry services were quite high, and the passenger ferry does not offer discounts to residents while the vehicle barge does offer discounts.

Resilience

The Magnetic Island community consider themselves a resilient community that come together when times get tough. Many residents have lived through severe weather-related events and felt comfortable they were prepared for any potential future events. There is a Magnetic Island Disaster Management Group as part of the Townsville Local Disaster Management Plan (TLDMP).

The main finding regarding resilience on Magnetic Island is the complete reliance on the mainland for essential goods and services, such as electricity, water, food, medication and waste removal. There is no emergency back-up power supply to the island, however a small number of residents have their own generators which could be used if required during a power outage. The water treatment plants on-island do have backup generators which can be used for prolonged power-outages.

The Magnetic community recognises this and wants to work towards a future where they are less dependent on the mainland for these essential goods and services.

The island has recently been impacted by storm surges/cyclones (January 2019) and is currently receiving funding under the QCoast2100 program to support councils in identifying coastal hazards and climate change risks through to decision-making and implementation phases[23]. The island has experienced 11 natural disasters over the last 10 years including floods, cyclones, storm surges, and a bushfire[24].

What was said:

Water supply, natural disasters, power generation and the island's reliance on the mainland for food, water, energy and medical services are seen as areas of significant concern. Both residents and businesses reported increasing insurance expenses are their biggest climate related impact.

In terms of changes to the current climate of Magnetic Island (Figure 19), it is estimated that there will be slight declines in spring rainfalls, but higher intensity rainfall events over the next 50 years[3]. The same pattern is estimated for severe weather events: less frequent, but more severe (higher intensity rainfall and winds)[3]. Furthermore, for Magnetic Island and the North Queensland Region, a sea level rise of 0.8m by 2100 is estimated[4]. This will most likely lead to more frequent sea level extremes and inundation.

Community resilience concerns

- High insurance premiums
- Tidal and runoff flooding
- Access to energy and water
- Isolation during severe weather events
- Coastal erosion

Island mode: Perceived Island Mode* is estimated at 6 days for businesses and 7 days for residents based on survey results.

*Island mode is defined as the ability to operate without ongoing support or resources (such as power generation, water supply, food supply and waste removal etc.) from the mainland.

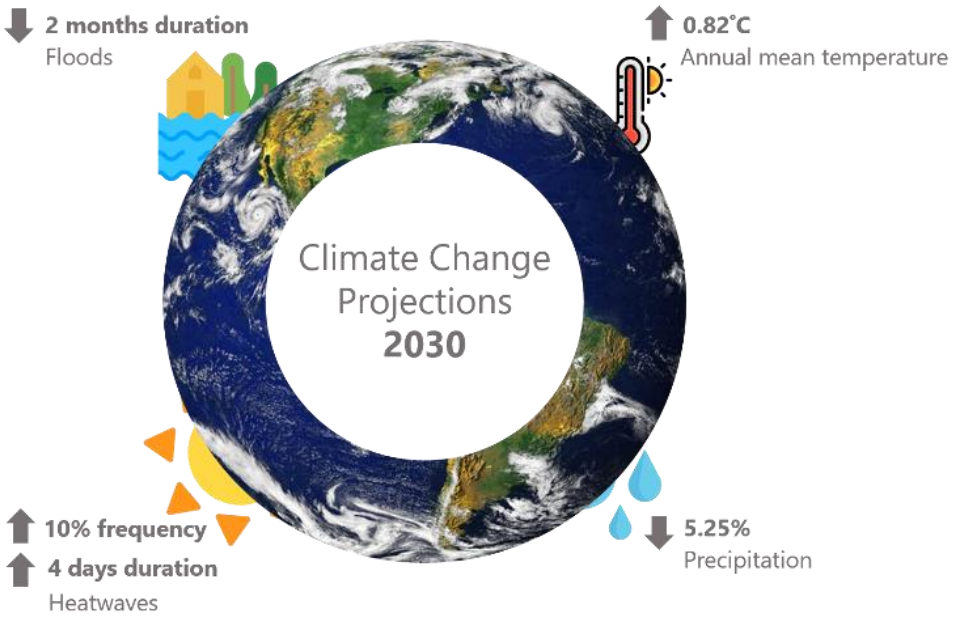


Figure 19: Climate change projections for 2030, Magnetic Island

Key findings

- **Current climate and climate change:** Coastal inundation is the largest climate related threat to Magnetic Island, including rising sea levels, increasing intensity in storm surges, coastal erosion and increased flooding during storm events. The majority of the island's infrastructure is located along the coastlines and bays are more likely to be cut off.
- **Projected climate change impacts:** Climate change is likely to increase the severity of these extreme events. Recognising this, the council is committed to the QCoast2100 program to improve the resilience of the island's assets and areas. Climatic events already have an impact on the tourism industry with domestic and international travelers reluctant to come during the summer/cyclone/storm season.
- **Experienced events:** Magnetic Island has experienced damage over the last decade and predictions indicate that this will continue to worsen over time, mainly due to impacts from floods, storm surges and cyclones. Severe weather events such as the North and Far North Queensland Monsoon Trough in January 2019 caused an estimated $5.68 billion in physical damage to communities, property, and infrastructure and an estimated $116 million in small business disruption for Magnetic Island.
- **Community preparedness and perceived resilience:** The perceived resilience to climate related impacts by Magnetic Island residents is high, due to strong community support. Residents show strength within community groups and are willing to work together for repairs/reconstruction after a climate related event. However, as the island is dependent on the mainland for supplies and essential services, actual resilience is low if the island is forced to operate independently for more than a week.
- **Current emergency plans:** There is no designated cyclone shelter on the island and many residents stated they would not evacuate the island. There is a disaster management plan for the Townsville Region which includes actions for Magnetic Island and delegated authority TCC, however there is no stand-alone evacuation or disaster management plan for the island, which was raised as a concern by community.

An island-wide risk assessment was conducted at the completion of the sustainability assessment to identify Magnetic 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. These risks were focused on as part of the project generation to ensure appropriate solutions to minimise risks were produced. 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	Depletion of natural energy resources through consumption of fuel.	Previous projects encouraged the installation of solar panels (30% of dwellings) across the island to reduce demand on non-renewable electricity.
	Use of diesel generators as back-up during peak loads, increasing GHG emissions.	Limited use of battery systems.
	Vehicle emissions causing air pollution and negatively impacting human health.	No current mitigating strategies observed.
	Depletion of freshwater resources through overconsumption. Increase in visitors will add pressure on natural resources.	Water conservation notices are provided in some hotels.
	Failures in operation of the wastewater treatment plant causing environmental damage and human harm.	On-island wastewater treatment plant operator to monitor and respond (operating personnel are however located in Townsville).
	Inability of local infrastructure to sufficiently respond to peak demand during tourism seasons (with regards to wastewater).	No current mitigating strategies observed.
	Lack of beach restoration programs increasing the risk of damage to nearby property during severe weather events.	Sand restoration projects at Horseshoe Bay. TCC planning for likely retreat. Also considered under the CHAP.
	Insufficient consideration of climate change risks in land use planning and development causing damage to property and infrastructure.	TCC began assessing coastal hazards in 2012 and has a strong knowledge of climate change risks for the island.
	Dependency on ferry company for waste removal, which if Magnetic Island is cut off from the mainland leads to an issue in the capacity of the waste transfer station.	Waste facility has additional built-in storage capacity if the island becomes cut-off.
	Costs associated with removing waste off-island as there is no on-island landfill.	Waste transfer station has been designed with additional storage in mind in case the island is cut off from the mainland, but there is no way to treat/manage the waste during the isolation period.
	Recycled waste disposed of in the general waste stream.	TCC provides fortnightly pick-up of recyclables.
	Greenhouse gas emissions from waste from the island sent to landfill on the mainland.	TCC has invested in landfill gas flaring at their landfills in Townsville.

Table 2: High, Severe and Extreme Risks

High cont...	Difficulty in achieving consensus on sustainability goals and actions across many community organisations.	Large number of sustainability actions are being undertaken by community groups, currently not under an overarching framework and vision.
	Increased psychological issues from experiencing severe weather events.	Range of community groups to assist. Well serviced region in Townsville for disaster relief
Severe	Impacts to critical energy pipeline infrastructure and mainland infrastructure during and following severe weather events creating a risk to livelihoods, human health and liveability.	No current mitigating strategies observed.
	Use/ reliance on non-renewable energy contributing to climate change.	Some residents (30%) and businesses have installed solar, but most rely on grid power from mainland. Those that do have solar power, cannot access electricity generation if the grid is down
	Use of non-renewable fuel consumption in transportation to and from the island contributing to climate change.	Ferry operator has increased efficiency of vessels but still a total reliance on diesel.
	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.
	Impacts to critical water pipeline infrastructure during and following severe weather events creating a risk to livelihoods, human health and liveability.	No current mitigating strategies observed.
	Water shortages on the mainland during periods of drought impacting livelihoods, human health and resilience on the island.	Water conservation program offered by TCC.
	Impacts to local ecosystems from excessive visitor numbers and from increased visitor infrastructure (including buildings, facilities, transport etc.)	Limited signage in National Park areas. Parking and congestion issues (e.g. Forts Walk Carpark, Horseshoe Bay).
	Impacts to local ecosystems from increased development on the island.	Environmental impacts assessed in planning and development applications.
	Coastal hazards including cyclones and storm activity causing coastal erosion and damage to infrastructure.	Extensive program of work to identify major areas at risk through the TCC Coastal Hazard Adaptation Program (CHAP).

Table 2: High, Severe and Extreme Risks

Severe cont...	Reliance on external transport providers to bring visitors, workers and local residents on and off the island, including evacuations during severe weather events.	No current mitigating strategies observed.
	Poor condition of roads and connectivity of roads on the island limiting mobility during severe weather events.	No current mitigating strategies observed.
	High cost of insurance premiums increases cost of business impacting profitability or meaning that insurance is unaffordable and assets are uninsured, leading to greater vulnerability during severe weather events.	Insurance resilience programs are improving properties to reduce future claims. Queensland Reconstruction Authority (QRA) leading disaster resilience programs.
	In the instance of a severe weather event, the island is isolated from the mainland meaning that food cannot be delivered for the food outlets.	Limited community gardens and limited supply of stocked food items.
	Severe weather events leading to the island being cut-off from the mainland, and some parts of the community cut-off from the rest. This leads to a range of issues including evacuations for health reasons, access to power, water, roads cut to critical infrastructure, telecommunications etc.	Paper based systems for payment of goods and services. MICC coordinator check elderly prior to weather event. Disaster Management Plans are in place. Frequency of extreme weather events has led to increases in community preparedness.
	Increased frequency of severe weather events reduces time for ecosystems to recover between events leading to loss of environmental habitats and amenity.	TCC began assessing coastal hazards in 2012 and has a strong knowledge of climate change risks for the island.
Extreme	Lack of on-island freshwater/potable sources (including rain tanks) impacting self-sufficiency and resilience of island stakeholders.	Limited use of bore water for landscaping.
	High cost to defend and protect coastal areas and infrastructure leading to allocation of funds to high risk areas (not all assets/ areas can be protected).	TCC began assessing coastal hazards in 2012 and has a strong knowledge of climate change risks for the island in order to make an informed decision on priorities.

Table 2: High, Severe and Extreme Risks

Options Shortlisting: Phase 2

The Options Longlisting process involved thinking about Magnetic Island's future, discussing what may contribute to community development, 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: Project Options.

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 Magnetic 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 20 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.

Table 3: Multi-criteria analysis

Objective Category	#	Criteria	Proposed weighting
Economic development	1	Potential to support sustainable economic development opportunities	15%
	2	Potential to support local job creation, skills development and/or capacity building	15%
		Total (economic development)	***30%***
Social development and culture	3	Promotion of community self-sufficiency and/or resilience	15%
	4	Protection of cultural heritage and assets	15%
		Total (social development & 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%**

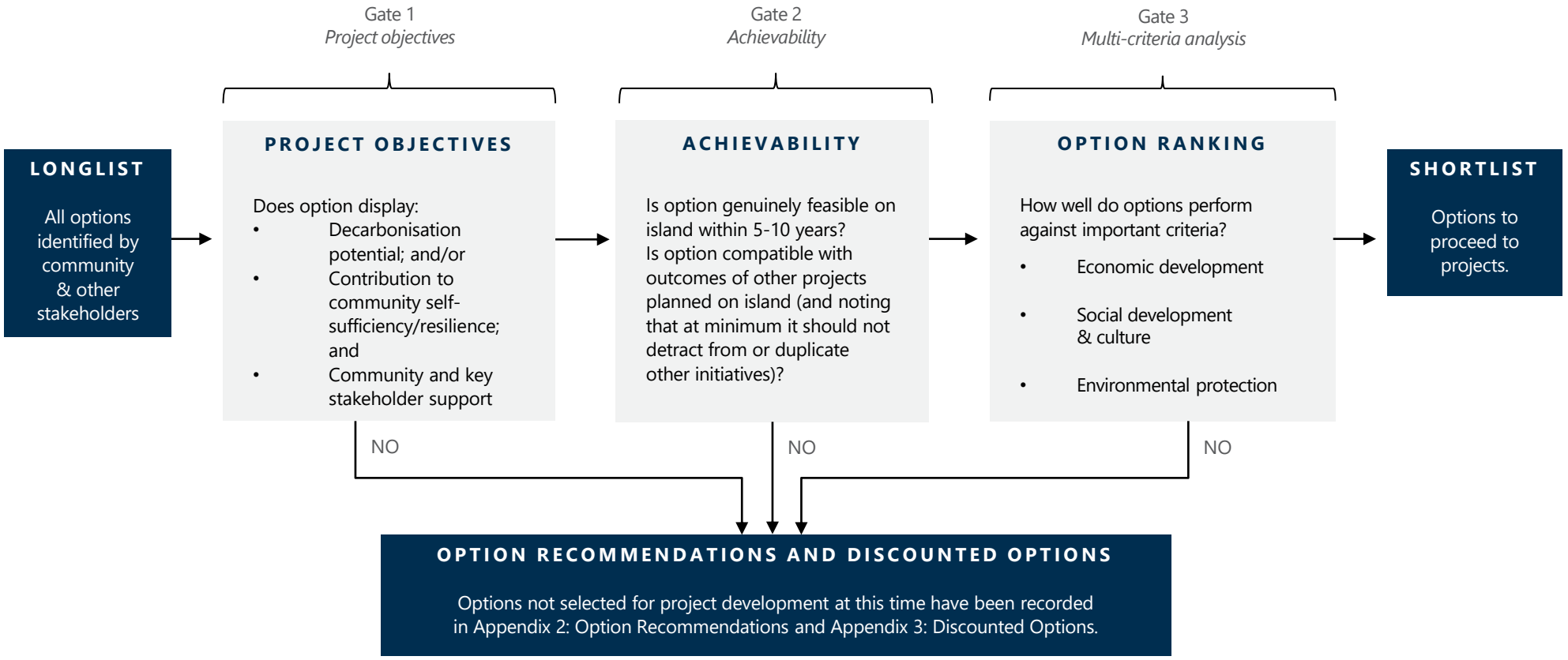


Figure 20: Options analysis process

Project Options and Project Outcomes: Phase 3 and 4

Options identified were based on discussed community needs and preferences, project objectives and feasibility for implementation on Magnetic 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.

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 Magnetic Island community and local stakeholders, including TCC and Ergon Energy.

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

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

Options identified were based on discussed community needs and preferences, project objectives and feasibility for implementation on Magnetic 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 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 provide the Magnetic Island community with the information to pursue the different decarbonisation and resilience projects best suiting the island's needs. Some final project options have natural owners, such as council, government bodies or Ergon, while are community or business-driven and owned.

Each final project option identifies potential carbon abatement, simple payback, cost savings, full time equivalent (FTE) job creation, opportunities, risks, barriers and identifies potential funding sources.

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

Option 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 exclude 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: Option Recommendations.

Overarching Findings and Policy Recommendations

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

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

The Overarching Findings 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 and opportunities within the Magnetic 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 Magnetic 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

There are many existing community groups on Magnetic Island representing different areas and interests of the community. These groups usually participate in community meetings, bid for projects or work for the island and represent the island during ongoing projects. Throughout this project, the team had the pleasure to work with many community groups on the island, however, feedback was received that it would be beneficial to bring all of these groups together on a regular basis (e.g., quarterly) working to ensure cohesiveness and alignment of goals and visions for the island's future.

A collaborative community-based governance structure would be extremely beneficial to the island and ensure successful option implementation for this project and any future works.

Recommendation 2: Consider grouping project options for increased positive impact

Many of the developed 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 compromised. This can be due to scheduling or logistical dependencies between project options.

Recommendation 3: On-island Resilience Plan

While a project option has not been put forward, an on-island resilience plan is recommended as all project option solutions inherently contribute to resilience in some way. A clear resilience plan would provide Magnetic Island with an overarching action plan to build a more resilient and sustainable island to live, work and visit. This could include cyclone rating assessments of island infrastructure, invasive species management plan, revegetation plans, beach erosion management, installation of a cyclone shelter and ongoing beach clean-ups (Option recommendations R4, R5, R10, R11, R16 and R18 respectively) to produce a holistic resilience plan for the island.

Recommendation 1: Upgrade all bulbs on the island to LEDs

There are approximately 1,000 streetlights on Magnetic Island which are all Ergon owned and council leased. Council have put forward a proposal to upgrade all bulbs on the island to LEDs.

Recommendation 2: Update sustainable housing information kit to newer version

TCC provides information on sustainable housing in an information kit, which includes information on energy savings achieved by having a white roof, drought resilient landscaping, etc. This information kit is becoming outdated with new information and technologies; therefore, a newer version would be very useful.

Recommendation 3: Create sustainable housing design and/or planning codes within council area

There is currently no sustainable housing design or planning codes within the council area, hence a broader plan will increase housing standards and ensure new investment is made taking into consideration energy efficient building and design practices.

Recommendation 4: Encourage installation of and education around rainwater tanks

The uptake of rainwater tanks is not widespread as the use was previously illegal; and the island has a predominantly dry tropical climate, rather than wet, hence many residents do not see the need.

Recommendation 5: Install disposal facilities for tourists travelling in motorhomes

There are currently no disposal facilities for tourist travelling in motorhomes, which may either limit their stay or encourage illegal disposal of sewerage and waste.

Recommendation 6: Monitor and regulate construction activities and disposal of waste materials

Some claims were made of construction operators illegally dumping waste concrete on the beach front. Further investigation is required to monitor and regulate construction activities on the island and the disposal of waste materials.

Recommendation 7: Better promotion of carrier/public transport service

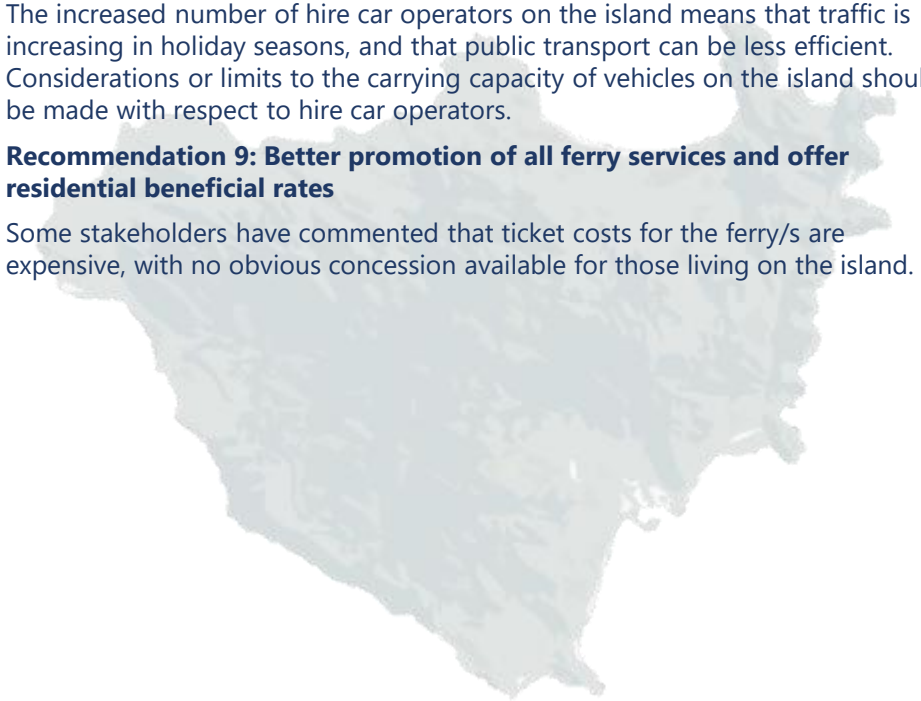
Visitors arriving on-island must transport their luggage to their hotels and may be unaware of the carrier/public transport service that exists, potentially increasing the use of taxis and hire cars.

Recommendation 8: Limit number of hire car operators on the island to respect carrying capacity

The increased number of hire car operators on the island means that traffic is increasing in holiday seasons, and that public transport can be less efficient. Considerations or limits to the carrying capacity of vehicles on the island should be made with respect to hire car operators.

Recommendation 9: Better promotion of all ferry services and offer residential beneficial rates

Some stakeholders have commented that ticket costs for the ferry/s are expensive, with no obvious concession available for those living on the island.



The project team recognises that many of the identified final project options stem from the Magnetic Island community and are not new propositions. Many have been the subject of discussion for some time.

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 Magnetic Island. The final project options which are summarised on the following pages in Table 4: Final Project Options for Magnetic Island, span the five themes (as well as a knowledge sharing options including multiple themes) of this project, as presented in Figure 21. **Refer to Appendix 1: Final Project Options** for the full detail on the final shortlisted project options.

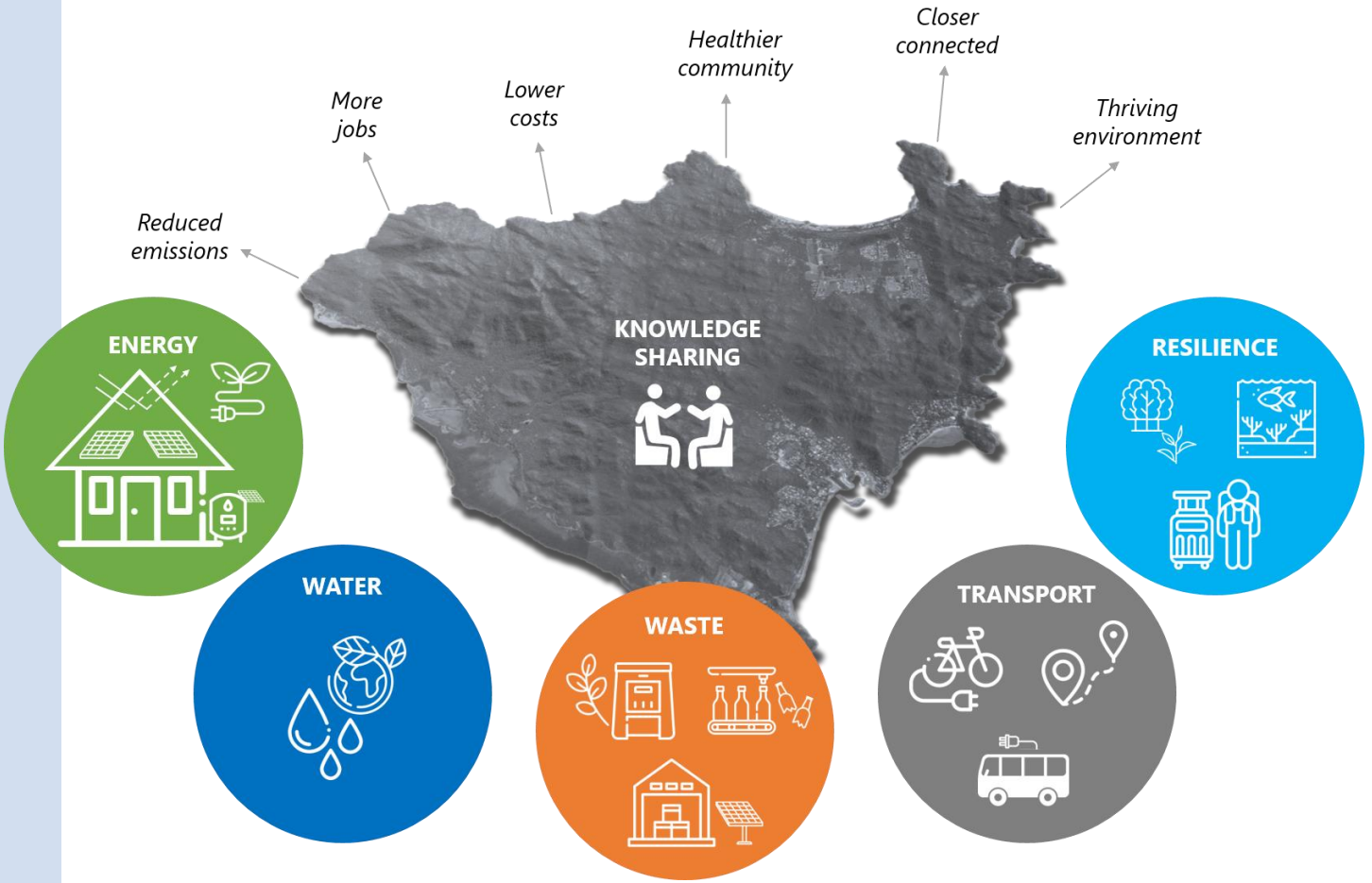


Figure 21: Summary of Final Project Options and Benefits

Final Project Options

Table 4: Final Project Options for Magnetic Island

Title	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
 **1. Electric Bicycle Rental Service** Solar powered – electric bicycle rental scheme for the community of Magnetic Island to support active travel	0 - 6	800,000	2.5	0.5 - 1	• There is the potential to partner with Ergon Energy to integrate the charging infrastructure (both solar powered and grid backup depending on the scale of the scheme) required into the Magnetic Island Network. The location of charging hubs will be critical to the success of the scheme, and planning will require Ergon's input.
 **2. Low Emission On-Island Shuttlebus** On-island shuttle bus for public transport, powered either as an electric vehicle (and associated charging infrastructure) or by alternative low emission fuels.	14	200,000	2	0.5	• Climate Solutions Fund – Emissions Reduction Fund • Clean Energy Finance Corp - Reef Funding Program • Australian Renewable Energy Agency – potential funding through exploration of innovative EV charging infrastructure • Ergon – potential funding and becoming partner on project due to EV charging infrastructure
 **3. Establishment of a Native Plant Nursery** A nursery and associated infrastructure to support establishment of a new Indigenous owned business to supply native plants to the Magnetic Island community.	1 – 10	300,000	1 - 3	1 - 3	• Advance Queensland Deadly Deals fund • Australian Government's Indigenous Procurement Policy • Australian Government's Indigenous Entrepreneurs Fund • Australian Government's Community Development Program Business Incubator Pilot • QLD Business Growth Fund Program • Indigenous Business Sector Strategy - pilot Indigenous Entrepreneurs Capital Scheme • Relevant concessions for growers: QLD Department of Environment and Science Fee Concession for Protected Plant Growing License
 **4. Path Networks to Support Active Transport** Establish appropriate path network infrastructure and associated facilities to promote active transport on Magnetic Island.	12	5,000,000 – 10,000,000	N/A	1 – 2	• Infra+, ATIP under the Cycle Network Local Government Grants (CNLGG) program, Department of Transport and Main Roads on identified principal routes. • Funding through the Queensland Action Plan for Walking, Department of Transport and Main Roads • Queensland Health (e.g. Healthier, Happier) and Department of Housing and Public Works (e.g. Active Community Infrastructure Initiative).
 **5. Sustainability and Environmental Education** This project seeks to engage the local community through community led sustainability and environmental knowledge sharing and education	N/A	200,000 – 300,000	N/A	1 - 3	• Round 3 - Community Sustainability Actions Grants1 • Social reinvestment2 • 1000 Jobs Package (Tranche Two)3 • Community Led Grants4 • The Container Refund Scheme Small Scale Infrastructure Grants Program (Queensland Government.) provides up to $10,000 in infrastructure and equipment to set up collection points for the newly introduced container deposit scheme

Final Project Options

Title	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
6. Energy Efficiency Retrofits Improving energy efficiency in residential and commercial buildings through passive cooling measures such as: improving air flow, insulation, glazing, heat reflective paint, gutter guards and other energy saving opportunities	400 – 800 (households) 450 – 900 (commercial)	1,000,000 – 1,500,000	2 - 4	1 - 2	• Discussions with Ergon Energy confirmed that they are supportive of opportunities to reduce peak energy demand on the island. Ergon also have audit capability which could be employed for the project.
7. Green Hydrogen Transport Demonstration Project A feasibility study for the development of a green hydrogen generation and refueling demonstration scheme	TBD by the study*	150,000 – 200,000 (for the study)	TBD by the study*	0.5 (study)	• There are potential funding opportunities through ARENA, Queensland Hydrogen Industry Development Fund, Clean Energy Finance Corporation.
8. Aquaculture Production Feasibility Study This project will develop a feasibility study to assess the potential for on island aquaculture production using local species.	0	80,000 (feasibility study) TBD by the study (farm)*	TBD by the study*	0.5	• Round 3 - Community Sustainability Actions Grants, Queensland Department of Environment and Science • Drought Communities Programme – Extension, Department of Infrastructure, Transport, Regional Development and Communications • Community Led Grants, Department of the Prime Minister and Cabinet
9. Waste Transfer Station Installation of Solar PV The installation of solar panels at the existing waste transfer station with possible future battery integration, reducing dependence on grid power and cutting emissions.	3.2	5,100	1 – 2 days	1 month	• 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

*To be determined (TBD) by the study indicates that a feasibility study is needed for this project option in order to ascertain the figure.

