THE TASMANIAN ENERGY INDUSTRY WORKFORCE DEVELOPMENT PLAN 2020 to 2027

(STAGE 1) December 2020

Tasmanian Energy and Infrastructure Workforce Advisory Committee

The Work Lab

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Disclaimer

Foreword

A once in a generation opportunity is unfolding for Tasmania. As Australia and the world turn to renewable sources of energy, the State is uniquely placed to take full advantage of its abundant natural resources. In doing so Tasmania will lead the way as the country transitions to a low-emissions, renewable energy-based economy.

The Tasmanian Government has set an ambitious Renewable Energy Target of 200 per cent by 2040. This will be supported through the progression of projects like Battery of the Nation, Project Marinus, Green Hydrogen and significant investment in wind and solar generation projects.

We must be prepared in order to realise the social, economic and environmental benefits which naturally accompany this significant investment in the energy sector.

To be successful, large scale infrastructure investment is required. We must also ensure that we have the right people with the right skills. The $16.143 million *Energising Tasmania* commitment from the Australian Government has the clear objective of developing a skilled workforce, equipped to meet the demands of major energy (and related) projects in Tasmania.

Energising Tasmania provides us with the opportunity to determine what skills and training will be needed to meet future demand. This includes undertaking staged workforce development planning to align with major energy and infrastructure projects.

The Workforce Development Plan for the Tasmanian Energy Sector (Stage 1) has been delivered with the intent of articulating the skills, training and employment needs that sit across major energy projects in the next 1-7 years.

On behalf of the Tasmanian Energy and Infrastructure Workforce Advisory Committee (TEIWAC), I would like to thank The Work Lab for the development of the Plan.

Developing the Plan required consulting closely with key industry, education and training stakeholders, and the Tasmanian Government to better understand the 'current state of play' pertinent to the Tasmanian energy sector.

I would also like to express my appreciation to TEIWAC members and those who have provided input into the development of the Plan. TEIWAC members' advice and direction has ensured that the Plan is representative of the challenges and opportunities faced by industry in the context of training and workforce development.

The delivery of the Plan will inform the immediate program of work relative to *Energising Tasmania* – including the establishment of new funding programs and initiatives that will be industry-led and intend to develop capability across our training system and regions. It will also lay the foundations for TEIWAC beginning to scope stage 2 of workforce development planning for the Tasmanian energy sector.

Ongoing workforce planning will require a coordinated approach across key stakeholders to reflect the training and workforce development needs of the Tasmanian energy sector.

I now call on all those with a positive interest in the sector to be close partners in ensuring that all Tasmanians understand and have the opportunity to be part of an exciting growth industry.

Ray Mostogl

Chair

Tasmanian Energy and Infrastructure Workforce Advisory Committee

Executive summary

This report provides a consideration of the skills, qualifications and jobs required by renewable energy infrastructure projects planned for construction up to 2027. The information presented is from desktop research and has been supplemented by interviews with key stakeholders.

The report acknowledges the absence of confirmed projects start dates and dynamic nature of Tasmania's renewable energy sector and presents a series of recommendations that attempt to mitigate the risks of action.

Tasmania's increased focus on renewable energy and new models of energy production represent part of a long-term vision for the state as a leader in renewable energy production.

This is set out in the Tasmanian Renewable Energy Action Plan. Amid the crisis created by the COVID-19 pandemic, short-term stimulus and recovery plans, and additional investment in renewable energy projects provide further impetus to address renewable energy workforce demands and provide the state with many opportunities.

- 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, 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.

There is uncertainty regarding timeframes and commitments to renewable energy infrastructure. Much is contingent on Project Marinus proceeding – without this second interconnector, additional energy capacity arguably has a limited path to market. This report is written on the assumption that the projects identified proceed to construction within their reported timeframes.

The risk of such an assumption is mitigated because the renewable energy industry sits within the broader infrastructure industry. Many of the recommendations will support broader workforce issues challenging many industry sectors.

