THE FUTURE for RENEWABLE ENERGY

OPPORTUNITIES for TASMANIA

Regional Development Australia
TASMANIA

www.rdatasmania.org.au

MESSAGE FROM THE CHAIR AND CEO

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Chair

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The RDA Tasmania committee[1] is pleased to present our latest research document.

Its purpose is to provide a summary of Tasmania's potential energy future and examine the benefits for regional Tasmania. Tasmania's renewable energy projects – current and under consideration – have inherent importance for energy security, but they also provide a critical opportunity to drive economic growth, regional development and employment.

The concept for this document originated last year, when the world was a far different place. In Australia, devastating bushfires, drought and the COVID-19 pandemic have changed our communities and our livelihoods for the foreseeable future.

Tasmania led Australian performance on economic indicators in the CommSec *State of the States* report in March 2020[2]. Its economy has experienced rapid change. Many high-performing economic sectors, such as tourism and hospitality, have endured the brunt of the COVID induced downturn while the traditional industry sectors, including primary production, forestry, mining and manufacturing, have softened the economic blow through continued trading.

The good news is Tasmania can lead Australia again, but it will require investment, self-belief and confidence. While most industry sectors will recover as global markets reopen and trading resumes, other sectors depend on a demonstration from government of a pathway forward.

The Tasmanian renewable energy industry is ready to leverage long-term opportunities and deliver tangible benefits for the Tasmanian economy and regional communities. Feasibility studies and business case assessments have concluded that the Marinus Link, Battery of the Nation and Hydrogen are all interrelated projects of significance that will provide post COVID-19 stimulus to employment and investment and reinvigorate Tasmania's economy.

Using its competitive advantage to generate renewable energy, in a sustainable manner for the long term, Tasmania has an opportunity to chart a path to recovery in a post COVID-19 world.

1 To read about Regional Development Australia – Tasmania, see Appendix 5.

2 www.commsec.com.au/content/dam/EN/Campaigns_Native/stateofstates/April2020/TAS_State_of_the_States_April2020.pdf

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1. EXECUTIVE SUMMARY

Tasmania has a proud history of renewable energy production dating back to the early 1900s, when there was a vision to bring electricity to every Tasmanian household. Now, with the national and global move towards renewable energy and increasing demand for electricity to power our lifestyle, Australia would benefit from significant investments in Tasmanian renewable energy.

The Tasmanian Government has released the Draft Tasmanian Renewable Energy Action Plan, which outlines key projects that will drive Tasmania's renewable energy future. These include:

- **Project Marinus** – an additional Bass Strait interconnector (Marinus Link).
- **Increased renewable energy production and storage** – Battery of the Nation, wind and solar.
- **Hydrogen production** to store and transfer energy.

To capitalise on renewable energy export opportunities, Bass Link, the existing interconnector, will not be enough. To unlock all the new investment in renewable energy generation in Tasmania and the mainland, a second Bass Strait interconnector, Marinus Link, with triple the capacity will be required. This infrastructure will enable Tasmania to contribute to Australia's renewable energy goals. In so doing, it will provide significant economic opportunities for Tasmania, including community development, employment and skill development. Without the Marinus Link increasing access to the National Electricity Market, local consumption and the unproven opportunity of hydrogen storage might not be enough to attract new renewable energy investment to Tasmania.

Obtaining funding for a project as significant as Marinus is complex. It will require both the Australian and Tasmanian governments to contribute financially, which has been made more challenging by the 2019-2020 bushfires and COVID-19 pandemic. Private sector funding is possible but may impact energy security and pricing flexibility. Tasmania has the option to 'go it alone', which was the model used to develop its world-renowned hydroelectric schemes. To do this, Tasmania would need to secure a favourable pricing scheme through the National Electricity Market that will provide the required rate of return to justify such a large investment, or source other Commonwealth funding such as from the National Infrastructure Fund.

The economic contribution derived from the construction of the Marinus Link, Battery of the Nation and other broader renewable investment is estimated to be $7.1 billion, with 1,400 Tasmanian jobs during peak construction and 2,350 ongoing renewable energy jobs[3]. Funding the Marinus Link unlocks a market for Tasmania's other renewable energy projects, which include Battery of the Nation (pumped hydro) and wind farm investments. Storing energy as hydrogen uses innovation and leading edge technology to present a new opportunity for Tasmania.

Tasmania's ability to deliver dispatchable renewable energy to the National Electricity Market through its extensive hydroelectric assets is a unique competitive advantage that can yield long-term. These opportunities will not present themselves indefinitely, and Tasmania will need to commit to its future soon or risk being overtaken by more rapid investments in the National Electricity Market.

Growing our economy through investment in large-scale renewable energy projects presents an exciting future for Tasmania.

3 The Draft Tasmanian Renewable Energy Action Plan 2020

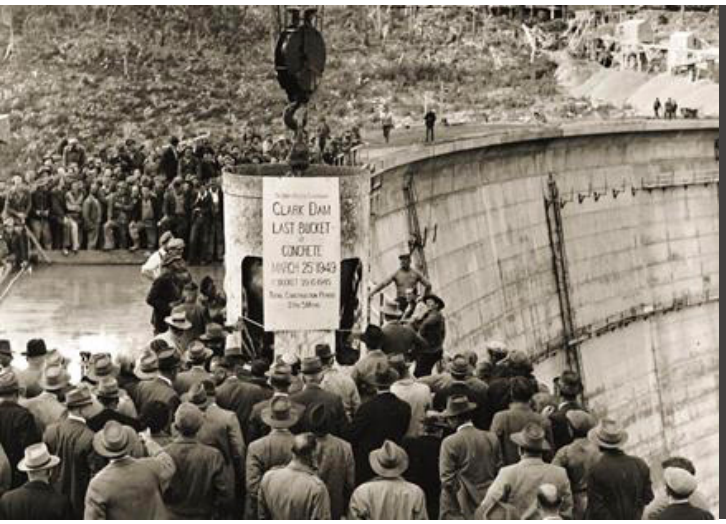
2. TASMANIA'S EXISTING RENEWABLE ENERGY ASSETS

Tasmania has an excellent renewable energy base to leverage from with over 100 years of hydroelectric development[4]. More recently, wind turbine farms at Woolnorth and Musselroe have complemented base load hydroelectric production. For a full list of existing renewable energy assets, see Appendix 3.

These existing assets are extensive and provide Tasmania with a sizeable advantage over other Australian states and territories in regard to renewable energy production. Renewable energy supplied between 4 per cent and 95 per cent of the electricity needs of Australia's states in 2018 (see Table 1). This extraordinary range reflects the differing natural resources of each region as well as the variations in historical commitments to supporting renewable energy.[5]

Tasmania's considerable hydro resources, now combined with wind and solar production, mean the state continues to be Australia's renewable energy leader. Tasmania generates 94.6 per cent of its annual electricity production from renewable energy – 9,681 GWh from hydroelectricity and 1,105 GWh from wind in 2018-19[6]. The Australian Capital Territory (54.1 per cent) and South Australia (51.2 per cent) are the next highest generators.[7]

Tasmania's natural advantages of rainfall and wind patterns contribute to high levels of renewable energy production, which provide economic and sustainable power generation for local consumers and interstate export.



The last bucket of concrete for the construction of the Clark Dam 1949[8]

Source: Hydro Tasmania https://www.hydro.com.au/about-us/our-history

4 https://www.hydro.com.au/about-us/our-history
5 Climate Council State of Play Renewable Energy Winner and Losers 2019
6 https://www.economicregulator.tas.gov.au/Documents/Energy%20in%20Tasmania%20Report%202018-19%2020%20210.pdf
7 Climate Council State of Play Renewable Energy Winner and Losers 2019
8 https://en.wikipedia.org/wiki/Butlers_Gorge_Power_Station

Table 1 – Renewable energy generation by state 2018-19

State / Territory:	Renewable electricity (2018)	Wind & solar capacity per person (kW) (March 2019)	% solar households (Oct 2019)	Renewable energy targets	Net zero emissions targets	Highlights
SA (A)	51.2%	1.25	35.0%	Net 100% in the 2030s	Net zero by 2050	Aiming for 100% renewables in the 2030s. Over 50% wind and solar energy in the grid.
ACT (A)	54.1%	1.27	16.1%	100% by 2020	Net zero by 2045	On track to achieve 100% renewable energy from 1 January 2020.
TAS (A)	94.6%	0.60	15.1%	100% by 2022	Net zero by 2050	Aiming to support the National Electricity Market as the Battery of the Nation.
VIC (B)	17.3%	0.34	17.9%	25% by 2020; 40% by 2025; 50% by 2030	Net zero by 2050	Legislated 50% renewable energy target by 2030. Greatest capacity of wind and solar projects in the pipeline.
QLD (B)	8.8%	0.38	35.7%	50% by 2030	Net zero by 2050	Installed the most large-scale wind and solar per capita since last year's report.
NSW (C)	17.3%	0.25	20.4%	-	Net zero by 2050	Shortlisting large-scale renewables and storage for funding and supporting uptake of rooftop solar and batteries.
WA (C)	8.2%	0.28	28.8%	-	Net zero by 2050	Introduced an aspirational target of net zero emissions by 2050.
NT (C)	4.0%	0.12	18.1%	50% by 2030	(Draft target) Net zero by 2050	Introduced a draft aspirational target of net zero emissions by 2050.