Final Project Options

Title	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
10. Tourism Master Plan This project seeks to develop a Tourism Master Plan to provide a sustainability accreditation pathway for Magnetic Island.	TBD during accreditation^	65,000 plus certification costs to be determined	N/A	1 – 3	• Round 3 - Community Sustainability Actions Grants, Queensland Department of Environment and Science • Community Led Grants, Department of the Prime Minister and Cabinet • Attracting Tourism Fund, Department of Innovation and Tourism Industry Development • Townsville City Council may also consider the possibility of providing support as part of their overall certification budget
11. Energy Demand Management Incentive Scheme Energy efficient appliances and tools to enable residents and businesses to actively monitor and manage their energy use.	0 - 740	20,000 – 1,500,000	N/A	1	• 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 • Ergon Demand Management Plan 2021
12. Solar Hot Water Systems Upgrade of residential electric hot water systems to solar hot water systems, providing decarbonisation benefits and power cost reductions to residents.	1,200 (for 1,000 residences)	4,500 per household	N/A	1 - 2	• Department of Housing and Public Works funding to subsidise purchase and maintenance of SHW systems, have similar arrangement on nearby islands, however different demographic of residencies of each island • Small-scale technology certificates (STC) for SHW systems through Small-scale Renewable Energy Scheme (SRES) – 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
13. Organic Waste Recycling Feasibility Study Feasibility study to undertake collection and composting of organic waste on the island to reduce transport and landfill emissions and provide a product for soil conditioning on the island.	TBD by the study*	100,000 – 200,000	TBD by the study*	0.5	• Resource recovery industry development program • Business grants

*To be determined (TBD) by the study indicates that a feasibility study is needed for this project option in order to ascertain the figure.
^To be determined (TBD) during accreditation indicates that accreditation needs to be undergone to determine the carbon reduction for this project option.

Final Project Options

	Title	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
	**14. Solar PV Rooftop Systems** Increasing the amount of managed solar PV installed on rooftops with potential battery integration, reducing dependence on grid power and emissions, while providing cost benefits to residents.	1.5 (per residence)	5,100 per 3kW system	1 - 2 days per installation	1 - 2	• Small-scale technology certificates through the Small-scale Renewable Energy Scheme (SRES) – from the Clean Energy Regulator • Reef Funding Program: funding available for emission reduction projects in Great Barrier Reef catchment, Clean Energy Finance Corporation • Regional and Remote Communities Reliability Fund • Climate Solutions Fund – Emissions Reduction Fund • Energy Efficient Communities Program, Community Energy Efficiency and Solar Grants 2020, Department of Industry, Science, Energy and Resources • Interest-free loans offered for solar and storage by Queensland Government (not currently running)
	**15. Glass Recycling Feasibility Study** Feasibility study to investigate initiatives to increase the volume of glass recycled and reused on Magnetic Island.	TBD by the study*	5,000 – 30,000	TBD by the study*	0.25 - 0.5	• Small scale business loans • Resource recovery grants
	**16. Low Emission Marine Transport** Current technology and market assessment of alternative low emission technology and fuel solutions for ferry services between Townsville and Magnetic Island, potentially including electricity, hydrogen and biofuels.	813 – 2,700	50,000 – 100,000	TBD by the study*	TBD by the study*	• Climate Solutions Fund – Emissions Reduction Fund • Clean Energy Finance Program - Reef Funding Program • Australian Renewable Energy Agency – potential funding through exploration of innovative emission reduction measures • Ergon – potential partner on project due to EV charging infrastructure • Benchmarking against global funding schemes for ferries to be conducted in review.
	**17. Microgrid Feasibility Study** A feasibility study for the development of a renewable energy microgrid on Magnetic Island, exploring a combination of renewable energy generation, energy storage, microgrid control systems and supplementary fossil fuel generation i.e. diesel generator.	0 – 13,000	200,000 – 300,000 (feasibility study) 20,000,000 – 70,000,000 (microgrid)	TBD by the study*	0.5 (study) 1 – 3 (microgrid)	• Reef Funding Program - funding available for emission reduction projects in Great Barrier Reef catchment area, Clean Energy Finance Corporation • Regional and Remote Communities Reliability Fund - Department of Industry, Science, Energy and Resources • Climate Solutions Fund – Emissions Reduction Fund • ARENA funding – project has similarities to previously supported King Island project

*To be determined (TBD) by the study indicates that a feasibility study is needed for this project option in order to ascertain the figure.

	Title	Carbon Reduction (tCO^2-e)	Investment ($)	FTE	Delivery Time (Years)	Funding Opportunities
	**18. Water Smart Demonstration Community** This project proposes implementation of sustainable water management solutions, to reduce water use, improve amenity, cost of living and environmental outcomes. positioning the island as a Water Smart demonstration community.	2.7 – 13.7	500,000 – 2,000,000	N/A	1 – 3	• No specific funding opportunities have been identified. It is likely that this will need to be funded by TCC.

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Appendix 1: Final Project Options

This section includes the full Final Project Option documents.

Magnetic Island | Transport

1 Electric Bicycle Rental Service

Support the development of a solar powered - electric bicycle rental scheme for the community of Magnetic Island to support active travel.

Description and overview

This project recommends supporting the development of a solar powered - electric bicycle rental scheme for the community of Magnetic Island. This scheme will include the provision of electric bicycles (or alternative option such as electric scooter) along with solar PV- renewable energy powered charging infrastructure to enable the low emission operation of the scheme.

Magnetic Island is home to eight car or scooter hire businesses and one bike rental[1] business primarily catering to tourists and visitors to the island. An opportunity exists in the market for a decarbonised active transport option for the community (and potentially visitors) and is intended as a complementary opportunity or potential expansion of the current existing electric bike rental[1] available on island. The scheme may be managed by Townsville City Council, private enterprise or other appropriate authority.

The Magnetic Island community is spread out in several bay areas with travel between communities generally a hilly commute in warm conditions. There is also a lack of parking at the ferry terminal hence it has been identified that a scheme with publicly accessible 24/7 bike rental at the major centres and ferry terminal may fulfil a need in the market for alternative transport for commuters and visitors wanting commuting, ad hoc or one-way travel.

It was also identified that some tourists, particularly the backpacker demographic, may be attracted to a low-cost transport option, particularly if there was an option of baggage delivery service between the ferry and accommodation.

The scheme would involve the provision of mobile and fixed assets, including solar powered charging stations. The goal of the scheme would be to increase community connectivity and reduce journeys made by car on the island to be replaced by renewable energy powered - electric bicycle travel.

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	0-6
Estimated payback period	Years	2-5
Estimated annual cost savings	$ mil	0.2-0.4
Timeframe to deliver project	Years	0.5 - 1
Estimated FTE	No.	2.5
Estimated capital costs	$ mil	0.8
Net present value (simple)	$ mil	-0.1 – 1

1. Refer to: https://magneticadventurehire.com.au/magnetic-island-electric-bike-hire/
2. Image credit Sunshine Cycles Facebook

Key project objectives

Carbon assessment
An increase in uptake of electric bicycles has the potential to reduce the number of trips taken in private motor vehicles. In particular, active transport options may typically replace short (<5km) journeys, which tend to produce a greater rate of emissions per kilometre due to the temperature of the engine upon start. Based on the average emission intensity of passenger vehicles, the yearly average utilisation of 50% of available bicycles replacing passenger vehicle journeys at an average distance of 5km will lead to an emissions reduction of 6.6t CO_2-e/year.

Ergon have confirmed that additional energy not utilised by the renewable chargers can be fed back into the network, increasing the potential carbon benefit for the island.

Community resilience & self-sufficiency
The uptake of active transport on Magnetic Island may have the following impact on community and climate resilience:

- Improved health and fitness of those undertaking active transport regularly
- Reduction in the community's reliance on imported fuel shipped to the island from the mainland and increase in the community's resilience to fuel supply chain shocks and fuel shortage
- Provision of an additional transport mode choice for residents and for tourists, offering efficient alternatives to cars
- Reduced congestion and cars on the road and parking areas, reducing air pollutants and noise

Alignment with other initiatives

Alignment with other project options
4. Path Networks to Support Active Transport
5. Sustainability and Environmental Education
17. Microgrid Feasibility Study

Alignment with external initiatives or investments
Queensland Cycling Strategy (TMR), Potential expansion of existing service through targeted investment.

Co-benefits

Economic

- A reduction in passenger vehicle journeys may lead to a reduction in maintenance costs for road infrastructure. This reduction would be net of maintenance costs for new active transport infrastructure including pathways and charging infrastructure.
- A reduction in passenger vehicles use may result in a reduction in cost of living for the community through reduced fuel and vehicle maintenance costs
- Expanded opportunities for tourism businesses resulting from improved access

Social and cultural

- An increase in active transport through the cycle scheme may lead to an increase in social cohesion and community engagement, and interaction with visitors
- Tourist attraction for tourists
- Active transport infrastructure will improve mobility for those on the island who are unable, unwilling or don't have access to drive passenger vehicles
- Opportunities to support young / budget tourists (e.g. backpackers) through affordable transport
- Reduced motor vehicle congestion and parking

Environmental (General)

- The adoption of active transport will reduce Magnetic Island's contribution to greenhouse emissions through the reduction in use of passenger vehicles for short journeys.
- In addition, reduction in passenger vehicle use may reduce air and noise pollution in the community centres and recreational areas, which was identified as a high risk in the project risk assessment.
- Reduction in passenger vehicle use may also aid in preventing deterioration of roads which was identified as a severe risk in the project risk assessment.

Environmental (impacts to Great Barrier Reef)

- A reduction in vehicular emissions on Magnetic Island will contribute to the global effort to reduce emissions which are impacting the reef through increased temperatures and ocean acidification. The reduction in fuel to be shipped to the island will directly benefit the reef through a reduction in requirement for barge journeys and reduce chance of fuel spillage.

Risks and opportunities

Barriers

- Traditional barriers to uptake of bicycles are the cost of the asset, the effort required to cycle and the maintenance of the asset. These barriers are ameliorated through the use of electric bicycles and the rental/hire scheme.
- Given ~58% of residents are over 50, age and mobility constraints of participant may dictate whether the community is more likely to adopt walking, cycling or electric bike or scooter options. Locals may already own bikes or scooters, reducing the likelihood that they would use the rental scheme.
- The warm climate and many hills of Magnetic Island may be a barrier for use of active transport, with participants choosing to avoid cycle journeys in hot weather. This is ameliorated by the provision of electric, rather than pedal, bicycles. Good weather conditions on the island generally provide a good environment for bicycle transport.
- Ineffective support and ancillary infrastructure such as seating, rest areas, drink fountains, directional signage can be a limiting factor active transport uptake.
- Path infrastructure improvements are required to allow access to all areas of the island (including Picnic Bay)
- Operator will be responsible for the movement of bicycles around the network to balance capacity
- Some parts of existing road and path network unsuitable for active transport by bicycle, necessitating partnering with aligning infrastructure solution to implement and/or improve safety

Risks

- Increased active transport will result in an upswing of crash risk. According to the Australian Transport Assessment and Planning Guidelines[1], crash risk for active travellers is eight times more risky than private motor vehicle transport with pedestrians being higher than cycling. Typically, most fatal cyclist crashes involve a motor vehicle. This risk can be mitigated through selection of location and design for infrastructure (e.g. bike paths and lanes).
- Risks observed in comparable schemes include those associated with insufficient dedicated infrastructure, mandatory helmet laws and complicated leasing arrangements.
- Low utilisation of scheme
- Participants not returning bicycles to collection points or charging areas

Opportunity

- Consider alignment with the Magnetic Island Trails Vision Plan (TCC, 2019) to facilitate connectivity between the various walking trails and tourist areas on the island
- Align with the 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
- Some cost of operation may be offset through revenue obtained through usage charges (by minute, by kilometre or by journey)
- Small business opportunities to provide complementary services along routes
- Provision of baggage collection service between ferry and accommodation
- Additional personal electric bike uptake by residents if charging infrastructure made available, providing additional social and environmental benefits

1. Australian Transport Assessment and Planning Guidelines - https://www.atap.gov.au/user-guide/2-the-atap-guidelines-website

Assumptions

- Magnetic Island Population (2016): 2,335 (1,495 of working age between 15-64 years old) [1]
- Average carbon dioxide emission of new passenger vehicle in Australia[2]: 180.9g/km.
- Electric scooters are also considered a viable alternative options for this scheme, and could be investigated by proponent further

The scheme will involve the procurement of the following:

- Initial 40 electric bicycles and helmets (average price of $1,700AUD based on Choice Australia estimate) [7] with 36V 10Ah battery capacity. Note that the number of bikes and types (e.g. on road mountain bikes and potentially stand up scooters), as well as cost, is subject to further market sounding.
- A total of 4 x10 bike dock stations have been included for storing the bicycles costed at $30,000 each[11]
- Solar powered electric bicycle charger capable of charging 2 electric bicycles simultaneously costed at $10,000AUD per unit[8]. Costing includes 3 units at 3 locations that are able to charging of 6 units simultaneously at each locations Total 18 charged simultaneously using solar charger. Locations to be further developed through further market sounding.
- Up-front costs of $250,000 to develop hybrid app and marketing material to facilitate bicycle hire, return and coordination. Ongoing costs associated with continuous improvement not considered. Partnership or ownership by existing e-bike scheme operator may ameliorate these costs[5].
- A team of 2.5 staff operating the scheme, providing services including coordination, user support and network re-organisation. Average wage assumed ~$40,000AUD[10] however on-island labour market may dictate higher, to be determined.
- Maintenance costs per bicycle of $300/y[7]
- Rate for hire assumed to be $65 per day to be competitive with current bicycle hire rates[6].
- Assume each bicycle is utilised 25-50% throughout the year. That is that each bike is used for between a quarter to half the trips per day (based on Brisbane and Melbourne rates).
- Local government discount rate of 3.2% (nominal) and CPI of 1%

Costs and funding considerations

Capital costs

- Cost of 40 bicycle assets (including helmets): ~$68,000AUD
- 4-off, 10 bike dock stations ~ $120,000
- Cost of charging infrastructure (3 charge points, 6 bicycle capacity): ~$90,000AUD
- Cost of development of app and marketing material: ~$250,000AUD
- Additional costs to set up business (including electric vehicle and auxiliary equipment: ~$80,000AUD
- The cost of path infrastructure upgrades, signage and other supporting infrastructure development has not been considered

Ongoing costs

Maintenance of bicycle assets: ~$12,000AUD/year
Maintenance of charging assets: ~$9,000AUD/year
Staffing costs: ~$100,000AUD/year
Ongoing equipment and vehicle costs: ~$20,000AUD/year

Additional costs, including provision and upkeep of maintenance vehicle and costs associated with network maintenance, are to be further refined at later stages of planning.

Potential cost savings or return on investment

Based on an assumed average yearly utilisation of 25 – 50% hires per bicycle per day, the scheme could generate between $237,250 and $474,500 per year. This assumption must be tested through further market sounding.

Based on this range of revenues, the project's internal rate of return over 5 years may lie between 0% and 60% depending on the uptake of the scheme.

Funding opportunities

There is the potential to partner with Ergon Energy to integrate the charging infrastructure (both solar powered and grid backup depending on the scale of the scheme) required into the Magnetic Island Network. The location of charging hubs will be critical to the success of the scheme, and planning will require Ergon's input.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
TMR Translink				
Magnetic Island Community				
Tourists				
Ergon Energy				
Existing or new business				

Additional information

The model for delivery of the electric bicycle rental scheme should be considered by a nominated business or operator as project owner. The opportunity to partner with an organisation such as Bykko or Lime to operate the assets should be considered.

Implementation and timeframes

Investment readiness

- This scheme could be implemented immediately alongside existing bicycle rental arrangements and following further market sounding. This could be operated by private organisations or government. Development of enabling infrastructure will impact readiness for expansion of scheme. A similar scheme exists in Sunshine Cycles - https://sunshinecycles.com.au/

Next steps

- Engagement with TMR Translink on opportunities. Engagement with local hire businesses to test the appetite for investment and any lessons learned from local schemes. Market sounding in the community to understand the potential demand. Engagement with Ergon Energy to plan network requirements, determine costs and location of charging points. Planning for supporting infrastructure, including signage to take place with local stakeholders.

Considerations for implementation

- Confirmation and provisions of helmets and bicycle locking equipment.
- Potential liability for accidents and damage.
- Consideration of community safety actions to ensure safe operation of the schemes.
- Arrangements by which the scheme will be operated.

Timeframes to deliver solutions

- The scheme could be delivered, and infrastructure constructed in 6 -12 months.

1. [https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/318021483?opendocument#:~:text=In%20the%202016%20Census%2C%20there,up%202.8%25%20of%20the%20population.&text=The%20median%20age%20of%20people,Level%202)%20was%2054%20years.]
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. Opus, 2017, 'Sydney Bike Share Feasibility Study | Project Feasibility Report', [http://cdn.sydneycycleways.net/wp-content/uploads/2014/12/28212910/2018-069529-Bike-Share-Feasibility-Recommendations-Report_Final1.pdf]
6. FNF Outdoor Adventure Centre and Hire Centre, 'Bike Hire', [https://fnfmagneticisland.com.au/magnetic-island-bike-hire/]
7. Choice Australia, 2019, 'How to buy the best electric bicycles', [https://www.choice.com.au/transport/bikes/electric/buying-guides/electric-bicycles]
8. ESL Mobility (https://esl-emobility.com/en/)
9. Sunshine Cycles (https://sunshinecycles.com.au/book-your-ride/)
10. Minimum Wage https://www.fairwork.gov.au/pay/minimum-wages#:~:text=As%20of%201%20July%202020,in%20their%20award%20or%20agreement.
11. Docking station https://www.washingtonpost.com/news/dr-gridlock/wp/2015/08/05/a-3-5-million-capital-bikeshare-bike-purchase-explained/

Magnetic Island | Transport

2 Low Emission On-Island Shuttlebus

On-island shuttle bus for public transport, powered either as an electric vehicle (and associated charging infrastructure) or by alternative low emission fuels.

Description and overview

This project includes a feasibility study and roll out program for an on-island shuttlebus public transport service that could use low emission technology – electric vehicles (EVs) or diesel vehicles using renewable diesel-low emission fuels when commercially more available on market. Community consultation identified a desire by members of the community for a more frequent service by smaller public buses. It is envisaged the shuttlebus service could be complementary to the current service of large diesel buses in operation, however the preferable mix of large and small buses to meet island needs would be confirmed together with funding and ownership as part of the feasibility study. It has been assumed for the purposes of this assessment, that two smaller electric shuttlebuses would be replacing a single equivalent larger diesel-powered bus. There is currently privately-owned public transport available on the island that utilises diesel buses. The proposed service would include:

- EV shuttlebus for 12 – 15 passengers
- No. shuttlebuses: 2 (to replace existing 1 bus)
- Route length: 35 minutes, 12km route from Picnic Bay to Horseshoe Bay
- Operating hours: similar to existing ie.5:55am to 9:45pm daily (extended hours Friday & Saturday)
- Charging infrastructure: initially connected to main grid, but also potential for renewable energy generation or purchasing of green power to reduce emissions

An annual emissions reduction of ~14 tonnes CO_2 and fuel cost saving of ~ $35,000 could be achieved comparing one diesel bus to 2 smaller electric buses, however this cost saving is likely displaced by the cost of an additional driver with minimum wage of ~$40,000 per year. Additional indirect emissions reductions could be realised due to less dependence on private cars and if the grid were to have an increase of renewables and lower carbon intensity in the future.

On-island EV shuttlebuses could provide several benefits to the community, additional to decarbonisation benefits, such as: more frequent services, improvement of safety due to smaller vehicles on winding roads, and EV charging infrastructure access for residents and an electric bike scheme could assist in uptake of other EVs on the island. Collaboration with existing bus service on island would be required – driver likely to be major ongoing expense of service.

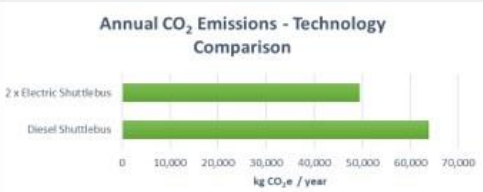
E-Bird Commuter Bus ©SEA Electric

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	14
Estimated payback period	Years	N/A
Estimated annual cost savings	$	0
Estimated capital costs	$ mil	0.2
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	0.5
Estimated FTE	No.	2

Key project objectives

Carbon assessment
Utilising two EVs for a public transport service would provide an annual emissions reduction of ~14 tonnes CO_2e compared to a single larger diesel equivalent, as shown in the graph below.



The emissions from the EVs are due to the carbon intensity of the grid, as Magnetic Island is grid connected, the QLD grid carbon intensity value has been used[1]. If the renewable energy penetration on the island were to be maximised or the EVs charged during periods of the day with high renewable resources, the emissions reduction from implementing EV shuttlebuses could be maximised.

There is also the potential of purchasing green power from the mainland grid or implementing a dedicated renewable energy charging station for the EVs; a dedicated renewable charging system could effectively reduce the shuttlebuses' annual emissions to zero.

Community self-sufficiency & resilience
Introducing an EV shuttlebuses could be a catalyst for further EVs and electric modes of transport on the island. It would be feasible for the EV shuttlebuses to use charging stations during the day located at central locations for other residents and tourists to use for their personal vehicles.

If on-island renewable electricity was used to power the system, it would reduce the island's reliance on imported fuels for transport, improving the island's self-sufficiency and further reducing the Island's footprint.

Co-benefits

Economic
There will be a reduction in fuel costs compared to that of a diesel bus, along with potentially reduced servicing costs. More frequent services could encourage more residents and visitors to utilise the service, generating more revenue for the operator of the service and economic activity. However these cost savings may be displaced by the additional driver's wages required to provide a more frequent service across more vehicles.

Social and cultural
More frequent public transport services could increase community connectivity, encouraging more community engagement and freedom of movement within the island community.

The community has raised safety concerns with the current bus service due to bus size relative to the small, constrained and winding roads. The community has also identified a need for more flexible, frequent service. Implementing two 12-15 passenger EV shuttlebuses replacing a single larger diesel bus would relieve the safety concerns of the community while providing a more frequent service.

EVs also have the added benefit of being quieter when compared to traditional diesel vehicles.

Environmental (General)
EVs would provide emissions reduction in comparison to their diesel counterpart, which was identified as a severe risk in the project risk assessment. However, the full possible emissions reduction would not be met unless the carbon intensity of the grid on the island has higher renewable energy penetration or charging occurs directly from renewable energy chargers or green energy credits. Furthermore, EVs provide air pollution reductions, which was identified as a high risk in the project risk assessment.

Environmental (impacts to Great Barrier Reef)
A reduction of greenhouse gas emissions through utilisation of EVs will 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
- Collaboration with Sunbus to either own/operate service or avoid clashing with their current service
- Initial investment for new buses and infrastructure is a barrier due to uncertainty around ownership structure and revenue models
- Difficulty garnering consumer base considering a bus service already exists.
  - Promotion of new service could require additional costs.
- The capacity of the electricity connector to the mainland grid is constrained which could limit the power resource options for EV charging

Risks
- Residents and visitors not utilising service
- Clashing with offering of existing Sunbus service
- Timing of service not properly aligning with ferry timetables
- If the EVs are to be charged from the grid, there might be a peak demand risk to Ergon if multiple electric vehicles charging during peak times. Renewable charging stations would mitigate this risk.

Opportunity
- Publicly available EV charging infrastructure could help other residents transfer to EV usage as well as for vehicles that visit the island
- Opportunity to expand the user base of the charging infrastructure to include privately owned vehicles and rental vehicles
- Alternatively could use a hybrid (electric and diesel), or hydrogen vehicle. These technologies were not explored due to lack of available vehicles on the local market for the identified 12-15 passenger capacity size, however they may be available in the next 5-10 years.
- Smaller buses could be more efficient for smaller numbers of people which could increase travel during non-peak periods such as in the middle of the day. This has been highlighted from community as a potential benefit of more frequent services.

Alignment with other initiatives

Alignment with other project options
- 1. Electric Bicycle Rental Service
- 14. Solar PV Rooftop Systems

Alignment with external initiatives or investments
- Alignment with the existing Sunbus service
- EV charging infrastructure could be utilised for personal vehicles and rentals, by expanding the scheme to include additional vehicles there is potential to capitalise off the chargers used.
- Ergon have expressed support for advice on connection points, undertaking planning assessments and ability to utilise EV charging tariffs.

1 National Greenhouse Accounts Factors August 2019 [https://www.industry.gov.au/sites/default/files/2020-07/national-greenhouse-accounts-factors-august-2019.pdf]

Assumptions

- Calculations based on assumption that shuttlebuses run daily and continuously from ~6am to 10pm over a 12km route length at ~230km per day. Potential for timetabling of both smaller buses to match demand at certain peak and low periods. It is likely that only one bus will run in the late evenings and potentially later than what is assumed (to match ferry time). To be determined through further investigation.
- Shuttlebus charging utilising Ergon's EV Home Charging Plan (Ergon tariff 33 rates)
- Using manufacturers performance specifications for both diesel and electric shuttlebuses – assumption that any inefficiencies and variance due to conditions of route are equally applicable to both vehicles
- Performance specifications and costing estimate of the SEA Electric E4B Commuter Bus (EV) and average large (~75 capacity) diesel bus used for calculations.
- Cost of diesel taken as $2/Litre for calculations of cost reduction
- No transport or traffic modelling has been conducted. Including no estimates of expected consumer base and financial returns from fares.
- No vehicle (diesel / electrical power) efficiency analysis has been conducted.
- Solar PV costed on ~$1,300 / kW and battery systems costed on ~$1,500/kWh, which includes a regional escalation factor based on Rawlinson's Construction Handbook 2020
- Solar PV and battery cost estimates include supply and installation, however location of potential solar PV and battery installation not determined
- Average wage assumed to correspond to minimum wage in Australia ~$40,000AUD[3]. This represents the lower bound and there is potential business partners would expect greater salaries, however this is to be determined through further assessments.

Costs and funding considerations

Capital costs

- Approximate total capital cost: ~$205k
  - Costs include the purchase of the two electric vehicles: ~$100k each
  - EV Charging Unit x 2: ~$5,000[2]
- Costs do not include storage location for vehicle, suitable parking and associated structure costs to be determined in next phase.
- *Optional* cost of renewable energy charging infrastructure for two EVs;

Operating Case	Daily Charge	Solar PV, Battery	Capital Cost
460 km / day	170 kWh	50 kW, 200 kWh	~$365k

- A feasibility study is also required to confirm operational parameters, capital costs and business plan. Estimated $50-100k for feasibility study.

Ongoing costs

- Cost of power, from grid, to charge vehicles: ~$35 / day
- Servicing of electric vehicle: $1,000 - $2,000 / year[3]
- Replacement costs
- Wages of drivers & training costs to be determined in later phase

Potential cost savings or return on investment

- Less power is required to charge two electric vehicles compared to the diesel consumed by a larger diesel bus
  - Resulting in annual fuel savings of ~$35,000 in comparison to the diesel bus
  - If using renewable energy charger, annual fuel savings of ~$47,000
- However fuel savings are likely to be displaced by the minimum annual wage of an additional bus driver of ~$40,000
- An increased user base utilising the service could offset driver and power consumption costs for EV charging, however further investigation would be required to quantify this return

Funding opportunities

- Climate Solutions Fund – Emissions Reduction Fund
- Clean Energy Finance Corp - Reef Funding Program
- Australian Renewable Energy Agency – 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
Sunbus/Alternative business				
Translink / TMR				
Energy Qld / Ergon Energy				
Residents & visitors				

Additional information

The terrain of the route could be beneficial to implementing an electric vehicle operation with regenerative braking benefits from non-linear paths with changes of elevation.

There is the potential to integrate the renewable charging system with a secure storage location for the buses, i.e. rooftop solar PV. Suitable sizing of the renewable charging system is highly dependent on the bus route and frequency of operation, the charging system could also be designed to service other project initiatives i.e. electric bike scheme, publicly accessible charging infrastructure.

Implementation and timeframes

Investment readiness

Consultation must occur with Sunbus to confirm if they are interested in the usage of electric shuttlebuses. If Sunbus are not interested in owning/operating the service then it could be implemented as a government or alternate private venture, however careful consideration would be needed ensure transport services are not duplicated.

Next steps

- Consultation with Sunbus and determination of owner/operator structure
- Analysis of proposed route and design of EV charging station and infrastructure
- Community consultation on suitability of proposed route and estimate of userbase
- Consultation with Ergon to determine support for advice on connection points, undertaking energy planning assessments and ability to utilise EV charging tariffs.

Considerations for implementation

- Appropriate training of drivers with new vehicles to ensure most efficient usage
- Publication and promotion of bus route and operating time
- Time of charging of EVs and strategic charging infrastructure location
- Further analysis is needed to understand the impact of tourism on the islands existing bus service

Timeframes to deliver solutions

The timeframe to deliver the solution would primarily be dependent on the route analysis, delivery timeframe of the selected EV, appropriate training period for the driver(s), in addition to ownership and operating structure agreement. It is suggested ~6 months should be allowed for the completion of this process.

2 Ergon, accessed September 2020, 'Charging your electric vehicle', [https://www.ergon.com.au/network/smarter-energy/electric-vehicles/charging-your-electric-vehicle]
3 Canstar Blue, June 2019, 'Electric Car Servicing Explained', [https://www.canstarblue.com.au/vehicles/electric-car-servicing/]
4 Minimum Wage https://www.fairwork.gov.au/pay/minimum-wages#:~:text=As%20of%201%20July%202020,in%20their%20award%20or%20agreement.

Magnetic Island | Resilience

3 Establishment of a Native Plant Nursery

Support to establish a nursery building and associated infrastructure to support establishment of a new Indigenous-owned business to supply native plants to the Magnetic Island community. .

Description and overview

This option was put forward by members of the Wulgurukaba Traditional Owner community, who have undertaken work in scoping a suitable potential site and market offering for a Native Plant Nursery, including potential infrastructure requirements and considerations.

A business plan is currently being developed by the Traditional Owners and any future work is to align with the business plan objectives and outcomes. The market is initially proposed to be the local community and businesses of Magnetic Island with a view to joining the suppliers list for Townsville City Council when possible.