Recommendations include strategies to support:

- Managerial roles – these are required across the economy
- Skilled professional roles - accredited skills in engineering and ICT (for example) will be needed for highly technical aspects of large projects
- Para professional roles – these are in high demand across the infrastructure industry
- Trades and apprenticeships – these come with medium risk should projects not proceed
- School engagement – these will provide long-term benefits to Tasmania's energy and infrastructure sector irrespective of the project timeline.

Background

The *Project Agreement for Energising Tasmania* (the Agreement) was signed by Commonwealth and Tasmanian Government delegates in December 2019. The Agreement facilitates a $16.143 million investment to develop a highly skilled and valued workforce that will support the delivery of the Tasmanian Infrastructure Project Pipeline, Project Marinus, Battery of the Nation and Tasmania's competitive advantage in renewable energy.

The purpose of this Stage One Plan is to define the current status and capacity of the sector, and the education sectors that service it, and to articulate the training places, workforce development activities and education and training products required to optimise Tasmanian workforce opportunities arising from the Agreement.

This report relates to the short to medium term horizon (1 -7 period) and will provide the foundation for a longer-term view in relation to the Energising Tasmania agenda. The objective is to produce an industry-endorsed workforce development plan for the energy sector in Tasmania that will guide education, training and workforce development activities in the short and medium (1-7 year) period.

The consulting team was led by David Morgan, Managing Director, The Work Lab supported, through a sub-contract agreement by Susanne Rose, Director Workforce Innovations.

Governance

The Tasmanian Energy and Infrastructure Workforce Advisory Committee (TEIWAC) has been established to advise the Tasmanian Government on the implementation of the Agreement.

This report serves as a resource for the committee.

Table 1: Tasmanian Energy and Infrastructure Workforce Advisory Committee

Name	Organisation and title
Ray Mostogl (Chair)	RAMost - Principal
Jon Grant	TasTAFE – Acting Director, Business Growth
Megan Gunn	DoE - Assistant Director, Vocational Learning and Career Education
Professor Brian Yates	UTAS - Executive Dean, College of Sciences and Engineering
Phil Gee	Engineers Australia (Tasmanian Division Committee member, former President)
Hugh Maslin	Civil Contractors Federation - President
Kathryn Hansson	TasNetworks – Technical Capability Leader
Robert Tanti	Hydro Tasmania – Chief People and Corporate Services Officer
Dr Michael Connarty	UPC\AC Renewables Australia – Representative of the private energy sector
Tim Gardner	Stornoway - Representative of the private civil sector
Gary Swain	DSG – Deputy Secretary, Transport Services; Acting CEO, Infrastructure Tasmania

Key industry opportunities

Based on information provided, the Tasmanian renewable energy industry will soon commence a pipeline of projects and see significant growth. This provides significant impetus for the industry to act on further investment by government to engage on a planned pathway to support growth.

The workforce opportunities from renewable energy projects will vie with broader workforce demands from all other infrastructure projects in Tasmania; planning and coordination is vital to optimise outcomes.

Within stage one (to 2027)[1] over the entire period for all infrastructure work, there are an anticipated:

- 838 apprenticeships
- 1,317 para professionals
- 297 managerial roles.

The workforce requirements beyond this period will need to consider any delayed or new construction as well as operational and maintenance roles required by projects, upon commissioning.

With consideration of the regionality of the upcoming projects, mostly North West Tasmania, there is potential to look at talent sourcing and development at a community level as well as a state level. There will be demands on local resources and infrastructure. With sectors competing for attention on the various projects, collective efforts could enhance community engagement and career attractiveness.

There is opportunity to connect with the community through:

- Clear communications
- Analysis of local talent capabilities and procurement
- Analysis of flow-on impact of projects, including indirect employment.

With a long-term growth trajectory and a well-supported supply chain, the renewable energy and its broader infrastructure industry has the opportunity to build a robust and flexible workforce.