Source: Climate Council, 'State of Play: Renewable Energy Winner and Losers 2019'

Table 2 – Wind and solar generation by state, 2018

State/Territory	% of electricity generated from renewables in 2018 (inc. hydro)	% wind and solar electricity generation in 2018	Change in wind and solar generation from 2017
TAS	94.6	10.2	↓ 1.0
ACT	54.1[1]	51.0	↑ 7.9
SA	51.2	50.5	↑ 7.8
VIC	17.3	13.5	↑ 3.2
NSW	17.3	8.9	↑ 3.3
QLD	8.8	5.6	↑ 1.9
WA	8.2	7.3	↑ 0.8
NT	4.0	3.8	↑ 0.8

Source: Climate Council, 'State of Play: Renewable Energy Winner and Losers 2019'

3. MAJOR RENEWABLE ENERGY PROJECTS

The State Government intends that renewable energy developments will form an important part of rebuilding the Tasmanian economy in the aftermath of COVID-19.[9]

3.1. Tasmanian Renewable Energy Action Plan

The overarching framework for Tasmanian renewable energy initiatives was laid out in the State Government's draft Tasmanian Renewable Energy Action Plan, released in early 2020. A key pillar of the plan will be a world-leading Tasmanian Renewable Energy Target, which will see Tasmania double its renewable energy generation by 2040.

The Action Plan will deliver for Tasmanians by:

1. Transforming Tasmania into a global renewable energy powerhouse
2. Making energy work for the Tasmanian community
3. Growing the economy and providing jobs.

3.2. Battery of the Nation

Hydro Tasmania has been investigating the established concept of 'pumped hydro'. This turns an existing hydroelectric station into a storage system, enabling Hydro to buy electricity when the spot market price on the National Electricity Market is low, and sell it when the price is high. In times of excess electricity production from sources such as wind or solar, water is pumped from a low level dam uphill to the upper level reservoir, augmenting the supplies from rain. In times of high demand, the water supply feeds the hydroelectric power station in the normal way.

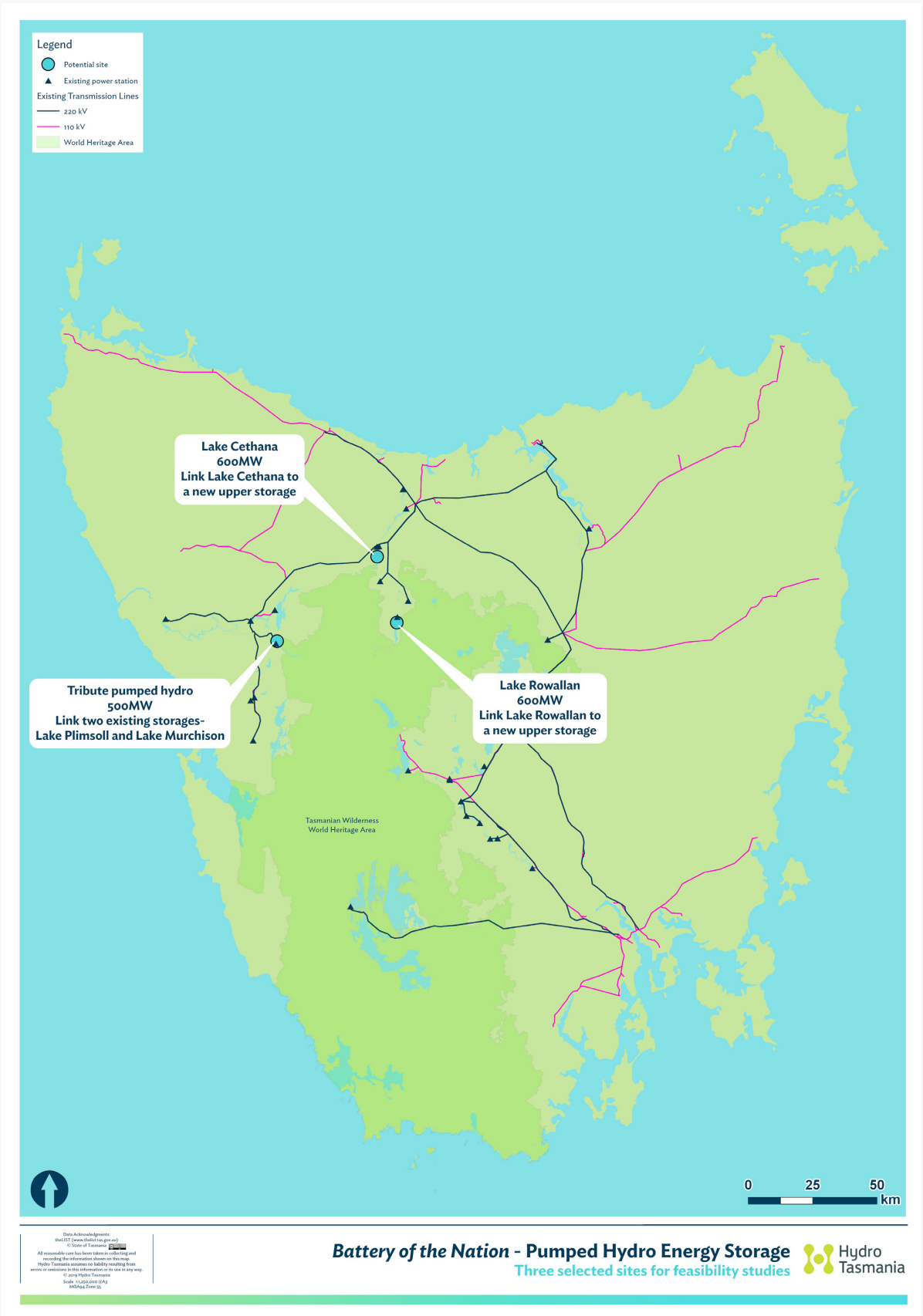
For the latest information about the Battery of the Nation, please go to: www.hydro.com.au/renewable-energy/battery-of-the-nation

Known as Battery of the Nation, this initiative could double the state's renewable energy storage capacity. It will involve repurposing existing hydropower infrastructure by adding pumped hydro, taking full advantage of Tasmania's unmatched deep water storage and wind resource. Key to the success of the Battery of the Nation project is the building of the Marinus Link.

Hydro Tasmania investigated numerous hydroelectric sites to determine three potential sites for future pumped hydro development, at Cethana, Lake Rowallan and the West Coast (Figure 1). Further planning and business case development will determine which site is preferred to host the preliminary pumped hydro facility. See Appendix 4 for more detail about the sites.

9 https://www.stategrowth.tas.gov.au/energy_and_resources/energy/renewable_energy

Figure 1 – Pumped hydro preliminary sites for Battery of the Nation



Source: www.hydro.com.au/renewable-energy/battery-of-the-nation/pumped-hydro

The Australian Renewable Energy Agency (ARENA) has supported the Battery of the Nation initiative with $5 million in funding for project studies, matched by Hydro Tasmania. The resulting extensive research undertaken by Hydro Tasmania includes:

The case for deep storage – summarises the market analysis, demonstrating that Tasmania has an ideal opportunity to develop the cost-effective deep storage pumped hydro (12+ hours) that Australia needs to manage these uncertainties and support a reliable future National Electricity Market.

Challenges in modelling the transforming National Electricity Market – takes a close look at the challenges driving future uncertainty and how modelling and decision-making must adapt to create and select robust options that work across a range of potential futures.

Operation of storages without perfect foresight – discusses how deep storages will be more robust to realistic forecast uncertainty, making deep storage the optimal, least-cost choice to manage energy reliability during the country's energy transition.

Unlocking investment in storage for a reliable future National Electricity Market – considers the challenges for investing in flexible supply options, particularly storage. The paper shares cost analysis showing that Tasmania's storages can underpin a least-cost market outcome.

https://www.hydro.com.au/renewable-energy/battery-of-the-nation/future-state

The Battery of the Nation will provide the certainty Tasmania requires to deliver *future consistent* base load power generation, which will indemnify against climatic events and unforeseen challenges.

3.3. Marinus Link

Project Marinus is a feasibility study of 'Marinus Link', a proposed 1,500 megawatt (MW) capacity undersea and underground electricity connection to more strongly link Tasmania and Victoria as part of Australia's future electricity grid[10]. Transmission will be via two 750 MW cables. Marinus Link will operate in addition to the existing privately owned Basslink Interconnector, which has 500 MW capacity.