Details were verbally provided to the project team and included in development of this project. the Native Nursery service offering is strongly aligned with the skills, capabilities and traditional knowledge held by the proponents.

Native plants, particularly those endemic to the area, are preferred for biodiversity and resilience purposes (i.e. appropriate to climate and land conditions), generally requiring less water to establish and maintain.

The project is seeking initial funding for establishment with a future vision for this project is for a new self-sustaining business that can also serve as a potential hub for environmental education and bush tucker foods. Any development of Indigenous led enterprise needs to ensure the protection of generations of Indigenous intellectual property.

Project summary

Item	Units	Total*
Estimated annual emissions reduction	t-CO_2-e	1 – 10
Estimated payback period	Years	N/A
Estimated annual cost savings	$	N/A
Estimated capital costs	$ mil	0.3+
Timeframe to deliver project	Years	1-3
Estimated FTE	No.	1-3

* Note that the feasibility study will determine optimum project details. An estimate of potential project costs and benefits is provided in this project outline overleaf. This project is for initial establishment of the nursery. The proponent is developing a business plan for ongoing operation and commercial market outcomes.

Key project objectives

Carbon assessment

A nursery will indirectly reduce the island's carbon footprint through sequestration due to cultivation of native plants. The rate of carbon sequestration depends on the growth characteristics of the plant species, conditions for growth where it is planted and the density of the wood for woody plants (however note native plants and some bush tucker could also be understorey/ground cover species). While there is good data for commercial forestry species, there is little data to confirm sequestration rates for environmental plantings. As an estimate, 'Trees for the Future' has estimated that their agroforestry trees, planted in tropical climates, will sequester CO_2 at an average of 22.7 kg of carbon dioxide per tree per year. There is uncertainty around sequestration potential depending on end use and life of the resulting plants.

There could be emissions benefits from not travelling to the mainland for plants/trees and this can potentially offset for plants that are transported off the island.

Up to 500 plants planted on-island each year sequestering carbon at between 2 - 20kg per year each would reduce the island's emissions between 1 – 10 t-CO_2-e per annum. The rate of sequestration depends on the species of plant and the permanence of the plantation.

Community self-sufficiency & resilience

The project primarily aligns with the self-sufficiency and resilience objectives. The development of this business would contribute to the increased economic self-sufficiency of the community through business activity and local job creation. It will also provide an opportunity for skills development, and for the promotion and sharing of traditional skills and cultural knowledge.

These factors align with the National Indigenous Reform Agreement 'Closing the Gap' objectives for economic participation. The business would make available on-island, native species which are more resilient to the local conditions and better adapted to the climate. Magnetic Island can be severely impacted by cyclones where damage caused by tree falls is common. The nursery could support replanting initiatives and species selection for cyclone resilience.

Coastal area plantings of native species may also help with managing shoreline erosion as a co-benefit.

Co-benefits

Economic

- Indigenous owned and run business or cooperative
- Contributes to economic opportunity on and off island
- Nursery industry data suggests that a small to medium size operation could support **1 to 3 ongoing FTE**[1]
- Construction works would also support employment
- TCC are incentivised to increase their Indigenous procurement and have indicated a need for this nursery
- Presents opportunities for skills development and capacity building on and off island (e.g. young people from the mainland could work with the project and could be part of a youth engagement project and cultural awareness/education initiative)

Social and cultural

- Promotes the sharing, retention and celebration of traditional skills and cultural knowledge as it relates to native plants and the natural environment
- Valuing and protecting of indigenous knowledge and intellectual property.
- Capacity of solution to leverage local content, knowledge, suppliers and services
- Application, mentoring and retention of Indigenous knowledge (all ages including youth and elders from the mainland could work with the project and could be part of a youth engagement project and cultural awareness/education initiative)

Environmental (General)

- Promotes planting of native, locally adapted species rather than introduced species
- Help to enhance native biodiversity and resilience of ecosystems on the island
- Planting bush tucker foods can deliver emergency food supply in the event the island is isolated from the mainland, which was identified as a severe risk in the project risk assessment.
- Plant absorption of carbon dioxide and can be used for land and coastal/beach restoration, with local native plants using less water generally and being more adapted to the soil and water conditions of the island

Other

- Could present an opportunity to collaborate with and improve social cohesion with other nearby local communities (e.g. Palm Island) and be a local supplier for plantings on the mainland and other islands of the Great Barrier Reef

Risks and opportunities

Barriers

- Supply of plants to mainland subject to transportation costs, potentially reducing competitiveness relative to supplier on the mainland (anecdotally no current competition)

Risks

- Technical: Site development suitability and risks unknown at this time (e.g. approvals, land ownership, technical suitability for intended use etc)
- Supply chain: Sufficient supply of resources (e.g. availability of water) in long term
- Weather/climate: Potential environmental and disaster risk to product, though could be mitigated to some extent by native stock and could be supported with aid of the local indigenous knowledge/experience
- Commercial: The ongoing viability of this initiative will depend upon successful business planning supported by a suitable agreement for sale of plants to Townsville City Council
- Nursery operations should consider the impacts of this land use on the island's land and water environments as well as the surrounding marine environment, mainly run off containing nutrient loads (plus other chemicals like herbicides/pesticides). However, management practices can be used to reduce impacts like runoff (capture and reuse etc.) with guidance available through the industry Farm Management System (i.e. best management program). Also the nursery role in increasing penetration of native, more environmentally resilient species on the island would be expected to reduce harmful runoff and storm detritus entering the Great Barrier Reef from the island.

Opportunity

- Collaboration with on-island food cultivation, other nurseries or community gardens in other communities (e.g. Palm Island) through promotion of shared learnings, capacity building activities, sharing stock for cultivation and efficiencies gained
- Potential opportunity for sale of office plants or even landscaping. Considering the approach to 'start small', could start by servicing local businesses and schools.

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

Assumptions

This project is for the establishment of the nursery structure and connecting infrastructure. It is assumed that the proponent is in the process of finalising a business plan for this opportunity and this would be made available as part of any grant application.

The range of local plant species that will be cultivated will require further planning and information gathering. Ecological investigations about native plants that are growing naturally on the island (and are also desirable for cultivation) would be useful and could be considered. There is potential for growing key or threatened plant species for plantings.

This project assumes that the operation will be relatively small-scale for supply to the local island community and to potentially to other businesses within Townsville, however this will be determined through additional development of the business plan.

Alignment with other initiatives

Alignment with other business cases
- 5.Sustainability and Environmental Education
- 8. Aquaculture Production Feasibility Study
- 13. Organic Waste Recycling Feasibility Study
- 14. Solar PV Rooftop Systems

Alignment with external initiatives or investments
- There is an opportunity to collaborate with nurseries and gardens established in other communities, such as in Townsville or Palm Island (potential for trade in seedling and seed stock while moving plants is unlikely to be cost effective)
- Sustainability and environmental education, Green waste Recovery and this Native Plant Nursery could be combined into one aligning project
- Potential alignment with QPWS opportunities, to link with their work especially regeneration and their potential requirements for native plants from the local provenance

Costs and funding considerations

Capital costs
- Capital costs based on establishing a new native plant nursery (i.e. a structure, planning and services)
- Land: Proposed site is owned by Traditional Owner.
- Construction cost: A warehouse developed on site, including connection of utilities and services is likely to cost between the range of $100,000 - $200,000
- Warehouse fit-out costs could range between $10,000 - $50,000
- Equipment costs to be considered, depends on scale, infrastructure and even plant species
- Notes that this is anticipated to be a small-scale nursery

Ongoing costs
- Not considered as part of funding requirement for this project start-up funding. Ongoing costs and revenues represent a commercial decision to be assessed within the business plan.

Potential cost savings or return on investment
- The nursery would represent a new commercial venture on the island
- Could also be used as a platform for training youth (local skills development)
- Self-sustaining business supported by a Townsville City Council supplier contract

Funding opportunities

Funding opportunities exist for this project including:
- Advance Queensland Deadly Deals fund
- Australian Government's Indigenous Procurement Policy
- Australian Government's Indigenous Entrepreneurs Fund
- Australian Government's Community Development Program Business Incubator Pilot
- QLD Business Growth Fund Program
- Indigenous Business Sector Strategy - pilot Indigenous Entrepreneurs Capital Scheme
- Relevant concessions for growers: QLD Department of Environment and Science Fee Concession for Protected Plant Growing Licence

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Proponent (Traditional Owners and main stakeholders)	■	■		
Townsville City Council			■	■
Magnetic Island community			■	■
Queensland Parks and Wildlife Service (QPWS)			■	

Additional information
- Townsville City Council have indicated interest in entering a contract for the supply of native plants throughout the region
- Queensland Parks and Wildlife Service may have an interest in this initiative and could act as a project partner, collaborator with the proponent, or end user
- Licence and permit requirements need to be considered in the business plan, e.g. nurseryman's licence and commercial producer's licence

Implementation and timeframes

Investment readiness

A business plan is currently being developed by the Traditional Owners. A grant application for capital works can be developed and submitted following this.

Next steps
- Finalisation of business plan
- Seek letter of endorsement / support to enter into a supply agreement (with Townsville City Council)
- Development of funding application(s)

Considerations for implementation
- Short-term: Design development and planning permission
- Long-term: Construction, service connections and fit out

Timeframes to deliver solutions

It is estimated that a nursery could be delivered in approximately 1 to 3 years, dependent upon the progression and finalisation of the business plan; successful application for funding; and timeframes for planning, design, procurement, construction and fit out.

Magnetic Island | Transport

4 Path Networks to Support Active Transport

Establish appropriate path network infrastructure and associated facilities to promote active transport on Magnetic Island.

Description and overview

Building upon the existing island path networks program, this project recommends the development of additional continuous path networks to promote an expansion of active transport on Magnetic Island. Active transport may include walking, cycling and other means of non-vehicular transport (including electric bikes and scooters) that may be used for normal daily commuting 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.

Magnetic Island is home to a thriving community and tourism industry, including many established pathways and bush walking tracks managed by the Townsville City Council (TCC) and Queensland Parks and Wildlife Service (QPWS). The Magnetic Island Trails Vision Plan (MITVP)[1] (TCC, 2019) and further engagement with TCC identified that the following pathway links could be improved and have identified a series of infrastructure investments that would improve integrated network of pathways. These paths are to be confirmed through further panning and investigations:

- Between Picnic Bay to Geoffrey Bay are incomplete paths
- Geoffrey Bay to Alma Bay
- Geoffrey Bay to Horseshoe Bay

Additionally, the pathway would provide an alternative mode of transport for members of the Magnetic Island community, who commonly commute via personal motor vehicle (1,315 passenger vehicles registered on island[2]).

There is an opportunity to develop bike paths throughout the island to align with those outlined in the Magnetic Island Trails Vision Plan, including the delivery of primary (including pathways and equipment) and secondary (including drinking fountains, lighting and shaded rest areas) infrastructure to enable active transport. The goal of the plan would be to enable a high level of uptake of active transport leading to a reduction in journeys made by car (commuter journeys by locals and car hire journeys by tourists) on the island. Consideration of bicycle routes (mountain bike vs city bike) as well as walking trails is key.

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	12
Estimated payback period	Years	>10
Estimated annual cost savings	$	N/A
Estimated capital costs	$ mil	5-10
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1 – 2
Estimated FTE	No.	N/A

1. Magnetic Island Trials Vision Plan - https://www.townsville.qld.gov.au/__data/assets/pdf_file/0027/72648/Magnetic-Island-Trails-Vision-Plan.pdf
2. Australian Bureau of Statistics, 'Magnetic Island (S) (LGA), Census 2016, (35790)

Key project objectives

Carbon assessment
An increase in uptake of active transport could reduce the number of trips taken in private motor vehicles. In particular, active transport options may typically replace short (<5km) journeys, which tend to produce a greater rate of emission per kilometre due to the temperature of the engine upon start. Based on the average emission intensity of passenger vehicles, a reduction in passenger vehicle use by one 1km trip per vehicle per week may correspond to an emissions reduction of 12.3t-CO_2/year[1]. Based on 1,315 total vehicles on the island.

Community and climate resilience
The uptake of active transport on Magnetic 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[2].
- 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
- Improvement in visitor experience and safety due to recued riding on roads.

Alignment with other initiatives

Alignment with other project options

- 1. Electric Bike Rental Scheme: Demand for active transport infrastructure should be considered alongside complementary initiatives, including possibility of inclusion of bicycle racking on shuttle busses to facilitate mixed mode trips.

Alignment with external initiatives or investments

- Queensland Cycling Strategy (TMR)
- Queensland Walking Strategy (TMR)
- North Queensland Principal Cycle Network Plan (QLD Government)
- Magnetic Island Trails Vision Plan (TCC/QPWS)

Co-benefits

Economic

- A reduction in passenger vehicle journeys may lead to a reduction in maintenance costs for road infrastructure. This reduction would be net of maintenance costs for new active transport infrastructure including pathways.
- The potential improvement in health outcomes associated with active transport may cause a reduction in healthcare costs for treatment issues associated with inactivity, particularly as healthcare is primarily undertaken on the mainland incurring related costs including accommodation and transport
- A reduction in passenger vehicle use may result in a reduction in cost of living for the community through reduced fuel and vehicle maintenance costs
- Economic opportunities for community include maintenance provision and broader tourism industry benefits from increased traffic/travel between areas

Social and cultural

- An increase in pedestrian traffic through the most populous areas of the island may support social cohesion and community engagement
- Active transport infrastructure will improve mobility for those on the island who are unable or unwilling to use passenger vehicles, including lower-income households or those under the age of 17

Environmental (General)

- The adoption of active transport will reduce Magnetic Island's contribution to greenhouse emissions through the reduction in use of passenger vehicles for short journeys, which was identified as a severe risk in the project risk assessment
- In addition, reduction in passenger vehicle use may reduce air and noise pollution in the populous areas of the island, which was identified as a high risk in the project risk assessment
- Establishing appropriate path networks will support mobility including during severe weather events where roads may be cut off, which was identified as a severe risk in the project risk assessment

Environmental (impacts to Great Barrier Reef)

- A reduction in vehicular emissions on Magnetic Island will contribute to the global effort to reduce emissions which are impacting the reef through increased temperatures and ocean acidification. The reduction in fuel to be shipped to the island will directly benefit the reef through a reduction in requirement for barge journeys and reduced chance of fuel spillage.

Risks and opportunities

Barriers

- Commuters may be less likely to adopt active transport methods due to increased travel time compared to private vehicles
- Age of participants (median age on island is 54) may impact whether the community is more likely to adopt walking, cycling or electric bike or scooter options
- The warm climate and many hills of Magnetic Island may be a barrier for use of active transport, with participants choosing to avoid strenuous walks or cycle journeys in hot weather.
- Topography of the island and large amount of national park could make spatial provisions for paths challenging.
- Ineffective support and ancillary infrastructure such as level paths, seating, rest areas, shade, drink fountains, directional signage can be a limiting factor active transport uptake
- 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 MITVP is at an advanced stage within the council, meaning that any planning or feasibility works to align the path networks and trails to form a holistic active transport solution for the island must be performed immediately. Due to the similarity of the projects, additional funding for a separate project if the two are not aligned would be unlikely to be approved.
- Current legislation around shared bicycle and pedestrian pathway width may impede the ability to include new infrastructure along existing corridors

Risks

- Depending on the final strategy and design, 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
- Increased active transport may result in increased crash risk. According to the Australian Transport Assessment and Planning Guidelines[3], crash risk for active travellers can be up to eight times riskier than private motor vehicle transport (depending on the infrastructure type and separation from the road). Typically, most fatal cyclists' crashes involve a motor vehicle. This risk can be mitigated through selection of location and design for infrastructure as well as engagement in community awareness.

Opportunity

- Explore infrastructure to support 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. The consideration of short-term infrastructure should not preclude the potential for installation of charging infrastructure for future options.
- Align with the 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

1 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]
2 The Heart Foundation, 2019,'Blueprint for an Active Australia, Third Edition'
3 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

Opportunities cont.

- There may also be an opportunity as part of this work to pave the existing track from Nelly Bay to West Point to better enable active transport users to access this area however this needs to be tested further.
- Leverage active transport improvements (providing for active experiences) to support island as a tourism destination and development of tourism products and experiences
- Future developments to include additional lighting to increase safety

Assumptions

- Magnetic Island Population (2016): 2,335 (1,495 of working age between 15-64 years old) [1]
- Average carbon dioxide emission of new passenger vehicle in Australia[2]: 180.9g/km
- Depending on the type of pathway to be installed and the nature of the surrounding infrastructure, cost of construction of footpath can lie between ~$150 - $650 per linear metre constructed
- TCC feedback highlights that an upgrade from Nelly Bay to Geoffrey cost $4.7M in 2012 for 800 metres due to local conditions along a cliff (~$5-6k/m)
- Engagement with TCC outline that extension of existing shared paths is preference for enhancing active transport on the island and hence assumed shared bike path only for this business case
- No land acquisition cost has been assumed in the indicative costing for the new or upgraded routes. This cost may be investigated further during the planning process.

Costs and funding considerations

Capital costs
The benchmark costs associated with the bike path only upgrades noted in the map below are as follows:

- Picnic Bay to Young Bay (7.8km): ~$1.17M - $5.07M
- Picnic Bay to Nelly Bay (1.3km): ~$195,000 to $845,000
- Nelly Bay to Geoffrey Bay (2km): ~$300,000 to $1.3M
- Geoffrey Bay to Horseshoe Bay (5.1km): ~$765,000 to $3.32M

These costs have been based on industry benchmarks and are highly dependent on the local conditions and commercial pricing received following detailed planning and investigations. There is potential that these costs highlighted could be 5-10 times this amount as seen in the upgrade works conducted by TCC in 2012 due to the challenging construction environment along a cliff.

An infrastructure assessment/feasibility study is required to progress this business case further. This could be in the order of $100-200k depending on the complexity.

Ongoing costs
Ongoing maintenance to be included in the overall maintenance program through TCC and does not represent additional costs.

Maintenance costs for associated infrastructure to be investigated through planning process, depending on detailed requirements.

Funding opportunities

- Infra+, ATIP under the Cycle Network Local Government Grants (CNLGG) program, Department of Transport and Main Roads on identified principal routes.
- Funding through the Queensland Action Plan for Walking, Department of Transport and Main Roads
- Queensland Health (e.g. Healthier, Happier) and Department of Housing and Public Works (e.g. Active Community Infrastructure Initiative).

Other potential sources may be determined as part of the planning process.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Townsville City Council	■	■	■	
QLD Govt (Queensland Parks and Wildlife Service, Transport and Main Roads)	■	■	■	
Magnetic Island Community				■
Private Tourism Operators			■	■
Tourists				■

Additional information
The rationale for selection of infrastructure for development should be investigated in the planning stage of the project, through multi-criteria analysis prior to option design or through cost-effectiveness or cost-benefit analysis once detailed costs are known.

Implementation and timeframes

Investment readiness
A further infrastructure identification and evaluation process must take place prior to the commencement of works to refine options and costs. Given the current status of the MITVP, proactive engagement and further action is required if these works are to be performed as a holistic solution for active transport on the island.

Next steps

- Identification and evaluation of options.
- Inclusion in works and maintenance schedule for the island.
- Procurement and delivery.
- Ensure alignment with TCC current program of works

Considerations for implementation
Community engagement to ensure impacts of construction of infrastructure are managed and key objectives are realised.

Timeframes to deliver solutions
The timeframe to deliver the infrastructure depends on the options chosen for development and may take a matter of weeks or months from commencement to completion.

1. [https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/318021483?opendocument#:~:text=In%20the%202016%20Census%2C%20there,up%202.8%25%20of%20the%20population.&text=The%20median%20age%20of%20people,Level%202)%20was%2054%20years.]
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]

Magnetic Island | Multiple themes

5 Sustainability and Environmental Education

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

Description and overview

This project seeks to develop and deliver community-led sustainability and environmental knowledge sharing and education building upon the existing community knowledge and capacity and previous sustainability initiatives.

The Solar City - Magnetic Island Solar Suburb initiative[1] (2007 – 2013) was a highly successful community energy and sustainability initiative on Magnetic Island supported by Queensland Government funding. The project included the community hub for the project being the Smart Lifestyle Centre. Ergon Energy has indicated their support for the program through access to previously developed collateral and materials to the following programs:

- Indigenous Energy Efficiency Program and School Curriculum
- Solar City energy efficiency material
- Safety Heroes Program

The project will seek a champion and funding for the development and implementation of appropriate programs and materials in conjunction with the community, building upon existing knowledge and materials. This knowledge sharing will focus on the sustainable use of resources, resilient transport and household management options, tailored separately to residents and visitors. These initiatives will include:

- Energy efficiency improvements and solar panel education
- Solar hot water systems
- Sustainable transport options including education on vehicle efficiency and use (marine and island)
- Waste hierarchy principles in improving resource use and reducing waste production
- Improved water usage and management, including increasing rainwater harvesting for homes

Mediums used to deliver education to the community and visitors will be through a series of workshops and a variety of communication materials in public spaces on the island.

Celebrating and sharing knowledge of sustainability and environmental management will strengthen the community's resilience to future changes or developments on the island, including the increase in tourism ventures. This project will provide opportunities to support and upskill community members and businesses to deliver knowledge sharing, as well as engage the local community, school children and visitors in important sustainability initiatives. This project will also recognise the considerable investment and interest by the community in sustainability to date.

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	0.2 – 0.3
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1 - 3
Estimated FTE	No.	N/A

Key project objectives

Carbon assessment

- Reducing household and tourist consumption of materials will reduce the embodied carbon that goes into producing and transporting them, as well as avoiding emissions from their subsequent disposal in landfill
- Reducing household and tourist energy usage and increasing the community's energy efficiency will avoid electricity usage from the grid, which is currently carbon intensive
- Reduced water consumption by community and tourists as well as increased adoption of rainwater harvesting will reduce electricity used at the Water Treatment Plant (WTP) on the mainland 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

Community resilience

- A decrease in resource consumption will reduce the community's vulnerability to supply deficits i.e. water, energy
- Adoption of rainwater harvesting will provide sustainable water available for use without the need for processing
- This project will build upon the success of previous community capacity building as part of initiatives, such as Solar Cities, and those managed by the various Community Groups. This project will complement other island community initiatives, which is an additional benefit.
- A combination of industry and community champions to deliver the project will strengthen support and likelihood of success of outcomes. Initial support has been gained from Ergon and community groups as part of development of this project as outlined.

Co-benefits

Economic

- Costs savings for community members and tourism businesses by reducing their consumption of water and energy
- Skills development and capacity building with the potential for job creation
- Rainwater tank maintenance as a job opportunity
- Improved waste separation provides increased opportunities for reuse or recycling of resources and therefore new industries to be established
- Sustainable, 'green' image for the island to use as a marketing selling point

Social and cultural

- Celebrate traditional culture and knowledge
- Increased awareness of environmental protection and sustainable consumer behaviour
- Fostering a sense of place and a sustainable and harmonious community
- Liveability benefits from reduced spending on energy, water and other resources
- Recognition of community's strong drive to enhance sustainability and connection to sustainable practices

Environmental (General)

- Reduced environmental impact of the community and visitors regarding waste production, resource consumption, transport, water usage and energy usage, as well as impacts on local ecosystems which was identified as a severe risk in the project risk assessment
- Reduced single-use plastics
- Reduced cost associated with transport of waste off-island, which was identified as a high risk in the project risk assessment

Environmental (impacts to Great Barrier Reef)

- Reduced litter / pollution entering oceans and the GBR

Other

- Reduced demand on water and electricity providers on the island
- Tourists may take lessons learnt at Magnetic Island and apply at home
- Sustainable practices by tourists will reduce negative perceptions of visitors

Risks and opportunities

Barriers

- Ensuring communication mediums and infrastructure reach the right audience i.e. transient tourism populations may be difficult to effectively reach
- Need to confirm industry and community champions to deliver the project

Risks

- Community and visitors are not interested or engaged in knowledge being shared
- Loss of interest, funding and support over time, restricting its longevity
- Effectiveness of educating tourists who are generally less environmentally conscious

Opportunity

- Utilise the existing Horseshoe Bay Sports and Recreation Centre (formally known as the Smart Lifestyle Centre) for this program and to conduct workshops, rather than building a new facility
- Partnering with local schools as a platform for delivering education and knowledge sharing
- Partnership with traditional owners to leverage their knowledge in combination with modern technology as a key component of the knowledge sharing
- Support from TCC and use of their already developed materials

Alignment with other initiatives

Alignment with other project options

- 1. Electric Bicycle Rental Service
- 3. Establishment of a Native Plant Nursery, supported by a TCC supplier contract
- 8. Aquaculture Production Feasibility Study
- 10. Destination Management Plan
- 11. Energy Demand Management Incentive Scheme

Alignment with external initiatives or investments

- Potential for collaborative partnerships with NGO's like Keep Australia Beautiful, Community Sustainability Grants
- Zero Waste Magnetic Island - happy to champion zero waste projects
- Resource Recovery Industry Development Program
- Alignment with Townsville City Council's 'green' aspirations
- Funding support from state government to implement the Plastic Free Places program
- 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

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

Assumptions

- Some/all of the knowledge being transferred to others within the community will directly support skills development, capacity building, and the potential for job creation
- All knowledge being transferred has decarbonisation benefits and environmental/ecological preservation benefits. It has been assumed that knowledge transfer would be done under a paid engagement.
- The education and knowledge sharing program will be differentiated for its two target audiences – visitors and the local community

Costs and funding considerations

Capital costs

- Engage a consultant at $200/hr 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 develop and deliver the education materials and program.
- Approximate funding costs for such a program would be approximately $200-300K

Ongoing costs

- Assumed full time community member will facilitate all workshops with part time individual providing data collection, workshop assistance and other required services

Potential cost savings or return on investment

- Zero waste Magnetic Island on island will champion zero waste projects and reduce costs and time from this project
- Cost savings for households and tourism operators from reduced energy and water use

Funding opportunities

- Round 3 - Community Sustainability Actions Grants[1]
- Social reinvestment[2]
- 1000 Jobs Package (Tranche Two)[3]
- Community Led Grants[4]
- The Container Refund Scheme Small Scale Infrastructure Grants Program (Queensland Government.) provides up to $10,000 in infrastructure and equipment to set up collection points for the newly introduced container deposit scheme[5]

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Magnetic Island local community	■	■	■	■
Visitors/tourists				■
Townsville City Council	■	■	■	
NGOs				■
Tourism operators and businesses			■	
QPWS			■	
Magnetic Island Schools			■	■
Zero Waste Magnetic Island		■	■	
Queensland Government			■	

Implementation and timeframes

Investment readiness

- The Horseshoe Bay Sports and Recreation Centre is ready to accommodate workshops and activities
- Seek industry and community champions to deliver the project. Initial support has been gained from Ergon and community groups as part of development of this project as outlined

Next steps

- Formulate appropriate scope, linkages and delivery format of the program
- Engage with the local community and tourism operators to understand and identify priority areas that can be a key focus of the knowledge sharing. Two focus topics will be selected and focused on by the program initially.
- Evaluate what areas of sustainability are high impact for this community and align education with these issues
- Identify the most appropriate methods of knowledge sharing i.e. workshops, signage, mailbox drops, emails, Facebook groups etc. in consultation with the community

Considerations for implementation

- Partnerships with other NGOs or community groups who may already be active in this space to consolidate and make efforts more efficient Potential partners include Keep Australia Beautiful, Community Sustainability Grants, Schools - EcoMarine Warriors, Zero Waste Magnetic Island, other existing community groups and local schools
- Undertake regular workshops with stakeholders across the island including visitors, staff and residents to encourage adoption of sustainable and cost saving initiatives
- Ascertain mobilisation readiness of community members to deliver this program

Timeframes to deliver solutions

Initially six months are to be spent developing materials, collaborating with NGOs, planning the delivery of the program and attaining funding to support the employment of two community members to deliver the program. Once the program has officially begun it will be ongoing, with opportunities to reassess and update the program every six months in response to the community and visitor uptake and feedback. It is noted that some Townsville City Council material exists which may be used depending on a review by the consultant.

1. https://www.grants.services.qld.gov.au/#/service-details/60858?answers=1003,-2000,40024004,-3000,-5000&sortBy=status&sortDir=desc
2. https://www.grants.services.qld.gov.au/#/service-details/60201?answers=1003,-2000,40024004,-3000,-5000&sortBy=status&sortDir=desc
3. https://www.grants.gov.au/?event=public.GO.show&GOUUID=156490D8-ADBE-EF76-3EF103EFE89750B2
4. https://www.grants.gov.au/?event=public.GO.show&GOUUID=CB0C770F-0EF5-AD48-6B9FD6BC2E458366
5. https://www.qld.gov.au/environment/pollution/management/waste/recovery/funding-grants
6. https://www.fairwork.gov.au/pay/minimum-wages#:~:text=As%20of%201%20July%202020,in%20their%20award%20or%20agreement.

Magnetic Island | Energy

6 Energy Efficiency Retrofits

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. $2,000 per residence , $4,000 per commercial building) to:

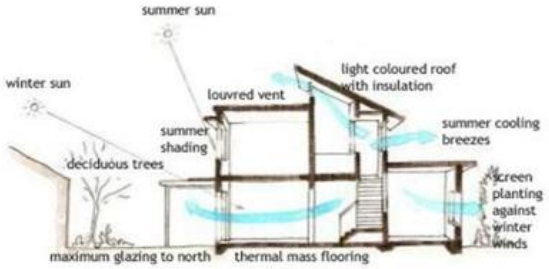
1. Fund building audits to establish the need for building improvements with the intent of enhancing energy efficiency
2. Fund the highest priority upgrade(s) in each building up to the subsidy amount

This option will benefit residents by allowing them to partake in effective and feasible retrofitting measures that 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 – Magnetic Island already has a program for this. It could involve aligning with this program.
- 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

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

An overarching operator has not yet been selected for the scheme but a council or community body (e.g. Townsville City Council) would be suitable. Ergon have indicated their willingness to support the project.



Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e households	400-800
Estimated annual emissions reduction	t-CO_2-e commercial	450-900
Estimated payback period	Years / household	10 - 30
Estimated payback period	Years / commercial structure	5 - 10
Estimated annual cost savings	$ / household	70-140
Estimated annual cost savings	$ / commercial structure	680-1,350
Estimated capital costs	$ mil	1 – 1.5*
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1 – 2
Estimated FTE	FTE	2 – 4

* This assumes: 350 residential dwellings (~20%) and 100 commercial structures[1](~33%); residential dwellings receive $2,000 and commercial buildings $4,000 to subsidise building improvements. Determining priority buildings to undertake scheme is to be confirmed in the planning phase. Payback based on per building/household.

Key project objectives

Carbon assessment

- The average residential dwelling on Magnetic Island consumes ~4,500kWh of electricity from the main grid annually based off data received by Ergon. It is assumed that all installed solar PV is currently being utilised behind the meter or exported back to the grid and as such Ergon would not see this energy supply or reduction in demand. Around 40% of home energy is expended on heating and/or cooling (national average). Meaning the average residential household on Magnetic Island is estimated to consume 1,800kWh on heating and/or cooling, which is equivalent to approx. 2,250kg CO_2-e, based on emission factor of 0.81t.CO2eq /MWh for Queensland grid NEM[1]. Typically a residential energy audit will identify measures that reduce energy usage by 15-30%. This means that the average Magnetic Island dwelling could reduce annual carbon emissions by abating approx. 220-440 kg of CO2e each year, total of 400-800 t-CO2-e/yr for the island based on 1,821 dwellings.
- Under these assumptions, the average Magnetic Island commercial building uses ~44,000kWh per year and could reduce annual heating and/or cooling electricity consumption by ~2,600-5,300 kWh, abating ~2,100-4,200 kg CO2eq , total of 450-900 t-CO2-e/yr for the island based on 211 commercial buildings.

Community resilience

- Passive cooling measures increase climate resilience as temperatures rise. Australia is predicted to experience more extreme heat events and enhancing passive cooling within buildings and homes will assist residents to better cope with these changes.
- Educating residents on energy efficiency can benefit the entire community as awareness is increased which in turn results in a more informed consumer
- By minimising energy consumption, the community will decrease their energy bills which currently represent a substantial part of their income. This will increase the community's resilience in the face of changing climate and potential supply issues via the mainland cables and future carbon taxes, if introduced.

Co-benefits

Economic

- Passive cooling measures reduce the need to utilise mechanical space conditioning (i.e. air-conditioning) which in turn reduces energy bills.
- This may contribute to the deferment of the investment required to augment the NEM network on Magnetic Island by reducing electricity demand
- Given the number of buildings on Magnetic Island, it is likely that the project would take between 1 to 2 years to pass through planning, audit delivery, and implementation of building improvements. This has the potential to support approximately 2 to 4 FTE jobs.

Social and cultural

- Increased liveability through improved cooling conditions
- Increased health and wellbeing, particularly for vulnerable residents such as young and elderly
- 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
- Preservation of natural energy resources through consumption of fuel, which was identified as a high risk in the project risk assessment

Environmental (impacts to Great Barrier Reef)

- During the installation process of the relevant building improvement materials may enter the waterways which could flow into Great Barrier Reef and surrounding environments
- Reduced energy usage will delay potential requirement to replace the under-sea electricity supply cable from the mainland, which has the potential for detrimental impacts to the reef areas between Magnetic Island and Townsville, and those surrounding Magnetic Island

Risks and opportunities

Barriers

- Complications regarding the upgrade of rental properties
- Questions surrounding the incentive of landlords to upgrade residences when the tenant receives the cost benefit
- Lack of or limited funding

Risks

- Each studied building has varying building characteristics meaning the complexity of the energy audit and resulting building improvement varies from building to building
- Coordination between building residents, energy audit conductors and building improvement installers
- Work completed in the SolarCity program will have removed some of the opportunities that could come out of any building audits
- To mitigate against the risk of poor-quality upgrades, a panel of providers should be selected to ensure quality workmanship

Opportunity

- Reduction in power consumption, and therefore electricity bills and environmental impact
- Educating residents and business owners on electricity usage and saving measures
- Potential to train and upskill residents to carry out the energy audits
- Leverage existing knowledge from SolarCity program to help foster greater learning and sharing.

Alignment with other initiatives

Alignment with other project options

- 5. Sustainability and Environmental Education
- 11. Energy Demand Management Incentive Scheme
- 14. Solar PV Rooftop Systems
- 17. Microgrid Feasibility Study

Alignment with external initiatives or investments

- As part of the Solar City Program:
  - Ergon Energy conducted free energy assessments of homes and businesses on Magnetic Island and provided measures to save electricity, amongst other outcomes
  - Some dwellings were painted with reflective roof paint
- This initiative could be integrated into new build requirements so new homes benefit from improved energy efficiency
- Ergon Energy's Household energy use calculator
- Australian Governments "Your Home" Energy learnings about reducing power consumption
- Queensland Government guidance -sustainable homes and reducing electricity bills

1. National Greenhouse Accounts Factors August 2019: https://www.industry.gov.au/sites/default/files/2020-07/national-greenhouse-accounts-factors-august-2019.pdf

Assumptions

It is assumed that the residential and commercial properties eligible for this project option would vary regarding their building characteristics (e.g. size, age, installed appliances etc).
Additional assumptions include:

- Capital costs are approximate, for more accurate values further research is required
- The cost listed for the energy audit was procured from a conversation with an energy 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 [4,5]
- Heat reflective roof paint[9] was assumed to cost $13 per m^2
- Average square meter of a residential roof is assumed to equal 160 m^2 and 3000 m^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 relate to savings on space conditioning expenses
- Timeframes provided are based on industry knowledge
- 1102kW of installed solar PV with an assumed capacity factor of 32% as per AEMO Inputs and Assumptions Workbook 2019. This results in approximately 18% of yearly load is met by solar PV. However it is assumed this is behind the meter and already factored into the average consumption per household.

Costs and funding considerations

Ongoing costs

- An additional energy audit (e.g. 1 year post initial audit) to measure success and validate seeking additional funding for future phases. Intent would be to be funded by the main beneficiary of future phases and to be determined through further planning.
- Costs associated with maintaining improvements

Capital costs

Approximate total capital cost: **$1.1 M**

- This assumes: 350 residential dwellings (~20%) and 100 commercial structures[1](~50%); residential dwellings receive $2,000 and commercial buildings $4,000 to subsidise building improvements. Determining priority buildings to undertake scheme is to be confirmed in the planning phase.

The fixed funding amount could subsidize the items listed in the table to the right.

Costs and funding considerations

Item	Ave. Residential Building	Ave. Commercial Building
Energy Audit	$200	$ 2-3,000
Roof insulation & installation [3, 4]	$2,560 – 4,160	$24,000 – 78,000
Wall insulation & installation [1, 2]	$1,536 – 2,496	$28,800 – 46,800
Heat reflective roof paint* [3]	$2,080	$39,000
Window awnings [6, 7]	$1,300 – 3,900	$2,500 – 7,000
Window Glazing [6, 7]	$800 – 1,500 per m2	
Skylights [8]	$400 – 1,300 per window	
Planting of vegetation*	$15 - 45 per tree	

**Supply cost only*

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%. Therefore, the average Magnetic Island residential dwelling could reduce their annual heating and/or cooling electricity consumption by ~270-540 kWh. Applying a usage charge of 0.22 $/kWh, each household could save ~$70-$140 on their electricity bill annually. Equating to a payback period between 15-28 years.

Following the same logic, the average commercial structure on Magnetic Island would save ~$680-1,350 on their electricity bill annually. Equating to a payback period between 5-9 years.

Funding opportunities

Discussions with Ergon Energy confirmed that they are supportive of opportunities to reduce peak energy demand on the island. Ergon also have audit capability which could be employed for the project.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Townsville City Council	■	■	■	
Residential inhabitants and homeowners	■			■
Business owners	■		■	■
Ergon Energy		■	■	
State Government			■	
Local Council	■		■	■

Additional information

About Magnetic Island:

- Magnetic Island is a popular holiday destination meaning electricity demand peaks across holiday periods (Christmas and Easter) when weather is hottest

Implementation and timeframes

Investment readiness

- Once funding is secured the project scheme audit rollout can be planned and implemented immediately

Next steps

- Creating a scheme structure detailing priorities
- Identifying organisations with energy audit capabilities, preferably in Townsville, to understand the feasibility of conducting numerous audits
- Assessment of overall island demand reduction benefits to help inform long-term strategy

Considerations for implementation

- Consultation with Ergon Energy will be required to establish an appropriate energy audit sample size. An appropriate sample size may be 10-20% of structures. The results of the energy audit will form the recommendations for an island wide program to address the audit findings. The scheme will fund the energy audit and part of the building improvement.
- Ensuring the effective dissemination and promotion of subsidy information to island residents
- Ergon have suggested that a trial of water and sewage pump load optimisation could help understand the benefit and impacts of any existing building improvements which would be addressed through consultation with Ergon
- Determination of future audits for scheme validation

Timeframes to deliver solutions

- This project could take between 1 to 2 years to pass through planning, audit delivery, and implementation of building improvements

1 Dwelling and building data provided by Ergon Energy
2. Energy Smart Strata: http://www.energysmartstrata.com.au/fact-sheets/energy-audit-fact-sheet/
3. Energy Basics for Householders: https://www.energy.gov.au/households/energy-basics-householders
4. HomeAdvisor, Insulation: https://www.homeadvisor.com/cost/insulation/
5. Home Insulation Guide: https://enviroshop.com.au/pages/home-insulation
6. HomeAdvisor, Awning: https://www.homeadvisor.com/cost/outdoor-living/install-an-awning/
7. Smart Canvas, Awning: https://www.smartcanvas.com.au/folding-arm-awning/
8. Hipages, Skylight Costs: https://hipages.com.au/article/how_much_does_a_skylight_cost
9. Solar Quotes, Air Conditioning: https://www.solarquotes.com.au/blog/solar-air-conditioning-vs-heat-reflective-paint/

Magnetic Island | Energy

7 Green Hydrogen Transport Demonstration Project

A feasibility study for the development of a green hydrogen generation and refuelling demonstration scheme.

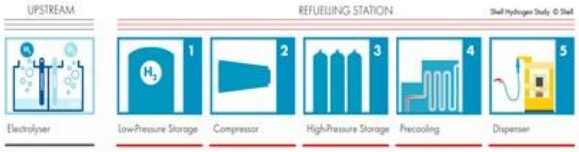
Description and overview

This project proposes a feasibility study examining the development of a green hydrogen transport demonstration project on Magnetic Island and would seek collaboration with the wider Townsville region hydrogen initiatives. The project would increase the visibility of Magnetic Island as an innovative sustainable-tourism destination. It would also be a local flagship for the development of Queensland's hydrogen industry and net zero carbon economy by 2050.

Green hydrogen is fast being recognised as an energy vector that has the potential to play a pivotal role in the transformation to zero carbon energy. It is produced by using an electrolyser powered by renewable energy to split water (H_20) into hydrogen and oxygen. The Queensland Hydrogen Strategy[1] has recognised that a variety of demonstration projects are needed to prove technology application and seed this future industry.

The feasibility study would investigate options for the on-island green hydrogen generation, refuelling and use for marine and land transport applications. An estimate of potential benefits and costs of a demonstration project are provided to inform the project study here. The study will include:

- Generation: in addition to considering mainland generation options, the potential for an on-island demonstration size electrolyser to produce green hydrogen from a local water supply (wastewater, mains connection or seawater); the potential for on-island renewable energy generation or purchase of green power options;
- Refuelling: refuelling station suitable for and accessible to local vehicles including ferries, barges, buses, forklifts, cars, waste vehicles and trucks. Purchasing of new vehicles suitable for hydrogen use would be required.
- Other opportunities and partnerships: Central to the feasibility study will be the development of partnerships. The study would also consider off-island production and use options, recognising that the industry is developing rapidly and there may be opportunities to link in with a regional hydrogen cluster initiatives which are currently under development, to improve project impact and viability. Also links with other energy and transport decarbonisation projects proposed for the Island (refer to Project 2 and 20).



Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	To be determined by the study
Estimated payback period *(assuming govt subsidy)	Years	To be determined by the study
Estimated annual cost savings	$	To be determined by the study
Estimated capital costs	$ mil	0.15-0.2 (study)
Net present value (simple)	$	To be determined by the study
Timeframe to deliver project	Years	0.5 (study)
Estimated FTE (construction)	No.	To be determined by the study
Estimated FTE (operation)	No.	To be determined by the study

Note that the feasibility study will determine optimum project details. An estimate of potential project costs and benefits is provided in this project outline overleaf.

1. https://www.dsdmip.qld.gov.au/resources/strategy/queensland-hydrogen-strategy.pdf

Key project objectives

Carbon assessment

When produced using renewable energy sources, green hydrogen is a zero-carbon emissions fuel source compared with other carbon derived fuel sources (diesel, petrol, natural gas).

Central to the feasibility study will be the development of partnerships to investigate opportunities for the generation, refuelling and use of green hydrogen for marine and land transport applications. To understand the potential for decarbonisation from hydrogen use in transport on Magnetic Island, the following table provides a comparison to the vehicles on Magnetic Island, yearly fuel usage, CO_2-e and resulting hydrogen equivalent.

In the situation where the fossil fuel based marine and land transport to/from and on the Island, as outlined in the table below, was converted to hydrogen fuel cells, these vehicles would result in a daily hydrogen demand of approximately 800kg/day which would reduce CO2 emissions by approximately 3,800 tonnes per year. Understanding the implementation and development of a hydrogen strategy requires a more detailed feasibility study to be undertaken to work with community and potential developers to better understand required infrastructure, utilities, offtake and siting.

Community resilience

- A locally generated fuel option would reduce reliance on imported fuels
- Building upon community identity as sustainable liveable community
- Demonstrate/lead best practice innovative decarbonisation measures.
- Building upon sustainable-tourism destination recognition and benefits. Innovative technology demonstration supports the Townsville region's innovative scientific hub for the GBR.

Co-benefits

Economic

- Opportunities to attract tourism through strengthening the sustainable-tourism brand will provide co-benefit to the community for tourism related economic stimulation
- Opportunities for local clean jobs in the hydrogen economy value chain
- Consideration of economic impact of existing on-island fossil-fuel suppliers and refuelling

Social and cultural

- A clean green Magnetic Island vision is supported by many of the Magnetic Island community groups and members of the community
- The project would build upon the momentum of the previous Townsville Solar City program and current variety of sustainability initiatives being undertaken by TCC and the Magnetic Island community for a common vision toward a sustainable Magnetic Island

Environmental (General)

- Reduction in fossil fuel reliance on the island and direct benefits to air quality and GHG/carbon emissions from vehicles, which was identified as a high risk in the project risk assessment

Environmental (impacts to Great Barrier Reef)

- Reduction in transport via bulk liquid carriers for delivery of fuels would be reduced, decreasing potential risk of spills and generation of emissions

Risks and opportunities

Barriers

- Magnetic Island does not have freshwater source for use on Island. Source of water resources to generate energy to be agreed with TCC
- Hydrogen is not currently commercial technology and subsidy of demonstration required
- Immature hydrogen market with current low availability of hydrogen vehicles in Australia. Access to required infrastructure (electrolysers, compressors) that are in high demand in an evolving global market.
- Social acceptance of hydrogen as a safe and acceptable fuel, Australian hydrogen standards.
- On-island renewable electricity supply may be insufficient to support additional load from hydrogen electrolyser, to be explored with Energy Queensland / Ergon
- Expansion beyond demonstration scale is largely dependent on development of the hydrogen economy in Australia and not within local control
- Source of water resources available to generate energy to be agreed with TCC

Risks

- Broader societal acceptance of hydrogen as safe fuel. Introducing a potentially hazardous area (hydrogen generation) on the island.

Opportunity

- Reduction in carbon derived fuels for transport and reduction in bulk fuel carriers delivering fuel to the island
- Magnetic Island to be at the forefront of technology and innovation
- Magnetic Island as a demonstration of a hydrogen economy for Australia and worldwide and in particular for island communities
- Potential to align with Energy Queensland / Ergon 'Distributed Energy Resources' initiatives

Alignment with other initiatives

Alignment with other projects

- 1. Electric Bicycle Rental Service
- 2. Low Emission On-Island Shuttlebus
- 14. Solar PV Rooftop Systems
- 16. Low Emission Marine Transport
- 17. Microgrid Feasibility Study

Alignment with external initiatives or investments

- Aligns with Australian National Hydrogen Strategy and Queensland Government Hydrogen Industry Strategy and Townsville Hydrogen Industry Working Group
- Significant investment and grant funding available from Australian Renewable Energy Agency (ARENA) and Clean Energy Finance Corporation (CEFC)
- Energy Queensland Distribution Annual Planning including future investment strategy for Magnetic Island & consideration of Distributed Energy Resource trials
- Sun Metals zinc refinery (Townsville) - green hydrogen scheme (public announcement and ARENA/CEFC funded)

Stakeholder Name	L fuel/year	Potential Fuel Energy MJ	kg CO2e	Combustion Engine Efficiency	Mechanical Work	Hydrogen Fuel Cell Eff	Potential Energy	H2 Equivalent - kg	kg/day
Public Transport Operator	49045	1839190	128,394	35%	643717	60%	1072861	7609	21
Cars (petrol)	224310	7761140	519,375	30%	2328342	60%	3880570	27522	75
Cars (diesel)	147787	5542013	386,888	35%	1939704	60%	3232841	22928	63
Bus Tour Operator	1035	38825	2,710	35%	13589	60%	22648	161	0.4
Marine Operator 1	450019	17370727	1,214,214	50%	8685363	60%	14475606	102664	281
Marine Operator 2	602027	23238229	1,624,352	50%	11297963	60%	18829938	133546	366

Assumptions

- Vehicle data based on information gathered and received from EarthCheck during the Sustainability Assessment island visit– September 2019
- OPEX includes labour, overheads, insurance, electricity purchase, water, consumables and maintenance
- CAPEX/OPEX is based off industry experience and benchmarking. There is a possibility that due to the remoteness of the island, the development of a facility will incur premiums that have not been considered.
- Hydrogen demand is based on 100% uptake. This will be explored further in feasibility study.
- Any cost or emissions estimates provided here are for indicative purposes only and require confirmation as part of a detailed assessment. Information on hydrogen project costs is not readily available in this fast-evolving technology market and should be re-confirmed at time of implementation.
- Close consultation with Ergon / Energy Queensland on potential impact on electricity network required during assessment.
- The feasibility study is the required first step before further development. The estimated annual emissions reductions depends on multiple factors such as scale of facility, offtake agreement and electricity source and without further details any estimates could be misleading. Similarly for cost savings and ROI will largely depend on available funding and outcomes of study.

Additional information

- Feasibility study will require collaboration and information from government and potential generators, refuelling and hydrogen users.
- Our understanding is that the existing grid connection to mainland is somewhat constrained. The inclusion of a 250kW or greater hydrogen facility and without additional corresponding on-island electricity generation & storage, could have material impact on grid reliability and peak demand and will need to be considered in detail with Energy Queensland / Ergon.

Costs and funding considerations

Capital costs

Two key areas of cost should be considered when assessing this project:

- The first is the fee to develop the feasibility assessment to determine the scale, use, costs and method of implementation of a hydrogen pilot study. This would include site selection, technology overview, sizing of systems, supplier engagement, engagement with potential offtakes, vehicle research and a high-level planning pathway. It would cost between $150-200k.
- The second is the approximate total capital and operating costs associated with the pilot facility. Approximate total capital cost of a 150kg/day hydrogen refuelling station is $7-10M. Please note that this is a high-level estimate that would be refined through the feasibility study.

Ongoing costs

Operating costs associated with a hydrogen refuelling station is approximately 5-8% of initial capital expenditure. Electricity is the largest operational cost associated with the production of hydrogen, sourcing cheap, renewable electricity could reduce the OPEX.

Potential cost savings or return on investment

The sale price of hydrogen will be determined through the feasibility study. The offtake agreement will likely involve a fixed price per kilogram. The revenue received would be fed into a financial model, determining the levelised cost of hydrogen (LCOH) which is the breakeven price taking into consideration lifecycle CAPEX and OPEX across. It is likely that for a 10-year operating period, the LCOH would be in the order of $35-40/kg for a small 100-200kg/day facility. This is largely due to the still relatively immature hydrogen market and large capital costs associated with infrastructure (e.g. electrolyser, storage, compression, dispensing etc.). Economies of scale would be for larger facilities. Any additional required return would be added to the LCOH following the development of the feasibility study.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Magnetic Island residents	■			■
Magnetic Island businesses	■		■	■
Potential Operator tbc	■	■	■	
Townsville City Council			■	■
Ergon / Energy Queensland			■	■
Queensland Government			■	
Federal Government			■	
Transport operators (e.g. SeaLink)			■	
Potential hydrogen producers (e.g. Sun metal)			■	

Implementation and timeframes

Investment readiness

- Early investment into the feasibility can occur immediately with suitable expertise available in the Queensland market
- There is potential for lag time (up to 2 years) for the purchase and procurement of hydrogen infrastructure and vehicles due to a high demand globally, especially in Europe. Given the design requirements for developing a system like this, the lead times for equipment can be included into an appropriate program.
- A small containerised electrolyser solution that is relatively quick and easy to install, can optimise lag times

Next steps

- Undertake the feasibility into a hydrogen economy at Magnetic Island, taking into account opportunities to leverage mainland initiatives

Considerations for implementation

- The feasibility study will provide the community a gateway opportunity to explore a potential local hydrogen economy. At the completion of the study, a decision to invest further into the demonstration study will need to be considered. At this point, further funding streams and contract structures including land, offtake, commercial terms, Operation & Maintenance and any other legal contract will need to be considered.

Timeframes to deliver solutions

- The feasibility study could be delivered in approximately 4-6 months
- Likely the detailed design phase, construction and commissioning would take at least a further 2 years

Funding opportunities

There are potential funding opportunities through ARENA, Queensland Hydrogen Industry Development Fund, Clean Energy Finance Corporation.

Magnetic Island | Resilience

8 Aquaculture Production Feasibility Study

This project will develop a feasibility study to assess the potential for on-island aquaculture production using local species.

Description and overview

This project seeks to undertake a feasibility assessment of the potential for a community-led ecologically sensitive and sustainable aquaculture production industry on the island. Given the location on the Great Barrier Reef, the feasibility study would need to consider space requirements, policy restrictions and technical and environmental suitability.

Arrangements would be commercial in nature, and this project will seek support for a feasibility and market assessment. It is understood that there was previously a commercial aquaculture industry on the island at White Lady Bay.

Potential commercial aquaculture industries would need to include local endemic species that do not pose a risk to the Great Barrier Reef ecosystem. These could include: clams; oyster, seaweed; crayfish and potentially a trial aquaponic farm. It is envisaged that the scope of this project would be similar to that recently undertaken for Palm Island's 2020 CSIRO study with James Cook University (JCU).

The findings of the feasibility study could open significant opportunities for new businesses and associated supply chains to be established on the island, providing economic and employment opportunities for the community. The feasibility study will also assess sustainable development opportunities for the construction and operation of the facility. On-island production would enhance community self-sufficiency and resilience to shocks or disruptions to the food supply chain.

A lead for this project would be identified through the course of the feasibility study.

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	<0
Estimated payback period	Years	To be determined in study
Estimated annual cost savings (oyster farm)	$	<$0 – ($100K)
Estimated capital costs (feas study)	$ mil	0.08
Estimated capital costs (farm establishment)	$ mil	To be determined in study
Net present value (simple)	$	To be determined in study
Timeframe to deliver project	Years	0.5
Estimated FTE	No.	To be determined in study

Note that the feasibility study will determine optimum project details. An estimate of potential project costs and benefits is provided in this project outline overleaf.

Key project objectives

Carbon assessment

- As with any new economic development the construction and operation of the aquaculture facility has the potential to increase carbon emissions. It is proposed that the feasibility study will incorporate sustainable development / circular economy principals and low emissions opportunities compared to business as usual.
- Replacing imports with locally grown goods will avoid transportation emissions and embodied energy in packaging, and embodied emissions for removal and disposal/breakdown.
- Carbon sequestration of blue carbon (atmospheric carbon removal by ocean ecosystems through plant growth and the accumulation and burial of organic matter in the soil).

Community and climate resilience

- As Magnetic Island's community are reliant on food imports this leaves the community increasingly vulnerable to price spikes or supply deficits that may result from natural disasters or changes in economic market factors outside of their control. On-island production of food will increase the resilience of these communities to shocks or disruptions in the food supply system, providing increased food security.
- Aquaculture provides the community with diversified jobs opportunities, making them more resilient to potential downturns in other industries.

Alignment with other initiatives

Alignment with other project options

- 5. Development and delivery of Sustainability and Environmental Education for residents and visitors
- 10. Support for tourism businesses to achieve sustainable-accreditation (Destination Management Plan)
- 13. Potential to align with an Organic Waste Recycling Feasibility Study
- 16. Low Emission Marine Transport for boats to island/potential biodiesel pilot

Alignment with external initiatives or investments

- Potential for collaborative partnerships with NGO's like Keep Australia Beautiful, Community Sustainability Grants, Schools - EcoMarine Warriors
- Reef Garden Schools (Great Barrier Reef Marine Park Authority Initiative)
- Land Restoration Fund Blue Carbon Projects.
- Stephanie Alexander Kitchen Garden Foundation

Co-benefits

Economic

- The creation of a new industry on the island will provide economic opportunity and development
- It will include capacity building, upskilling and employment opportunities for the local community
- Potential cost-savings for the community if food is sold locally at a competitive price and may guard against price spikes caused by disruptions in the supply chain
- Tourism opportunity may have potential for additional economic returns for aquaculture facility

Social and cultural

- Community resilience to disruptions in the supply chain
- Social inclusion and civic participation

Environmental (impacts to Great Barrier Reef)

- Potential to reduce open-sea fishing
- Reduced pollution from the transportation of food i.e. fuel leakage in water and air quality
- Increased community resilience as severe weather events can lead to island isolation meaning that food cannot be delivered, which was identified as a severe risk in the project risk assessment
- Impacts from aquaculture facility development such as water quality and biosecurity issues will need to be carefully managed and sustainable. Approval for relevant authorities required including Townsville Citty Council (TCC), Great Barrier Reef Marine Park Authority (GBRMPA), Department of Environment (DoEE)), Qld Government etc.

Risks and opportunities

Barriers

- Suitable available coastal location to be confirmed
- On-island technical expertise and labour to operate facility
- Aquaculture can be energy intensive and has emissions and costs associated with operation
- Restrictions on aquaculture under the GBRMPA where the project will be situated. Approval for relevant authorities required including TCC, GBRMPA, DoEE, Queensland Government etc.

Risks

- Restrictions and approval requirements in GBRMP may not be commercially viable
- Economically non-competitive with imported produce and goods
- Continuity of funding to support long-term operation
- Long lead times to financial return
- Long-term committed management ensuring secure finance, resource permissions and viable workforce, technical management and credible routes to the market
- Impact on water quality
- Cost and time expensive approvals required

Opportunity

- Collaboration with local community groups, schools and tourism businesses
- Potential revenue source if combine with tourism opportunity
- Utilising findings and recommendations from the JCU and CSIRO study on Palm Island
- JCU are currently undertaking work looking at macro algae options which ensure water quality is maintained, as well as work in algae to fuels which could make the project more viable

[1] https://www.daf.qld.gov.au/?a=109113:policy_registry/fish-comm-atsi-dvlp-policy.pdf

Assumptions

- Funding would be sought for the development of the feasibility study only
- No financial or market assessment has been undertaken
- Employment figures are speculative and subject to change following the completion of the feasibility study
- TCC to help suggest sites based on their knowledge of the island
- Indicative study cost based on 400 hours @ $200p/h

Costs and funding considerations

Capital costs
- Consultant fees to conduct the feasibility study
- Large upfront capital costs required to build an aquaculture industry, including equipment

Approximate total capital cost: $80,000 feasibility study for consultancy fees.

The cost of building the aquaculture industry is highly variable based on a number of key factors and will be clearer after completion of the feasibility study.

Ongoing costs
- No ongoing costs for feasibility study
- High maintenance and operation costs of the aquaculture facility
- Employee salaries to operate aquaculture facility
- Purchasing or leasing land for aquaculture facility
- Insurance fees
- Establishing infrastructure connections to electricity and water for the facility

Potential cost savings or return on investment
- Sales of aquaculture produce to cover upfront capital costs and ongoing maintenance and operational costs over the payback period (heavily reliant on the species being harvested)
- Potential for new food industry on Magnetic island to potentially feed out surplus to the mainland

Funding opportunities
- Round 3 - Community Sustainability Actions Grants, Queensland Department of Environment and Science
- Drought Communities Programme – Extension, Department of Infrastructure, Transport, Regional Development and Communications
- Community Led Grants, Department of the Prime Minister and Cabinet

Additional information
- Previous oyster farm operations in White Lady Bay
- A business plan produced in 2011 by AEC Group for Torres Straight Island Regional Council estimated costs for an oyster farm to be approximately $250K for initial capital costs making an annual commercial loss of ($42k) based on selling 15,000 rock oysters at current market rates. For the farm to become economically viable it would require the market rate of oysters to significantly increase[1]. This would need to be verified with a feasibility study tailored to the local geography and current market rates of ocean food produce. This study has been used to estimate similar start up capital costs for Magnetic Island

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Local community	■	■		■
Indigenous businesses	■	■	■	■
Aquaculture operator	■	■		■
Tourism businesses			■	■
GBRMPA			■	■
Qld Government			■	■
Commonwealth DoEE			■	■
Townsville City Council	■		■	■

Implementation and timeframes

Investment readiness
- This imitative is ready to undertake a feasibility study pending funding arrangement. There is a need to attract investment and private ownership of the aquaculture business. There is community support for this project.