There is opportunity to:

- Assess and build regional markets
- Build local expertise
- Build local business and increase benefits to the economy.

This workforce development plan is Stage One and spans the period 2020 to 2027. Significant energy and infrastructure activity is likely to continue beyond this time frame as part of the Tasmanian Government Renewable Energy Action Plan, particularly to 2030 and beyond. For this reason, it is recommended that TEIWAC monitor progress with the workforce development plan and update relevant data or information as required, in particular as detailed project labour requirements are confirmed.

It would be appropriate to undertake a Stage Two Workforce Development Report for Energy and Infrastructure to consider workforce requirements beyond 2027. The timeframe for undertaking Stage Two will need to balance the timing of key decisions points for major energy and infrastructure investments, particularly the Marinus Link(s), Battery of the Nation, hydrogen and other major projects, as well as the long lead times required to ensure that Tasmania's workforce is ready to take advantage of these opportunities.

The industry does not currently have a collective vision of itself, and there is a need for an organised, long-term and unified approach with strategies and actions that are supported by industry. Industry-wide improvements can be achieved through combined data collection and record keeping, shared and unified communication strategies, and a cohesive approach to developing the workforce.

[1] The timeframe for this report was determined by TEIWAC

There is industry support for:

- A centralised body working for the benefit of the industry as a whole