For the latest information about Project Marinus, please go to: www.marinuslink.com.au

The project is being undertaken by TasNetworks. Project Marinus received an initial $20 million in funding from the Tasmanian Government through TasNetworks and from the Australian Government through ARENA.[11]

As a result of the positive initial findings from the Business Case Assessment in 2019, the Australian Government has provided $56 million to progress the project into the Design and Approvals phase. The National Electricity Market is transforming as new energy generation infrastructure replaces ageing infrastructure across Australia. Marinus Link can help smooth this transition by providing access to a low-cost and reliable energy supply for customers.[12]

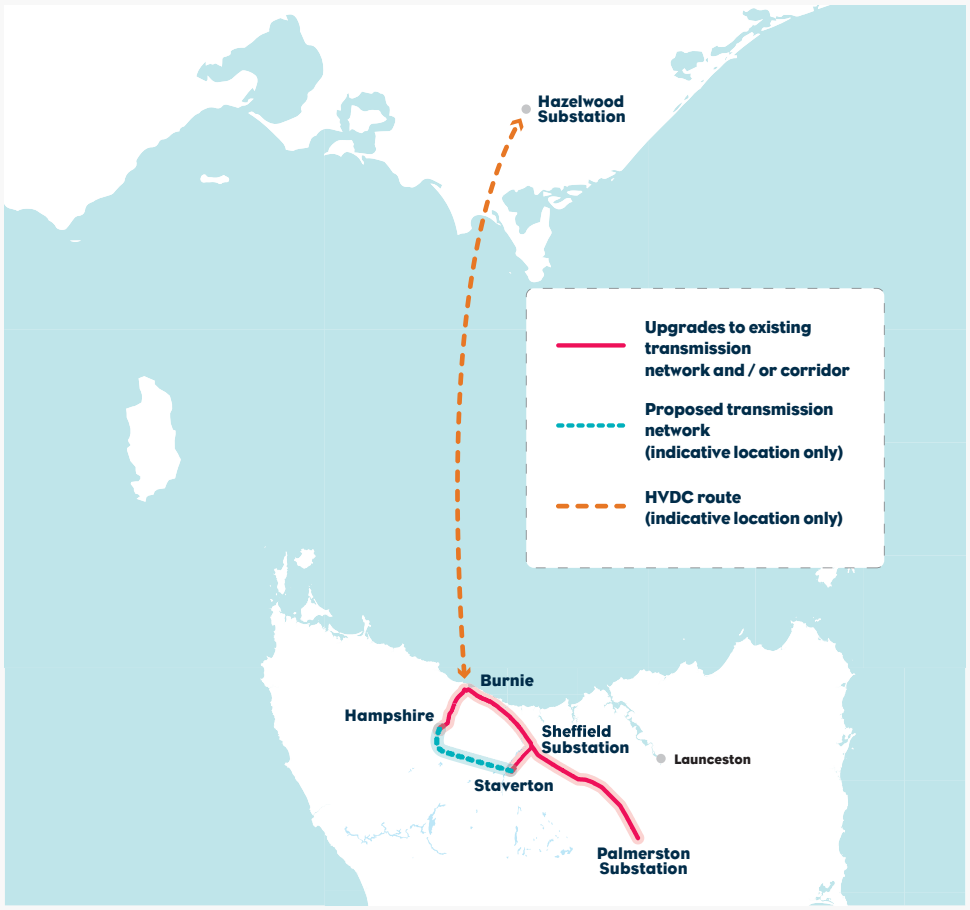
Figure 2 shows the proposed route between mainland Tasmania and Victoria for the Marinus Link, subject to landowner consent and regulatory planning requirements from both the Tasmanian and Victorian governments.

10 https://www.marinuslink.com.au/

11 TasNetworks Project Marinus Business Case Assessment report Page 62

12 https://www.marinuslink.com.au/

Figure 2 – Project Marinus: proposed link map



Source: marinuslink.com.au

Figure 3 shows the Project Marinus timeline from concept to realisation. Final investment decisions are expected between 2021 and 2023.

Figure 3 – Project Marinus: timeline to implementation

Source: marinuslink.com.au

3.4. Wind and solar assets

As shown in Table 3 and Table 4 below, a number of new small to medium scale renewable energy project proposal developments will complement the existing wind farms (appearing in Annexure 4).

More recently, larger scale projects have emerged including the Jim's Plain / Robbins Island project in Circular Head and the Whale Back Ridge project on the West Coast.

Additionally solar projects, such as the Wesley Vale and Georgetown solar farm projects, are providing additional renewable energy generation diversification.

Table 3 – Proposed wind farms

Wind Farm	Location	Capacity (MW)	Turbines
Whaleback Ridge Wind Farm and Energy Park (Pre-approval)	Zeehan (West Coast)	1500	427
Robbins Island (Pre-approval) / Jim's Plain Energy Park (Assessing)	Circular Head	1000	231
Western Plains (Pre-approval)	Stanley	46	13
Hellyer Wind Farm (Pre-approval)	Hampshire	150	40
Guilford Wind Farm (Pre-approval)	Guilford	300	80
Port Latta Wind Farm (Pre-approval)	Port Latta	25	7
Low Head Wind Farm (Pre-approval)	George Town	36	12
St Patricks Plains (Pre-approval)	Central Tasmania	300	67

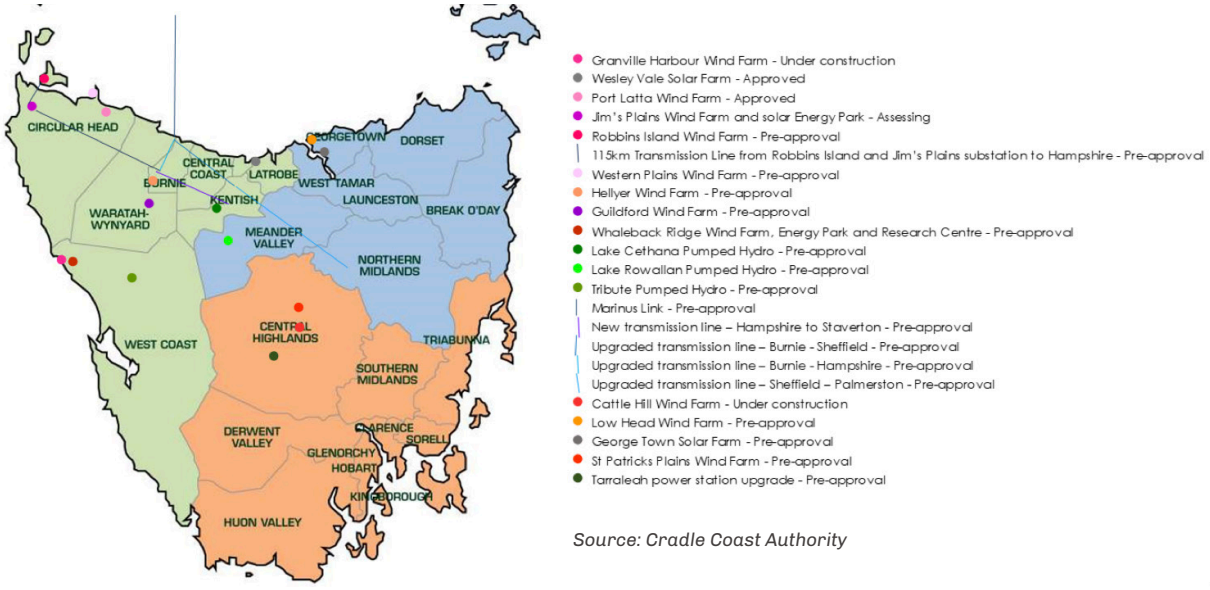
Source: Cradle Coast Authority

Table 4 – Proposed solar farms

Solar Farm	Location	Capacity (MW)
Wesley Vale Solar Farm	Wesley Vale	12.5
George Town Solar Farm	George Town	5

Source: Cradle Coast Authority

Figure 3 – Project Marinus: timeline to implementation



Source: Cradle Coast Authority

3.5. Hydrogen

For the latest information about hydrogen, please go to: www.stategrowth.tas.gov.au/energy_and_resources/energy/hydrogen

The Tasmanian Government's vision is for Tasmania to become a leader in large-scale renewable hydrogen production and a significant global supplier by 2030. It will work with industry, other governments, and the community to develop a renewable hydrogen industry that will provide ongoing benefits for Tasmanians.

3.5.1. Tasmanian Renewable Hydrogen Action Plan

Released in early 2020, this action plan sets out four pillars that will underpin the Tasmanian hydrogen vision:

- Explore the opportunities for using locally produced renewable hydrogen in Tasmania and for export.
- Provide financial support for hydrogen projects for export and domestic use, and continue investment attraction activities including with international trade partners.
- Ensure a robust and supportive regulatory framework and assess supporting infrastructure.
- Build community and industry awareness, develop skills, and support research and education.[13]

The Tasmanian Renewable Hydrogen Action Plan has been developed to complement the *COAG Energy Council's National Hydrogen Strategy* released in November 2019.

A support package designed to help facilitate the development of hydrogen manufacturing in Tasmania was also detailed, including:

- $20 million from the Tasmanian Renewable Energy Fund
- Up to $20 million in concessional loans
- Up to $10 million through competitive electricity supply arrangements and payroll tax relief.

These support measures will be made available through a competitive expression of interest process.

3.5.2. Why hydrogen?

As the global push to decarbonise gathers pace, low carbon sources of energy will become increasingly important to achieve sustainability objectives. Transferring renewable energy into hydrogen is a new way of storing and transporting energy. With no carbon emissions when produced from renewable energy, hydrogen is recognised as an important enabler for the transition to a global renewable energy system.

3.5.3. Why now?

The potential of hydrogen as a renewable and flexible energy carrier has been recognised for many years. However, the economic and technological challenges associated with creating a hydrogen economy have only recently started to be overcome.

With declining costs of renewable energy and hydrogen technology, and emerging export markets; the economics of developing a global hydrogen sector are starting to look attractive.

3.5.4. Why Tasmania?

Tasmania can take advantage of the global momentum behind hydrogen. With its abundant renewable energy and water resources, Tasmania is well positioned to capitalise on this new global industry.

The Tasmanian Government is actively preparing for this exciting opportunity, recognising that Tasmania's strengths make it an ideal location for the development of hydrogen projects. Importantly, our mix of established

13 www.stategrowth.tas.gov.au/energy_and_resources/energy/hydrogen/tasmanian_renewable_hydrogen_action_plan

renewable generation can support a hydrogen industry much sooner, and likely at lower cost than can be achieved in other Australian states.