Next steps
- Identify key lead in conjunction with Townsville City Council for this project and feasibility
- Engagement of a consultant to undertake the feasibility study, with a specific focus on the land availability, market viability, technical suitability, policy restrictions and environmental impacts. This study will also identify potential business partners.
- Develop funding opportunities for lead to undertake feasibility

Considerations for implementation
- Availability of social, cultural, organisational and natural resources
- Technical skills of local workforce
- Involvement of local people as project leaders and champions, using locally available resources
- Compliance with the Fisheries Act 1994

Timeframes to deliver solutions
- Phasing of aquaculture production, growing in size and capacity as local resources, community buy-in and demand for produce is established
- Long-lead time from feasibility stage to completion and operation of aquaculture facility

1. http://www.tsirc.qld.gov.au/sites/default/files/PDFs/Projects/kubin_oyster_farm_feasibility_study_draft_2_0.pdf

Magnetic Island | Waste

9 Waste Transfer Station Installation of Solar PV

The installation of solar panels at the existing waste transfer station with possible future battery integration, reducing dependence on grid power & cutting emissions.

Description and overview

This project is for the addition of solar panels, at the Magnetic Island waste transfer station. This will reduce electricity costs and has the potential to reduce the island's carbon footprint through reduced reliance on carbon-intensive mains electricity.

A suggested capacity of 3kW solar PV panels would be installed within the waste transfer station grounds. Either ground mounted or rooftop solar PV panels could be installed due to the abundance of open space and the clear rooftop respectively, the preferred mounting method should be determined as a next step and could have an impact on generation performance and cost.

Utilising an assumed daily load profile that involves 70% of the station's power consumption occurring during opening hours (7am to 4pm), 3kW of solar PV would reduce the waste transfer station's annual electricity consumption by ~3,900kWh. Resulting in cost savings of ~$1,100 / year (including solar feed-in to the grid) and an annual emissions reductions of ~3.2 tonnes CO_2e.

While in general implementing a battery system can help further reduce emissions, through storage and use of the renewable power, due to the expected load profile of the waste transfer station and current capital costs of battery systems, it is not currently recommended for implementation as an efficient use of resources at this time. This could be reassessed in the future as battery costs are expected to continue to decrease over the medium term.

This project would also further contribute to improving the island's energy self-sufficiency and less reliance on power supplied by Ergon via undersea cables from the mainland.

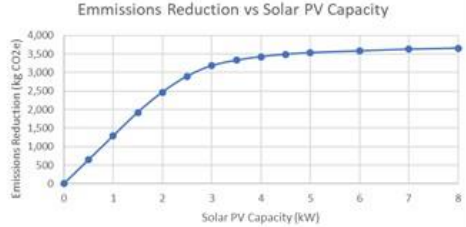
Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2e	3.2
Estimated payback period	Years	4.7
Estimated annual cost savings	$	1,100
Estimated capital costs	$	5,100
Net present value (simple)	$	N/A
Timeframe to deliver project	Month	1
Estimated FTE	No. days	1 - 2

Key project objectives

Carbon assessment

The carbon emissions reduction expected from a 3kW solar PV installation is annually ~3.2 tonnes of CO_2. This emissions reduction is only from reducing power consumption at the site and does not account for solar feed-in. Further increasing the amount of solar PV would reduce the station's dependence on mains power and could cut annual emissions by ~3.65 tonnes of CO_2 (8 kW installation).



Over a 20-year lifespan, and accounting for a two-year payback period for embedded emissions in manufacturing the panels, the 3kW of solar PV installations would reduce the island's emissions by ~57 tonnes of CO_2, based on a Queensland grid carbon intensity of 0.81 kg CO_2-e / kWh[1].

Community self-sufficiency & resilience

Solar PV panels will reduce the reliance on mains grid power throughout the day and reduce the demand on the network.

Greater solar PV penetration on the island will enhance self-sufficiency, and if coupled with battery installations further improve resilience. Solar PV, and battery installations, could also help reduce the need for temporary generators on island during peak summer periods, as have previously been required. This may also contribute to deferring the replacement of the undersea cable connecting Magnetic Island to the mainland.

Co-benefits

Economic

- In conjunction with the other solar PV focused business cases, there is an opportunity for job creation where local workers are trained in the maintenance and installation of solar PV systems
- The availability of local workers may reduce lead time to remedy underperforming or non-operational systems
- Whilst not a key focus of this business case, implementing battery systems could also increase the integrity of the network, allowing for further solar PV to be introduced with reduced negative effects on voltage throughout the network

Social and cultural

- Installing more solar PV on council facilities is aligned with the community's progressive attitudes towards environmental sustainability. This promotes displacement of power from the grid (which is primarily coal-generated).

Environmental (General)

- Reduced consumption of electricity from the grid will reduce the island's total emissions which will contribute to the global effort to reduce emissions that are impacting the reef through increased temperatures and ocean acidification. This was identified as a severe risk in the project risk assessment
- Preservation of natural energy resources, which was identified as a high risk in the project risk assessment

Environmental (impacts to Great Barrier Reef)

- No direct impacts identified

Risks and opportunities

Barriers

- Structural integrity of station's roof or ground conditions have not been confirmed
- Connection requirements to Ergon Energy's network – subject to assessment during the connection process. Capacity could be increased pending assessment
- The estimated 4.7 year payback period will likely pose a barrier when trying to secure funding

Risks

- Adverse weather damaging systems, orientation or shading negatively affecting performance of systems

Opportunity

There is the opportunity to couple solar PV installation and possible battery system with nearby water recycling facility using the available space on waste transfer station land. This could see a further decarbonisation benefit and a relative cost reduction in cost per kW due to common infrastructure, however the solar PV and battery system is currently being explored by a different consultant and hence has not been presented in this business case. There is the opportunity to combine business cases for solar PV and battery systems shared across multiple council owned and operated assets.

Alignment with other initiatives

Alignment with other project options

- 14. Solar PV Rooftop Systems
- 17. Microgrid Feasibility Study

Alignment with external initiatives or investments

- Solar Cities Program – previously conducted program resulted in the installation of ~1,100 kW of solar PV with a solar PV penetration level of ~ 22% being achieved on-island[2]
- Ergon Energy Network (EEN) maintenance – aligns with EEN aged asset replacement program – future project to replace the older of the two electricity supply cables to Magnetic Island is currently being investigated.
- Ergon Distributed Energy Resources (DER) Aggregation solution

1 National Greenhouse Accounts Factors August 2019 [https://www.industry.gov.au/sites/default/files/2020-07/national-greenhouse-accounts-factors-august-2019.pdf]
2 University of New South Wales for the Australian PV Association, September 2013, 'Magnetic Island and Townsville Solar City: A Case Study for Increasing PV Penetration in Electricity Networks', [https://apvi.org.au/wp-content/uploads/2014/05/Magnetic-Island-High-PV-Penetration-Case-Study-Report.pdf]

Assumptions

- Performance of solar PV based on GHI (irradiance) averaged historically and seasonally for Magnetic Island
- Power consumption remaining similar – growth of waste transfer station not considered
- Load profile involving 70% of recorded power consumption occurring daily during 7am to 4pm
- Daily load profile based on monthly power consumption of facility provided for 2018 to 2020, and facility opening hours[3]
  Solar PV operational and appropriate repairs, and replacements made over lifespan
- Solar PV installed and performance is not restricted by Ergon Energy – this is subject to network review during the connection process. Connection advice can be provided by EEN.
- Solar PV costed on ~$1,700 / kW (for 3 kW), ~$1,300 / kW (for 8kW) and ~5 m^2/kW area requirement for rooftop mounted systems, including regional mark-up from Rawlinsons Construction Handbook 2020[4]
- Battery systems, including inverter and charger for integration with solar PV, costed on $2,000 / kWh (for 4 kWh and smaller system)
- Assuming solar feed-in (8 c/kWh) received[5]
- Solar PV estimates based on 18% PV cell efficiency, and PV derating factor of 80%
- Detailed analysis of solar PV performance for waste transfer station not conducted, all emissions and performance parameters based on assumptions and subsequent theoretical calculations
- No structural or orientation analysis of solar PV has been conducted
- Costing based on Australian industry benchmarking, as opposed to vendor quotes
- Ground, geotechnical, rooftop stability conditions not assessed – assumed suitable for installation of solar PV

Costs and funding considerations

Capital costs

- Approximate total capital cost of 3kW system: ~$5,100 (~$1,700 / kW)
- Costs include the supply of solar panels and installation of solar PV panels including mounts
- Costs could be altered if local members of the community trained in the installation & maintenance of the solar panels instead of / or in combination with external contractors
- Costs could differ for ground mounted verses roof-mounted systems, choice of mounting methodology required
- Optional battery system, inclusive of inverter and charger, ~$8,000 for 4 kWh fully installed system

Ongoing costs

- Maintenance of solar PV systems
- Replacement costs

Potential cost savings or return on investment

- Annual savings of ~$1,100 - inclusive of possible $70 / year from solar feed-in tariff
- Simple payback period of ~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 obtained then the payback period would also be halved to ~2.5 years.
- Revenue from LCG certificates to be quantified in further work

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
Townsville City Council				
Ergon				
Solar PV Installer				

Additional information

A battery or larger solar PV installation could further reduce the dependence of the waste transfer station on grid power consumption, providing greater yearly power savings and emissions reductions. However, solar PV systems greater than 3kW become heavily dependent on solar feed-in for return on investment, and the inclusion of batteries only appear to worsen the cost/emissions reduction ratio of the system.

Option	Grid Power Reduction	Cost vs Emissions Reduction
Solar PV: 3 kW	~3,900 kWh	~ $1.6 / kg CO_2e
Solar PV: 8 kW	~4,500 kWh	~ $2.9 / kg CO_2e
Solar PV: 8 kW, Battery: 4 kWh	~5,240 kWh	~ $4.3 / kg CO_2e

Implementation and timeframes

Investment readiness

- The project would be ready for investment, however confirmation of the daily load profile of the waste transfer station is required

Next steps

- Analysis of solar PV output considering the climate
- Finalise size of system and if ground or roof mounted system to be installed
- Vendor engagement to confirm pricing of systems and ongoing maintenance costs
- Selection of funding avenue and determination of percentage of subsidy

Considerations for implementation

- The ability to train locals in the installation of the systems should be considered in combination, minimising overall cost and time taken for the installation
- Training may delay installations, although maintenance and any future installations could be achieved more efficiently by trained local workers

Timeframes to deliver solutions

- Delivery timeframes are dependent on an analysis of ground conditions. Delivery may take as little as 1 month, pending the availability of qualified technicians.

3 Townsville City Council, accessed September 2020, 'Transfer Stations and Landfills', [https://www.townsville.qld.gov.au/water-waste-and-environment/waste-and-recycling/waste-facilities]
4 Rawlinsons, 2020, Australian Construction Handbook 2020
5 Ergon, accessed September 2020, 'Solar feed-in tariffs', [https://www.ergon.com.au/retail/residential/tariffs-and-prices/solar-feed-in-tariff]

Magnetic Island | Resilience

10 Tourism Master Plan

This project seeks to develop a Tourism Master Plan to provide a sustainable accreditation pathway for Magnetic Island.

Description and overview

Magnetic Island currently sits under the Townsville Enterprise Ltd Destination Management Plan, yet is challenged by a unique set of circumstances. Given Magnetic Island's geographic positioning (and relative isolation), perceived issues with carrying capacity and specialised tourism development issues, it is proposed that a Tourism Management Plan (TMP) is developed for the island.

The *Plan* should be an ambitious and strategic document that provides an overview of the direction for growth and action required to make Magnetic Island a more sustainable tourism destination. It should be developed with a broad array of stakeholders including Magnetic Island Tourism, Townsville Council, Traditional Owners and tourism businesses. Action items should be reflective of funding cycles and be achievable within the timeframe.

As Townsville City Council is currently undergoing Eco-Tourism Destination Certification through Eco-Tourism Australia, the policy agenda and sustainability actions should align to key needs of the certification program to build local capacity. Through this process Magnetic Island has the opportunity to become a leading destination, benchmarking performance and creating a sustainable future. The TMP will explore opportunities to incentivise tourism operators to engage with a business-based certification program to maximise the benefits of the destination certification program and ensure a whole of destination approach.

Community engagement with the Tourism Management Plan provides opportunity for collaboration and coordination of tourism-related activities, in pursuit of the more efficient use of shared resources and broader sustainability objectives for Magnetic Island. These outcomes also serve to enhance community resilience and self-sufficiency.

Through a clear strategic direction and with a sustainable vision embedded as part of the destination direction, Magnetic Island will be able to leverage sustainable tourism positioning, attracting conscious travellers aligning to Tourism and Events Queensland's Travel for Good brand.

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	To be determined during accreditation
Estimated payback period	Years	1 - 3
Estimated annual cost savings	$	N/A
Estimated capital costs for Plan and Destination Certification for 3 years	$ mil	0.065 + certification costs to be determined
Estimated capital costs for Individual Certification Cost for 3 years	$ mil	0.065 + certification costs to be determined
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1 - 3
Estimated FTE	No.	N/A

Key project objectives

Community and climate resilience

- The TMP will direct the strategic intent on tourism on the island, addressing concerns around environmental and social pressures brought by tourism.
- The document can be utilised by key stakeholders on the island as an advocacy document for environmental protection, development guidance and the prioritisation of investment.
- It will assist the community and businesses identify opportunities to collaborate, achieving mutually beneficial outcomes (i.e. better use of common resources).
- The TMP will provide guidance for promoting investment in sustainable initiatives which add to the character and resilience of Magnetic Island.
- Increasing the sustainability of operations on the island will help preserve the natural environment which they are built on, providing longevity of the industry and employment.

Carbon assessment

- The encouragement of businesses to attain accreditation will lead to decarbonisation as businesses reduce energy and water usage, resource consumption and waste production. The potential to decrease carbon emissions will be determined post-delivery of the tourism master plan.

Alignment with policy & programs

- Townsville City Council Eco-Tourism Australia Destination Certification.
- Townsville Enterprise Limited – Product and Experience Development Plan 2019-2024
- State and TCC Plastic Free Places initiatives
- Building a resilient tourism industry Tourism Sector Adaptation Plan, the Small Business & Built Environment Sector Adaptation Plans (SAP)
- Tourism and Events Queensland's Travel for Good.
- CrisisReady Townsville.
- EcoBiz – waste, water & energy auditing.

Co-benefits

Economic

- Competitive advantage in the market through sustainable positioning.
- Establishment of Magnetic Island as a leading sustainable tourism destination, enhancing brand and promotional value.
- Ability to leverage off Tourism for Good branding.
- Reduction in costs for tourism operators (i.e. waste, water and energy).

Social and cultural

- Perceived pressures of tourism adequately managed leading to community buy-in and pride in tourism industry.
- Reputational benefits for Magnetic Island through strategically managed tourism.
- Provide a stronger relationship between the community and tourism.
- Social license to operate for tourism businesses.

Environmental (General)

- Reduced environmental footprint of tourism operations.
- Improvement in tourism industry supply chain.

Environmental (impacts to Great Barrier Reef)

- Conservation of significant GBR ecosystems and species.
- TMP mechanisms will contribute to a reduction in litter, and this will minimise marine pollution.
- Reduce excessive energy and water usage by tourists.
- Improvement of transportation practices will support improvements to air quality.
- Potential for new reef restoration tourism businesses to emerge.

Other

- Magnetic Island to be an industry leader, reducing future regulatory and legislative risks.
- Strengthen financial reporting to shareholders.
- Potential for benchmarking against competitors.
- Overarching strategic plan to direct investment, experience development and sustainable pathways.

Risks and opportunities

Barriers

- Upfront costs of TMP plus requirements for implementation investment (in particular for certification among businesses).
- Governance of implementation of TMP actions.
- Administration burden of ongoing certification and maximum uptake of tourism businesses might be limited, further limiting decarbonisation impact.

Risks

- Tourism business buy-in.
- TMP development that lacks the strategic intent or aspirational sustainable outcomes.
- Lack of governance.

Opportunity

- A coordinated, community-led TMP that creates a strong opportunity for collaboration between businesses across Magnetic Island to pursue more sustainable outcomes. For example, encouraging more engagement with business certification and efficient and sustainable uses of shared resources.
- Develop a high-quality destination that will encourage visitors to spend more and stay longer.
- Create a strategic sustainable vision for the destination based on social and environmental outcomes.
- Attract a high yielding nature-based tourism market.
- Provide third party verified results of energy and water usage and waste generation reductions for the island, providing confidence to community, businesses, stakeholders, visitors and shareholders.
- The TMP presents the opportunity to embed sustainability and resilience into a broader range of tourism development areas including infrastructure and capital works investment, tourism experience development and private investment.

Alignment with other project options

- 1. Electric Bicycle Rental Service – reduction in reliance of diesel fuelled transport
- 2. Low Emissions On-Island Shuttlebus - reduction in reliance of diesel fuelled transport
- 5. Development and delivery of Sustainability and Environmental Education Program – promotion of sustainable behaviours
- 6. Existing Building Improvements – reduction in energy consumption leading to reduced emissions
- 8. Aquaculture Production Feasibility Study for sustainable on-island food production.
- 11. Energy Demand Management Incentive Scheme – reduction in emissions through demand management

Assumptions

- At this stage this project option is seeking funding for the *Tourism Master Plan*, which includes a sustainable vision, market review (including COVID-19 context), strategic fit of Magnetic Island in relation to national and regional frameworks, positioning, target markets, capacity, experience development, access, attitudes, environmental stewardship, capacity and development, leadership and structures, risk and crisis management and governance.
- Given the inclusion of sustainability, it also proposes a review against the GSTC destination criteria and 3 years of fees for an accreditation body.
- The project would include incentivisation of business certification to support destination measures.
- Several local operators from Magnetic Island will be recruited to champion the project within the region.
- Coordination for delivery of this project could potentially be managed by Tourism Magnetic Island
- (TMI), Townsville Magnetic Island Community Development Association (MICDA), Regional Tourism Office (RTO) and/or Townsville City Council (TCC) (or a combination)
- There are approximately 60 tourism operators on Magnetic Island, including accommodation, food and beverage, tour operators, attractions or activities and hire companies.
- There are currently two tourism operators with active sustainability accreditation.

Additional information

- As international tourism re-emerges following the removal of COVID-19 restrictions, the marketplace is likely to be increasingly competitive. Magnetic Island has the opportunity to capture the growing environmentally-conscious traveller market.
- Based on a study conducted by Professor Susanne Becken, overall, business in the EarthCheck program managed to reduce resource use annually by as much as 4.2% (water), 5.7% (electricity), and 7% (waste).

Costs and funding considerations

Capital costs

- *Consultancy cost:* Engagement of a consultant to develop the Tourism Master Plan for Magnetic Island including an initial assessment, market review, strategic positioning and review against GSTC criteria $65,000.
- *Destination Certification cost:* To be determined post-delivery of the tourism master plan.

Ongoing costs

- Costs of retaining certification, including administration and monitoring requirements ~ to be determined post-delivery of the tourism master plan (costs can vary depending on the certification type)
- Upgrading or undertaking new initiatives to meet any changing certification requirements for each business
- Certification audits ~ to be determined post-delivery of the tourism master plan

Potential cost savings or return on investment

- Unlocking new market of visitors
- Ongoing savings from reduced water and energy costs

Funding opportunities

- Round 3 - Community Sustainability Actions Grants, Queensland Department of Environment and Science
- Community Led Grants, Department of the Prime Minister and Cabinet
- Attracting Tourism Fund, Department of Innovation and Tourism Industry Development
- Townsville City Council may also consider the possibility of providing support as part of their overall certification budget

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Tourism businesses and operators				
Magnetic Island community				
Visitors/ tourists				
Townsville City Council				
RTO & MI Tourism				

Implementation and timeframes

Investment readiness

- Planning for the tendering and development of a TMP could commence within 3 to 6 months, following a period of consultation with local business
- Businesses on the island differ in terms of maturity, size and existing sustainability status. They will also have differing capability and capacity to pursue certification.

Next steps

- Engage with TCC, RTO, MICDA and MI Tourism to establish appropriate roles and responsibilities (including coordination, delivery, oversight, implementation and monitoring).
- Engage a consultant to scope development of the TMP and evaluate eco-accreditation options.

Considerations for implementation

- Consultation with tourism businesses to ascertain their willingness to gain their buy-in. These activities should be aligned to the work of TCC and MI Tourism.
- Consider options for the effective promotion of certification and the wider TCC destination accreditation, and the benefits of this to the business community.
- Ensuring that the certification of select businesses do not unfairly impact other operators.
- Targeting businesses who are operating sustainably that do not have the funds to attain certification (means testing).
- Whilst accreditation processes may be incorporated into the TMP, businesses already seeking accreditation should be actively encouraged to do so.

Timeframes to deliver solutions

- 6 – 12 months will be required for securing funding, consultation, and tendering and delivering the TMP. Certification of businesses may occur at any time prior to or post-implementation of the TMP.

Magnetic Island | Energy

11 Energy Demand Management Incentive Scheme

Demand management appliances and tools to enable residents to actively monitor and manage their energy use.

Description and overview

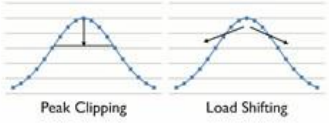
The Solar City - Magnetic Island Solar Suburb initiative[1] (2007 – 2013) was a highly successful community solar energy and efficiency trial on Magnetic Island supported by Queensland Government funding. The scheme announced that '*compared to the Solar City Business Case, annual maximum demand in 2011-12 was 40% below that predicted without the intervention of the Solar City project, and 19% ahead of the target set. This means that $17 million worth of investment in an additional cable has been deferred for eight years*[1]'.

Building upon this success, this project seeks funding for subsidised energy demand management devices such as smart meters and plugs to residents on the island and will supplement the smart meters still in operation from the Solar City scheme. This will assist more residents to actively monitor and manage energy use which can significantly reduce the island's energy demand and provide energy reduction and cost savings to residents.

Demand-side management devices can be used to help residents actively monitor and manage their energy usage and can help to shift demand and minimise consumption. Leveraging off the Internet of Things (IoT), smart plugs could be implemented to enhance energy management on the island and reduce costs. Ergon have indicated their support for this program and to assist in developing a trial for residents.

It is proposed that in conjunction with Ergon, the trial would consist of up to 20 homes receiving demand management devices (smart meter and smart plugs) and an alternative tariff structure, such as the load control tariff structures proposed in the Energex network. This will provide the infrastructure and necessary incentives to reduce energy in peak periods. The trial will provide Ergon with a platform to explore demand management initiatives across the island and provide confidence in widespread deployment.

This initiative is to be aligned with Ergon's Demand Management Plan 2021[1] and could be considered as part of an Ergon distributed energy response aggregation solution or be co-designed with the community as an energy efficiency and renewable energy demonstration project in a location close to major centre.



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 (whole island)	t-CO_2-e	0 - 740
Estimated payback period	Years	N/A
Estimated annual cost savings	$ / household	N/A
Estimated capital costs	$ mil	0.02-1.5
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1
Estimated FTE	No.	N/A

1. https://www.ergon.com.au/__data/assets/pdf_file/0020/830450/2020-2021-Demand-Management-Plan.pdf

Key project objectives

Carbon assessment
Smart demand management devices assist residents to better understand and reduce their usage. However, it must be noted that there may be barriers to the use of smart meters for rental properties or resorts.

As there is a fixed tariff structure on the island (General Tariff T11 – Ergon) there is no economic benefit to residents from shifting demand at this stage, although this could be explored with Ergon at a later date. Ergon could be particularly interested to offset demand on the island to reduce peak. Below summarises some of the potential benefits for implementation.

Current asset	New Asset	Carbon saving
Energy meter	Smart meter	Indirect saving – encourages lower usage
No smart demand management/ peak shifting	Smart plugs/demand shifting systems and/or incentives	Direct saving – encourages lower usage

Demand management activities that result in a 5% saving on daily energy consumption would result in up to 740 t-CO_2-e annually if the trial was successful and rolled out across the whole island. This is based on current average demand of 50MWh/day[2] at 5% possible energy reduction and using the NEM Qld grid intensity factor of 0.81kg CO_2/kWh.

Community resilience
Residents will be able to minimise the risk of power failure due to network overloading by reducing demand and usage in peak times. This would need to be managed through Ergon and then incentivised to reduce demand.

By minimising energy consumption, the community will increase their resilience against supply issues via the mainland cables and future rising electricity costs, if introduced.

Co-benefits

Economic
- Reduction in peak demand from residents may enable the further delay of replacement/upgrade to the supply cable from the mainland, at significant cost saving to Ergon Energy.
- Engagement with Ergon is required to determine if there is financial benefit for Magnetic Island to reduce the demand. This could be incentivised through credits for load shedding during peak periods.
- Possibility for new employment if workers are willing to be trained in performing energy assessments and provide education around demand management initiatives.

Social and cultural
- By reducing peak electricity consumption, electricity bills will similarly be reduced. This will help the island move towards a progressive attitude for the introduction of further renewables and decarbonisation schemes.
- Smart meter scheme may help promote environmental concern and awareness, which can in turn increase perceived satisfaction and usefulness of such devices[1]

Environmental
- Reduced peak electricity demand and subsequent in-direct greenhouse gases from electricity grid and usage of peaking plants which are typically carbon emitting.

Environmental (impacts to Great Barrier Reef)
- Reduced energy usage could delay the construction of the replacement under-sea electricity supply cable from the mainland, which has the potential for detrimental impacts to the reef areas between Magnetic Island and Townsville, and those surrounding Magnetic Island.
- A reduction in emissions on Magnetic Island will contribute to the global effort to reduce emissions which are impacting the reef through increased temperatures and ocean acidification.

Risks and opportunities

Barriers
- Behaviour change takes time and effort
- Demand management appliances can be costly to install/replace;
- Further study into smart meters should be undertaken to understand if there are benefits for customers when compared to other devices
- Due to island topography Internet of Things (IoT) devices would require significant network investment

Risks
- Confusion with Solar City program (2007 – 2013)[3] which can be ameliorated by good community communication program showing how this is building upon it
- Lead time of residents making change
- Regulatory requirements and current island infrastructure for demand management
- Providing devices does not necessarily mean they are installed correctly and utilised correctly

Opportunity
- Opportunity to further already present progressive attitude towards renewables and decarbonisation schemes in the community due to success with Solar City program
- Opportunity to trial Springbrook initiatives (Ergon led)
- Smart demand management systems may overcome barrier of behaviour change
- Opportunity to investigate smart devices in holiday homes to better align electricity usage to occupancy (e.g. activating fridges 2 hours before a holiday maker checks in)

Alignment with other initiatives

Alignment with other project options
- 5. Development and delivery of Sustainability and Environmental Education for residents and visitors.
- 6. Energy Efficiency Retrofits
- 12. Solar Hot Water Systems
- 14. Solar PV Rooftop Systems

Alignment with other initiatives:
- Solar City Program – 1.1MW solar PV installed on island as part of program – displaying progressive attitude towards renewables. Also aligned with Ergon priorities - The scheme announced in 2012 that '$17 million worth of investment in a replacement cable has been deferred 8 years'.
- Opportunity to be a demonstration location for roll out of some of Ergon's planned innovations and initiatives. E.g. potential Distributed Energy Resource planning trial; could further defer replacement/upgrades to undersea cabling.

1. Refer to Ghazal et al. 2016 https://www.sciencedirect.com/science/article/pii/S1364032115007431
2. Provided by Ergon
3. https://www.ergon.com.au/__data/assets/pdf_file/0010/310996/Townsville-Solar-City-Final-Report_2006_2013.pdf

Assumptions

- Ergon are interested in developing demand management solutions over the replacement of one of the undersea cables
- Price estimates obtained via unofficial quote
- Three smart plugs given to each home as a demonstration (or more supplied via subsidy)
- No detailed analysis of the site has been performed
- Ongoing engagement with Ergon is required to be able to quantify the benefit to the island and costing structure/payback period. This could be beneficial to Ergon to develop an effective demand management scheme for the island.

Additional information

In 2013 Solar City undertook a similar initiative. Their scheme involved community energy assessments and appliance replacement incentives. Smart meters and other technologies have decreased in cost and should be re-examined to determine their feasibility within this scheme.

Energex/Ergon currently have a demand management plan that is implementing demand management initiatives across Queensland. This initiative should be co-developed in line with this plan.

Costs and funding considerations

Capital costs

- Approximate total capital cost for full deployment across Magnetic Island: $1.4m
- Investigation into the costs to develop a demand management trial should be undertaken with Ergon following delivery of this project. It is anticipated that that will involve the installation of smart meters and smart plugs in the home.
- The trial could include up to 20 residential properties at an estimated cost of $14,000 for supply and installation, of one smart meter and three smart plugs per dwelling
- To create behavioural change, community members will need to be sufficiently educated on the devices

Item	Cost per building	Island total
Smart meter supply and installation	$600	$1.2m
Smart plugs (3)	$100	$200k

Ongoing costs

- Ongoing costs are estimated to be minimal; most of the augmentations performed within this scheme will be the responsibility of the homeowner once installed

Potential cost savings or return on investment

- Cost savings for demand management initiatives will depend largely on an agreed new tariff structure to benefit demand reduction. If users simply shift their electricity consumption to non-peak periods, this will have a net zero gain on their bill, however a reduction of 10% could directly benefit their electricity bill. Engagement with Ergon is required to quantify this amount through a comprehensive demand reduction trial.
- A further detailed study should be developed to understand implications of demand management scheme
- If this scheme can delay the replacement of one of the undersea cables, there is potential for a significant cost saving for Ergon Energy

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
- Ergon Demand Management Plan 2021

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Magnetic Island local community	■	■		■
Rental property owners	■	■		
Townsville City Council	■	■		■
Tourism operators and businesses	■	■		■
Electrical Supplier (TP-Link)			■	
Retailers (Ergon)			■	

Implementation and timeframes

Investment readiness

- Technology is market ready. Co-development with Ergon is required for smart meter roll out and demand management program specific to Magnetic Island
- Further consideration is needed of the systems required for a demand management scheme utilising smart plugs

Next steps

- Community engagement and notification of upcoming energy assessments such that engagement rate can be estimated, and assessments booked
- The results of energy assessments should be used to form the basis for the scheme. Understanding the typical number and type of appliances in households will better enable bulk purchasing and maximise the decarbonisation impact of funding
- Further development of smart meter assessment and trial should be conducted on the island with Ergon

Considerations for implementation

- The potential for the community to engage with the energy assessment is unknown. The ways in which this scheme differs from that of the Solar City scheme should be emphasised.
- The scheme should investigate subsidising the cost of plugs/meters rather than supplying for free to minimise expense to Ergon/Government.
- A mechanism should be pursued to ensure those premises which have not benefited from schemes in the past are preferences over those premises that have.
- Technology requirements that allow monitoring or active management of demand
- Businesses could be included in future trials and following further consultation with Ergon.

