

Cradle Coast Renewable Energy Jobs and Investment Prospectus

2021



CRADLE COAST
AUTHORITY

Stronger Councils, Stronger Region

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CCA CEO

foreword

Today, Tasmania's renewable energy industry is one of the state's key economic drivers; and the Cradle Coast region is home to Tasmania's largest and most prospective Renewable Energy Zone, with significant potential for new generation and energy storage.

The Cradle Coast has had a long and proud history of renewable energy generation and innovation leveraging off its natural assets to provide the community and Tasmania with a highly reliable source of clean energy and extensive industry and business opportunities.

It is worth remembering that since 1883 when Tasmania's first hydroelectric power system was built at Mount Bischoff Tin Mine, the Cradle Coast has been involved in world leading innovation in renewable energy. The region is well placed to continue to lead in this field: with our abundance of natural assets; our proximity to mainland Australia, and a well-developed maritime infrastructure to provide access to national and international markets.

The current growth and future opportunities for growth in agriculture, advanced manufacturing, mining and aquaculture present scope for synergies between new renewable energy generation and further growth in energy demand.

In addition to several exciting major projects that will support growth in electricity generation and demand, work is underway to prepare the region's workforce, businesses and infrastructure for the future.

As Australia's transition towards renewable energy generation continues at a world leading pace, the Cradle Coast's capability to contribute more of the nation's dispatchable energy needs, coupled with our world class wind resource, not only offers massive potential for generation and its support industries, but also opens the door to exciting opportunities for electricity consumers seeking clean, reliable and affordable power.

Having reached 100% self-sufficiency in renewable generation, Tasmania has now set the global leading goal of 200% renewable by 2040.

I invite you to learn more about the many opportunities now emerging to participate in this exciting industry.



Sheree Vertigan AM
Interim Chief Executive Officer

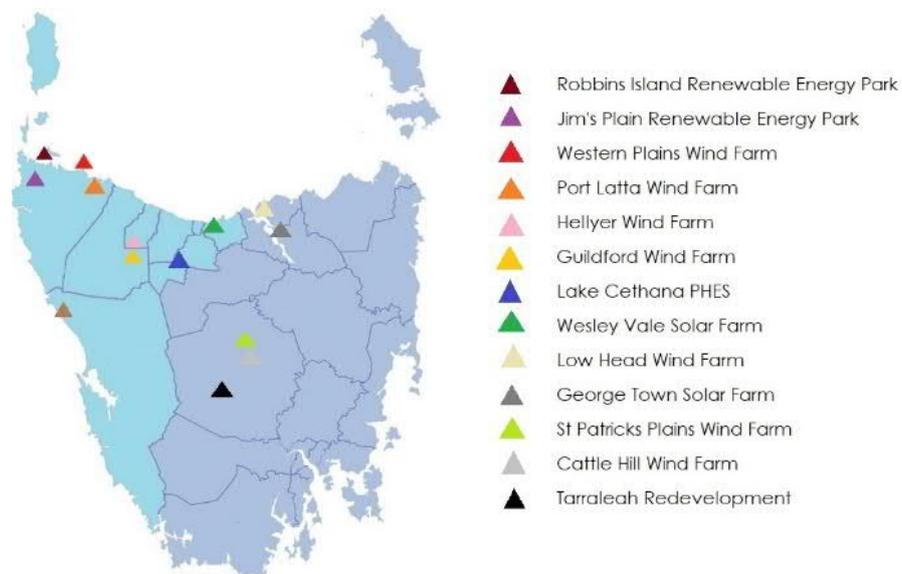
Coal fired power stations across Queensland, New South Wales and Victoria are scheduled to be retired over the next 20 years. Many of these individual power stations, such as Eraring (2800MW) and Liddell (2000MW) are comparable in size to Hydro Tasmania's entire hydro generation (2500MW). Australia's power consumption will increasingly be met by wind, solar and storage, constructed across widely dispersed Renewable Energy Zones. Large amounts of energy will need to be transmitted enormous distances to reach the major load centers where it is needed.

Around the world, transmission has emerged as a critical bottleneck limiting renewable energy's cost-effective contribution to the power mix. It is a challenge faced intra- and inter-state across Australia and is widely attributed to the 40% drop in total renewable energy spending from 2018 to 2019.

To unlock the generation capacity of Australia's Renewable Energy Zones, significant additional transmission will be required.

North West Tasmania's Renewable Energy Zone (REZ) is comparable in transmission distance to major load centres to REZs under development in Victoria and New South Wales. Tasmania's preferred pumped hydro sites are around the same transmission distance to Melbourne as Snowy Hydro 2.0, and not much further than from Snowy Hydro 2.0 to Sydney.

Over the next 15 years, 12,000MW of retired coal will need to be replaced by 40,000MW of variable renewable capacity and 8,000MW of dispatchable capacity. Multiple Renewable Energy Zones will need to be unlocked to achieve it. The majority of these projects are concentrated in the Cradle Coast region.



Projects in Tasmania

The Cradle Coast – Tasmania's Renewable Powerhouse

The Cradle Coast region is central to Tasmania's future in contributing a solution to the nation's energy trilemma.

As a source of much of the State's hydro, wind and pumped hydro generation, and due to its proximity to the mainland, the region can provide energy that is affordable, reliable, and environmentally responsible.

Currently the region generates 1140MW of renewable energy. Renewable developments in the region are estimated to potentially generate an additional 5000MW.

Renewable energy from Tasmania is currently supplied to Victoria and other southern states through the 500MW BassLink Interconnector. This interconnection allows Tasmania to participate in the National Electricity Market (NEM).

TasNetworks is proposing to construct two 750MW interconnectors through its Project Marinus operation, with the potential for further interconnectors into the future. Burnie (Heybridge), in the Cradle Coast, is the preferred location.

The significant generating potential within a relatively small geographic area, together with the proposed investment in generation and transmission, and community support for renewable energy provides an excellent foundation for companies seeking to invest in the renewable energy sector in the Cradle Coast.

TasNetworks has purchased the former Toxide site in Heybridge as a potential site for the Tasmanian Converter Stations for Marinus Link. The undersea component of Marinus Link will consist of two 250km long, 750MW undersea cables. Tasmania's only current interconnector, Basslink, is 290km long undersea, and 500MW. It was built in 2005 and runs out of George Town, near Launceston.