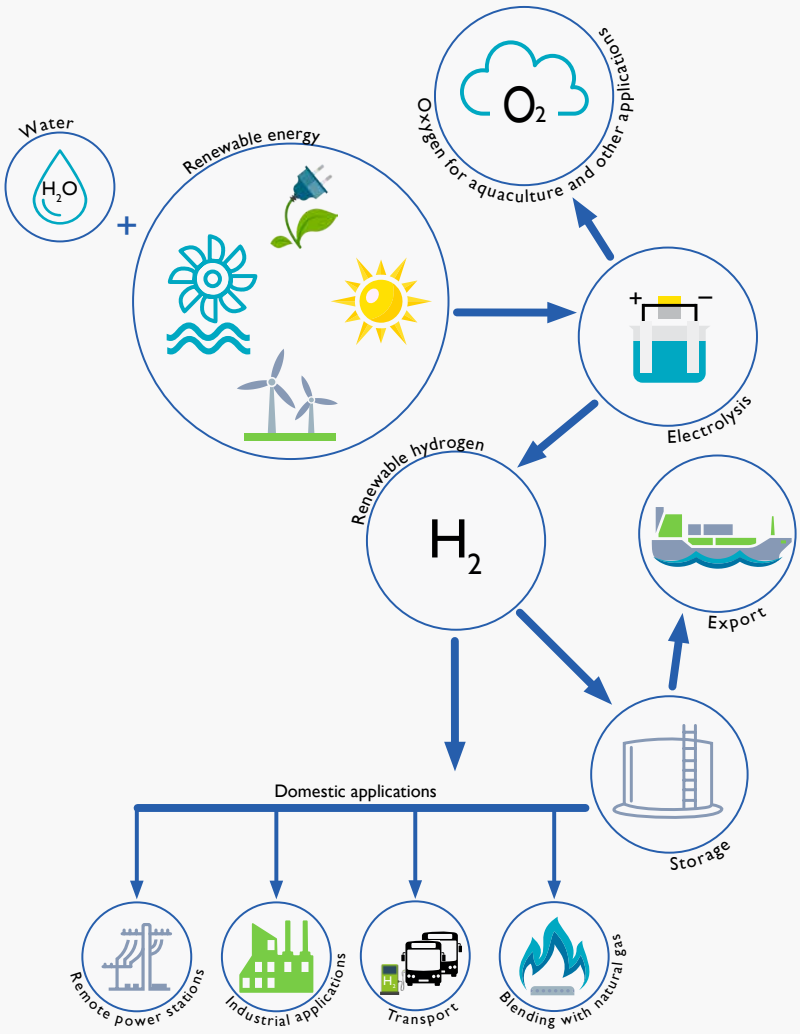
The cost of production of hydrogen in Tasmania could be 10 to 15 per cent lower than from other Australian power grids, and 20 to 30 per cent lower than from dedicated off-grid variable renewables.[14]

Tasmania's key competitive advantages include:

- High renewable energy contribution from low-cost, reliable hydropower and wind
- Access to abundant fresh water
- Industrial precincts with available land and access to high quality infrastructure.

Hydrogen has been recognised as the next generation fuel that has minimal emissions and can be stored for long periods. Potential adaptation for transport and other industry sectors is significant.

Figure 5 – Hydrogen production and potential uses



Source: 'Tasmanian Renewable Hydrogen Action Plan 2020', page 10

14 https://www.stategrowth.tas.gov.au/energy_and_resources/energy/hydrogen

3.6. Renewable energy research

Tasmania is also leading significant research into renewable energy. Work of this nature is well aligned to our island state's position as a global leader in renewable energy production.

3.6.1. Wave energy research

Ocean waves are an abundant and untapped source of renewable energy with less variability than wind or solar power. Research into this growing sector is gathering momentum at the University of Tasmania's Australian Maritime College (AMC), which has national funding to support two key projects.

The first project, supported by a $256,000 Australian Research Council grant, is a partnership with Perth-based company Bombora Wave Power to conduct physical scale-model experiments on its wave energy converter. The first round of trials took place in AMC's model test basin in November 2019.

The second project is a formal collaboration between AMC and Swinburne University of Technology to develop modelling of the performance of wave energy farms. Researchers will focus on identifying the impact of wave energy converters on each other and the impact of current flows around a converter. The project is funded through a $770,000 grant from ARENA.[15]

3.6.2. The Blue Economy CRC

The University of Tasmania will lead the largest ever Cooperative Research Centre (CRC), bringing together expertise in seafood, renewable energy and offshore engineering to transform Australia's blue economy.

The Blue Economy CRC aims to drive an evolution in marine-based industries, unlocking enormous economic, environmental and technological benefits. The $329 million research project is a 10-year collaboration between 45 national and international partners from industry, research and government, underpinned by a $70 million cash investment from the Australian Government.

The Tasmanian Government is also a supporting partner, which has been a key factor in gaining local industry involvement. The focus of the first five years of the program will be developing and testing new offshore aquaculture and renewable energy technologies, which will then be brought together on a single platform to demonstrate the economic and environmental benefits of co-location.

The offshore research platform will act as a living laboratory where the CRC can vertically integrate renewable energy and aquaculture technologies with other engineering activities, such as autonomous and remotely operated vehicles, in a proof of concept for how Tasmania could operate in the future.[16]

3.7. Call to Action – Key Recommendations

15 https://www.utas.edu.au/news/2015/9/2/14-making-waves-in-renewable-energy/

16 https://www.amc.edu.au/about-amc/news-and-events/news-items/$329m-research-partnership-to-transform-australias-blue-economy

4. THE BENEFITS FOR REGIONAL TASMANIA

4.1. What happens next?

The next 12-18 months will be crucial for Tasmania as a number of renewable energy projects take shape and mature to final investment stage. Key factors affecting these projects include:

- Tasmanian Government options for funding Project Marinus and Battery of the Nation, including possible co-funding with the Australian Government or private sector equity
- Australian Government refinements to government policy on the National Electricity Market, and how Tasmania will factor in these considerations
- Hydrogen production and the development of pilot projects in Tasmania supported by funding opportunities from the Australian and Tasmanian governments
- Proposed wind farm developments, notably Robbins Island and Jim's Plain.

Tasmania will gain significant regional development opportunities during construction and in the long term when these infrastructure assets integrate into Tasmania's renewable energy generation and transmission systems.

4.2. Unlocking the national market for renewable energy

Marinus Link and Battery of the Nation are the linchpins of Tasmania's renewable energy plan, having the capacity to unlock new investment in renewable energy generation. For Australia, Marinus Link can help smooth the nation's transition to renewables by providing access to a low-cost and reliable energy supply for customers. For Tasmania, the benefits of building the Marinus Link[17] and Battery of the Nation are as follows:

- The increased transmission capacity will provide improved access to the National Electricity Market (NEM) and will unlock a broader national market for our reliable, renewable energy.
- By providing energy export opportunities, it 'firms up' the economics of existing and new wind and solar generation, which in turn increases Tasmania's energy security.
- It will strengthen the security and stability of the network by using modern interconnector technology.
- In summer, Victoria requires more energy than in winter; it's the opposite in Tasmania. Therefore, each state can better support the other by exporting its excess energy.
- It spreads the risk of relying upon a single electricity link between Tasmania and Victoria.
- It will potentially deliver the lowest possible electricity prices to Tasmanian consumers.
- It will unlock significant infrastructure development, employment and career opportunities and broader regional economic growth.

4.3. Expanding and growing economic activity in Tasmania

Expanding and growing the Tasmanian economy is one of RDA Tasmania's key priorities. Increased economic activity and wealth creation raises the standard of living and attracts skilled, working age people to the state. This is important for Tasmania, which has some of the highest unemployment rates in the country, with low participation rates. Education and skill capabilities vary considerably and are not always matched to job opportunities.

17 https://arena.gov.au/projects/project-marinus-further-bass-strait-interconnection/

Economic opportunities exist in Tasmania through building on our strength and reputation as a renewable energy generator, and leveraging opportunities created by the expansion of the National Electricity Market.

Apart from the clear economic contribution, the construction of the Marinus Link, Battery of the Nation and other broader renewable investment is estimated to be $7.1 billion with 1,400 Tasmanian jobs during peak construction and 2,350 ongoing jobs in renewable energy.[18]

4.4. Local industry sectors that already rely on renewable energy

Retaining renewable energy within Tasmania for localised use is appealing where the potential flow-on benefits can help provide Tasmanian communities with full-time jobs, skill development and improvements in standards of living.

The provision of cost-effective renewable energy has been a major attractor for large-scale industry to Tasmania for decades. This has become more apparent as smaller-scale industry continues to leverage Tasmania's natural assets – clean water, renewable energy and a conducive climate – as suitable characteristics for long-term investment.

Tasmania's major manufacturers including Bell Bay Aluminium, Nyrstar and Norske Skog rely on an efficient and reliable power source, which is provided by Hydro Tasmania. These global companies provide valuable employment and economic contributions to the state's economy.

Bell Bay Aluminium, in particular, also contributes to the reliability and consistency of the Tasmanian power grid by regulating the inflows and outflows of power through the Basslink cable in line with market requirements.