Timeframes to deliver solutions

- To delay the replacement of one of the undersea cables, the energy assessments should be undertaken as soon as practicable. All augmentations could be completed within 2 – 3 years.

Magnetic Island | Energy

12 Solar Hot Water Systems

Upgrade of residential electric hot water systems to solar hot water systems, providing decarbonisation benefits and power cost reductions to residents.

Description and overview

This project is proposing to subsidise the upgrade of existing residential electric hot water systems to solar hot water (SHW) systems providing a potential cost benefit to residents and decarbonisation benefit. SHW systems would reduce reliance on the grid for hot water during peak times i.e. having the co-benefit of grid demand management.

Previous surveys have shown that 56% of the residents on Magnetic Island (~1,000 residencies) have electric hot water systems, 21% have gas hot water systems and the remaining 23% already have SHW systems installed. The average residency on Magnetic Island has two occupants, on this basis the average household's hot water requirements could mostly be satisfied all year round by a $2m^2$ collector panel and 180L SHW system.

An annual emissions reduction for the island if the 56% residential (electric) hot water systems were upgraded is ~1,210t CO_2e (total) and provides an average cost saving of ~$320 per residency. The emissions and cost savings are in comparison to the equivalent electricity consumption from the Queensland grid required for an electric system. Additional emissions and cost savings could be realised for the ~21% of residencies currently with gas systems installed, if they were to be included in the subsidy.

Replacing fully-functional electric systems with new SHW systems may not be economic for residents with a payback period of ~15 years. Therefore it is recommended that a subsidy be provided to incentivise system upgrades and realise the benefits to decarbonisation and peak electricity load demand management. It is noted that a more favourable payback period would be observed when presenting SHW systems as an alternative to electric/gas systems for new builds. Upgrading the hot water systems to solar could provide decarbonisation and grid supply benefits through freeing network capacity, in addition to annual cost savings to the residents. Other opportunities to consider when implementing the scheme would be the use of timers to combine rooftop photovoltaic (PV) installations with electric hot water systems, and heat pumps. Ergon have indicated their willingness to participate in further development of this scheme.

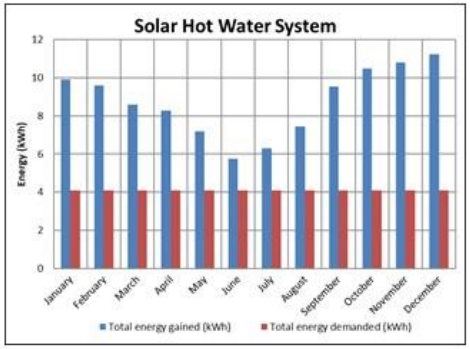
Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	~1,210 (total for 1,000 residences)
Estimated payback period (replacement system)	Years	15
Estimated payback period (new build)	Years	<1
Estimated annual cost savings	$ / household	320
Estimated capital costs	$ / household	4,500
Net present value (simple)	$	N/A
Timeframe to deliver project	Years	1 - 2
Estimated FTE	No.	N/A

Key project objectives

Carbon assessment

Upgrading the electric hot water systems to SHW systems could provide an annual emissions reduction of ~1,210 kg CO_2e for each residency. This is determined assuming current electric hot water systems utilise ~4kWh of electricity per day and utilising the carbon intensity of generation present in the Queensland grid of 0.81kg CO_2e / kWh[1]. Overall the power consumption of the island could be reduced by up to ~6%.



Due to the embedded carbon emissions from producing new SHW systems these annual emission reductions would not be realised until a one-year emissions payback period has passed, over a ten-year period a total emissions reduction of ~11,900 tonnes CO_2e could be achieved from all residents.

Community resilience

Installing SHW systems would reduce reliance on mains grid power for hot water, providing cheaper hot water to residents with a decarbonisation benefit, but also reducing reliance on grid during peak times (demand management).

More resilience against future rising of electricity cost, if eventuated.

Co-benefits

Economic

The economic benefit will directly accrue to residents, as power bills fall due to lower use of grid electricity for hot water. Each household could see a power bill reduction of ~$320 / year, a combined saving of $320,000 / year for the residences involved in the scheme. Furthermore, it should be noted that electricity prices are expected to increase into the future, meaning return on investment would be increased.

Social and cultural

Associated education should be made available to residents to ensure the most efficient use of the system. This could help to upskill residents and enable them to make the most of the systems.

Use of solar hot water together with implementing water wise shower practices to use less water (e.g. shorter 4-minute showers; water wise shower head) will together provide a substantial contribution to decarbonisation and energy bills for households.

Environmental (General)

SHW systems provide emissions reduction when compared to the current electric hot water systems, which was identified as a severe risk in the project risk assessment. This is due to less dependence on the grid to provide power for hot water heating – especially relevant as the grid in Queensland in general having a higher carbon intensity than the rest of the National Electricity Market (NEM).

Introducing solar hot water systems can increase resilience during severe weather events and power outages, which was identified as a severe risk in the project risk assessment.

Environmental (impacts to Great Barrier Reef)

A reduction of greenhouse gas emissions through increased utilisation of SHW systems will contribute to the global effort to reduce emissions which are impacting the reef through increased temperatures and ocean acidification.

Other

Reduced reliance on grid for hot water could help reduce peak demand and delay augmentation the electricity grid to meet increasing loads. This is especially relevant for summer, when there is more strain on the connection, as this is also when solar resources are most prevalent so the most energy can be gained by SHW systems.

Risks and opportunities

Barriers

- Residents and visitors utilising hot water responsibly
- Efficiency losses due to shading or poor orientation of roofing
- Upfront investments for those who choose to partake in the scheme
- Variation in roof structure and integrity across the various homes within the community and roof-space availability

Risks

- Adverse weather could cause non or inefficient operation
- Costs still being endured by residents on days with poor solar resources
- When required, electric boosting for SHW systems could occur at a similar time across all installations – still contributing to network strain on days of poor solar
- If the NEM were to achieve a higher renewable energy penetration or a renewable microgrid was to be developed on Magnetic Island, the emissions reductions provided would be reduced

Opportunities

- There is opportunity to expand SHW installations to cover commercial buildings and the replacement of gas water systems. Approximately 21% of residents use gas hot water systems and including these systems in the program and analysis could further increase emissions reductions observed.
- There is the opportunity to upskill and create jobs for members of local community by providing training in maintenance and installation of systems
- A SHW scheme could benefit from economies of scale considering the large number of homes that could be installed with a SHW system

Alignment with other initiatives

Alignment with other project options

- 5. Development and delivery of Sustainability and Environmental Education for residents and visitors
- 11. Energy Demand Management Incentive Scheme
- 14. Solar PV Rooftop Systems
- 17. Microgrid Feasibility Study
- 18. Water Smart Demonstration Community

Alignment with external initiatives or investments

- Department of Housing have funding for the installation of solar hot water systems on nearby islands, extending that fund to Magnetic could further help reduce emissions

1 National Greenhouse Accounts Factors August 2019 [https://www.industry.gov.au/sites/default/files/2020-07/national-greenhouse-accounts-factors-august-2019.pdf]

Assumptions

- Overall emissions reductions calculation assuming project goal that all residencies currently with an electric hot water system will partake in the scheme to convert to SHW systems (~1,000 residencies)
- 1,821 total residencies on island
- Assumed hot water and associated electricity consumption for average household of two occupants per residency as Census 2016.
- Specific hot water system sizing for each residency will vary dependent on number of residents
- Assuming SHW system installed are 80% efficient
- Households already with SHW systems installed have been appropriately sized and have not been included in the possible emissions reduction calculation.
- Structural integrity of every residency satisfactory to house SHW systems.
- Costing includes regional mark-up from Rawlinson's, however, is not based on actual vendor quotations.
- Hot water usage analysis for each individual residency on island not compiled or analysed, all emissions and performance values based on assumptions
- Specifications of currently installed electrical hot water systems not utilised in calculations.
- Small-scale technology certificate estimate calculated for SHW system of 180L[2]

Additional information

One of the major benefits of utilising SHW systems as opposed to electric systems coupled with solar PV panels is that the SHW systems are not constrained by Ergon's network solar PV hosting capacity limits and can therefore be installed on every residency without network limitation on solar feed-ins. However, reducing the demand for grid electricity could alter Ergon's projections, and close consultation would be required.

Alternate hot water system setups, such as heat pumps and the pairing of solar PV with timing systems to electric systems, could also provide similar benefits to SHW systems, and could be included as part of the scheme. One of the main benefits of heat pumps is avoiding installing panels on a rooftop, instead drawing heat from the atmosphere. The pairing of solar PV with timing systems could potentially be more cost-effective than SHW systems, however would require further consultation with Ergon due to the effect on the network.

Costs and funding considerations

Capital costs

- Approximate total capital cost: $4.5 million
- Unit presented: 180L & 2m^2 solar panel
- Supply and installation: $5,000 per unit
- Costs reduction for STC's: ~$500 per unit
- Total unit costs: $4,500 per unit

Ongoing costs

- Maintenance of SHW systems
- Replacement costs for damaged SHW not included
- Cost of electricity on days of poor solar availability or high hot water usage

Potential cost savings or return on investment

- Savings of ~$320 / year per residency
- Estimated ~15-year simple payback period for residents (including STC subsidy)
- A more favourable payback period would be realised when comparing a new SHW system to an equivalent new electric/gas hot water installation

Funding opportunities

The project would primarily seek partial or full subsidies for residents purchasing SHW systems. Some of the funding avenues for the project are as follows:

- Department of Housing and Public Works funding to subsidise purchase and maintenance of SHW systems, have similar arrangement on nearby islands, however different demographic of residencies of each island
- Small-scale technology certificates (STC) for SHW systems through Small-scale Renewable Energy Scheme (SRES) – 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

Bulk purchasing and installation agreements have not been factored into costings, however, could show a reduction in capital costs required if such agreements are made for the scheme.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Residents / Homeowners	■	■		■
Townsville City Council/ Government	■			
Ergon Energy	■		■	
SHW Manufacturers / Installers			■	
Dept. Natural Resources, Mines and Energy	■		■	

Implementation and timeframes

Investment readiness

SHW system installations would be ready for investment, existing technology with on-island proven track record.

Next steps

Confirmation of number of existing SHW systems and impact on grid of future SHW systems installed should be conducted, confirming the emissions reduction achieved and effect on grid demand.

Considerations for implementation

- The ability for local workers to be trained in the installation of the systems should be considered.
- With differing household sizes, in terms of residents and size of residence, different sizes of hot water systems will be required, and the appropriate SHW system sizing will need to be selected on a case by case basis
- An education campaign could be rolled out alongside this scheme, promoting the emissions reduction benefits of SHW systems and good hot water usage practices
- Consultation with Ergon around impact to grid electricity

Timeframes to deliver solutions

Timeframes will depend on the planning process, household interest, the supply of SHW systems and availability of the skilled labour required to install upgraded systems on potentially ~1,000 residences. The program may take between 1 to 2 years to complete.

2 Clean Energy Regulator, accessed September 2020, 'Solar water heater STC calculator', [https://www.rec-registry.gov.au/rec-registry/app/calculators/swh-stc-calculator]

Magnetic Island | Waste

13 Organic Waste Recycling Feasibility Study

Feasibility study to undertake collection and composting of organic waste on the island to reduce transport and landfill emissions and provide a product for soil conditioning on the island.

Description and overview

This project proposes a feasibility study into organic waste recycling – feedstock, separation, collection, composting and beneficial reuse on the island.

Townsville City Council (TCC) is responsible for waste management on the island. With closure and rehabilitation of the on-island landfill, all waste is now shipped off the island for processing and disposal on the mainland. Currently general waste and comingled recycling from Magnetic Island households and some businesses is collected by TCC and delivered to the on-island transfer station where it is processed for transport off the island, via charter barges. Once on the mainland, comingled recycling is processed at the local materials recovery facility (MRF) and general waste disposed to landfill. Island residents are encouraged to drop off garden organic waste at the transfer station where it is mulched and provided for free back to the Magnetic Island community.

A significant proportion (estimated 30%+) of total waste weight and associated cost of waste shipped from the island is associated with organics, providing the opportunity for on-island organics recycling to improve environmental outcomes, improve manageability of barged waste (without putrescibles); reduce associated barge costs and would fill an potential need for nutrient-rich compost for use on-island.

The proposed feasibility study would be undertaken with council and community to investigate:

- Feedstock: Confirmation of likely volumes of organic waste available from food waste, green garden waste and potentially biosolid sludge from waste water treatment plant
- Separation: Potential for household and business separation of organic waste (food and green waste);
- Collection: Potential for additional organics bin and altered collection schedules to meet needs (i.e. higher frequency for organics, lower frequency for non-organics). Also option for drop off green waste to the facility;
- Composting: Establishment and ongoing management of composting facility;
- Re-use: Options for Council and community use, including as part of TCC Water smart community program (refer to Water Smart Demonstration Project).

Project summary

Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	To be determined by the study
Estimated payback period	Years	To be determined by the study
Estimated annual cost savings	$	To be determined by the study
Estimated capital costs	$ mil	0.1 - 0.2
Net present value (simple)	$	To be determined by the study
Timeframe to deliver project	Years	0.5
Estimated FTE	No.	To be determined by the study

Key project objectives

Carbon assessment
General waste can comprise up to 30% organic materials. Removal of organics from the general waste stream may result in this material being suitable for transport to the mainland on the regular barge service and therefore no additional trips would be required. In addition if biosolids were incorporated this would reduce this waste stream shipment also. This would have a positive carbon impact.

Degradation of organic waste within a landfill produces landfill gas which contains 40-60% methane, a greenhouse gas approximately 30 times more potent than carbon dioxide. Removal of organic content from the general waste stream for recycling would reduce the overall quantity of waste disposed to landfill and subsequently reduce the quantity of landfill gas produced.

Establishment of a collection and processing system for organic waste on the island to produce compost or soil conditioning materials would reduce the overall need for transport of these nutrients from the mainland, subsequently further saving on transport emissions.

The project would look to establish end markets for the compost product on the island to avoid carbon miles in transporting excess to the mainland.

Community resilience
Should management of organic waste on Magnetic Island be adopted this would not only promote higher order use of materials on the island but would also provide resilience during times when access to the mainland is limited, such as during cyclone events. If organic waste can be managed on the island this reduces the overall waste needed to be transported to the mainland for disposal and removes the putrescible portion thereby the general waste will be able to be stored longer at the transfer station until transport routes are open.

Production of on island compost enhances self-sufficiency for the community and reduces reliance on the mainland for these products. Water security is also a key issue for the region, and it is recognised that use of mulch and soil conditioners/compost helps retention of water in the soil[1].

Co-benefits

Economic
Should collection and processing of organic material on the island be considered feasible, the following economic benefits could be realised for the Magnetic Island community and TCC:

- Reduction in costs for transport of soil conditioning, compost and fertiliser products to the island for use in gardens and landscaping
- Reduction in costs to transport general waste to the mainland for disposal to landfill
- Reduction in levy payment for general waste disposal, particularly if the levy rebate on household waste is revoked
- Reduction in costs for transport of biosolids transported to the mainland for reprocessing
- Increase in local jobs through collection, processing and distribution of organic material

Social and cultural
Residents on Magnetic Island value sustainable principles, and a circular economy approach to waste management. Zero Waste Magnetic Island is an active community group on the island with good community support. There is an eagerness to adopt sustainable initiatives and protect the environment and marine parks surrounding the island. Magnetic Island is viewed as an ideal location to trial initiatives on a small scale.

Environmental
The use of nutrient rich compost products, rather than artificial fertilisers, on parks, gardens, small scale agriculture and landscaping improves soil condition and also reduces the risk of nutrient run off into waterways and the Great Barrier Reef, which is associated with harmful outbreaks such as algal blooms and increase in crown of thorn starfish.

Introducing practices for beneficial use of organic waste material provides an opportunity for higher order use of the materials and reduction of waste to landfill, in line with the waste hierarchy.

Composting green waste also decreases the dependency and cost of transport associated with waste, which was identified as a high risk in the project risk assessment.

Risks and opportunities

Barriers

- Council approval and sourcing of funding for feasibility study
- Identification of suitable land for a composting facility
- Should the feasibility study recommend progressing with an organics collection system and processing facility for household organic waste, barriers would include:
    - Gaining community support for collection and recycling of food waste
    - Development application and licencing requirements *(Environmentally relevant activity 53 Composting and soil conditioner manufacturing,* processing >200t organic material/year)
    - Testing and quality control for compost products, particularly with the risks associated through inclusion of biosolids

Risks

- Contamination in the organic materials stream making it unsuitable for composting or reuse, this material would have to be transported to the mainland for landfill disposal
- Over production of compost on the island leading to stockpiling or transport to the mainland for sale, which would increase carbon footprint of the product
- Introduction of government restrictions on processing of biosolids for reuse on land
- Ban on single use plastics will increase use of compostable products the feasibility study would need to consider the processing and management of such items

Opportunity
Application of circularity principles on the island, increase diversion from landfill and recycling in line with the QLD Waste Management and Resource Recovery targets. Depending on the outcomes of the feasibility study, this project could be flexible to meet the needs of the island, through small scale facilities in each bay or one large scale facility servicing the whole island.

Alignment with other initiatives

Alignment with other project options

- 3. Establishment of a Native Plant Nursery
- 5. Sustainability and Environmental Education
- 8. Aquaculture Production Feasibility Study
- 18. Water Smart Demonstration Community

Alignment with other initiatives

- North Queensland Regional Waste Management Strategy
- TCC Dry Tropics Smart Water Residential Outdoor Water Conservation Program
- QLD Waste Management and Resource Recovery Strategy
- This project would also be attractive for eco-accreditation purposes for the island and businesses and is in line with objectives of the Zero Waste Magnetic Island group.

1 https://www.townsville.qld.gov.au/water-waste-and-environment/sustainability/water

Assumptions

This project assumes support from TCC and the Magnetic Island community for development of a feasibility study for organics collection and processing on the island.

Costs and funding considerations

Capital costs
Depending on the outcomes of the feasibility study, capital costs for implementation of an organics collection and processing project for the island could include:

- Roll out of organics collection service for households (food and garden organics)
- Composting facility for processing of organic waste (this may be one large facility or a series of small-scale technologies)
- Development of end markets for output products on island

Ongoing costs
If an organic waste collection and processing facility was recommended by the feasibility study the following ongoing costs may be applicable:

- Weekly/fortnightly collection of garden organics and/or food organics from households
- Operation of the composting processing facility/facilities
- Testing of output product to ensure it complied with regulation and quality requirements for end market
- Distribution of product

Potential cost savings or return on investment
If organic waste is removed from the general waste stream this will reduce the volume of waste transported to the mainland for disposal, reducing the cost of barge hire and disposal fees, including landfill levy fees should the council rebate on household waste be revoked. This would also be applicable to transport costs for biosolids.

Costs and funding considerations

Producing a compost product on the island would reduce the cost of importing material from the mainland and provide a cost saving to residents and businesses.

Potential funding opportunities

- Resource recovery industry development program
- Business grants

Costs to undertake a feasibility study are assumed to be between $100,000 - $200,000 based on 500 – 1000 hours @$200p/h

Additional information
TCC are currently in the process of developing a new North Queensland Regional Waste Management Strategy for the region, of which reduction of organic waste to landfill is a consideration.

It is understood that a Bio-Regen Unit has been purchased by TCC for roll out as a trial this year on Magnetic Island. This type of technology is suitable for use by commercial businesses that produce a large volume of food waste. The Bio-Regen Unit processes the food waste into a liquid bio-fertiliser. The Bio-Regen Unit processes food waste from householders and businesses to produce a valuable and nutrient rich product for agricultural application. Small scale technologies, such as the Bio-Regen Unit are perfect for use by commercial businesses and based the TCC trial may be suitable for roll out to each bay on the island. This business case primarily focuses on a feasibility study for an organics collection service and processing system for households. However, should the Bio-Regen trial be successful for organic waste from businesses this would provide a complete solution for organic waste management on the island.

In 2015 Pollution Solutions and Designs Pty Ltd produced the *Magnetic Island Biosolids Strategy 2036* which outlined the most cost effective and beneficial solution for management of island biosolids based on the information at the time. Should a feasibility study be conducted it could look to update of this strategy given changes to local and state regulation and infrastructure since 2015.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
TCC	■	■	■	■
Department of Environment and Scient			■	
Magnetic Island Businesses			■	■
Magnetic Island Households				■
Zero Waste Magnetic Island			■	■
Magnetic Island community				■

Implementation and timeframes

Investment readiness
This project could go ahead immediately if the funding could be sought for the feasibility study.
This would be based on 30% (organic component) of 1,635 tonnes of general waste per annum; 491 tonnes of organics.

Next steps
TCC to commission feasibility study for collection and processing of household organic material (garden and food waste) and potentially biosolids on the island, exploring the possibility to utilise this product on island for landscaping and gardening.

Considerations for implementation
Set up of a trial installation of the Bio-Regen Unit at Magnetic Island would provide useful data on the following:

- Readiness for uptake of organic collection schemes by the community;
- User behaviour; and
- Issues and unexpected outcomes.

Timeframes to deliver solutions
Feasibility study (3 to 6 months)

Magnetic Island | Energy

14 Solar PV Rooftop Systems

Increasing the amount of managed solar PV installed on rooftops with potential battery integration, reducing dependence on grid power and emissions, while providing cost benefits to residents.

Description and overview

The Solar City - Magnetic Island Solar Suburb initiative[1] (2007 – 2013) was a highly successful community solar energy and efficiency trial on Magnetic Island supported by Queensland Government funding. The scheme announced that '*compared to the Solar City Business Case, annual maximum demand in 2011-12 was 40% below that predicted without the intervention of the Solar City project, and 19% ahead of the target set. This means that $17 million worth of investment in an additional cable has been deferred for eight years*[1]'. Building upon this success, this project seeks funding for subsidised purchase and installation / upgrade / extension of solar photovoltaic (PV) systems for residential properties with potential battery integration.

An audit of suitable available roof space will be undertaken to identify underperforming, underutilised roof space and new build roof spaces on the island, and confirmation of system design undertaken prior to roll out. As a baseline system size, the impact of installing 3kW systems shows that a ~$680 annual cost saving for each residency is achievable. If these systems were spread over 500 residencies, 1,500kW additional solar PV would be installed on Magnetic Island and this quantity of rooftop solar PV could optimally increase the renewable energy penetration by ~13%. Providing an annual emissions reduction of ~1.5 tonnes CO_2 for each residency, and ~1,800 tonnes CO2 over the entire island when including solar feed-in.

The addition of de-centralised, behind-the-meter, battery systems reduces the risk of curtailed solar and can have network strength and emission reduction benefits, however, currently has high capital costs. A 5kW solar PV, 8kWh battery system for the average household could achieve $1,080 / year of savings and ~2.8t CO_2 emissions reduction, however, would have a payback period of ~20.5 years. This unfavourable payback period highlights the need for subsidies to make batteries more economically appealing for residents.

While the emissions and cost benefits presented in this business case primarily focus on installing systems on residential properties currently without solar PV, commercial premises or residencies looking to augment existing solar PV and battery systems could also be included in the scheme.

Project summary

Items – for each 3 kW Solar PV Installation	Units	Total*
Estimated annual emissions reduction	t-CO_2-e per residency	1.5
Estimated payback period	Years	~7.5
Estimated annual cost savings	$ / residency	680
Estimated capital costs	$ / 3 kW	5,100
Timeframe to deliver project (total)	Years	1 - 2
Estimated FTE (each installation)	No. days	1 – 2

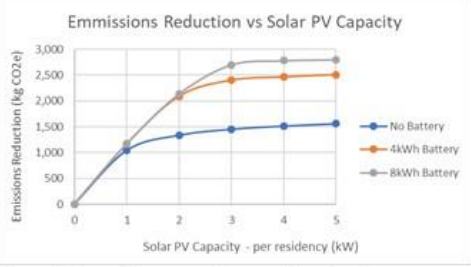
*Note that the initial audit and scheme design will determine optimum project details. An estimate of potential project costs and benefits is provided in this project outline overleaf.

1 Townsville Solar City, accessed September 2020, 'Magnetic Island Solar Suburb', [http://townsvillesolarcity.com.au/Overview(2007-2012)/MagneticIslandSolarSuburb/tabid/65/Default.aspx]

Key project objectives

Carbon assessment

Maximising the amount of solar PV in the network will reduce the island's dependence on grid electricity and could directly cut annual emissions by ~1,800 tonnes of CO_2 (additional 1,500kW solar PV installed with unrestricted network feed-in). The graph below shows the emissions reductions directly contributed by an average residency with solar PV installations and varying behind-the-meter batteries. The graph does not include any associated decarbonisation benefits from non-guaranteed solar feed-in. In this case, a 3 kW solar PV system presents residents with a ~1.5 tonnes of CO_2 annual emissions reduction, assuming all excess solar is exported to the network this annual emissions reduction increases to ~3.6 tonnes of CO_2.



Over a 20-year lifespan, and accounting for a two-year payback period for embedded emissions in manufacturing the panels, 1,500kW of additional solar PV installations could optimally reduce the island's emissions by ~32,400 tonnes of CO_2 based on a Queensland grid carbon intensity of 0.81 kg-CO_2-e / kWh[2].

Community self-sufficiency & resilience

Increasing the solar penetration will expand upon the previous installations made as part of the Solar Cities project and would increase community energy self-sufficiency and reduce household cost of living costs from behind the meter energy.

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.

Co-benefits

Economic

- Residents will receive lowered power bills as solar panels are actively able to generate power throughout the day
- Higher solar PV couple with battery installations could reduce the need to locate temporary generators on the island during peak periods of summer and reduce the reliance on the undersea cabling connecting Magnetic Island to mainland Australia
- Resulting economic benefit of jobs for suppliers and installers
- There is also an opportunity to upskill workers on-island in undertaking maintenance, which could increase the capital costs of the program but reduce maintenance costs
- Bulk purchasing and installation agreements have not been factored into costings, however could show a reduction in capital costs required if such agreements are made for the scheme

Social and cultural

- By reducing the cost of electricity, energy bills will be reduced. Further helping the island's progressive attitude with the introduction of more renewables and potential storage to displace powering from the grid, which has a relatively high carbon intensity due to coal and other fossil fuel generators in the National Electricity Market (NEM).
- If locals were trained in the maintenance and installation of the solar PV systems, there could be a reduced lead time on fixing any underperforming or non-operational systems and the community could benefit from job creation

Environmental (General)

- Reduced dependence on the NEM through increased solar generation will see a reduction of greenhouse gas emissions, which was identified as a severe risk. Implementing battery systems could increase the integrity of the network, allowing for further solar PV to be introduced with the ability to strengthen network security.
- Increased community resilience during severe weather events including power outages by providing an alternative energy source to the main grid, which was identified as a severe risk in the project risk assessment.

Environmental (impacts to Great Barrier Reef)

- Benefits for deferring the replacement of one of the undersea cables between Magnetic Island and the mainland.

Risks and opportunities

Barriers

- Stability of Ergon's network, ability to host ~1,500 kW more rooftop solar PV. To be assessed in consultation with Ergon in next steps, current hosting limit has not been specified to date.
- Structural integrity, roof space availability and shading conditions of each residencies roof has not been assessed since Solar City project

Risks

- Adverse weather or other external factors such as damage to systems and shading conditions negatively affecting performance of systems
- There is a risk that SES workers may not be allowed to access a roof to assess damage or to make repairs during or after a storm if PV panels are present unless cleared by an electrician
- Negative impacts on grid stability, due to high amounts of solar feed-in during middle of the day affecting voltage of network, this risk could be mitigated through the installation of behind-the-meter batteries and further consultation with Ergon.
- Lead-time on maintenance

Opportunity

- Possible to focus on solar PV installations on council/government owned buildings, structures or land (if any is identified as available for ground-mounted solar). Similar decarbonisation benefits and a reduction in capital costs as compared to installing the same additional amount of solar PV on residences may be achieved. However, cost reductions would be realised by council instead.
- The addition of battery systems may in future be able to assist with load curtailment for the grid
- Whilst not the focus of this project option, the installation of solar systems within businesses provides further opportunity to reduce grid electricity demand
- Potential to defer or negate the upgrade of undersea cabling.

Alignment with other initiatives

Alignment with other business cases

- 5. Development and delivery of Sustainability and Environmental Education for residents and visitors
- 11. Tourism Business Eco-Accreditation
- 12. Solar Hot Water Systems
- 17. Microgrid Feasibility Study

Alignment with external initiatives or investments

- Solar City Program – 1.1MW solar PV installed on island as part of program – displaying progressive attitude towards renewables. Learnings from the previous program can be explored in further work.
- Opportunity to be a demonstration location for roll out of some of Ergon's planned innovations and initiatives. E.g. potential Distributed Energy Resource planning trial; could further defer replacement/upgrades to undersea cabling.