- A single point of contact for industry and government to use to channel information
- Sharing resources for identification and training of talent
- Engaging effectively with community.

A collaborative system to education, training, with industry playing a part in guiding course development and providing spaces for workplace experience is necessary to successful workforce development. Taking a proactive approach, industry and training organisations are already collaborating on courses and qualifications that will support the industry, with pilot programs taking place state-wide.

The increase in renewable energy projects could put pressure on local communities to support the new infrastructure builds. The remoteness of some of these projects will require a supportive community structure for the local workforce.

Risks have been identified with trainer knowledge and capacity and an industry-wide process would be beneficial.

Long lead times to the operations and maintenance phase of these projects (2028 onwards) will allow time to build an experienced and portable workforce as well as due consideration of the supply of critical materials required for renewable energy infrastructure.

There is further opportunity to:

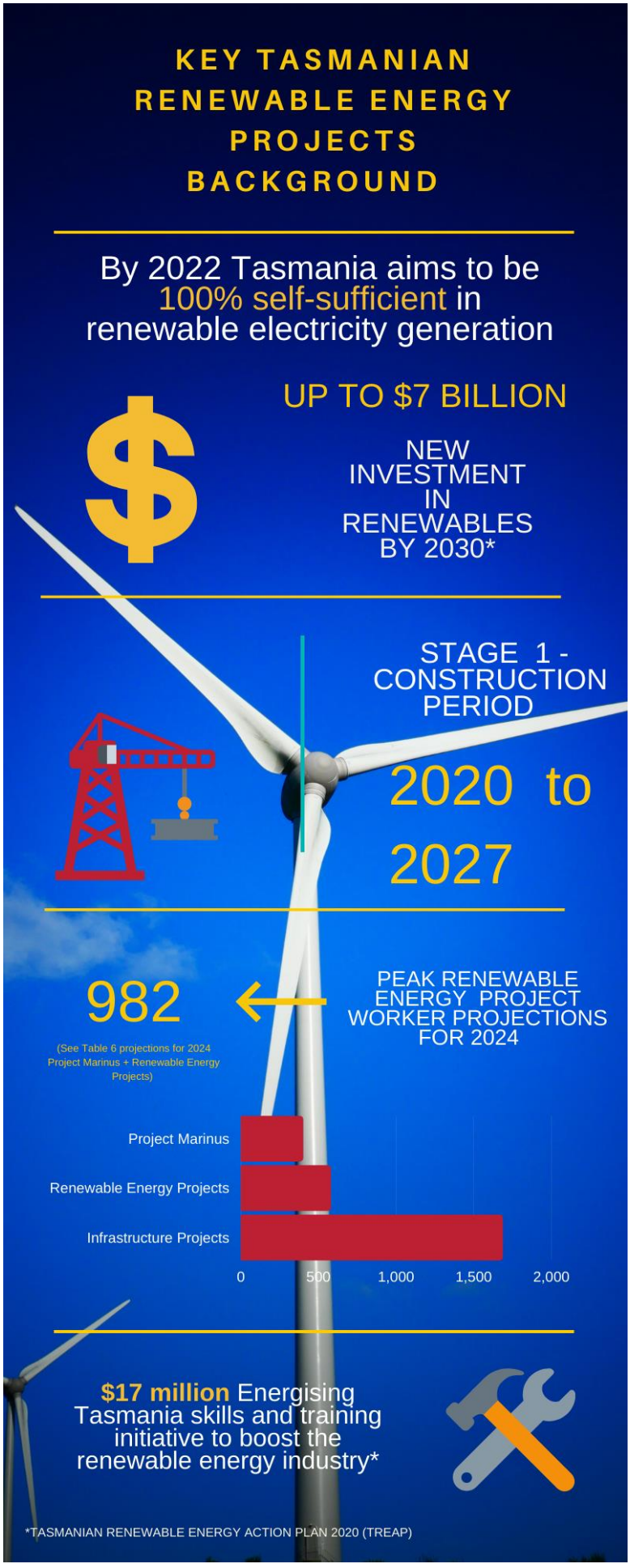
- Customise training according to future demand and industry input
- Enhance trainer capacity
- Address immediate skills gaps and ensure competence is on hand to deliver and maintain renewable energy programs
- Build technical expertise through combining practical and academic training
- Create clear industry and learning pathways
- Use the projects as a training ground to shape and nurture the future workforce
- Look at skills portability.