Adding to this, a significant number of other industry sectors draw on Tasmania's power network to produce value-add outcomes for Tasmania. These industry sectors include:

- Advanced manufacturing
- Agriculture
- Aquaculture
- Horticulture
- Construction
- Tourism
- Retail
- Health and community services
- Education and training

The foresight of the investments made into the hydroelectric infrastructure has provided Tasmania with a significant advantage, with no need to transition to renewable energy generation (unlike other states). Tasmania's long-term involvement in hydroelectric generation has also created a strong local highly skilled workforce with capacity to support this form of power generation.

4.5. Emerging industry that can use renewable energy

Tasmania enjoys a renewable energy advantage due to its location, rainfall and temperate climate, and available arable land. These factors provide desirable 'green field' opportunities for Australian and international businesses to consider Tasmania as an option for long-term investment in energy-intensive industries as well as in energy production.

This has occurred already with recent investments made by fish feed manufacturers, specialist timber manufacturers and defence industry contractors.

18 The Draft Tasmanian Renewable Energy Action Plan 2020

In addition, other industries including data centres for larger multinational computer firms and speciality primary production that require these key attributes are considering Tasmania as a realistic option for long-term business investment.

4.6. Blending the options to produce the best results for Tasmania

Having surplus renewable energy is an envious position Tasmania finds itself in, and other states are aiming to replicate this where their natural resources allow.

In Tasmania's case, the opportunity to export renewable energy and retain renewable energy for local applications appears to be the most sound and logical model to aim for. This approach has the ability to deliver external income streams to Tasmania and also support the development of local industry sectors and help deliver employment, skill development and long-term improved standards of living.

Many renewable energy opportunities for Tasmania, such as hydrogen, are in their exploratory phase, so it may be premature to consider these opportunities as certainties. However, having the flexibility to use renewable energy in Tasmania to support industry is an important factor that needs to be incorporated into any long-term strategic planning.

4.7. People and communities

As well as the direct benefits from Project Marinus, Battery of the Nation, and the significant other private energy investments planned, these projects also provide regional communities with the opportunity to plan and leverage indirect benefits as each project is planned and implemented.

Project Marinus will be an opportunity to install another data cable between Tasmania and the mainland to provide increased capacity for higher speed telecommunications and internet for local communities and industry.

The investment in renewable energy infrastructure in regional and remote communities will help provide employment for local residents and create skill development opportunities for existing workers in industries that support the renewable energy sector.

Additionally, the construction of new facilities will indirectly fast track supporting infrastructure for the construction workers in these areas that rely upon the local communities for services and retail. The outcomes created by these upgrades will assist these communities after the construction phase has concluded.

A practical example of how to take advantage of emerging economic activity is the laundrette at Cressy. Local residents identified a market opportunity emerge from growth in the local berry farm, finding there were not enough clothes washing facilities in the town to cater for tourists and berry pickers. They successfully established the Cressy Laundromat.

This could be easily replicated in other communities, with local residents setting up new business opportunities that take advantage of the economic flow-on that renewable energy projects in their area will provide.

4.8. Support-infrastructure improvements

The infrastructure investment required to support the construction of renewable energy projects will be significant. This will generate benefits for the remote and regional communities in which these projects are located, as the improvement in amenity will remain post construction. Therefore, any investment in support infrastructure should consider who will maintain and provide the ongoing upkeep.

Any funding provided by the Tasmanian Government and local council to support this infrastructure development will help attract further investment and improve liveability for local residents.

The UPC Renewables wind farm proposals in Tasmania's far North West illustrate where benefits can be leveraged.

CASE STUDY –

UPC RENEWABLES: ROBBINS ISLAND AND JIM'S PLAINS

The UPC Renewables wind farm project at Jim's Plain and Robbins Island is one of the most significant projects to be undertaken in the Circular Head region. Employing over 300 workers during peak construction, this project will provide another avenue (in addition to the Woolnorth Wind Farm development) for the Circular Head region to contribute to Tasmania's renewable energy generation capacity. The considerations regarding infrastructure for a project of this size include:

Worker accommodation

Temporary housing is being considered in close proximity to Smithton so that workers can use the local services (banks, post office etc) as required. Accommodation type (relocatable or permanent) will be determined based on budget and ability to source an adequate location for the duration of construction.

Waste water and technology infrastructure

Specific waste water infrastructure will be required to support worker accommodation on site. Additionally, technology at the worker accommodation (including NBN and mobile phone coverage) may need to be boosted or introduced at the construction site if no existing facilities are available.

Roads (for delivery of turbine infrastructure)

The existing road infrastructure is a mix of sealed, gravel and dirt roads. These will need significant upgrade to accommodate the regular traffic flow of workers, support vehicles, construction vehicles (concrete trucks etc) and the weight of turbine components as they are delivered.

Worker transportation to and from site

This is a large daily requirement to get the construction workforce to two separate sites, one of which is an island that is less accessible at stages of the tide. Bus transportation and then barge (to Robbins Island) is likely; however, the road will need upgrading to ensure worker safety.

In all cases, UPC Renewables continues to work proactively with the Tasmanian Government and Circular Head Council (and other major government bodies) to address these and other issues, understanding that the construction phase will not be indefinite and the infrastructure upgrades that remain will provide ongoing community benefit.

The UPC Renewables project has the benefit to adopt the learnings from previous wind farm construction projects in Tasmania, and this may result in financial and resource savings, time cost savings and minimising construction times. Conversely, like many sites in Tasmania, the Circular Head region is renowned for its climatic extremes and this will need to be factored into planning.

4.9. Developing a knowledge economy

Seldom do communities have the opportunity to invest in the capability of their people in parallel with infrastructure investment, particularly in an emerging industry sector. The renewable energy technology adopted in Tasmania is among the most progressive available, and the opportunity to leverage this into a knowledge economy through extensive and in-depth skills training must be grasped.

Low education outcomes impede Tasmania's young people and working age population from participating in regular employment and improving their economic circumstances. Conversely, educational attainment is positively linked to higher levels of employment, increased labour force participation, higher wages and higher levels of productivity. There is also growing evidence that education has a positive causal effect on such social outcomes as better health, greater civic engagement and reduced crime.

Understanding how to refine and improve the opportunities offered by renewable energy in local employment and skills development, particularly in regional communities, will be vital in leveraging the advantages to Tasmania. We discuss this below.

4.10. Skilling up the workforce

While planning for the workforce to construct renewable energy infrastructure projects is well advanced, work still needs to be undertaken to understand the jobs that will result post-construction in regional and remote communities (where this infrastructure is located) and in Tasmania's urban centres.

A strategy to assist this process is undertaking a Skills Audit. Industry experts, government and community representatives come together to consider the jobs that will become available.

Additionally, some renewable energy companies are providing funding and expertise within local communities to plant the seed of forthcoming opportunities. Scholarships in local schools and community organisations along with information centres are helping to develop the mindset of what careers may be available post-construction and how young workers seeking employment can participate.

Tasmania is fortunate in that the skill sets and generational knowledge-sharing among its hydroelectric scheme workforce still provide clear benefit. This is most evident with the Battery of the Nation project. Additionally, wind and solar farm projects provide opportunities for specialists and new entrants to the renewable energy sector seeking a career option.

Career development options are now extending to other industry sectors where renewable energy technologies are being adopted as a means of best practice and to offset emissions – which is now a qualification to trade in increasingly competitive global markets.

4.10.1. Energising Tasmania

Tasmanians will benefit from the $17m 'Energising Tasmania' initiative. This will provide fee-free training in priority skill areas needed for Battery of the Nation and Marinus Link, starting in 2020[19]. The Australian and Tasmanian governments are determining the priority skill needs and eligibility for the training, and Skills Tasmania is responsible for delivering the program.

Skills Tasmania develops and manages the Tasmanian training and workforce development system in partnership with industry, the vocational education and training (VET) sector, and other training providers.

Skills Tasmania will:

1. Establish an industry advisory group
2. Prepare a workforce development plan

19 https://www.employment.gov.au/delivering-skills-today-and-tomorrow

3. Establish a training development fund to facilitate student enrolments
4. Provide funding support for energy, infrastructure and related training.

More details will be released to key stakeholder groups to maximise engagement and the opportunities to train and skill future workforces in renewable energy sectors.

4.10.2. Vocational Education and Training

As the largest public provider of VET in Tasmania, there is a clear expectation that TasTAFE will play an important role in providing a 'job ready' workforce for renewable energy projects.

Some of these jobs will emerge as renewable energy projects are developed and the skills obtained may transition into other industry sectors or remain within the renewable energy sector.

The retention of this skilled workforce will be crucial in supporting future regional economic development opportunities.

Table 5 – Table of skills required in Renewable Energy sector

Trades	Project roles	Support services
Electrical	Project manager	Education and training
Mechanical	Procurement	Accommodation
Building	Architects	Hospitality
Welding	Surveyors	Food Services
Plumber	Ecologists	Family and community care
Carpenter	Drafting	Medical services
Metal fabricator	Accountants	Telecommunications

Source: Hydro Tasmania

The renewables industry offers specialised roles including jobs installing and maintaining light and power, designing and installing new hardware platforms, conducting networking and automation, and working with the internet and fibre-optics[20] TasTAFE offers specialist courses in electro technology that cover a wide range of electrical, instrumentation, control and communication technologies.

4.10.3. Hydrogen industry training

The recently released *Tasmanian Renewable Hydrogen Action Plan* details the need for a skilled workforce to help drive the recently announced hydrogen energy hubs in the North and North West of Tasmania.[21,22]

For example, a 100 MW hydrogen production facility would contribute an estimated 120 ongoing regional jobs, while a 1,000 MW facility, which could be feasible by 2030, would contribute an estimated 1,200 regional jobs.