As the world transitions towards variable renewable energy and more cross-jurisdictional electricity networks are established, numerous major interconnector projects are planned or under construction around the world. The EuroAsia Interconnector, connecting Greece, Cyprus and Israel, will be 2000MW and 1208km long. The EuroAfrica Interconnector to Egypt will be 2000MW, and laid up to 3km deep under sea level. The North Sea Link, from Norway to the UK, will be 730km long and 1400MW. The UK already has interconnectors to France, Belgium, The Netherlands and Ireland, and will have three more international interconnectors, to France, Norway and Denmark, by 2024.

Interconnectors are very much a key part of the modern global approach to transitioning electricity generation, ensuring excess wind and solar energy generation is transmitted and traded, and not wasted.

The construction of Marinus link will inject over \$1 billion into the local economy, particularly in the heavy and civil engineering construction, renting, hiring and real estate, construction services, professional scientific and technical services, and manufacturing sectors. According to EY's Economic Contribution analysis (2019), during peak construction from 2025 to 2027 Marinus Link and its associated infrastructure is expected to support 283 direct and 1109 indirect jobs per year in Tasmania, including electricians, engineers, builders, carpenters, plumbers, welders, metal workers, technicians, surveyors, marine specialists, and support industry workers.

The construction of Marinus Link will enable new energy generation, energy storage, and energy consuming businesses requiring reliable renewable energy and a strong transmission network to be established on the Cradle Coast.

The Tasmanian Office of the Coordinator-General is Tasmania's principal entity to attract and support investment in the state. It provides free confidential services and professional advice to investors, including:

- acting as the first point of contact for project proponents and investors to government
- case managing major projects on behalf of government
- providing information on Tasmania's industry capabilities and strengths, specific business opportunities, investment regulations and government assistance
- assisting investors to identify and select the best Tasmanian site for their business
- facilitating visits to Tasmania and arranging appropriate meetings and introductions
- providing introductions to local industry, government departments and potential joint venture partners
- assisting with access to export markets

Tasmania has reached its target of becoming "100% renewable", with the capacity and capability to generate more renewable electricity annually than average consumption. This gives Tasmania a massive boost in securing the reliability of the state's energy supply.

In 2017, the Tasmanian Energy Security taskforce found that Tasmania needed an extra 700 to 1000GWh generated on the island in order to balance supply and demand. Although Tasmania is connected to the National Electricity Market (NEM), the state currently only has the one connection to the mainland, Basslink – meaning there is no redundancy if anything goes wrong.

The annual generation of Tasmania's many hydro electric power stations is not limited by their capacity, but rather by the annual inflow of water – which has been reducing since the mid-1970s. The annual deficit between supply and demand was previously filled by The Tamar Valley natural gas-fired power station, and by importing more electricity than the state exported to the NEM.

Since 2017, two new wind farms have been constructed – Cattle Hill Wind Farm and Granville Harbour Wind Farm. This additional generation means Tasmania can now provide 100% of its energy requirements from renewable energy and puts Tasmania in a secure position to rely on its own renewable generation if a significant energy security event were to occur in the future.

Snapshot of the Cradle Coast Region

Drawing upon unique investment and lifestyle advantages, Tasmania's Cradle Coast offers the perfect business ecosystem in which to locate operations in well-established sectors of advanced manufacturing, agribusiness and tourism. It also is an ideal location for emerging sectors in renewable energy, shared service centres, data centres and agri-tourism.

Home to over 7 800 businesses, the Cradle Coast delivers \$6.7 billion in Gross Regional Product. With its lifestyle offering, it is the place to live and work. With continued strong competition for the best talent, the Cradle Coast is an ideal place to offer the flexibility of working remotely and for you and your business to relocate.

The Cradle Coast Advantage

Investors looking at establishing in the Cradle Coast region will benefit from a number of advantages that enable Tasmanian businesses to deliver globally competitive products and services:

- lowest aggregate land and accommodation costs in Australia
- low costs of production and a committed and collaborative workforce
- the best industrial relations record with the highest employee retention rate and loyalty in Australia
- a cluster of diverse and successful industries with a culture of innovation collaborative industry, government, and educational facilities one of the lowest business taxation ratios in Australia
- low sovereign risk with transparent and streamlined development approval processes
- first class infrastructure including transport, energy and telecommunications
- a safe and secure island with strict biosecurity
- Tasmania's temperate maritime climate, water resources and significant renewable energy resources present significant comparative advantages in relation to climate change, particularly in industries such as viticulture, aquaculture and dairy farming.



Granville Harbour Wind Farm

The Cradle Coast Regional Futures Plan

Completed by the Cradle Coast Authority in late 2018, the Cradle Coast Regional Futures Plan (the Futures Plan) provides the blueprint for an ambitious new approach to economic development, having received significant backing from all levels of government, industry and the university sector. The Futures Plan has provided the opportunity for community, business, education and government leaders to work together to guide decision making, priority setting and actions to improve the region's competitiveness and productivity.

The implementation is being guided by a Regional Economic Development Steering Group, a high profile, go-to group on regional economic development matters. The Plan has established a Regional Investment Framework to consider and support projects of regional significance. More details can be found at <https://www.cradlecoast.com/regional-investment-framework/>

The Future Energy Hub showcases the potential of the Cradle Coast's renewable energy sector by:

- Providing relevant, timely and accessible information through Hub visitations, social media, website content, articles, and presentations
- Expanding community reach and forming constructive community connections
- Initiating opportunities for community engagement
- Supporting opportunities for public participation in developments and the growth of the industry
- Enabling opportunities for proponents to cooperate with the community to achieve shared goals
- Developing connections with and between stakeholders



Our Renewable Heritage

It took eight decades to create Tasmania's electricity system with 30 power stations and 54 major dams.



Tribute Dam, Hydro Tasmania

In the beginning

In 1914, the Tasmanian Government bought a small electricity company in financial difficulty and created the Hydro-Electric Department.

The first power station in the Cradle Coast region was the Lake Margaret Power Station, built in 1914 by the Mt Lyell Mining and Railway Company to provide energy for its mines. By the 1920s, hydro-electric power was revolutionising Tasmanian farms, mills, mines and factories, but electricity was not yet widely available for household uses. Constantly growing demand for power kept the pressure on the construction program through the 1930s, but equipment, materials, expertise and labour became scarce, and progress slowed during the Great Depression and the Second World War.