2 National Greenhouse Accounts Factors August 2019 [https://www.industry.gov.au/sites/default/files/2020-07/national-greenhouse-accounts-factors-august-2019.pdf]

Assumptions

- Seasonal performance of solar PV averaged based on historical GHI (irradiance)
- Power consumption remaining similar – growth rate of island not modelled
- Solar PV all operational and appropriate repairs and replacements made over lifespan
- Solar PV installed and performance not restricted by Ergon
- Calculations are based on average household power consumption. Using 1,821 residencies, and 53% commercial & 47% residential energy split of total island consumption provided by Ergon
- Total costs and emissions reductions achieved assuming 500 residencies are installing additional solar PV, and battery installations where applicable.
- Emissions reductions presented on a residential level not including the contribution of excess solar PV beyond the residencies power consumption
- Solar PV costed on ~$1,700 / kW (for 3kW), $1,300 / kW (for 5kW system), and ~5 m^2/kW area requirement for rooftop mounted systems
- Battery systems, including inverter and charger for integration with solar PV, costed on ~$2,000 / kWh (for 4 to 8kWh systems)
- Costs include installation and supply
- Costing based on average Australian industry benchmarking with regional mark-up from Rawlinsons Construction Handbook 2020[3], as opposed to vendor quotes, no guarantee these are the minimum costs obtainable
- Assuming solar feed-in (8 c/kWh) received[4]
- Detailed analysis of solar PV performance for each residency not conducted, all emissions and performance parameters based on assumptions and subsequent theoretical calculations
- No structural or orientation analysis of residency roofs has been conducted
- Residencies currently with solar PV may not see same cost benefits from installing more solar PV

Costs and funding considerations

Capital costs

Solar PV & Battery Sizing per Residency	Cost per Residency	Total Cost (500 units)
3kW PV, No Battery	$5.1k	$2.55m
3kW PV, 4kWh Battery	$13.1k	$6.55m
5kW PV, No Battery	$6.5k	$3.25m
5kW PV, 8kWh Battery	$22.5k	$11.25m

Ongoing costs

- Maintenance of solar PV and battery systems
- Replacement costs
- Resulting Ergon network modifications (unless suitable batteries are utilised)

Potential cost savings or return on investment

Solar PV & Battery Sizing per Residency	Energy Bill Savings	Solar Feed – In	Payback Period (Years)
3kW PV, No Battery	$470	$210	7.5
3kW PV, 4kWh Battery	$770	$90	15
5kW PV, No Battery	$500	$430	7
5kW PV, 8kWh Battery	$890	$190	21

- Delay of cable upgrades could save millions incurred by Ergon

Funding opportunities

- Small-scale technology certificates through the Small-scale Renewable Energy Scheme (SRES) – from the Clean Energy Regulator
- Reef Funding Program: funding available for emission reduction projects in Great Barrier Reef catchment, Clean Energy Finance Corporation
- Regional and Remote Communities Reliability Fund
- Climate Solutions Fund – Emissions Reduction Fund
- Energy Efficient Communities Program, Community Energy Efficiency and Solar Grants 2020, Department of Industry, Science, Energy and Resources
- Interest-free loans offered for solar and storage by Queensland Government (not currently running)

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Residents				
Ergon				
DNRME (Qld Government)				
Solar PV / battery, installers and suppliers				

Additional information

The addition of larger centralised battery systems is another alternative, providing Ergon with the ability to secure their network and provide a pathway for further rooftop solar PV penetration. 6MW of solar PV systems coupled with an 8MWh centralised battery could theoretically provide ~6,500 t CO2e in emissions reductions, a renewable energy penetration of 50%.

Implementation and timeframes

Investment readiness

- Confirmation is required regarding the capability of the network to accommodate an additional ~1.5 MW+ of solar PV
- Consultation with Ergon to understand the capability of the network

Next steps

- Further analysis of solar PV and battery performance taking into consideration the tropical conditions is required
- Audit of available roof space on island
- Vendor engagement to confirm pricing and ongoing maintenance costs
- Selection of funding avenue and determination of percentage of subsidy
- Exploration of system control by Ergon to manage island demand

Considerations for implementation

- The ability to train locals in the installation of the systems should be considered in combination minimising overall cost and time taken for the installation
- Training may delay installations, although maintenance and any future installations could be achieved more efficiently by trained local workers
- Different sizes of residencies and energy consumption patterns suggest the appropriate solar PV and battery sizing should be selected on case by case basis
- Comparing the economic viability of a battery and solar system is largely dependent on the individual's willingness to invest in projects with a slow payback period. It has been determined that a subsidy of 50% would reduce the ~15 year payback period for 3 kW solar PV, 4 kWh battery system to ~7.5 years equalling the payback period of a 3 kW solar PV only installation. Further investigation is required to determine the optimal subsidy package including solar feed-in tariffs.

Timeframes to deliver solutions

Delivery timeframes are dependent on the required network analysis, program planning, households registering interest in participating, and the supply and installation of the panels. Approximately 1 to 2 years may be required to complete the program, as is also dependent on the availability of qualified technician(s).

3 Rawlinsons, 2020, Australian Construction Handbook 2020
4 Ergon, accessed September 2020, 'Solar feed-in tariffs', [https://www.ergon.com.au/retail/residential/tariffs-and-prices/solar-feed-in-tariff]

Magnetic Island | Waste

15 Glass Recycling Feasibility Study

Feasibility study to investigate initiatives to increase the volume of glass recycled and reused on Magnetic Island.

Description and overview

This project outlines a feasibility study to investigate viable initiatives to increase glass recycling and reuse on Magnetic Island. The feasibility study is anticipated to include the following which would be confirmed through further engagement with TCC and community;

- Increased uptake of the QLD Container Deposit Scheme (CDS)
- Installation of a glass crusher to process glass on the island
- Community education to improve utilisation of recycling bins for residents and businesses

Waste glass is collected in general refuse from households and businesses by Townsville City Council (TCC) and consolidated at the transfer station on Magnetic Island before transport via barge to Townsville for sorting and recycling. Approximately 240t/year of comingled recycling is transported off the island, of which approximately 30% is glass material.[1]

As an alternative to the recycling service, under the QLD CDS residents and businesses are able to drop off eligible glass containers and receive a refund, with two Containers for Change drop off points run located the island. One collection point is located at Horseshoe Bay and the other at Nelly Bay, operating on a Tuesday and alternating between location and operating times. The feasibility study would investigate if limited accessibility to these drop off points is a barrier collection of glass containers for recycling.

Other barriers and potential options to improve recovery and recycling of glass on the island would be investigated within the feasibility study, including the possibility for installation of a glass crusher on Magnetic Island to reduce the volume of glass, and therefore decreasing the collection and transport frequency required to remove waste from the island. Glass crushers have been used with success on more remote tourist resort islands and their application to a community island could be further explored.[2] A reduction in waste collection frequency may provide an economic saving through reduction in transport costs and a carbon saving through reduction in transport movements. Community perception of waste recycling initiatives and the need for education and awareness would also be explored.

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	To be determined in the study
Estimated payback period	Years	To be determined in the study
Estimated annual cost savings	$	To be determined in the study
Estimated capital costs	$	5,000 - 30,000
Net present value (simple)	$	To be determined in the study
Timeframe to deliver project	Years	0.25-0.5
Estimated FTE	No.	To be determined in the study

*Note that the initial study and scheme design will determine optimum project details. An estimate of potential project costs and benefits is provided in this project outline overleaf.

1. https://www.qld.gov.au/__data/assets/pdf_file/0033/129669/recycling-waste-report-2019.pdf
2. https://www.sciencedirect.com/science/article/pii/S2212609016301157 - Dependant on future projects on island and procurement change requirements of using recycled aggregate

Key project objectives

Carbon assessment
The feasibility study would explore any carbon savings that can potentially be achieved through increased glass recycling initiatives.

For example, installation of a glass crusher may reduce the volume of glass and therefore reduce the number of barge trips per year and associated emissions savings for transport of waste glass to Townsville for recycling.

Volume reduction of glass could also realise carbon savings through reduction of vehicle movements on the island transporting glass waste to the transfer station for consolidation.

Alternatively if crushed glass could be utilised on the island as a sand or aggregate material this would not only save on transport movements for recycled glass material to Townsville but would save on transport of materials to Magnetic Island for landscaping and construction.

Community resilience
The feasibility study would explore initiatives that could increase the resilience of the Magnetic Island community through increased glass recycling. Some examples could include:

- A glass crusher can be used to reduce the volume of waste that would require storage within businesses, providing extra contingency should transport of waste not be feasible due to extreme weather events, such as cyclones, when the island may be temporarily cut off from Townsville. A glass crusher would also supply a produce for use on the island and reduce reliance on materials to be transported from the mainland.
- Increased recycling and reuse options for glass on the island could provide benefit to the community through engagement and education on the waste hierarchy and circular economy principles.

Co-benefits

Economic
The feasibility study would explore potential economic savings that can be realised from improved glass recovery, recycling and reuse on the island.

Depending on the initiatives assessed, the potential economic savings could include:

- Increased refund value through the CDS for the community and charities due to greater distribution of and access to drop off points for eligible containers.
- Crushing of glass to achieve reduced transport and barge costs for recycled glass materials
- Opportunity to produce sand and aggregate material on Magnetic Island and reduce costs for transport of product from the mainland.

Social and cultural
The feasibility study would explore the potential social and cultural benefits that could be realised through increased glass recycling initiatives on Magnetic Island.

Social and cultural benefits through improved recycling practices could include increased awareness and promotion of the waste hierarchy and circular economy principles on Magnetic Island. In addition, should an installation of a glass crusher be assessed as feasible, crushed glass produced could be used to replenish sand and for use in local gardens and community spaces on Magnetic Island.

Environmental
The feasibility study would assess the potential environmental benefits that could be realised through increased recycling of glass on the island. Some benefits could include, reduction in vehicle and barge movements to and from the island which will reduce costs and emissions (high risk), availability of recycled glass for remanufacture into other glass products, availability of recycled glass for regeneration and restoration of natural areas, particularly along the shoreline.

Risks and opportunities

Barriers
Barriers to increased glass recycling on Magnetic Island would be explored in the feasibility study, some examples could include:

- Insufficient volume of glass available to justify purchase of a glass crusher
- Insufficient interest from the community for uptake of increased CDS utilisation
- Lack of small business loans or government funding for small scale infrastructure
- Existing collection contracts with the nominated business for collection of glass recyclables.

Risks
Risks associated with increased glass recycling on Magnetic Island would be explored in the feasibility study, some examples could include:

- A glass crusher might divert glass from local charities taking advantage of the QLD CDS.
- If use for a crushed glass product material cannot be identified on the island this material will need to be reintegrated with the recycling stream and shipped back to the mainland.

Opportunities
Opportunities associated with increased glass recycling on Magnetic Island would be explored in the feasibility study, some examples could include:

- Businesses may be interested in increased glass recycling schemes to save on space, reduce waste collection costs and to contribute to green star business ratings.
- Increase in community awareness of glass recycling would expand knowledge of recycling practices to other materials.

Alignment with other initiatives

Alignment with other project options
- 4. Path Networks to Support Active Transport
- 5. Sustainability and Environmental Education

Alignment with external initiatives or investments
- TCC are running trials for utilisation of recycled glass aggregate and sand as a substitute material for pavements

Assumptions

High level estimates provided for a consultant to undertake a feasibility study.

Capital costs are provided for the glass crusher based on estimates obtained for a crusher with a compaction ratio of 6:1 and throughput of up to 500kg/hr.

Costs and funding considerations

Capital costs
Capital costs for this project include approximately $5 - $30,000 to undertake a high-level feasibility study based on 25 – 150 hours @ $200 p/h.

Depending on the outcomes of the study, potential additional capital costs to implement the findings could include:
- $15,000-30,000 to purchase and install a glass crusher
- $2,000-$5,000 to increase CDS collection points and recycling education on Magnetic Island

These costs would be explored in greater detail within the feasibility study.

Ongoing costs
Ongoing costs would be explored within the feasibility study.

Potential cost savings
The feasibility study would assess cost savings for various glass recycling options however potential cost benefits for this project could include:
- Reduced barge transport costs
- Reduced costs for waste collection and transport
- Sourcing of aggregate and sand, reducing import of materials from the mainland
- CDS refunds for the community and charities

Funding opportunities
- Small scale business loans
- Resource recovery grants

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Townsville City Council				
Magnetic Island community				
Commercial businesses				
Zero waste magnetic island				

Additional information
Currently material in the household comingled recycling bin is collected by TCC and processed by material type at the Townsville Material Recovery Facility. Recently a Krystelline Glass Implosion system was installed onsite at this facility to process the separated glass material into a high-quality sand product. TCC utilise this product in civil applications for public works and other as various sand and aggregate replacements.

Implementation and timeframes

Investment readiness
This project could progress immediately upon securing funding and identification of a suitable consultant to undertake the feasibility study.

Next steps
- Further engagement with TCC to confirm suitable scope of feasibility study
- Undertake feasibility study
- Implement assessment outcomes

Considerations for implementation
- Entity to drive this study and solution to be identified, potential candidates could include Townsville City Council or a nominated sustainability coordinator associated with 'Zero Waste Magnetic Island'.

Timeframes to deliver solutions
3-6months for commissioning and finalisation of a feasibly study

Magnetic Island | Transport

16 Low Emission Marine Transport

Current technology and market assessment of alternative low-emission technology and fuel solutions for ferry services between Townsville and Magnetic Island, potentially including electricity, hydrogen and bio-fuels.

Description and overview

There are two main marine transport ferries operating between Townsville and Magnetic Island – a passenger service catamaran and vehicular barge service. The Townsville – Magnetic Island passenger ferry route is a declared public transport service contract route by Queensland Department of Transport and Main Roads which is currently operated by SeaLink. The SeaLink service operates up to 18 trips each day dependent on seasonal needs. A vehicular barge operated by Magnetic Island Ferries also completes up to 8 trips daily depending on seasonal needs servicing vehicles, goods and some walk-on passengers.

Both are currently diesel powered and therefore low-emission technology and fuel options represent a significant opportunity to reduce island transport emissions. Low emission technologies and fuels are developing quickly and up to date market information is required to inform procurement and to consider substantial lead times for delivery of craft. This project option proposes investment in an independent review of available marine transport alternative energy/fuel technologies to inform low-emission focussed procurement of these services and therefore future investment in low-emission marine transport on these routes and the wider Great Barrier Reef (GBR) transport network (e.g. adjacent Palm Island route).

This would involve direct engagement with ferry operators and manufacturers (local and international), potential research programs and other new technologies including: Electric; Hydrogen (in both fuel-cell and combustion applications); Solar; biodiesel / renewable diesel and combination options. A route investigation, energy fuel requirements, schedule (i.e. charging, refuelling timing options) would be taken into consideration for the assessment.

This project is to be aligned with the Palm Island low emission marine transport study.

Project summary

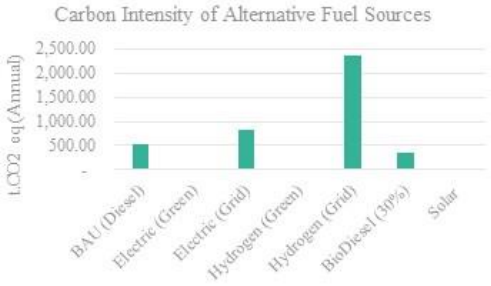
Item	Units	Total
Estimated annual emissions reduction	t-CO_2-e	813 – 2,700*
Estimated payback period	Years	To be determined by the study
Estimated annual cost savings	$	To be determined by the study
Estimated capital costs	$ mil	0.05 - 0.1
Timeframe to deliver project	Years	To be determined by the study
Estimated FTE	No.	To be determined by the study

*Note that the technology and market assessment will determine optimum project details. An estimate of potential project costs and benefits is provided in this project outline overleaf. Cost savings from switching from diesel are likely to be negative due the current costs of alternative fuels when compared to diesel.
Emissions reductions are dependent on the type of fuel used and the supply chain carbon intensity of the fuel creation. Carbon emissions have been based on replacing the fuels with either a carbon neutral fuel compared to diesel or a drop in biofuel.

Key project objectives

Carbon assessment

- The realised greenhouse emissions reductions will be dependent on the alternate energy source selected and the emissions currently emitted by the ferries and barge whilst operating the studied route
- To maximise emission reduction a clean energy source would need to be utilised for electric or hydrogen ferries
- The most common blends of biodiesel have a composition mix of 5-20% biofuel which would be a direct reduction in baseline greenhouse gas emissions
- The distance between Townsville and Magnetic Island is approximately 13 km (straight line).
- A high-level comparison for the annual CO_2 equivalent has been conducted for the Queensland Government contracted route for representative purposes. For the electric and hydrogen cases, the source of electricity will impact the overall carbon impact. If sourced from green electricity then the carbon is negligible, if sourced from the current electricity grid across Queensland the carbon intensity is higher than BAU. This would need to be further explored in the independent review.



Community and climate resilience

- By minimising diesel consumption, the Island will increase resilience against supply issues and future taxes, if introduced

Co-benefits

Economic

- New technology will be initially more expensive than existing diesel and it is expected that subsidy will be needed for capital expenditure
- Potential change in operational costs associated with alternative fuel / power cost and alternative maintenance regime will depend on option selected
- Any potential reduction in operational costs could translate to lower ticket prices
- Potential unique tourism selling proposition

Social and cultural

- The installation of the relevant charging infrastructure could encourage the wider community to own and operate a vehicle that utilises an alternate energy source (i.e. uptake in electricity vehicles or hydrogen vehicles depending on the proposed solution)
- Potential to upskill Magnetic Island residents to operate new energy infrastructure
- Aligns with green ethos of community

Environmental (General)

- A ferry that utilises a renewable fuel source will provide emissions reduction when compared to its diesel counterpart. This was identified as a severe risk in the project risk assessment. If charging from the grid, emission reductions could be achieved, however further investigation into the efficiencies of electric ferries and the BAU diesel engines is required. Due to the inefficiencies of diesel engines, there could be some emissions reductions even when compared to carbon intensive grids. Investigation into where the fuel is derived would be a key focus point in the independent review.
- The implementation of this watercraft could abate the environmental impact diesel shipping currently causes –air pollution, water pollution, noise pollution and oil pollution.

Environmental (impacts to Great Barrier Reef)

- By removing diesel boats from the water there is reduced emissions and potential for spills within the ocean

Other

- Can be included in wider hydrogen and electric studies and alternative fuel use for decarbonising the region including Townsville mainland generation and refuelling options to supply island transport

Risks and opportunities

Barriers

- Significant upfront cost likely required from operator - recommendations of assessment may not be financially viable
- Availability of grant funding to support new technology innovation and implementation at scale

Risks

- Assessment recommendations not undertaken due to expense
- Any option selected must ensure reliability and safety of service is paramount
- High capital costs associated with new ferry and/or associated energy infrastructure
- Issues surrounding suitable location and available site for refuelling facilities at port locations

Opportunity

- Large scale decrease in emissions if electric, hydrogen or solar options are pursued
- Publicly available EV charging infrastructure could help other residents transfer to EV usage
- Progressing the decarbonisation of a typically hard to abate industry
- International showcase for early uptake of cutting-edge technology
- Potential unique tourism selling proposition
- Seeding wider uptake of low emission transport technology for the GBR islands and wider region

Alignment with other initiatives

Alignment with other Magnetic Island project options

- 1. Electric Bicycle Rental Service
- 2. Low Emission On-Island Shuttlebus
- 7. Green Hydrogen Transport Demonstration Project
- 10. Destination Management Plan
- 17. Microgrid Feasibility Study

Alignment with external initiatives or investments

- International Maritime Organisation (IMO) Strategy to Reduce GHG Emissions
- Queensland Climate Transition Strategy – Zero Net Emissions Transport Roadmap
- Alignment with Palm Island Alternative fuels study

Assumptions

The following assumptions were utilised in the carbon intensity calculations:

Input	Value	Input	Value
Distance	13.2 km	EV Battery Eff	95%
Diesel	9ML	QLD Grid	0.77kg/kWh
Diesel LHV	37.5MJ/L	Hydrogen LHV	141MJ/kg
Diesel CO2	0.07kg/MJ	Hydrogen FC Eff	60%
Ferry Engine Eff	50%	Hydrogen Energy Required	70kWh/kg

Additional information

About Magnetic Island

- Magnetic Island is a popular holiday destination meaning the population of the island swells across holiday periods (Christmas and Easter)
- The 2016 Census data report that the island has a population of 2,335 people
- The island is powered by an underground cable from mainland Australia. The independent review would explore the location of charging infrastructure (Magnetic Island verses Townsville).

Costs and funding considerations

Capital Costs

There are two main costs that should be considered when assessing this project:

1. The first is the fee to develop the independent current technology and market assessment and the potential transition to alternate fuel sources. This independent review would include analysis of the route, fuel type, current ferry technology utilised, and the available suppliers and costs of an alternative fuelled ferry for Magnetic Island. The independent review would cost between $50-100k.
2. The second is the approximate total capital costs/operating costs associated with the new ferry and barge. Approximate total capital cost of an electric ferry is approx. $4m AUD and for a barge is $40m AUD which represents approximately 40% CAPEX increase to conventional diesel vessel. Capital costs associated with alternative fuels to be confirmed through study

Ongoing costs

- If this ferry is to replace the existing service then these costs are removed/reduced
- Wages of drivers/captains and training costs
- Port/dock access
- Boat storage
- Maintenance
- Cost of alternative fuel

Potential cost savings or return on investment

- Potential to reduce on-going costs associated with fuel by 80% if an electric ferry
- Detailed savings and cost comparison to be determined during the independent review

Funding opportunities

- Climate Solutions Fund – Emissions Reduction Fund
- Clean Energy Finance Program - Reef Funding Program
- Australian Renewable Energy Agency – potential funding through exploration of innovative emission reduction measures
- Ergon – potential partner on project due to EV charging infrastructure
- Benchmarking against global funding schemes for ferries to be conducted in review.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
SeaLink/Magnetic Island Ferries	■	■	■	■
Magnetic Island Community				■
Local Council			■	■
Qld Gov (TMR, DSDMIP, DSDTI, DNRME)			■	
Local Businesses			■	■

Implementation and timeframes

Investment readiness

- Currently this project is in the concept phase, no funding has been recieved. To progress this project funding needs to be procured. The assessment is ready to be undertaken.
- Current market ready low emission ferries require investigation into availability and/or development for an Australian context
- Pilot projects using alternative technologies and fuels require government transport and safety regulations to be aligned which has substantial lead times
- Investment is to be aligned with the Palm Island low emissions marine transport project

Next steps

- Consultation needs to take place with SeaLink or Magnetic Island Ferries and the Future Cities Office, Department of Transport and Main Roads (TMR) and Queensland Government and other stakeholders
- Analysis of the proposed route, refuelling / charging options and infrastructure
- Engagement with potential technology providers

Considerations for implementation

- Route distances and charging requirements
- Refuelling time and strategic location of changing infrastructure
- Appropriate training of captains for new ferries may be required
- Publication and promotion of routes and operating time
- Consultation with Maritime Safety Queensland, TMR and the Australian Maritime Safety Authority (AMSA)

Timeframes to deliver solutions

- Assessment could be delivered within 6 months
- Dependent on the selected alternate energy fuel source and the implementation of the relevant refuelling infrastructure
- Lead times of novel ferry technology and any update to regulations for implementation could be substantial (2yrs+).

- OPEX savings - https://electrek.co/2018/02/03/all-electric-ferry-cuts-emission-cost/
- Ferry CAPEX - https://www.bbc.com/news/business-50233206 - https://www.pv-magazine-australia.com/2020/01/22/southern-hemispheres-first-electric-commuter-ferry/

Magnetic Island | Energy

17 Microgrid Feasibility Study

A feasibility study for the development of a renewable energy microgrid on Magnetic Island, exploring a combination of renewable energy generation, energy storage, microgrid control systems and supplementary fossil-fuel generation i.e. diesel generator.

Description and overview

This project is for the development of a feasibility study for the implementation of a renewable energy microgrid on Magnetic Island. Currently Magnetic Island is connected to the mainland electricity grid (and National Energy Market – NEM) by undersea cables owned and operated by Energy Queensland/Ergon. Average daily energy requirements for the island are reported to be in the order of 50MWh by Ergon. Some members of the local Magnetic Island community have expressed a desire to be more self-sufficient with renewable energy. Ergon have also indicated support for investigating the opportunities for microgrids to manage peak load demand on the island. This study would explore the feasibility of this opportunity.

The microgrid would initially consider locations on the island where renewable energy generation (i.e. solar PV rooftop and/or solar farm), with energy storage (i.e. batteries), potentially paired with diesel generators, synchronous condensers and/or and microgrid control systems would be used to create a resilient system capable of operating without dependence on the mainland supply. It is envisaged that as drop-in biodiesel becomes commercially available on the market, generators could also be powered with low carbon fuels.

The capital cost of any microgrid depends on the scale of the system, combination of technology and degree of supplementary / backup power or diesel generation employed. This would be determined and optimised through a detailed feasibility study in consultation with Ergon, the community and other potential partners. At this point in time with current technology, it is considered likely not feasible for the whole island to be a centralised microgrid but rather multiple discreet locations. This is to be further explored in the feasibility study.

Three potential scenarios have been put forward in this project to highlight the potential greenhouse gas benefits. The three scenarios for a microgrid for the island explored are 50%, 75% and 100% renewable energy penetration.

Project summary

Item	Units	Total*
Estimated annual emissions reduction	t-CO_2-e	0 – 13,000
Estimated payback period	Years	To be determined in the study
Estimated annual cost savings	$	To be determined in the study
Estimated capital costs (feasibility study)	$ mil	0.2 -0.3
Estimated capital costs (microgrid)	$mil	~20-70
Timeframe to deliver project (feasibility study)	Years	0.5
Timeframe to deliver project (microgrid)	Years	1 - 3
Estimated FTE (construction)	No.	To be determined in the study
Estimated FTE (operation and maintenance)	No.	To be determined in the study

* Note that the feasibility study will determine optimum project details. An estimate of potential project costs and benefits is provided in this project outline overleaf.

Key project objectives

Carbon assessment
The table below displays potential carbon emissions reduction from example scenarios of how a microgrid could be implemented for Magnetic Island. The scenarios include 50%, 75% and 100% renewables with no requirement to utilise mains power from the undersea cable and based on previous historical power demand supplied by Ergon.

#	Solar PV (MW)	Battery (MWh)	Diesel Generator (MW)	Renewable Energy Penetration (%)	Carbon Emissions Reduction (t CO2e/yr)	Capital/ Emissions Reduction ($ / kg CO_2e)
1	6	8	4	50%	~6,500	~3
2	14	18	3	75%	~9,750	~4.5
3	16	32	0*	100%	~13,000	~5

**Days with historically poor solar could still require diesel generation or mains power – generation and storage required to be refined in feasibility study.*

Due to the capital cost of energy storage the marginal cost of carbon abatement ($/kg CO_2e) increases as renewable energy penetration percentage goes up beyond 50%.

Community and climate resilience
Community resilience is dependent on a clean, reliable and affordable power supply, and all combination of options considered in the feasibility study must prioritise this as well as decarbonisation.

It is noted that power was previously cut to the island during a cyclone event which lasted for approximately five days. Seasonal peaks have occasionally been met by mobile generators being placed on the island.

Other
Could position Magnetic Island and the Townsville region as a leader in the decarbonisation of regional communities, with potential benefits to economic and tourism development as a sustainable and innovative hub.

Co-benefits

Economic
The overall economics of the business case and potential cost to energy users for a microgrid will be largely dependent on the ownership structure and investment partners. The Queensland Government currently supports regional Queenslanders with energy affordability by subsidising additional costs involved in supplying electricity to regional communities. The is achieved via subsidy payments to energy service providers such as Ergon as part of the Community Service Obligation. The feasibility study will need to take this into account in assessing options. Benefits of a resilient microgrid to be taken into consideration include: avoidance or delay investment in upgrade/replacement undersea power cable infrastructure; reduce the need to locate temporary generators on the island during peak periods of summer and improve reliability of power supply to help minimise financial losses to business and residents that may occur due to blackouts and inconsistent power availability.

Social and cultural
By training local residents in the installation and maintenance of the microgrid systems, it presents social and economic co-benefits for capacity building, skills development, and potential job creation, and could reduce lead time on maintenance of underperforming systems.

The community already has a culture of sustainability and self-sufficiency which would be supported by this initiative. Opportunity to have an opt-in for those interested, however this presents unique challenges which are to be resolved once ownership structure confirmed.

Environmental (General)
Reduced dependence on the NEM through increased renewable generation and storage will see a reduction of greenhouse gas emissions by displacing grid emissions. Increased resilience by reducing impacts to ciritical energy pipelines following severe weather events, which was identified as a severe risk in the project risk assessment.

Environmental (impacts to Great Barrier Reef)
A reduction of greenhouse gas emissions through renewable electricity use will contribute to the global effort to reduce emissions which are impacting the reef through increased temperatures and ocean acidification.

Risks and opportunities

Barriers
- Potential impacts to Ergon's network and the close consultation required
- Determination of potential investment and ownership structure of project and potential cost to residents
- Available space for solar PV/ other generation technologies, willingness of residents to house additional solar PV or identification of potential land and possible vegetation clearance to construct ground mounted solar
- High capital costs associated with the infrastructure required, potential cost to users/residents depending on ownership structure

Risks
- Sizing of power system: Potential increase of power demand on the island due to growth and unprecedently large seasonal peaks – variation in power demand throughout the day and year due to relatively large proportion of temporary or seasonal visitors to the island vs permanent residents

Opportunity
- Ownership structure of microgrid – potential to be community-owned
- Sub-sections of island being operated as micro-grid, while others remain dependent on undersea cable
- Range of generation technologies to be explored i.e. possibility of wind, tidal
- Potential to roll out a pilot study / sub-microgrid installation
- Shared learnings from recent application by Ergon under Regional and Remote Community Reliability Fund
- Co-design and development in partnership with Ergon
- Potential to delay/avoid major capital infrastructure upgrade of Ergon undersea power cable

Alignment with other initiatives

Alignment with other project options
- 7. Green Hydrogen Transport Demonstration Project
- 12. Solar Hot Water Systems
- 14. Solar PV Rooftop Systems

Alignment with external initiatives or investments
- Solar City Program – 1.1MW solar PV installed on island as part of program – displaying progressive attitude towards renewables.
- Opportunity to be a demonstration location for roll out of some of Ergon's planned innovations and initiatives. E.g. potential Distributed Energy Resource planning trial ; could further defer replacement/upgrades to undersea cabling.