TasTAFE, with the support of the Tasmanian Government, will develop courses designed to provide relevant qualifications for the hydrogen sector in anticipation. These courses will be offered at a new $14 million Trades and Water Centre of Excellence at TasTAFE's Clarence campus.[23]

20 https://www.tastafe.tas.edu.au/courses/industry/plumbing-and-electrical

21 https://www.stategrowth.tas.gov.au/__data/assets/pdf_file/0003/207705/Draft_Tasmanian_Hydrogen_Action_Plan_-_November_2019.pdf

22 https://www.theadvocate.com.au/story/6761672/burnie-in-line-to-become-hydrogen-hub-in-50m-package/

23 https://www.theadvocate.com.au/story/6786908/tastafe-announces-hydrogen-skills-plan/

4.10.4. Skilled, professional training

The University of Tasmania is very well placed to respond to the evolving skilled, professional workforce needs of the renewable energy transition, and the opportunities for Tasmanians are diverse. The courses listed below are representative of the jobs that will become available.

Associate degrees

The University College's new associate degrees bring hands-on experiences and flexible online learning. Relevant examples are the Associate Degree in Equipment Design & Technology and the Diploma of Construction Management. Students in the latter will build from their technical work experience and develop the skills required for roles like Site Supervisor, Contract Administrator, Project Management Associate and Estimating Associate.

Technical short courses

The University also has an emerging pipeline of short courses that will be relevant to the sector including the Industry 4.0, new technologies, leadership and project management.

Bachelor degrees

Energy-related teaching for bachelor level courses is currently provided through diverse disciplines ranging from engineering, to economics, architecture and geography. Practical experiences are a large part of the course offerings at UTAS, which are supported by industry partnerships including with TasNetworks, Hydro Tasmania and Entura Energy.

Engineering

The demand for engineers in particular has the potential to grow in Tasmania as a direct result of four major energy generation transitions: expansion of HVDC (high-voltage direct current) import/export capabilities between Tasmania and Victoria (i.e. Project Marinus); renewal of major hydro schemes and in particular addition of significant new pumped hydro storage facilities (Battery of the Nation); accelerated expansion of wind generation capacity in Tasmania; and the incorporation and management of distributed energy resources in distribution networks at large scale. Each of these opportunities, in differing degrees, demands engineers from across the spectrum of engineering disciplines.

A fifth major opportunity for Tasmania, yet to be understood fully, is the creation of a hydrogen production and domestic use and/or export sector, which, if it comes to fruition, will also increase the demand for skilled engineers. Innovative and scientific applications to help develop a robust hydrogen production facility in Tasmania will be crucial and will require higher skilled workers with relevant tertiary qualifications to drive this development opportunity.

Electrical engineers

Graduates in electrical power engineering are destined to feature heavily in all the major renewable energy projects that Tasmania will see, and will no doubt be in high demand both locally and in other key regions around Australia. In recognition of the importance of electrical engineers in steering Tasmania through the energy transition, the University is designing a new Professional Masters in Electrical Renewable Engineering. Through careful consultation with industry, this degree will cover the key specialist technologies associated with each of the major projects, and will also cater to the non-specialist requirements of major energy projects such as project economics, commercial risk and the development process.

Civil engineers

Civil engineers are required too, especially for key aspects of pumped hydro projects, new power transmission and interconnect infrastructure development, new wind farm projects, as well as providing general infrastructure (e.g. roads, transport, foundations) for most small and large projects. The Professional Masters in Civil and Structural Engineering has a focus on major project development and management.

Mechanical engineers

Mechanical engineers will be essential for hydro power developments, in particular for novel pumped hydro storage developments.

Economists

Exploring hydrogen opportunities in Tasmania also requires a workforce that can work on the economics of building a new industry, identify potential markets, compute costs and benefits, and manage risk. In addition, work will be needed to understand consumers' response to a potential domestic hydrogen market.

It will also be necessary to have a trained workforce that can work on the economics of the large energy infrastructure projects (such as Battery of the Nation and Marinus Link). Understanding and managing the distribution of costs and benefits of these projects is necessary as well as the economics of the interaction of these investments and the National Electricity Market.

Postgraduate studies

The University also specialises in postgraduate training of engineers, economists and cross-disciplinary problem-solvers to meet the more niche needs of energy industry developments. These skilled professionals will have the opportunity to drive innovation and entrepreneurship in the renewable energy transition.[24]

Finally, the Australian Maritime College (AMC)'s engineering course, with its specialisation of ocean engineering in particular, brings a combination of core knowledge and maritime specialisations, including renewable offshore energy sources.

4.11. Call to Action – Key recommendations

24 More information can be found at www.utas.edu.au/courses/study/engineering

5. FUNDING OPTIONS

The issue of infrastructure investment is challenging for government and private investors alike, with the need to prioritise investment decisions and plan them to ensure the best financial and economic outcomes for regional communities and shareholders.

In many projects of significance, project proponents typically look to government to help support the feasibility, business planning and construction costs because of the long-term benefits for regional communities. In Tasmania's case, Project Marinus, Battery of the Nation and associated interconnections are substantial investments.

To the Australian and Tasmanian governments' credit, they have each provided financial support for both Project Marinus and Battery of the Nation to date, through their respective initial planning stages. Attracting the remaining investment in a post COVID-19 economic environment may be challenging. It may therefore be incumbent on government to further support these projects (in some measure) as a means of demonstrating confidence to potential investors that these projects will occur.

5.1. Funding Project Marinus

Funding for Project Marinus through the Australian or Tasmanian government (or as a collaboration of both) is seen by many stakeholders as an ideal outcome: ownership of the assets can remain in public control and the resulting income streams and benefits flow back to government to be used for community benefit. Alternatively, private equity funding remains another strong option.

5.1.1. Current AEMO status

As a roadmap to guide Australia's energy transition, the Australian Energy Market Operator (AEMO) 2020 Integrated System Plan (ISP) is described as an actionable roadmap for eastern Australia's power system to optimise consumer benefits through a transition period of great complexity and uncertainty. It does so by drawing on extensive stakeholder engagement as well as internal and external industry and power system expertise.[25]

In its report, the AEMO recognises Project Marinus as a key contributor to supporting Australia's transition from traditional coal fired power generation to a renewable future through the delivery of renewable energy to the NEM.

The Tasmanian Minister for Energy further cites in this report that the Marinus Link is an "actionable project with decision rules" confirming the second Bass Strait interconnector will be needed to keep the lights on across the country and will be delivered with "the successful resolution of how the costs will be recovered". "This means that resolution of a fair costing allocation for Tasmanians is an essential step in implementing this project."[26]

5.1.2. Australian and Tasmanian government funding

At the Tasmanian Government Legislative Council – Government Business Enterprise (GBE) scrutiny hearing for TasNetworks in December 2019, discussion of the potential funding models for the Marinus Link occurred.

25 Final 2020 Integrated System Plan Page 9

26 https://www.theadvocate.com.au/story/6854991/marinus-link-confirmed-in-20-year-national-energy-plan/?cs=12

As noted in the transcript of discussion, the Energy Security Board[27] will provide its recommendations back to the COAG[28] Energy Council in mid-2020. This will include a cost-benefit analysis and a fair pricing model for the Marinus Link and other interconnectors.[29]

The Tasmanian Government has stated it will pay its fair share of these costs, based on these analyses. This will provide some clarity around funding options as the date to commit to Project Marinus in 2023 draws closer.[30]

In a further move of confidence, Prime Minister Scott Morrison announced in June 2020 that the proposed Marinus Link was one of 15 major projects set to be fast tracked. This was not a funding announcement, but it signals that assessment and approval periods will drop from an average of 3.5 years to 21 months.[31]

The Tasmanian Minister for Energy in a media interview further outlined that the Marinus Link ownership model would be "regulated with a guaranteed rate of return".[32]

5.1.3. Tasmanian Government funding

The Tasmanian Government provided the majority of the funding for the original Tasmanian hydroelectric scheme, one of the state's biggest infrastructure project achievements.

Owning the scheme has given successive Tasmanian governments the flexibility to leverage economic opportunities for industry sectors, knowing that the self-sufficiency created by the hydroelectric scheme will continue to deliver Tasmania's ongoing energy requirements. This ownership and control also give the Tasmanian Government the capacity to ensure the state's energy security into the future.

Adopting a similar approach for Project Marinus and Battery of the Nation may be appealing to many Tasmanians, and current economic conditions are conducive for low-cost lending to fund these projects.

5.1.4. Private equity funding

Another means of funding projects of significance is to attract private equity investment, which will relieve government of the responsibility of funding and any associated risk. Many large infrastructure projects in Australia (and globally) rely on this method of funding.

However, private equity shareholders may include foreign ownership, which has to be considered by the Foreign Investment Review Board[33]. While this is not necessarily a disadvantage, compliance requirements can delay funding for projects if the required thresholds are not met.

5.1.5. Mix of public and private funding

Many different models of public–private investment exist. In some cases, the initial capital cost is funded by government and then the asset is leased or contracted to a private operator. Alternatively, government grants or loans can be provided directly to a private entity, or government can fund the support infrastructure such as access roads, water and sewerage upgrades.