The pioneers

After the Second World War, large numbers of international migrants were recruited to construct dams and power stations in Tasmania. This common goal brought English, Polish, German, Italian, Scandinavian, Eastern European and other migrants together with Tasmanians, and created lively and diverse communities. Many workers from overseas settled permanently, stayed with the organisation for decades, even creating multi-generational hydropower families.

The post-war boom

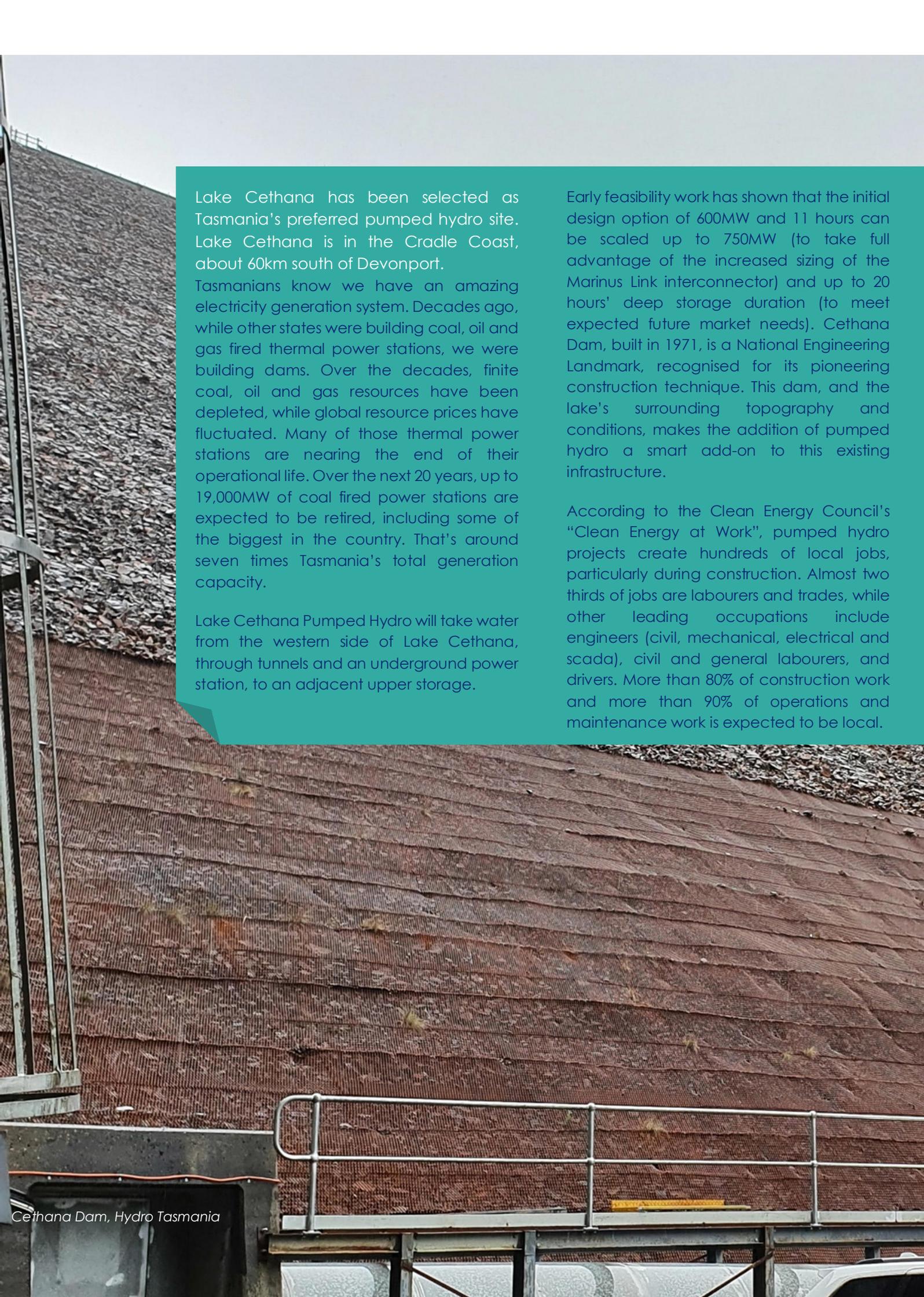
During the 1950s, insatiable demand stretched electricity supplies to the limit. Tasmania's industries had boomed, and most ordinary Tasmanians were now enjoying fully electric homes.

It was at this time that a number of major new developments were constructed and commissioned in the Cradle Coast region through the 1960s and 1970's, including the Mersey-Forth, Pieman and King-Yollande schemes, comprising 13 power stations in total.

The age of major dam-building in the region drew to an end in the early 1990's. At its peak, "the Hydro" employed more than 5200 people. The last power station commissioned in 1994 was named 'Tribute' in honour of the thousands of workers who sacrificed so much to build the State's power system.

Reinvention

To meet the ever-growing demands for energy, the State explored alternatives to hydro-electricity, the Basslink interconnector cable connecting Tasmania to Victoria, and the renewable resource of wind power. Since the 1990s, the Hydro have invested in wind farms on King Island, and at Woolnorth in the Cradle Coast region.



Lake Cethana has been selected as Tasmania's preferred pumped hydro site. Lake Cethana is in the Cradle Coast, about 60km south of Devonport.

Tasmanians know we have an amazing electricity generation system. Decades ago, while other states were building coal, oil and gas fired thermal power stations, we were building dams. Over the decades, finite coal, oil and gas resources have been depleted, while global resource prices have fluctuated. Many of those thermal power stations are nearing the end of their operational life. Over the next 20 years, up to 19,000MW of coal fired power stations are expected to be retired, including some of the biggest in the country. That's around seven times Tasmania's total generation capacity.

Lake Cethana Pumped Hydro will take water from the western side of Lake Cethana, through tunnels and an underground power station, to an adjacent upper storage.