The rate of changing technology in the renewable energy industry requires a dynamic skill and qualification model – which will be challenged by Australian's national skill qualification process.

Common technology skills exist across all sectors, subsequently there are opportunities to:

- Work collaboratively to cover current skill requirements
- Share resources and network.

Industry overview



As a part of the Tasmania-First Energy Policy, the Tasmanian Government has set a target to deliver 100% self-sufficiency in renewable energy generation by 2022 – with a 200% target by 2040.

Additional economic stimulus as a response to COVID-19 means that Tasmania is headed for unprecedented growth in the renewable energy industry, with opportunities expected across all sectors.

Opportunity exists to:

- Showcase Renewable Energy as an industry of choice for employment
- Promote industry-wide approaches to workforce development
- Broaden the industry supply chain involvement to optimise economic and workforce benefits
- Future proof the industry through multi-level education strategies and career pathways.

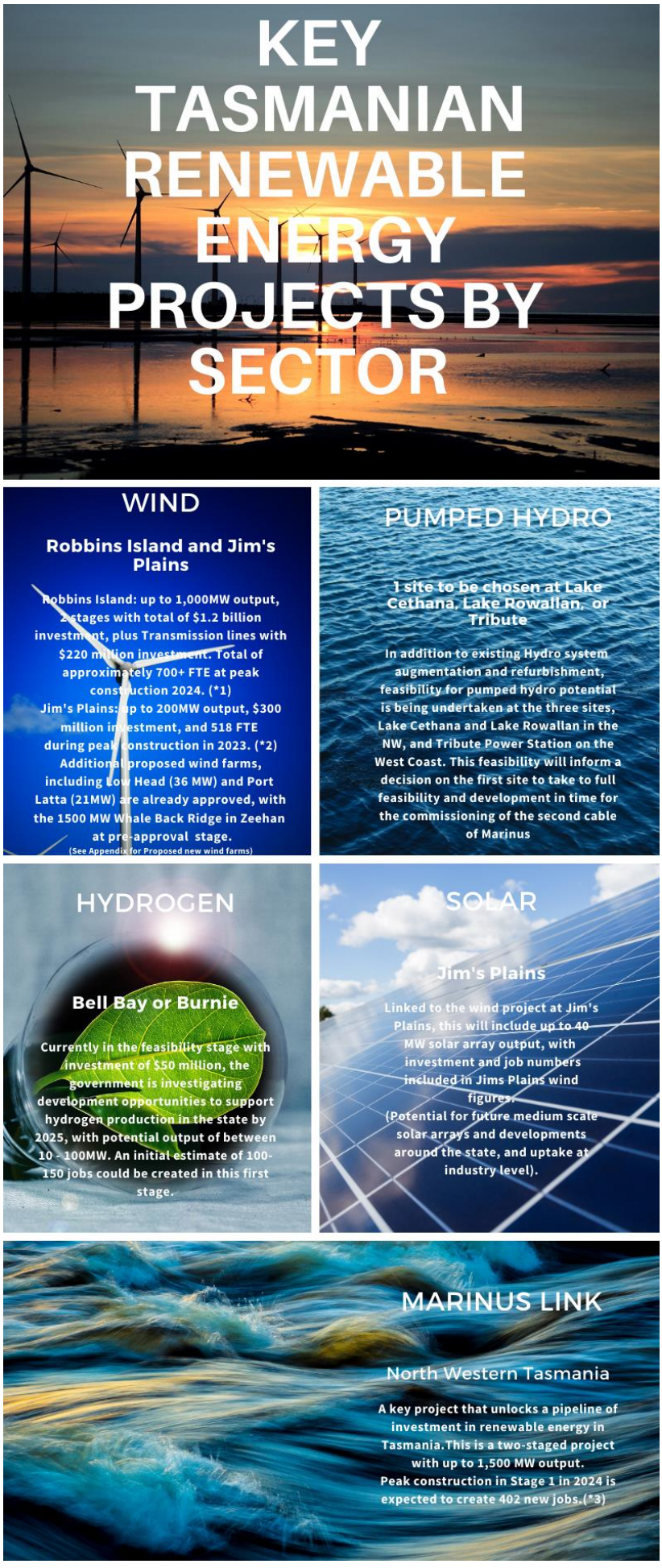
These workforce opportunities sit with a broader industry action agenda. The Department of State Growth published the Tasmanian Renewable Energy Action Plan in May 2020 (TREAP).

The actions and targets from this are included in the appendix. This report and its recommendations align with priority three of the TREAP.