27 http://www.coagenergycouncil.gov.au/market-bodies/energy-security-board

28 May 2020 COAG has been replaced by National Cabinet

29 https://www.parliament.tas.gov.au/ctee/Council/Transcripts/GBA%202019/LC%20Thursday%205%20December%202019%20-%20TasNetworks%20Pty%20Ltd.pdf Page 13

30 https://www.parliament.tas.gov.au/ctee/Council/Transcripts/GBA%202019/LC%20Thursday%205%20December%202019%20-%20TasNetworks%20Pty%20Ltd.pdf Page 13

31 https://www.theadvocate.com.au/story/6792656/scott-morrison-announces-marinus-link-priority/

32 https://www.tasmaniatalks.com.au/listen

33 https://firb.gov.au/

5.2. Deciding which model best suits Tasmania's needs

Research and discussions into which funding model is the best option to support the Project Marinus and Battery of the Nation projects are continuing.

Consideration of the ownership structure (including any resulting income streams and responsibilities) will be crucial in deciding which model is suitable. A consideration should be the ability for Tasmania to be protected from longer-term price fluctuations or adverse outcomes that may put local industry sectors, businesses and communities in a vulnerable position.

Notwithstanding the immediate to short-term challenges it faces, the Australian Government is being increasingly relied upon to support business and community through recent crises including the Bushfire Disaster of 2019/2020 and the COVID-19 pandemic. A nation-building project such as this should remain an option for Australian Government funding. However, the Infrastructure Australia priority list suggests the Australian Government has other infrastructure aims it wishes to pursue in the short to medium term.[34]

Similarly, the Tasmanian Government continues to provide support to Tasmanian business and community through the COVID-19 pandemic. While it may have the ability to fund Project Marinus on its own, a number of factors need to align for this to be considered, including:

- An appropriate pricing mechanism in the National Electricity Market to recoup the required return on investment
- Support from the other Australian states in the National Electricity Market to accept this pricing mechanism (with the support of the Australian Government)
- Protection for any agreed pricing mechanism into the long term to ensure the export of renewable energy to the National Electricity Market remains economically viable for Tasmania
- Energy security for all Tasmanians in the future
- Protection for Tasmanian consumers (both commercial and households) from unexpected or unreasonable power price increases.

34 www.infrastructureaustralia.gov.au/infrastructure-priority-list

6. CONCLUSIONS AND RECOMMENDATIONS

Tasmania's status as a leader in renewable energy production in Australia continues, with the vast majority of the state's energy requirements already satisfied by renewable energy production. Mainland Australian states are increasingly recognising the benefits of renewable energy production and are focusing their own efforts on increasing renewable energy use and generation.

Tasmanian renewable energy numbers make impressive reading, with annual renewable energy production levels exceeding 10,000 GWh, which adequately supports local demand.[35,36] The level of renewable energy production in Tasmania remains the highest in Australia at approximately 95 per cent of the state's total energy production[37]. Tasmania's 100 per cent renewable energy target by 2022 appears assured, allowing the state to make a cost-effective contribution to the mainland states also meeting their targets.

Significant wind farm developments in Northern and North West Tasmania are only attractive to investors if excess production can be sold to the mainland (Marinus Link) as well as being stored in Tasmania (Battery of the Nation). Some of these projects have been completed, some are under construction, while others remain at feasibility stage. Importantly, all these projects aim to maximise the return on investment by harnessing the available wind resource, blending it with other renewable energy generation, including hydroelectric and solar, and turning it into a commercial outcome via export to the National Electricity Market.

It is important to note that Tasmania is well placed to deliver dispatchable renewable energy to the National Electricity Market through its extensive hydroelectric assets. This is not easily replicated anywhere else in Australia and should be recognised as a distinctive competitive advantage that will deliver long-term benefit for Tasmania.

Increasing export capacity to the National Electricity Market can only be done by investing in Project Marinus, with two 750 MW cables to run between Tasmania and Victoria. While the investment in this infrastructure is substantial, the opportunity cost of delay or deferral remains greater when considering the loss of earnings, economic growth and employment opportunities that will result.

Recent business case analysis reporting confirms Project Marinus as the first priority for Tasmania, so that it can supply the National Electricity Market and assist other mainland Australian states that are transitioning from coal power generation. Over the life of the Marinus Link, it is envisaged the resulting income streams from supplying Tasmanian renewable energy to the National Electricity Market will be substantial and will justify the investments made in the Marinus Link and the associated renewable energy generation assets.

However, who will pay for the Marinus Link? The most popular option appears to be a regulated model which is funded by the Australian and Tasmanian governments in a shared investment arrangement. While this may be easier for the Tasmanian Government to support, recent national events, including the 2019-2020 bushfires and the COVID-19 pandemic, may make it challenging for the Australian Government to contribute adequate financial resources in the short to medium term.

This leaves the Tasmanian Government to potentially 'go it alone'. This is not the first time Tasmania has gone down this path, with many older Tasmanians recalling the days of Hydro Bonds to fund the numerous hydroelectric schemes we now take for granted. Ironically, the economic conditions of low interest rates and available credit, when the hydro schemes were constructed in the 1950s and 1960s, prevail again today. These conditions may support Tasmania revisiting this option once more.

35 https://www.hydro.com.au/about-us/what-we-do

36 https://www.economicregulator.tas.gov.au/Documents/Energy%20in%20Tasmania%20Report%202018-19%2020%20210.pdf

37 Climate Council State of Play Renewable Energy Winner and Losers 2019

The go-it-alone option may also be contingent on the mainland states in the National Electricity Market supporting a more favourable pricing model for Tasmania to support the investment in the Marinus Link. This may be quite challenging for these states when considering their own renewable energy developments.

Separately, what does it mean for Tasmanian communities who are the recipients of these renewable energy developments? Many communities are still processing the available research and communicating with the project proponents to gain better and more informed understandings. While the benefits these projects deliver to Tasmanian communities may not necessarily translate into reduced power bills, there are many direct benefits to be derived from future renewable energy opportunities. These include new employment opportunities and careers for school leavers and job seekers, infrastructure investment in communities, and innovation opportunities into new and emerging industry sectors including hydrogen production.

Providing certainty to Tasmania that these projects will occur will encourage Tasmanian communities to prepare and plan accordingly. Government has a role to play to provide assurances and certainty when Tasmanians are depending on positive economic and social initiatives in a post COVID-19 world.

For substantiation, Tasmania only has to look at the legacy created by its world-renowned hydroelectric schemes and the benefits they continue to deliver to both industry and the community.

To conclude, the following recommendations should be considered and adopted for Tasmania:

1. Australian and Tasmanian Governments to fund Project Marinus as a priority project for Tasmania
2. Australian and Tasmanian Governments to support Battery of the Nation planning and investment activities to enable the introduction of pumped hydro in Tasmania
3. Tasmanian Government and industry to continue investing in hydrogen technologies to ensure long-term local production capacity
4. Industry to leverage skills training in line with employment opportunities for regional Tasmanian communities
5. All levels of government and renewable energy sector to encourage positive community engagement in anticipation of any new renewable energy project development as a means of fostering collaboration, support and ownership of any outcomes.

APPENDIX 1 –

RENEWABLE ENERGY: CONCEPTS AND PHRASES

What is renewable energy?

Renewable energy is energy that is collected from renewable resources, which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat. Renewable energy often provides energy in four important areas: electricity generation, air and water heating/cooling, transportation, and rural (off-grid) energy services.[38]

In the Tasmanian context: approximately 90 per cent of electricity generation is from renewable resources, putting Tasmania in a unique position to pursue national opportunities. Approximately 10 per cent of Tasmania's renewable energy comes from wind, and the remainder from hydroelectric generation, which delivers base load and peaking electricity for Tasmania's major industrials, small businesses and households.[39]

What is base load?

The base load (also baseload) on a grid is the minimum level of demand on an electrical grid over a span of time, for example, one week. Power plants that do not change their power output quickly, such as large coal or nuclear plants, are generally called base load power plants.[40]

What is dispatchable energy?

Dispatchable generation refers to sources of electricity that can be used on demand and dispatched at the request of power grid operators, according to market needs. Dispatchable generators can be turned on or off, or can adjust their power output according to an order.

This is in contrast with non-dispatchable renewable energy sources such as wind power and solar (photovoltaic) power, which cannot be controlled by operators. The only types of renewable energy that are dispatchable without separate energy storage are hydroelectric, biomass, geothermal and ocean thermal energy conversion.[41]

Why is water so important to hydroelectric power generation?

Hydroelectric power is fuelled by water, so it's a renewable fuel source, meaning it won't pollute the air like power plants that burn fossil fuels, such as coal or natural gas. Because hydropower plants can generate power to the grid immediately, they provide essential back-up power during major electricity outages or disruptions.[42]

However, in order to provide reliable and consistent power generation, strict management of water storage reservoirs and dams is crucial to protect base load supply and provide supplementary power generation during peak demand cycles.

38 https://en.wikipedia.org/wiki/Renewable_energy

39 http://www.dpac.tas.gov.au/divisions/climatechange/tasmanias_climate_change_action_plan_20172021/advancing_our_renewable_energy_capability

40 https://en.wikipedia.org/wiki/Base_load

41 https://en.wikipedia.org/wiki/Dispatchable_generation

42 https://www.energy.gov › eere › water › benefits-hydropower

Can you store wind, solar and tidal energy?