Early feasibility work has shown that the initial design option of 600MW and 11 hours can be scaled up to 750MW (to take full advantage of the increased sizing of the Marinus Link interconnector) and up to 20 hours' deep storage duration (to meet expected future market needs). Cethana Dam, built in 1971, is a National Engineering Landmark, recognised for its pioneering construction technique. This dam, and the lake's surrounding topography and conditions, makes the addition of pumped hydro a smart add-on to this existing infrastructure.

According to the Clean Energy Council's "Clean Energy at Work", pumped hydro projects create hundreds of local jobs, particularly during construction. Almost two thirds of jobs are labourers and trades, while other leading occupations include engineers (civil, mechanical, electrical and scada), civil and general labourers, and drivers. More than 80% of construction work and more than 90% of operations and maintenance work is expected to be local.

Network capacity



Marinus Link, TasNetworks

Under sea

The current BassLink Interconnector provides a 500 MW link to the National Energy market.

TasNetworks is proposing to construct a 1,500 MW interconnector link through Project Marinus, with the potential for two further interconnectors in the North West region.

The initial interconnector will increase transmission capacity between Tasmania and Victoria and be delivered in two concurrent or staged 750 MW developments.

Infrastructure Australia has declared Marinus as a high priority initiative.

The Australian Energy Market Operator (AEMO) has called for Marinus to be progressed through feasibility, business case and approvals phases as a matter of priority.

Marinus Link is currently in the “design and approvals” stage, with a Final Investment Decision due in 2023-24. Selecting the preferred route for Marinus Link involved considering a number of prudent and feasible alternative corridors.

Although co-locating with the existing Bass Link cable from George Town would have some advantages, it would not meet a key objective of Marinus Link, which is to increase energy security. This risk of an event damaging both Bass Link and Marinus Link simultaneously, potential capacity constraints at the Victorian connection, and the advantages of locating Marinus closer to Tasmania's largest Renewable Energy Zone in North West Tasmania, were some of the reasons why only routes from the Cradle Coast in Tasmania were considered.

Above land

The Cradle Coast and the broader area is likely to see significant activity as part of Tasmania's role in the NEM transforming to a clean energy future. The activity comes from potential renewable energy generation, additional interconnection, and pumped hydro storage, where North West Tasmania:

- Was identified as a high priority renewable energy zone in the AEMO Integrated System Plan;
- Is the favourable connection point for Marinus Link; and
- Has high potential to host pumped hydro storage.

TasNetworks has developed a long-term strategic transmission plan for North West Tasmania to facilitate these potential developments.



TasNetworks

The first step in the environmental, land-use planning and heritage impact assessment and approvals process for the North West Transmission Developments is now underway.

TasNetworks has submitted a referral under the Commonwealth Environmental Protection, Biodiversity and Conservation Act 1999 for the Staverton to Hampshire Hills transmission line.

Proposed transmission developments for North West Tasmania include upgrades to existing transmission lines and the development of new transmission routes. The existing transmission system in North West Tasmania does not have sufficient capacity to support the proposed generation, storage and interconnector developments. As a result, changes to the existing transmission network and potential new transmission routes will be required in the region to increase network capacity and ensure the power system can accommodate the future renewable energy developments proposed for the region, including Marinus Link.

North West Tasmania is identified as a high priority Renewable Energy Zone in the Australian Energy Market Operator's (AEMO's) Integrated System Plan. This is because the region has excellent potential for developing renewable energy generation and storage projects, including new large-scale wind generation in the order of 5,000 megawatts (MW); and new pumped hydro energy storage developments of at least 750 MW. The region also hosts the expected connection point for Marinus Link, a proposed 1500 MW capacity undersea and underground electricity corridor that will link North West Tasmania to Victoria.

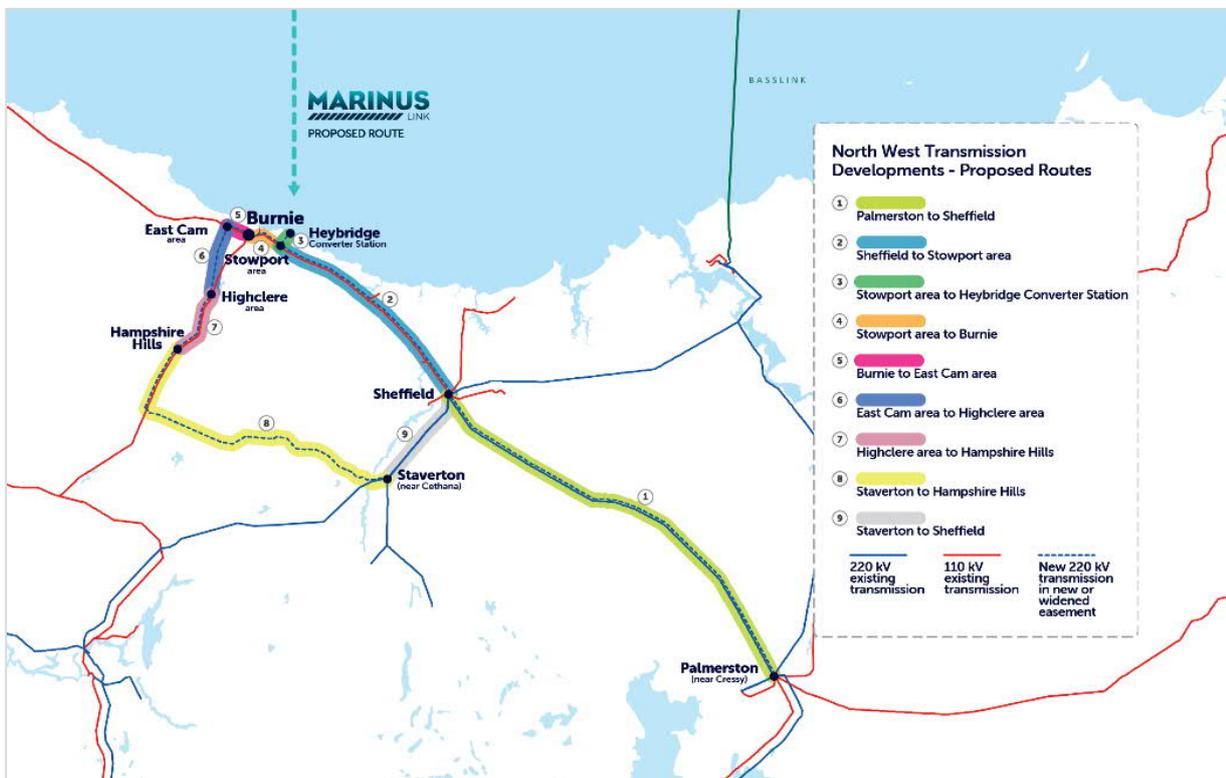
TasNetworks' strategic plan for the North West Tasmanian transmission network is part of supporting the significant jobs and investment opportunity in Tasmania from Marinus Link, the Battery of the Nation and the state's world class wind resources.