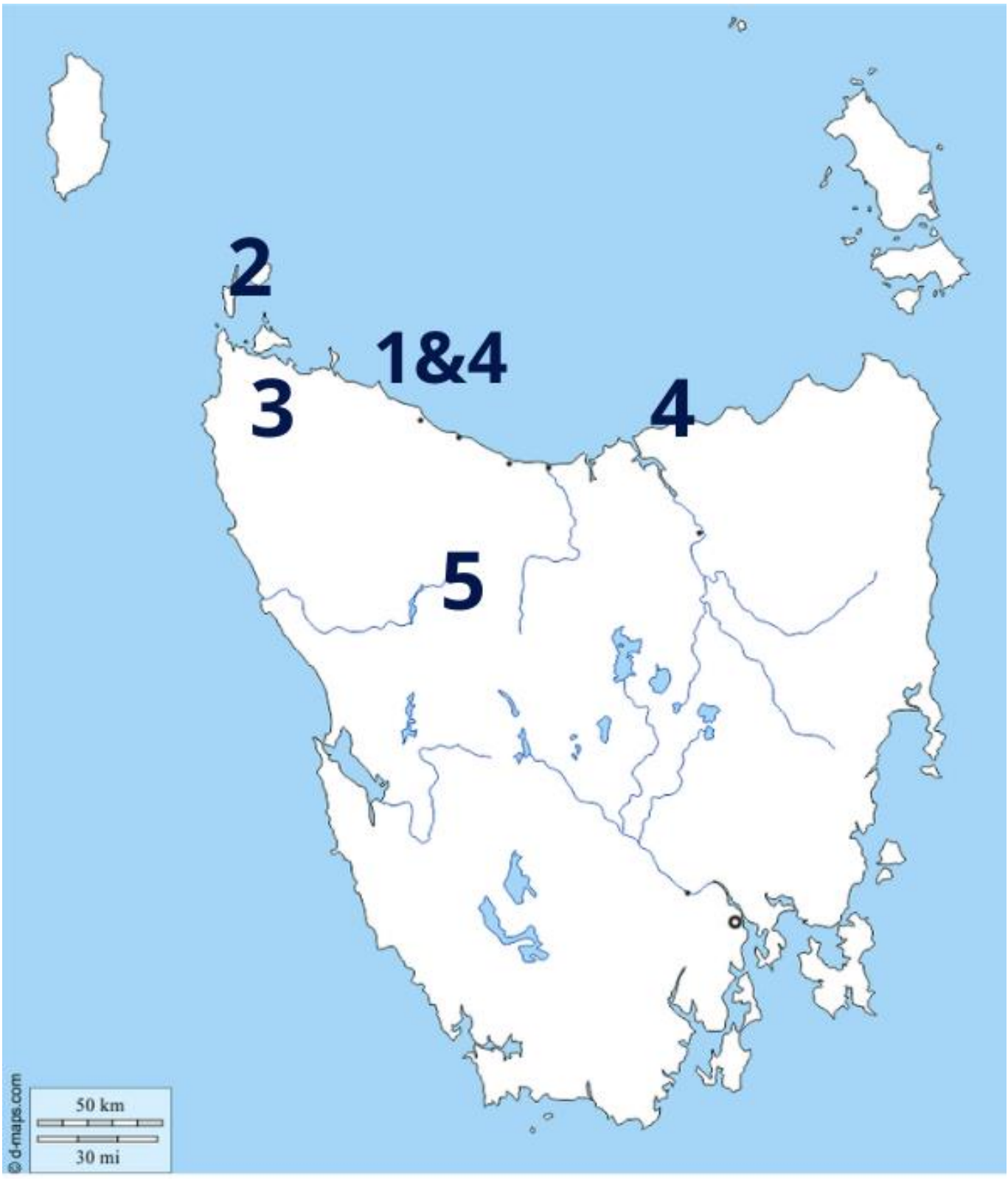
Tasmania's renewable energy sectors

The following are the key high investment projects in the Tasmanian Renewable Energy Action Plan slated for priority:

- Project Marinus (see page 18)
- Existing Hydro system augmentation and refurbishment, and potential pumped hydro development (see page 20)
- Robbins Island wind farm (see page 22)
- Jim's Plains wind farm and solar array (see page 24)
- Hydrogen production and export to align with government policy at Bell Bay and / or Burnie (see page 25).