The major challenge to using wind as a source of power is that it is intermittent and does not always blow when electricity is needed. Wind cannot be stored (although wind-generated electricity can be stored, if batteries are used), and not all winds can be harnessed to meet the timing of electricity demands.[43]

Similarly, solar batteries work by storing energy produced by solar panels and storing it for later use. When installing a solar battery as part of a solar panel system, excess solar electricity can be stored instead of sending it back to the grid.[44]

Conversely, tidal power or tidal energy is the form of hydropower that converts the energy obtained from tides into useful forms of power, mainly electricity.

Although not yet widely used, tidal energy has potential for future electricity generation. Tides are more predictable than the wind and the sun. Among sources of renewable energy, tidal energy has traditionally suffered from relatively high cost and limited availability of sites with sufficiently high tidal ranges or flow velocities, thus constricting its total availability.

However, many recent technological developments and improvements, both in design (e.g. dynamic tidal power, tidal lagoons) and turbine technology (e.g. new axial turbines, cross flow turbines), indicate that the total availability of tidal power may be much higher than previously assumed, and that economic and environmental costs may be brought down to competitive levels.[45]

43 windeis.anl.gov › guide › basics

44 https://www.energysage.com › solar › how-do-solar-batteries-work

45 https://en.wikipedia.org/wiki/Tidal_power

APPENDIX 2 –

RECENT STRATEGIES, PLANS AND REPORTS

Table 1 – Project announcements

Date	Announcement	Reference Link
November 2019	Australia's National Hydrogen Strategy	https://www.industry.gov.au/sites/default/files/2019-11/australias-national-hydrogen-strategy.pdf
December 2019	Release of Project Marinus Business Case Assessment report	https://www.marinuslink.com.au/business-case-assessment/
December 2019	Release of Draft 2020 Integrated System Plan 2020	https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2020-integrated-system-plan-isp#Draft%202020%20ISP
December 2020	Project Marinus RIT-T Project Assessment Draft Report	https://www.marinuslink.com.au/rit-t-process/
March 2020	Tasmanian Renewable Hydrogen Action Plan	https://www.stategrowth.tas.gov.au/__data/assets/pdf_file/0007/223927/Tasmanian_Renewable_Hydrogen_Action_Plan_web_27_March_2020.pdf
March 2020	Tasmanian Renewable Hydrogen Industry Development Funding Program	https://www.stategrowth.tas.gov.au/energy_and_resources/energy/hydrogen/tasmanian_renewable_hydrogen_industry_development_funding_program
April 2020	Hydro Tasmania – Deep Storage White papers	https://www.hydro.com.au/clean-energy/battery-of-the-nation/future-state
May 2020	Australian Government Technology Investment Roadmap Discussion Paper	https://consult.industry.gov.au/climate-change/technology-investment-roadmap/supporting_documents/technologyinvestmentroadmapdiscussionpaper.pdf
May 2020	Tasmanian Renewable Energy Action Plan	https://www.stategrowth.tas.gov.au/energy_and_resources/energy/renewable_energy
May 2020	Tasmanian Renewable Energy Target 200% by 2040	https://www.stategrowth.tas.gov.au/energy_and_resources/energy/renewable_energy
May 2020	Australian Government Advancing Hydrogen Fund	https://www.energy.gov.au/news-media/news/government-announces-300m-advancing-hydrogen-fund
May 2020	Tasmanian Hydrogen Hubs confirmed	https://www.stategrowth.tas.gov.au/energy_and_resources/energy/hydrogen/tasmanian_renewable_hydrogen_industry_development_funding_program

APPENDIX 3 –

TASMANIA'S EXISTING GENERATION ASSETS

Table 1 – Gas (thermal)

Power station	Max. Capacity (MW)	Turbines	Fuel type
Bell Bay (Decommissioned)		0	natural gas

Table 2 – Gas turbine

Power station	Max. Capacity (MW)	Turbines	Fuel type	Combined cycle
Tamar Valley	208	1	natural gas	yes
Tamar Valley	178	4	natural gas	no

Table 4 – Wind farms

Wind Farm	Max. Capacity (MW)	Turbines
Huxley Hill Wind Farm	2.5	5
Musselroe Wind Farm	168	56
Woolnorth Wind Farm	140	62

Source: https://en.wikipedia.org/wiki/Category:Wind_farms_in_Tasmania

Table 3 – Hydroelectric

Power station	Max. Capacity (MW)	Turbines
Bastyan	79.9	1
Butlers Gorge	12.2	1
Catagunya	48	2
Cethana	90	1
Cluny	17	1
Devils Gate	60	1
Fisher	43.2	1
Gordon	432	3
John Butters	144	1
Lake Echo	32.4	1
Lemonthyme	51	1
Liapootah	87.3	3
Mackintosh	79.9	1
Meadowbank	40	1
Paloona	28	1
Poatina	300	6
Reece	231.2	2
Repulse	28	1
Rowallan	10.5	1
Tarraleah	90	6
Trevallyn	90	4
Tribute	84	1
Tungatinah	125	5
Wayatinah	38.25	3
Wilmot	30.6	1
Total	**2272.45**	

Source: https://en.wikipedia.org/wiki/Hydro_Tasmania

APPENDIX 4 –

TASMANIA'S PROPOSED GENERATION ASSETS

Hydro Tasmania – Battery of the Nation pilot project sites

Table 1 – Option 1, Lake Cethana[46]

Mersey-Forth: Lake Cethana		
Detail	**Max. Capacity (MW)**	**Storage (hours)**
• A new off-river upper storage on the western side of the Lake, linked by underground tunnels to Lake Cethana as the lower storage. • An underground pumped hydro power station at the lower end of the water conveyance tunnels. • A new transmission line connection from the proposed Cethana switchyard to Sheffield Substation, using existing easements where possible.	600	11

Table 2 – Option 2, Lake Rowallan

Mersey-Forth: Lake Rowallan		
Detail	**Max. Capacity (MW)**	**Storage (hours)**
• A new off-river upper storage linked by underground tunnels to Lake Rowallan as the lower storage. • A new underground pumped hydro power station at the lower end of the water conveyance tunnels. • A new transmission line connection from the proposed Rowallan switchyard to Sheffield Substation, using existing easements where possible.	600	24

46 https://www.hydro.com.au/renewable-energy/battery-of-the-nation

Table 3 – Option 3, West Coast

West Coast: Tribute pumped hydro		
Detail	**Max. Capacity (MW)**	**Storage (hours)**
This option uses two existing storages – Lake Plimsoll as the upper storage and Lake Murchison as the lower storage. • New underground water conveyance tunnels linking the two existing lakes. No new water storages are required. • A new underground pumped hydro power station at the lower end of the water conveyance tunnels and adjacent to the existing underground power station. • Upgraded transmission line connection from the proposed Tribute switchyard to Farrell Substation, with an upgraded transmission line connection to Sheffield Substation as required. Existing easements will be used where possible.	500	31

Source: https://www.hydro.com.au/renewable-energy/battery-of-the-nation/pumped-hydro

Wind farms

Table 4 – New wind farms (actual)

Wind Farm	Max. Capacity (MW)	Turbines
Granville Harbour	112	31
Cattle Hill Wind Farm	148.5	48

Source https://en.wikipedia.org/wiki/Category:Wind_farms_in_Tasmania

Solar farms

Table 6 – New solar (proposed)

Solar Farm	Location	Capacity (MW)
Wesley Vale Solar Farm	Wesley Vale	12.5
George Town Solar Farm	George Town	5

Source: Cradle Coast Authority

Table 5 – New wind farms (proposed)

Wind Farm	Location	Capacity (MW)	Turbines
Whaleback Ridge Wind Farm and Energy Park (Pre-approval)	Zeehan (West Coast)	1500	427
Robbins Island (Pre-approval) / Jim's Plain Energy Park (Assessing)	Circular Head	1000	231
Western Plains (Pre-approval)	Stanley	46	13
Hellyer Wind Farm (Pre-approval)	Hampshire	150	40
Guilford Wind Farm (Pre-approval)	Guilford	300	80
Port Latta Wind Farm (Pre-approval)	Port Latta	25	7
Low Head Wind Farm (Pre-approval)	George Town	36	12
St Patricks Plains (Pre-approval)	Central Tasmania	300	67

Source: Cradle Coast Authority

APPENDIX 5 –

ABOUT RDA TASMANIA

Regional Development Australia (RDA) is an Australian Government initiative established to encourage partnership between all levels of government to enhance the growth and development of Australia's regional communities.

RDA Tasmania operates under a national RDA Charter and reports to the Australian Government on key outcomes. A national network of 52 RDA committees has been established and RDA Tasmania represents the entire state of Tasmania.

RDA Tasmania is fully funded by the Australian Government but is an independent not-for-profit entity tasked with working on what is important for our region – Tasmania. RDA Tasmania is co-located in State Government offices and works closely with local councils and regional council bodies.

The RDA Tasmania committee supports the development of Tasmanian businesses through engagement with key regional stakeholders. Through liaison with industry, business and community sectors, RDA Tasmania engages with a broad range of perspectives without the burden of pushing any particular agenda.

The RDA Tasmania Regional Plan states the following priorities for Tasmania:

1. Expand and grow economic activity in Tasmania
2. Increase collaboration and efficiencies between federal, state and local government; and between government and the private sector
3. Improve educational attainment and employability skills
4. Address the needs of Tasmania's changing demographic profile.[47]

RDA Tasmania's regional priorities align with Tasmania's increasing investment into renewable energy generation, access to emerging markets through the National Electricity Market and the ongoing development of Hydrogen production, storage and export.

47 RDA Tasmania Regional Plan 2017-2019

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