Wind Generation

Tasmania's wind resource is high-quality and diverse. This is due to a high-quality natural resource and low correlation with wind patterns on mainland Australia. Further development of this resource could bring substantial diversity to the NEM over the next ten years.

This diversity will become more and more valuable as the penetration of variable renewables increases, and is a key benefit of the nationally planned Renewable Energy Zones.

Tasmania's typical diurnal cycle has been found to have a low correlation with mainland wind energy, and also a notably different daily pattern of generation. This difference in wind patterns provides diversity benefit to the NEM. This advantage is coupled with the highest capacity factor for wind energy generation in the NEM. While all states have high correlation between locations within the same state, building geographically diversified wind generation across Tasmania and other states leverages the low correlation of wind patterns between them.



TasNetworks North West Transmission Developments

The benefit of Tasmania's wind energy diversity can be visually demonstrated to change the NEM-wide characteristics of wind energy production.

Australia is the sunniest and windiest continent on earth. Three quarters of the nation's coal-fired power stations are already operating beyond their expected lifespans. As markets intentionally shift away from fossil fuels, our electricity grid is undergoing a global leading transition towards variable renewable energy.

Most of the new renewable energy generation being constructed is wind and solar. As coal-fired power stations retire over forthcoming years, the NEM, which covers the eastern side of Australia including Tasmania, will become more reliant upon variable wind and solar to meet its electricity needs.

Storage will play a significant role in solving the mismatch between when electricity is generated and when it is needed, but it can't do it all. Australia's largest battery, in South Australia, can only store 2 seconds' worth of the NEM's total consumption.

Even Snowy 2.0, the massive pumped hydro scheme under construction in NSW, will store less than an hour's worth of the network's consumption.

What will become crucial to ensure energy security is generating variable electricity over a range of locations – so that as much as possible, if when the sun isn't shining or wind isn't blowing in one area, it is in another, and is generating electricity.

Tasmania not only has some of the best wind resources in Australia, it also has some of the lowest correlation with demand and supply in other areas – meaning that when electricity is in high demand, but the wind has stopped blowing in other areas, it is still blowing in Tasmania. This will fill the gaps between demand and supply that can't be achieved by storage alone.

The National Electricity Market (NEM) is changing from “peak” and “off-peak” periods being controlled by when electricity demand is high or low, to when electricity is generated. As more massive coal-fired power stations are retired in the coming years, a system that was developed with base loads (mostly coal) and peak loads (mostly gas) responding to network demand, will become dominated by use-it-or-lose-it variable renewable energy (solar and wind), and storage (pumped hydro and batteries).

While the width of the NEM somewhat spreads solar generation from across the network – high noon in Byron Bay

occurs at a different time to high noon in Adelaide - there are many hours each day when the entire NEM is in darkness. South Australia, where almost a third of houses already have solar panels, generates so much solar energy in a short period each day that requirements for new rooftop solar, including the ability for them to be switched off remotely, were recently introduced.

The transitioning grid is driving exciting advances in technology that will not only change how, where and when electricity is used, but will also ensure “excess” electricity generation is

transmitted or stored. Each coal-fired power station retirement will remove a massive amount of generation capacity from the network. Just the next coal fired power station due to be retired (Liddell in NSW, in 2023 – 2024), annually generates more than ten times that of all of South Australia's rooftop solar.

With many coal and gas-fired power station retirements to follow in coming years, it will become increasingly critical that variable renewable generation, regardless of when it is generated, is used, transmitted or stored, and not switched off.

Pumped Hydro Potential

Existing Tasmanian hydropower assets can be repurposed to provide more valuable services in the future market; and targeted pumped hydro investment in the system strengthens this proposition.

When the obligation of Tasmanian energy security is shared with wind generation and more substantial interconnection, the hydropower system can provide new system support services at very low cost to construct and operate. Adding pumped hydro capability to existing hydropower schemes will also increase the value of existing schemes through increased controllability.

Tasmania's extensive and established hydropower system is well-placed to contribute to the challenges facing the energy system with proven, reliable, dispatchable renewable energy backed by Hydro Tasmania's extensive experience developed over the last century.

Tasmania's hydropower assets are currently primarily focused on long term energy security for the state, and most plants are optimised to provide baseload power to Tasmania. However, with the right investment, Tasmania can repurpose existing elements of the hydropower system to store energy when sun and wind energy are abundant, and draw on this storage to deliver power to the nation when weather conditions limit wind and solar generation. As shown below, increasing the flexibility of a greater proportion of hydropower assets in

Tasmania would result in more cost-effective energy dispatch and lower prices for consumers.

The suite of pumped hydro energy storage projects under Battery of the Nation is large, mostly being able to support 24 hours of continuous supply, and cost-effective with construction costs that range from \$1.05 to \$1.5 million per MW. Note the actual energy storage for each pumped hydro station is largely dictated by geography and has little correlation to construction costs, resulting in economically scalable duration of supply.

Modelling of existing hydropower in Tasmania has shown that under a likely future energy mix the schemes with more storage (which are more flexible and controllable) are substantially more valuable than those that have smaller storages. The value of existing run-of-river hydropower assets could increase by as much as 25% with selective development of pumped hydro energy storage.

A major advantage for the suite of projects being considered in Tasmania is that a pumped hydro installation towards the top of a series of cascaded hydropower stations amplifies the contribution of the pumped hydro asset as released water from the station can pass through all downstream power stations.

Tasmania has natural topographical advantages and existing infrastructure that position the state as a very attractive location to develop large-scale pumped hydro necessary to meet all elements of the energy trilemma (security, affordability, and sustainability).

Investment in pumped hydro will help ensure Tasmania can deliver valuable system security services to the market when they are most needed.