Key Tasmanian Renewable Energy projects by location 2020-2027



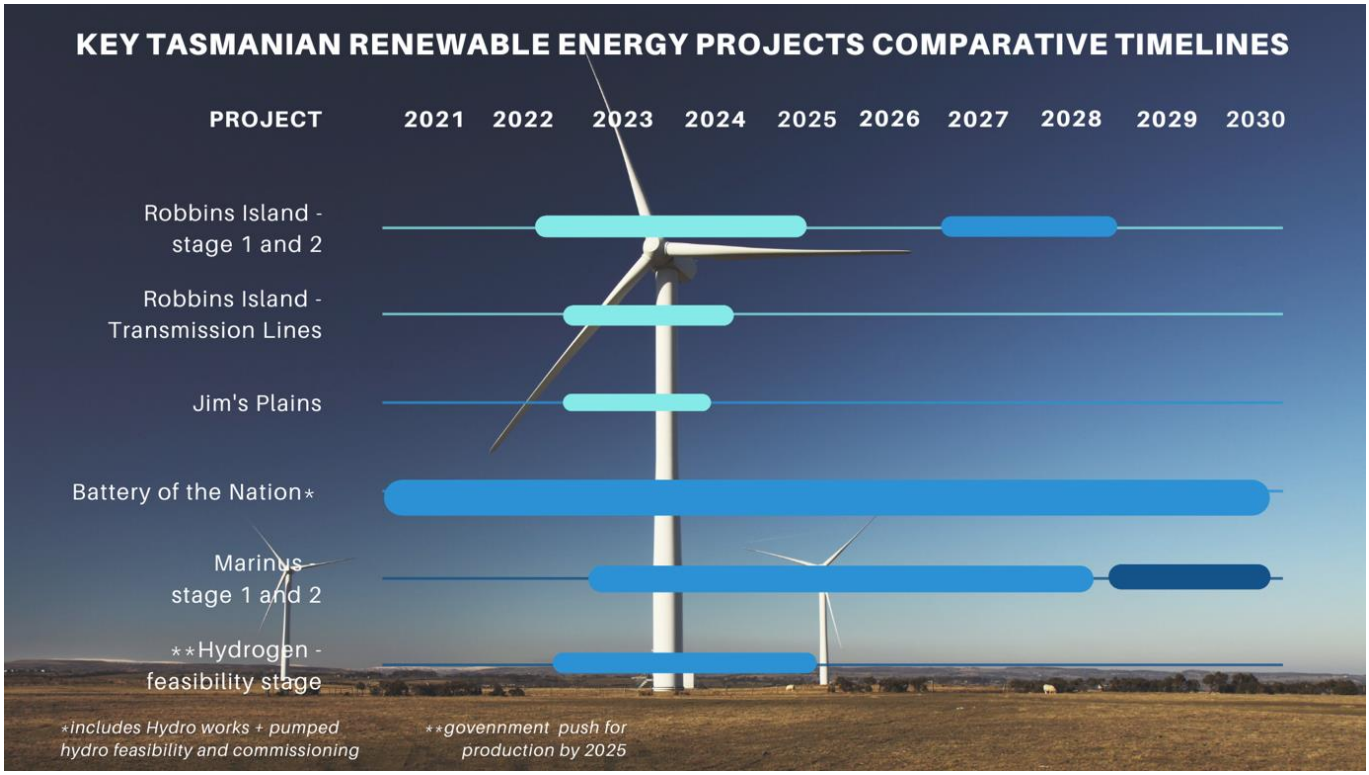
Project and location

1. Project Marinus – Burnie
2. Robbin Island Wind Farm
3. Jim's Plain Wind Farm and Solar Array
4. Proposed Hydrogen Production/Export-Burnie/Bell Bay
5. Pumped Hydro – Tribute, Lakes Cethana and Rowallan

Project timelines

These energy projects sit within a broader context of an infrastructure pipeline and interaction with civil and other construction projects is expected within the period 2020 – 2027.

A comparison of the current renewable energy project timelines is below.



Jobs peaks and troughs

The Civil sector reports[2] on the stop-go nature of infrastructure project works and the effect this has on employment and workforce development: addressing the expected peaks and troughs in each of the pipeline projects against any civil construction projects will need to be prioritised through:

- Workforce retention strategies
- Skills portability
- Sector collaboration.

Peak construction is noted as between 2022 and 2026, with the highest point of project activities overlapping in 2023/4. Keeping the pipeline of activity flowing as well as restoring demand for jobs will help support Tasmania's economic recovery from the COVID-19 crisis.

Slowing or increasing workforce supply will create overlapping challenges in the civil construction and renewable energy industries. With fluidity of targets and timelines, it will be important to slow or increase the workforce flow according to demand.

Standard workforce flexibility practices, sharing of workers across sectors and appropriate planning may be required to address potential issues arising out of the pipeline demands.

[2] Civil Construction Industry Workforce Plan, 2019 – 2025, Skills Tasmania

Recommendations

It is recommended that:

1. TEIWAC monitor progress with the workforce development plan and update relevant data or information as required, in particular as detailed project labour requirements are confirmed.
2. TEIWAC consider creating a collaboration mechanism that will allow all sectors within the renewable energy industry (hydro, wind, solar, hydrogen) and the broader infrastructure industry to potentially share workforce, training, and recruitment related resources.