1 National Greenhouse Accounts Factors August 2019 [https://www.industry.gov.au/sites/default/files/2020-07/national-greenhouse-accounts-factors-august-2019.pdf]
2 Refer to: http://townsvillesolarcity.com.au/Overview(2007-2012)/MagneticIslandSolarSuburb/tabid/65/Default.aspx

Assumptions

- Seasonal performance of solar PV averaged based on historical GHI (irradiance)
- Power consumption averaged seasonally and historically
- Power consumption remaining similar – growth rate of island not modelled
- Sizing estimates provided for all of island microgrid
- No optimisation in example scenarios provided for indicative carbon emissions assessment
- Minimum load ratio of generators not considered in basic modelling
- Synchronous condensers and network control systems not including in costing
- CAPEX/OPEX is based off industry benchmarking with regional mark-up of 30%. There is the possibility that due to the location of the island, development of the microgrid will incur alternate premiums to the ones that have been considered
- Costing rates including supply and installation:

Solar PV ($/kW)	Battery ($/kWh)	Diesel Generator ($/kW)
~1,150	~1,500	~550

Additional information

The amount of solar PV required to generate the annual power demand of the island to achieve 100% renewable energy microgrid operation (in addition to the assumed ~1.1 MW of solar PV already installed) is ~16MW. This would be coupled with an appropriate amount of battery storage.

This amount of ground mounted solar PV requires ~170,000 m^2 of area assuming a typical spacing for roads, row spacing and other balance of plant (50% coverage rate). Alternatively could require 106,000 m^2 for rooftop systems (80% coverage rate).

It is estimated there is a total of ~460,000 m^2 area of rooftops total on the buildings. This is not taking into consideration ideal orientations, infrastructure, or rooftops already with solar PV installed.

It is suggested that alternate generation technologies are explored in addition to solar PV in the feasibility study.

Costs and funding considerations

Capital costs

There are two costs that should be considered when assessing this project option. The first is the fee to develop the feasibility assessment to determine the scale, use, costs and implementation of a microgrid at Magnetic Island and the second is the approximate total capital costs/operating costs associated microgrid itself.

Feasibility study at Magnetic Island should include site selection for battery storage and generation technologies, technology overview, sizing of systems, engagement with vendors, extensive consultation with Ergon. While exact costing is dependent on extensiveness of scope, the study has an estimated cost of ~$200-300k.

The capital costs of the development of the microgrid itself will depend on the balance of generation technology, storage and grid control. Indicative costs;

#	Solar PV (MW)	Battery (MWh)	Diesel Generator (MW)	Capital Costs ($m)	Diesel Gen. Fuel & OPEX ($m / year)
1	6	8	4	21,1	6
2	14	18	3	44.8	3
3	16	32	0*	66	0

Ongoing costs

Operating costs of the renewable energy microgrid are heavily dependent on the presence of diesel generators with fuel and the operation of these generators forming a major part of the operating costs.

Potential cost savings or return on investment

- No longer requiring expensive upgrade/replacement to undersea mains cable
- Reduction in transmission costs across undersea cables

Funding opportunities

- Reef Funding Program - funding available for emission reduction projects in Great Barrier Reef catchment area, Clean Energy Finance Corporation
- Regional and Remote Communities Reliability Fund - Department of Industry, Science, Energy and Resources
- Climate Solutions Fund – Emissions Reduction Fund
- ARENA funding – project has similarities to previously supported King Island project

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Local Community / Residents / Businesses				
Ergon				
Townsville City Council				
Queensland Government				
Qld Gov (DNRME)				

Implementation and timeframes

Investment readiness

The feasibility study is ready for investment subject to funding, which will form a major component of determining the overall investment readiness of the microgrid project.

Next steps

Undertake the feasibility study into whole of island microgrid. It could also include the investigation of the feasibility of smaller microgrids within the island, i.e. possibility of separating Picnic Bay area from rest of network, which could increase network stability.

The feasibility study could also further discuss possible ownership structures of the microgrid.

Considerations for implementation

A clear scope will need to be determined for the feasibility study, defining the generation, storage, and microgrid control technologies that will be explored, and their performance based on the available resources on the island including land considerations. Costs through vendor engagement could form a key part in assessing the optimal mixture of technologies for the system, overall capital costs and ultimate renewable energy penetration achieved.

Further engagement with Ergon to provide lessons learnt, co-development with other initiatives and guidance on project direction.

Review of potential funding streams or grants that could reduce capital costs and any potential payback periods.

Timeframes to deliver solutions

The feasibility study could be delivered 3-4 months following approval. Likely the detailed design phase, construction and commissioning would take a further 2 years. Ergon has energy audit capability and can provide advice on design and content.

Magnetic Island | Water

18 Water Smart Demonstration Community

This project proposes implementation of sustainable water management solutions, to reduce water use, improve amenity, cost of living and environmental outcomes. positioning the island as a Water Smart demonstration community.

Description and overview

This project proposes a suite of water management initiatives to improve the sustainability of the Magnetic Island community and to be a Townsville City Council (TCC) 'Water Smart' community demonstration for the Townsville region. The project would leverage current TCC initiatives and build upon current and previous Magnetic Island community efforts.

Magnetic Island does not have its own water source and relies on water pumped from Townsville. Like Townsville more broadly, the island faces unique challenges to sustainable water cycle management. The dry tropical climate is characterised by long dry seasons, with the majority of rainfall occurring over a relatively small number of intense storms during the wet season, with climatic conditions expected to be more extreme with climate change. Household water consumption is high and well above the Queensland average at 283kL/yr compared to 203kL/yr. Any water savings will reduce associated electricity and carbon footprint of the water supply and provide community cost of living savings. Additionally outdoor water smart approaches can make the best use of water available to improve the amenity of island living and protect the environment of the Great Barrier Reef (GBR) by minimising nutrient runoff.

The roll out of the plan will be refined in close consultation with TCC and the community. Key strategies may include:

- Prioritised roll-out of smart water meters and associated communications infrastructure;
- Insight driven water demand management involving utilisation of near real-time smart water meter customer portals to provide customer feedback and influence behavioural change;
- Extension of council's existing water conservation programs to focus on Magnetic Island;
- Targeted leak detection and restoration program (network and behind the meter leaks) aided by smart metering infrastructure and network water balance assessment;
- Smart water, wastewater and stormwater network operation and asset management, through strategic deployment of sensors and active control (e.g. virtual demand management zones, network pressure management, sewerage network flow/ level monitoring and active control); and
- Water sensitive urban design, outdoor smart water conservation approaches.

© Arup 'Design With Water' Framework

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	2.7 - 13.7
Estimated payback period	Years	10 - 30
Estimated annual cost savings (water treatment)	$	1 – 6K
Estimated capital costs	$ mil	0.5 - 2
Timeframe to deliver project	Years	1 - 3
Estimated FTE	No.	N/A

Key project objectives

Carbon assessment

- Reduced overall water consumption and associated carbon footprint from treatment and supply;
- Increased asset lifespans; and
- Identification of opportunities for incorporation of water sensitive urban design and water smart community strategies to reduce the requirements for and extent of landscape irrigation and attenuate runoff to the GBR catchment.

Water use on Magnetic Island is well above the Queensland State average (556L/day vs. 776L/day). CSIRO report[1] estimates that it takes 0.65kWh/kL to treat and pump water for municipal use. This is likely to be conservative for water use on Magnetic Island due to pumping from mainland.

Uptake of water smart demonstration is difficult to estimate, however for example if a 1 – 5% saving in water use per household was achieved, this would equate to 2.8 – 14.1kL reduction/household/yr. Across 1,821 households on the island this represents between 5,123 – 25,767kL saved which equates to 3.3 – 16.7MWh in electricity saved/yr. This equates to between 2.7 - 13.7t-CO2-e saved based on a 1-5% reduction in water from water treatment annually.

Using an average rate of electricity of 22c/kWh this could represent $726 - $3,674 in water treatment costs/yr for council. Savings have been based on averages across Queensland and would be subject to actual water demand electricity use. Actual savings amounts would vary.

Community resilience

- More sustainable and resilient infrastructure;
- Better management of water demand;
- Increased asset redundancy and reliability;
- Increased likelihood of identifying leaks or bursts early reducing the impacts on water loss and potential groundwater contamination; and
- Improved asset management, operation, maintenance.

Co-benefits

Economic

- Potential for reduced overall cost of water service provision for TCC (to be determined through project)
- Potential for reduced cost to consumers (where behavioural change strategies are effective)
- Minimise water losses through leakages within the network
- Extended asset lifespans
- Targeted and cost-effective maintenance and renewals plans based on quantitative data such as network usage, demand and leak detection
- Reduced wastewater treatment costs (increased irrigation)
- Project monitoring, evaluation and learning plan to establish baseline conditions (e.g. water consumption, level of service, supply costs, water loss and network performance) prior to project commencement

Social and cultural

- Increased level of service delivered to community in terms of water security, reliability, quality and wastewater compliance
- Better understanding within community of the usage and costs associated with water and wastewater service provision

Environmental (General)

- Identification and notification of water main leakages or sewer main bursts, reducing the risk of contamination of the potable water supply and to the environment
- Reduced overflows from wastewater network
- Improved water conservation within the community, which was identified as a high risk in the project risk assessment
- Reduced impacts on critical water pipeline infrastructure during and/or following severe weather events, which was identified as a severe risk in the project risk assessment

Environmental (impacts to Great Barrier Reef)

- Reduced nutrient export to from surface water runoff to the GBR
- Reduced wastewater nutrient export to GBR

Risks and opportunities

Barriers

- High up-front cost for the rollout of smart water meters and associated infrastructure within the Magnetic Island community and installation of sensors and active controls within the network
- Potential difficulties in communication and integration with council's existing supervisory control and data acquisition (SCADA) network due to the remoteness of the community from Townsville and the pocketed spread of development across the island
- Strategies to overcome the barriers will need to be developed as part of the project implementation plan

Risks

- Long-term community engagement is required to sustain potential benefits. This will require ongoing investment from TCC.

Opportunity

- With Magnetic Island as a demonstrator site, successful strategies may be rolled out across Townsville, other islands, communities or regions

Alignment with other initiatives

Alignment with other project options

- 3. Establishment of a Native Plant Nursery: Potential to use plants from the proposed native plant nursery in their tree planting program both on Magnetic Island and in the wider regional area
- 5. Sustainability and Environmental Education: Development of community education to improve water usage and management, including increasing rainwater harvesting

Alignment with external initiatives or investments

- Townsville City Council's dry tropics water smart residential outdoor water conservation program (refer additional information section)
- Cooperative Research Centres for Water Sensitive Cities
- Reef Guardian Council program, an initiative of the GBR Marine Park Authority
- Ergon are interested in understanding the associated energy demand with pumping and treating water within Magnetic Island and smart water meters could facilitate better understanding of the network demands
- Berdikan Plan for water supply (Townsville City Council)

1. Refer to https://publications.csiro.au/rpr/download?pid=csiro:EP122271&dsid=DS4

Assumptions

Average household water use on Magnetic Island is amongst the highest in Australia (283kL/yr/household compared with a Queensland household average of 203kL/yr) with a significant proportion of this being used outdoors[2,3]. Magnetic Island is assumed to have a similar demand and water use pattern.

CSIRO report[1] in 09/10 estimates that it takes 0.65kWh/kL to treat and pump water for municipal use.

A 1 – 5% saving in water use per household

This equates to between 2.7 - 13.7t-CO2-e saved based on a 1-5% reduction in water from water treatment based on a 0.81 kg CO_2-e/kWh NEM grid intensity factor.

Average rate of electricity of 22c/kWh

Additional information

The 'Dry Tropics Water Smart - Residential Outdoor Water Conservation Program' is an initiative of TCC, Townsville Water and the Queensland Government. The program aims to encourage residents to 'adjust watering schedules to match weather conditions and landscape requirements' through the investigation of methods to encourage this behaviour and the quantification of the resultant household water savings[2,4].

Effective community engagement will be key to achieving water demand reduction objectives. A co-designed initiative will be beneficial.

Costs and funding considerations

Capital costs

- Project scope and costs could be scaled to meet available budget
- Estimates to be derived in the next phase of the project
- A nominal budget of $500k to $2M is proposed subject to confirmation of project priorities and scope.
- The roll-out of smart water meters across the island has been identified as an immediate opportunity and enabler of other aspects of this initiative. The capital cost of a smart meter roll-out has been estimated at ~$400k by TCC, comprised of:
  - ~1430 (no.) residential meters;
  - ~120 (no.) commercial/ irrigation meters;
  - Receiver infrastructure;
  - Data visualisation and communication tools (via TCC's existing platforms)
- Larger scale infrastructure (e.g. retrofitting passive irrigation/ WSUD) into the urban landscape will be more expensive. The extent of such works will be dependent on budget and will limited initially to a few pilot sites.

Ongoing costs

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

Potential cost savings or return on investment

- Potential for avoided/ delayed investment in upgrading water supply infrastructure (extraction, treatment, storage, distribution)
- Potential for avoided investment in operating and maintaining water supply infrastructure (pumping, chemicals, consumables)
- Potential reduced need for treated effluent storage infrastructure, through utilising capacity within bespoke passive irrigation solutions

Funding Opportunities

- No specific funding opportunities have been identified. It is likely that this will need to be funded by TCC.

Key Stakeholders

Stakeholder	Asset / initiative owner	Operator	Potential partner	End user
Townsville City Council	■			
Townsville Water		■		
Magnetic Island Community			■	■
University of Adelaide			■	
Queensland Government (DES, DNRME, HPW)			■	

Implementation and timeframes

Investment readiness

- Planning could commence within a period of 3 months

Next steps

- Consultation with key stakeholders to confirm scope
- Determination of delivery approach

Considerations for implementation

- Refer previous pages

Timeframes to deliver solutions

- The project scope is highly scalable and delivery timeframes are dependent on scope
- The roll-out of smart water meters (sensible first step of project) could be commenced immediately and delivered within a short timeframe as contracts are already in place)
- A broader program of works could be expected to be delivered over a three-year program with initial concept and feasibility, planning and design undertaken in year one, construction/ implementation in year two, and operation and evaluation in year three

2. Refer to https://www.townsville.qld.gov.au/water-waste-and-environment/water-supply-and-dams/saving-and-consumption
3. Refer to https://www.townsville.qld.gov.au/water-waste-and-environment/sustainability/water
4. Refer to http://www.townsvillesolarcity.com.au/Portals/0/docs/2012/Communications%20Journey%20Book%20Low%20Res.pdf?ver=2013-12-27-213147-810

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

ID	Title	Rationale
E1	LED cells in council-owned streetlights	Through engagement with TCC it was established that a final project option had already been developed and put forward to transition to LED cells. This was moved to be a recommendation to avoid duplication of effort
E2	Pilot research trial for renewable fuels from cooking oil or biomass	Renewable fuel feedstocks are currently limited and would need to be transported to the island which may not have a direct decarbonisation impact, however could be explored in combination with final project option 16, Low Emission Marine Transport.
E7	Solar powered A/C with no grid return for commercial systems	There are a few large providers that this may be applicable to. This option would need to consider the varying operations and maintenance capability of business systems. Success would be dependent upon operational requirements and reliability needs.
E13	Adopt best practice building code for island	This was considered to be an external policy consideration outside the jurisdiction and scope of this project.
E19	Central control system for accommodation providers on-island	There are few providers large enough to warrant consideration and the decarbonisation impact is unclear. This is considered to be a commercial decision for consideration by these businesses.
WT4	Stormwater management	There is currently no storm water management on-island. Stormwater management processes are under the jurisdiction of TCC, and therefore considered out of scope for this project. This recommendation could be considered in combination with final project option 17 Water Smart Demonstration Community
WT5	Variable Speed Drives for water pumps	This option has already been advanced by TCC through a final project option.
WS1	Increase buying of bioplastic/paper disposable items	These options would form part of a 'Plastic Free Places' initiative, which is a collection of strategies to reduce use of and waste from single-use plastics in a given area. As TCC is already progressing with the 'Plastic Free Places' initiative for the region, these options are excluded from the shortlist.
WS4	Phase out single use items	
WS5	Reduce packaging for shipments to island	
WS11	Ban plastic bottle sales at cafes/ bars/ restaurants	
WS12	Surcharge for using takeaway coffee cups	
WS14	Plastic repurposing	
T3	Efficient boat propellers upgrades	This is considered to be a private commercial decision for relevant businesses to undertake. It is understood SeaLink recently upgraded propellers as a pilot for some marine craft.
T4	Efficient boat coatings	This is considered to be a private commercial decision for relevant businesses to undertake. It is understood SeaLink recently applied new coatings as a pilot trial for some marine craft.

ID	Title	Rationale
T13	Infrastructure upgrade (roads)	Road upgrades are considered outside of the scope of this project, and belong under the jurisdiction of Council and the Department of Transport and Main Roads. The decarbonisation benefits of upgrades upon reduced road roughness (and therefore fuel consumption) were also not considered to be significant in this context.
T18	Car share scheme for local community	This is considered to be a voluntary, community-driven measure which does not suit the format of a final project option. Other existing services such as taxis and ride-share apps may already provide a suitable platform for this scheme.
T22	Courier service for luggage for visitors	This does not align with core project objectives. This is considered to be a private commercial decision for businesses to make.
R2	Creek clean up	It is understood that creek and coastal clean-ups are undertaken on a semi-regular basis by volunteers and community groups.
R4	Cyclone rating assessment	This is outside of the scope of this project.
R5	Feral/invasive animal management plan	This is outside of the scope of this project.
R8	Nature walking tracks	This is under the jurisdiction of Council, Transport and Main Roads and Queensland Parks and Wildlife Service. A program of works to review and progress walking tracks is currently underway.
R9	Ongoing management of islander wellbeing	This is outside of the scope of this project.
R10	Overall beach erosion plan	It was determined that this would form one part of an overarching resilience plan for the island (which has been idnetified as a policy recommendation). This is outside of the scope of this project.
R11	Revegetation	It was determined that there is minimal land available to revegetate. The plant nursery option has progressed to final project option #3 (Establishment of a Native Plant Nursery) to support small scale plant requirements.
R13	Whole of island resilience plan	It was determined that a range of component activities and plans would come together to form an overarching resilience plan, many of which are being led by other agencies. This has been elevated as an overarching policy recommendation.
R16	Cyclone shelter	This is considered to be out of the scope of the project, and should form part of State or Council-level disaster preparedness and mitigation activities.
R17	Aged care facility	This is outside of the scope of this project.
R18	Ongoing coastal clean-ups	It is understood that creek and coastal clean-ups are undertaken on a semi-regular basis by volunteers and community groups.
R19	Permanent Indigenous rangers for the establishment of traditional environmental knowledge sharing.	Should additional Ranger or community education programs be considered needed by State or Local government, it is recommended that it include indigenous cultural ranger programs. This recommendation could link with final project options recommended on neighboring Palm Island., such as #8 Indigenous Ranger Program.

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

Discounted Options

ID	Title	Rationale
E3	Fuel cells using natural gas for energy generation	This option would not provide a significant decarbonisation benefit in comparison with renewable energy generation options such as solar or hydrogen.
E4	Heat recovery from compost at waste transfer station	Considered to be a technically complex approach to energy generation. The physical space requirements for such a system are also likely to be infeasible given the capacity of the transfer station.
E5	Methane capture from upgraded Sewage Treatment Plant to flare	Due to existing Townsville City Council processes, it was advised that further sludge digestion is unlikely to be viable.
E8	Tidal or wave generators	There was a low level of community and stakeholder support for this option, and other technologies (i.e. solar) are considered to provide greater value for money and reliability.
E9	Waste to energy plant with gas boost	This option is technically and legislatively complex. The location and feedstock availability do not make Magnetic Island a feasible location for this project.
E10	Wind turbines offshore	There was a low level of community and stakeholder support for this option, and other technologies (i.e. solar) are considered to provide greater value for money and reliability. Impacts to the Great Barrier Reef would need to be considered.
WT7	Water storage dam	There was not strong community support for this option, and issues were raised regarding the potential for adverse environmental impacts.
WS7	Biosolids reuse as compost or fertiliser	Townsville City Council have previously progressed pilot projects reusing biosolids in the region but have no current plans for wider implementation of their strategy to Magnetic Island.
WS8	Motor home sewage dump facilities	Survey findings indicated a low level of community support for this option, and the total number of motorhomes on the island is generally quite low.
WS13	Sweage facilities for yachts/boats	Sufficient public pump out facilities exist for boats at Nelly Bay.
T6	Reducing speed limit from 60km/h to 50km/h or 40km/hr	This is in the jurisdiction of Council or Transport and Main Roads and outside of project scope.
T7	Solar powered speeding signs	Recommended for new signage in locations remote to mains power. This is in the jurisdiction of Council or Transport and Main Roads and outside of project scope.
T8	Driverless vehicles	This option did not align with core project objectives and did not have community support.
T15	Bridge from mainland	This option did not align with core project objectives and did not have community support.
T16	Ban motor homes on island	This option did not align with core project objectives and was not considered a feasible policy position.
T17	Reduce number of car hire businesses	This option did not align with core project objectives and was not considered a feasible policy position.
T19	Incentive schemes to reduce number of vehicles used on-island	This option did not align with core project objectives and was not considered a feasible policy position.

Discounted Options

ID	Title	Rationale
T20	Electric tram/train tunnel	This option was not considered to be viable nor represent value for money.
T21	Change bus fuel to natural gas	This is considered to be a commercial decision by the bus owner and/or operator as it relates to profitability after costs. It is not considered to provide a significant decarbonisation impact in comparison with conversion to EV or hydrogen.
R12	Visitor number restrictions and ongoing management	This option did not align with core project objectives and was not considered a feasible policy position.

Appendix 4: Stakeholder Register

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

Stakeholder Register

Position	Business/Organisation	Category
	4TO/Hot FM	Business and the business community
	4TTT	Business and the business community
	ABC	Business and the business community
	ABC TV	Business and the business community
Manager/Owner	Amaroo on Mandalay	Business and the business community
	Apex Camps Magnetic Island	Business and the business community
	Aquasearch Aquarium	Business and the business community
	Arcadia Beach Guest House and Car Hire	Business and the business community
	Arcadia Village Motel	Business and the business community
Owner	Arcadia Village Motel	Business and the business community
	Barefoot Art Food Wine	Business and the business community
	Base Backpackers Magnetic Island	Business and the business community
Owners	Batuta Gallery – Tribal Arts and Antiques	Business and the business community
	Beached on Magnetic	Business and the business community
	Beachside Magnetic Harbour Apartments	Business and the business community
	Beachside Palms Holiday Units	Business and the business community
	BlueHaven Holiday Rental	Business and the business community
	Boardwalk Restaurant and Bar	Business and the business community
	Bungalow Bay Koala Village	Business and the business community
	Butterfly House Graphic Design	Resident
	Canopy Chalets	Business and the business community
	Captain's Manor on Cook	Business and the business community

Stakeholder Register

Position	Business/Organisation	Category
	Channel 7	Business and the business community
	Chris Chappell Consulting	Resident
	Cranky Curlew Productions	Resident
	Dandaloo Gardens	Business and the business community
	Duo Magazine	Business and the business community
Solar City Community Engagement Manager	Ergon Energy	Utility Providers
	Fire Station	Government (State)
	Fish N Fuels Outdoor Adventure and MI Rentals	Business and the business community
	Floriade on Magnetic Island	Business and the business community
	FoodWorks	Business and the business community
	Great Barrier Reef Marine Park Authority (GBRMPA)	Local Council
	Golf Course	Business and the business community
	Harbour Manager	Business and the business community
	Hire Car Company	Business and the business community
	Horseshoe Bay Ranch	Business and the business community
	Horseshoe Bay Rural Fire Brigade	Resident
	IGA	Business and the business community
Manager	Island Leisure Resort	Business and the business community
	JCU (Zero Waste Magnetic Island)	Community Association
	Kooyong Holiday Units	Business and the business community
	Live FM	Business and the business community
	Magnetic 4x4 Rentals	Business and the business community

Position	Business/Organisation	Category
	Magnetic Community News	Business and the business community
	Magnetic Hair	Business and the business community
	Magnetic Island Bed and Breakfast	Business and the business community
	Magnetic Island Community Care (MICC)	Community Association
President	Magnetic Island Community Development Association (MICDA)	Community Association
	Magnetic Island Community Development Association (MICDA)	Community Association
	Magnetic Island Community Development Association (MICDA)	Community Association
	Magnetic Island Country Club	Business and the business community
	Magnetic Island Disaster Management Committee	Community Association
	Magnetic Island Electrical	Resident
	Magnetic Island Ferries	Business and the business community
	Magnetic Island Hairport	Business and the business community
	Magnetic Island Holiday Units	Business and the business community
	Magnetic Island Magpies Junior AFL Club	Community Provider
	Magnetic Island YHA	Business and the business community
	Magnetic Limousines	Business and the business community
	Magnetic Retreat	Business and the business community
	Magnetic Sunsets	Business and the business community
	Magnetic Times	Business and the business community
	Mamma Roma	Business and the business community
	Man Friday Restaurant	Business and the business community
	Marguerites on Magnetic	Business and the business community

Stakeholder Register

Position	Business/Organisation	Category
Director	Marina (Nelly Bay)	Business and the business community
	MI Lions Club	Community Association
Vice President	MI Nature Care Association (MINCA)	Community Association
	MI Nature Care Association (MINCA)	Community Association
President	MI Residents & Ratepayers Association (MIRRA)	Community Association
Vice President	MI Residents & Ratepayers Association (MIRRA)	Community Association
	MI Skip Services	Business and the business community
	MICDA	Community Association
	Myra's Bed and Breakfast	Business and the business community
	National Parks	Government (State)
	NENA	Traditional Owner representative
Manager	Noodies on the Beach	Business and the business community
Campaigns Manager	North Queensland Conservation Council	Community Association
	Oskar's Rain Forest Retreat	Business and the business community
	Pacos Beach Hut	Business and the business community
	Picnic Bay Hotel	Business and the business community
	Picnic Beach'scape	Business and the business community
	Prime Radio	Business and the business community
	Pro Dive Magnetic Island	Business and the business community
	QLD Police	Government (State)
	Queensland Fire and Emergency Services (QFES)	Government (State)
	Queensland Government Parks and Forests	Government (State)

Stakeholder Register

Position	Business/Organisation	Category
	QPWS	Government (State)
	R & R Bar	Business and the business community
	Radio 4KIG-FM	Business and the business community
	Restaurant Le Paradis Brasserie & Take Away @ Nelly	Business and the business community
	Road Runner Scooter Hire	Business and the business community
	RSL	Business and the business community
	Saint Margaret's Anglican Church	Community Provider
	Samsara Holiday House	Business and the business community
	Scallywags	Business and the business community
	SEA-Esta	Business and the business community
	SeaLink Magnetic Island	Business and the business community
	SEW MAGNETIC	Business and the business community
	Shaka: Health Food Café on Magnetic Island	Business and the business community
	Shambhala Retreat	Business and the business community
	Smith & Elliot Retreat	Business and the business community
	Southern Cross 10	Business and the business community
	Stage Door Theatre Restaurant	Business and the business community
	State Emergency Services (SES)	Community Provider
	Success Magazine	Business and the business community
	SunBus (TransLink Bus Services)	Business and the business community
	Tempting on Magnetic	Resident
	The Early Bird	Business and the business community

Stakeholder Register

Position	Business/Organisation	Category
	The Industry Advocate	Business and the business community
	Tourism Business Association (TOBMI) Providential Magic P/L	Business and the business community
	Tourism Magnetic Island	Community Association
	Townsville Bulletin	Business and the business community
CEO	Townsville Chamber of Commerce	Business and the business community
Senior Officer – Environmental Operations Management Environmental Services Section Planning, Environment and Cultural Services Division	Townsville City Council	Local Council
Technical Officer – Property Management Infrastructure Operations, Assets and Fleet	Townsville City Council	Local Council
Councillor (Magnetic Island)	Townsville City Council	Local Council
Coordinator Creek to Coral, Townsville Water and Waste	Townsville City Council	Local Council
Lead Council Contact and Manager of Environmental Services	Townsville City Council	Local Council
Mayor	Townsville City Council	Local Council
Deputy Mayor	Townsville City Council	Local Council
General Manager – Environmental Services Coordinator – Environmental, Sustainability and Solar Division of Planning, Environmental and Cultural Services	Townsville City Council	Local Council
CEO	Townsville City Council	Local Council
Director Tourism and Events	Townsville Enterprise	Business and the business community
	Townsville Sun	Business and the business community
	Traditional Owner	Traditional Owner representative
	True North Bed and Breakfast	Business and the business community
	Villa Kembali	Business and the business community
	Whats On Magnetic Island (MICDA)	Business and the business community
	The Industry Advocate	Business and the business community
	Tourism Business Association (TOBMI) Providential Magic P/L	Business and the business community

Position	Business/Organisation	Category
	WIN TV	Business and the business community
	Windspray on Maggie	Business and the business community
Director	Wulgurukaba Aboriginal Corporation	Traditional Owner representative
	Wulgurukaba People	Traditional Owner representative
	Wulgurukaba Yunbenun Aboriginal Corporation	Traditional Owner representative
	Zero Waste Magnetic Island	Community Association