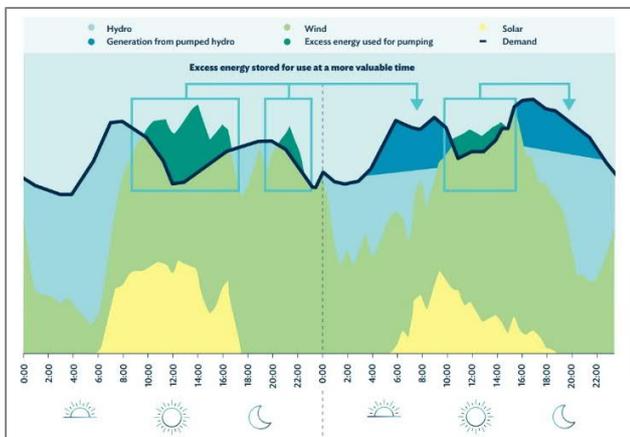


Image: *The Role of Energy Storage, Battery of Nation: Analysis of the future National Electricity Market, Hydro Tasmania, April 2018.*

Other renewable generation

Biomass

There is an abundance of suitable resources for biomass projects in Tasmania. A study suggested that up to 3.3 million green tonnes of woody biomass, equivalent to 33 PJ of energy, could be sourced and provided to the market, with the bulk coming from private plantation estates.

There are also substantial amounts of forestry waste products in the Cradle Coast region that can be utilised for biomass and bioenergy production.

Total annual green waste (green metric tonnes – 2019-2026)

Biomass Type	Min	Max	Total
Plantation Hardware	673,500	1,347,000	
Native Forest	10,400	52,000	
Wood processing			75,566

The Tasmanian Government is committed to looking at innovative ways to process residues from timber and agriculture and create value-added products. In 2016 it launched its Wood and Fibre Innovation Program. Eleven of its 14 recipients were awarded funding to support biomass projects; such as wood pellet plants, and biofuel projects.

A number of bioenergy investment opportunities are currently being evaluated and further opportunities exist in the sector for proponents to partner with business and industry. These include the opportunity to

generate and supply bioenergy to mainland NEM participants, generate and supply industrial heat, including flash heat from bioenergy, and the development of bioenergy hubs in Tasmania's industrial precincts.

Green Hydrogen

Tasmania is in a unique position to take advantage of the global momentum and emerging economic opportunity behind green (renewable) hydrogen.

Access to low cost and reliable renewable energy makes Tasmania an ideal location for renewable hydrogen production, and with our existing 100% renewable energy capacity, this can commence now.

Hydro Tasmania estimates the cost of producing renewable hydrogen in Tasmania could be 10 to 15 per cent lower than from other Australian power grids, and up to 30 per cent lower than from dedicated off-grid variable renewables.

Tasmania also has high quality industrial precincts with access to deep-water ports, strong transmission infrastructure, significant water availability and road and rail infrastructure, to support renewable hydrogen production.

The Tasmanian Government is implementing a comprehensive package of measures under the Renewable Hydrogen Action Plan, including a Tasmanian Renewable Hydrogen Fund, to support the development of a renewable hydrogen industry in the state.

It costs about the same to build the same sized wind farm or solar farm anywhere in the world. But how much electricity it will generate depends on the quality and reliability of the wind or solar resource at that location.

While Australia has enjoyed a relatively uneventful summer climatically over 2020-2021, it has been a very different story in the northern hemisphere. Parts of Europe and Asia have suffered massive winter storms, covering solar panels in snow. Ice and windstorms froze pipelines, instruments and lubricants, damaging transmission infrastructure and limiting every type of generation, throwing electricity markets and supply into chaos.

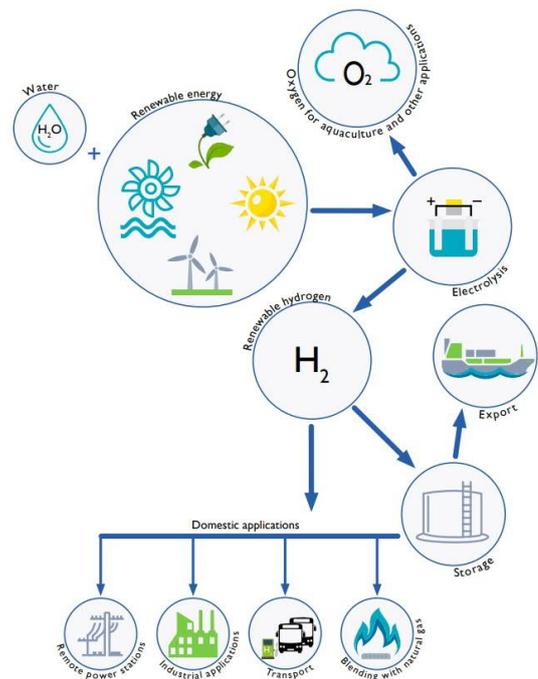
A report in 2015 by Beyond Zero Emissions found that Australia's relatively mild climate and large proportion of rural land means we have the potential to become a renewable energy export superpower.

An analysis of Australia's hydrogen production potential by Geoscience Australia in 2019 showed Tasmania's high potential for green hydrogen production owing to our wind, hydro and solar resource potential, land use, water availability and existing infrastructure.

Tasmania's consistent wind resource firm by hydro and pumped hydro is a globally rare combination. Not only is it drawing attention from the emerging green hydrogen industry, but also the growing range of modern industries seeking secure and reliable renewable energy.

The Australian Electricity Market Operator (AEMO) has proposed a scenario of future electricity demand that includes growing hydrogen usage. Domestic consumption will be for the replacement of natural gas consumption, fueling heavy vehicles such as trucks and trains, and generating grid electricity during peak demand. Also under this scenario, a strong, emerging export economy is assumed to start from 2030.

Nationally, 5 million tonnes of hydrogen could be produced from grid connected electricity by 2035, increasing to over 20Mt by 2050. In Tasmania, domestic consumption (diesel and natural gas replacement) could approach 100,000t by 2040. Even with improvements to hydrogen production efficiency, producing that much hydrogen could consume at least 40% of Tasmania's total current electricity generation, before exporting any hydrogen out of the state is considered.



Research Potential

Tasmania, particularly in the Cradle Coast, has a long history of renewable energy innovation. Tasmania's first hydroelectric power system was built at Mount Bischoff Tin Mine in 1883, which was one of the first in the world.

World-leading innovation in renewable energy in the Cradle Coast continued through the 20th century.

The Devils Gate Dam, built in 1969, was state-of-the-art for its time. It is recognised as one of the thinnest concrete arch dams in the world at just 5.1m at the base, reducing to 2.1m at the crest. The dam wall was designed using a large computer program developed in-house by Tasmania's Hydro Electric Company, saving many engineer-years of manual computations.

The 110m high Cethana Dam, built in 1971, is recognised as a National Engineering Landmark as the first concrete face rockfill dam over 100m high in the world to exhibit minimal leakage, proving a design used for future dams of that type around the world.

Today, the Cradle Coast continues to be the home of world-leading renewable energy innovation.

The UniWave 200 at King Island is a 200kW wave energy device, aimed at demonstrating the commercial viability of generating technology, which could revolutionise power generating capacity for smaller communities around the world.

The device is partially submerged as it sits on the seabed. It has an opening on one side to allow the movement of the waves in and out of the chamber. Water rises and falls inside the chamber, causing the pressure of the air trapped above to change between negative and positive pressure. The pressure fluctuations force air to pass through the turbine at the top of the chamber, generating electricity.

The Blue Economy CRC recently has acquired infrastructure to develop an offshore hydrogen microgrid for research and training. It consists of a 700kW electrolyser, a microturbine and a microgrid, to be co-located with the University of Tasmania in the North West. This will be the largest hydrogen electrolyser in Tasmania and amongst the largest in Australia, and will be the first hydrogen microgrid to be installed offshore worldwide. The project seeks to demonstrate an offshore renewable energy system to meet off-grid, offshore demand, such as aquaculture.

Although wave energy and green hydrogen are both still in relatively early stages of development, the Cradle Coast is again at the global forefront of the next wave of advances in renewable energy.

King Island's award winning hybrid off-grid power system is capable of 100% renewable operation, using wind, solar, storage and innovative enabling technologies to provide 65% of the electricity that was previously generated from diesel.

It is now becoming the first power station in the world to simultaneously generate energy from three renewable resources: wave, wind, and solar.

The UniWave 200, a 200kW wave energy device, has recently arrived at King Island and has successfully commenced delivering generation to the network.

Infrastructure

Sea Access



Wind turbine components at Burnie Port, Granville Harbour Wind Farm

Two of Tasmania's most significant ports are located in the Cradle Coast: The Port of Burnie and The Port of Devonport.

The deep-water Port of Burnie is Tasmania's largest port in terms of freight throughput of over 5.3 million total freight tonnes, and around 214 000 TEUs per annum.

Accessing both the domestic and international markets, the port provides for container services, forestry products, minerals, general cargo and fuel import and export.

The port has recently undergone significant upgrades to accommodate projected growth including an enhanced intermodal terminal and rail facilities to improve the efficiency and capacity of freight handling. Situated on the coastline, the port is accessible and navigable with a draft of up to 10 metres.

Further upgrading of the port is anticipated to meet the TasPorts 2043 Plan; TasPort's 30 year plan to guide state wide port development for the benefit of industry.

The Port of Devonport is located near the mouth of the Mersey River. With over 900 ship calls per annum, the port provides for a range of domestic and international usages including container services, general cargo, fuel import/export, cement import/export and passenger ferry services.

Air Access

The Cradle Coast's two major airports, Devonport and Burnie airports, offer easy and regular access to the Australian mainland. The airports are serviced by national and intrastate operators offering daily access to Australian mainland and international hubs. Flights to and from Melbourne are approximately one hour.

The Devonport Airport is located 10 km from the city of Devonport and provides flight services to and from the North West coast of Tasmania. The airport handles over 145,000 passengers per annum serviced by Q400 aircraft, making four return services daily on weekdays, and three return services on weekends.

Burnie Airport is less than 20 km from the city of Burnie and provides services to and from the North West Coast of Tasmania. Burnie Airport provides four flights per day and freight services to and from Melbourne as well as two flights per day and freight services to and from King Island. There are approximately 80,000 passenger movements per annum through the airport.

Airports at Queenstown, Zeehan, Strahan and Smithton are used by charter flight companies and private aircraft owners.

Workforce Capability

The Tasmanian Energy Industry Workforce Development Plan 2020 to 2027 (Stage 1) was published in December 2020. This was the first workforce development plan developed for the industry in Tasmania. It identified that:

- Strong demand for workers is expected during the construction phase of renewable energy projects. The renewable energy sector sits within the broader infrastructure industry and will need to compete for workers. The 'stop-go' nature of projects, often cited by civil construction firms, makes planning difficult, and so leadership and collaboration is fundamental to managing growth.
- The industry comprises the full suite of job offerings from managers to labourers. It is supported by all education sectors. Apprenticeships and specialist skills need greatest attention.
- The industry is varied and technologically rich, with skill sets that are deep, and in demand. Greater connections need to be made to support forecasted demand for skills.
- The industry is North West region centric, mostly in remote areas, and requires actions that recognise the additional challenges this brings.

The current energy profile is built on over 100 years of investment in hydro- electric generation. This system has supported the Tasmanian community and economy and has positioned Tasmania well for the transition to a low emissions economy. Access to an available workforce and well-established education and training systems provide compelling support for investors.

The renewable energy industry in Tasmania is supported by all three levels of the education, tertiary, vocational and school. The University offering provides degree and research programs to suit the managerial and professional level occupations required, whilst the vocational sector supports the industry more broadly through a range of offerings across various areas of study

You can find the plan here:

https://www.skills.tas.gov.au/_data/assets/pdf_file/0007/274903/Workforce_Development_Plan_for_the_Tasmanian_Energy_Sector_Stage_1.pdf

Higher Education

Construction of the University of Tasmania's waterfront campus at Burnie's West Park continues to progress. West Park Campus will deliver distinctive programs designed specifically for the needs of the local community, and the industry and businesses of the North West.

New courses already introduced include Associate Degree in Equipment Design and Technology, and Diploma of Construction Management. Both of these courses provide multiple pathways for career paths that are in-demand in the renewable energy industry.



The University of Tasmania's new West Park campus, Burnie

Before 2020, working for a stint overseas was something many of us aspired to. As well as the adventure and experience of living in a new culture, the skills, knowledge and experience we gained could boost our career prospects, or kick-start embarking on a new career altogether. The opportunity to work alongside global leaders, or at the cutting edge of our professional passion, could lead to entirely new opportunities in the future. Particularly for those with interests in emerging industries, the desire to be with the world's leading innovators could drive people to pack their bags and go.

2020 changed the perception of "ex-pat" life. Previously, we could live overseas with the ability to return home for a family emergency or a friend's celebration within a day or two, giving us comfort to settle into employment in major cities or even some of the most far-flung parts of the world. Sadly, it may be years before we think of working overseas in the same way again.

While the dream of a stint working overseas, or even interstate, is something many of us have had to put on hold, there are some industries where studying and working in Tasmania can create a globally competitive career edge.

There are many examples of industries where Tasmania is considered to be a global leader. The University of Tasmania ranks in the top 10 globally for oceanography, Antarctic research, and agriculture. The Blue Economy Cooperative Research Centre (CRC) brings together 45 national and international partners from industry, research, and government to support innovation and collaboration in aquaculture, renewable energy and offshore engineering on a global scale.

As the world transitions towards renewable energy, Tasmania's successful history in storing, generating, transmitting, and balancing secure, affordable, and clean energy means many leading practitioners, researchers and specialists in renewable energy are right here in Tasmania.

Employers based in Tasmania are working on renewable energy projects on a global scale. Entura, part of Hydro Tasmania, is one of the world's most experienced specialist power and water consulting firms, supporting governments, funding agencies and clients across the Asia-Pacific region and Africa. Jacobs Engineering, which has 52,000 employees worldwide and an office in Tasmania, was recently awarded the Marinus Link interconnector project.

As major Tasmanian renewable energy projects progress from studies and regulatory applications, through to design, construction and operation, a wide range of locally-based businesses will be involved in each step. Tasmania will be great place to develop world-leading skills, and launch a broad range of careers in the renewable energy.

The Tasmanian Energy Industry Workforce Development Plan 2020 – 2027 (Stage 1) identified the jobs and skill sets that will be in demand as major project get underway.

Recent Tasmanian wind farm construction projects have reported difficulty in securing:

- Project Managers
- Grade A Electricians
- Quality, Health, Safety and Environment Professionals
- Installation Managers, Supervisors and Technicians
- Electricians and Supervisors with high voltage experience
- Trades in general with wind turbine generator experience
- Estimators
- Document Controllers

Energise Tasmania

The Commonwealth Government will invest around \$16 million over five years from 2018–19 to train a skilled workforce across Tasmania, needed for the energy sector and to support the Battery of the Nation initiative.

The Energising Tasmania initiative will make it attractive for Tasmanians to access vocational education and training to meet the skills needed, through nationally recognised training.

Fee-free training in priority skills areas will equip Tasmania's workforce with the expertise needed to build and maintain pumped hydroelectricity, and the electrical and engineering skills to build the interconnection infrastructure with the National Electricity Market.

The Tasmanian Government is delivering Energising Tasmania through a national partnership project agreement with the Australian Government. The Australian Government is working with the Tasmanian Government to determine priority skills needs areas and eligibility.

Key elements of the program include:

- A new training grants fund to deliver up to 2500 fully subsidised training places in areas of identified skills needs and provide up to \$1000 per learner to assist with non-tuition fee costs, such as training materials
- A new training market development fund to support capacity building of training providers, including trainer recruitment, upskilling trainers, supporting trainers to relocate, as well as developing courses and delivery methods that meet the needs of industry
- A new workforce development fund to deliver an industry-led workforce development plan to inform and drive priority training, and undertake activities identified in the plan that support necessary workforce development
- A new industry advisory group dedicated to building the skills needed to support the Battery of the Nation initiative and more broadly the renewable energy and related sectors that will engage with employers and registered training organisations, and support the development of the workforce plan and implementation of activities identified in the plan.



Tasmanian Government Support

As Tasmania powers ahead with its renewable energy ambitions, the projects are receiving strong support from all levels of government. Significant levels of government investment to advance the projects demonstrates the high level of confidence in supporting Tasmania's future energy potential.

The table below details this support.

Hydro Tasmania and TasNetworks continue to work closely with the Tasmanian and Federal Governments to progress the opportunities.

The Australian Renewable Energy Agency (ARENA) has supported the *Battery of the Nation* and Marinus Link projects with funding through its Advancing Renewables Program.

The Federal Government also announced the "Energising Tasmania" initiative. This will see the delivery of fee-free training and support for fee costs, supporting Tasmania to develop a skilled workforce equipped with the expertise needed for the pipeline of renewable energy projects under investigation and in development. Support is also being provided for industry engagement, workforce planning and development, and building training provider capacity.

Project Name	Total Value	Funding Providers	Status
Energising Tasmania	\$17,000,000	100% Australian Government	Current
Renewable Hydrogen Action Plan	\$50,000,000	100% Tasmanian Government	Current
Project Marinus			
Project Marinus: Further Bass Strait Interconnection	\$20,000,000	50% ARENA 50% Tasmanian Government	Complete
Project Agreement for Marinus Link	\$56,000,000	100% Australian Government	Current
Emissions Reductions Memorandum of Understanding (MOU) – Special Purpose Vehicle – D&A Phase	\$132,900,000	\$93.9 million Australian Government \$39 million Tasmanian Government	Current
Battery of the Nation			
Concept study of Tasmanian pumped hydro options	\$601,000	50% ARENA 50% Hydro Tasmania	Complete
Pre-feasibility study for pumped hydro options	\$1,430,000	50% ARENA 50% Hydro Tasmania	Complete
Pumped hydro feasibility study – identifying the first site	Up to \$30,000,000	100% Hydro Tasmania	Current
Repurposing the Tarraleah Hydropower Scheme	\$5,000,000	50% ARENA 50% Hydro Tasmania	Current
Augmenting the hydropower system	\$1,000,000	50% ARENA 50% Hydro Tasmania	Complete
Future energy market analysis – Stage 1	\$1,000,000	50% ARENA 50% Hydro Tasmania	Complete
Future energy market analysis – Stage 2	\$1,000,000	50% ARENA 50% Hydro Tasmania	Complete



Hydro Tasmania