Across education levels:

3. A plan be developed for identifying new talent, particularly to identify new trainers and educators for the renewable energy industry for all sectors.
4. A plan be developed to identify new and novel means to develop future talent. Taking into consideration the location of potential learners, their disbursement, travel and transit difficulties and more diverse modes of training facilitated within tertiary and vocational providers in partnership with enterprises.
5. TEIWAC to consider an audit of trainer capacity to determine sectoral needs and address gaps as an industry-wide approach.

School sector

6. Schools work with industry and TEIWAC to develop and promote pathways into renewables. Existing Department of Education programs and initiatives around the state, aimed at attracting and supporting new entrants into the industry, should be reviewed and adjusted to ensure they meet industry needs and then promoted.
7. Schools ensure a pathways plan, with a focus on industry exposure in project connected communities, be created and shared via an education network or renewable energy industry portal.

Vocational sector

8. A training guarantee be considered, with a requirement for all major projects to provide a minimum threshold of apprenticeship pathways.
9. Apprenticeship numbers be increased across all sectors to ensure that the industry is renewing, preparing for future demand, and providing adequate 'on the job' context for entrants into the industry.
10. Test the applicability of national training package pathways in civil infrastructure and electro technology – and if necessary, develop a state accredited solution.
11. Qualifications and skill sets be developed for hydrogen workers.
12. An industry specific skillset be created to meet the demands of the increased digital landscape. Include Cyber security, Digital Literacy, Data analysis, and Smart technology and automation.

Workplace

13. The Industry recognises the importance of both Hydro and TasNetwork's role in providing the 'stock' for the sectors growth and it is therefore recommended that skill sets required by the existing workforce be prioritised.
14. Higher apprenticeship programs for para-professionals be developed through university/ TAFE partnerships, particularly for engineering and electrical qualifications.
15. To develop and deliver a specific program of skills development for existing para-professionals. This program should cover digital technologies, quality assurance, onsite supervision, contract and project management.
16. Leadership and mentor programs should be implemented.

Tertiary sector

17. That UTAS consider the applicability of its engineering programs to the multi stream engineering technicians required by the renewable energy sector.
18. That UTAS consider subject 'modules' in renewables and sustainability for inclusion in humanities, finance, business and engineering.
19. That industry and UTAS work together to ensure a pipeline of suitably qualified managers and professionals to meet the future needs of the sector.

Community engagement

20. Provide business development and support activities for the renewable energy supply chain, particularly in advanced manufacturing. This includes support for local suppliers to engage with head contractors, particularly in regard to commercial and compliance obligations.
21. Establish community engagement and support programs with a focus on local/regional opportunities provided by the industry.
22. Augment existing or create a regional portal or communication hub with case studies/ stories / job opportunities / training information / industry benefits and attractiveness.

Supply chain

23. Establish a business case for Tasmanian assembly of manufactured components for the renewable industry.
24. TEIWAC consider the supply chain workforce requirements in its program of activities.

The renewable energy industry

Renewable energy has a major part to play in the transition to the 'low carbon economy'. Globally, energy supply is the highest greenhouse gas emitting sector and the urgent need to cut carbon emissions makes the development of renewable energy technology essential.

Investment in renewable energy also offers considerable capacity for generating employment opportunities, a key public policy concern in many countries. There is substantial employment potential associated with project development, construction, and installation for all renewable energy technologies.

Renewable energy jobs span numerous occupation groups and encompass a variety of career pathways. Many workers are involved in trades, while others perform essential administrative, technical, and sales functions. Thus, the industry creates an unusually diverse set of career routes to prospective workers.

The sector also looks promising because the job vacancies are not only in the usual engineering and research fields. Companies are now also hiring for construction, trades, administration and sales, law, finance, and recruitment – creating a pathway for more job opportunities for Tasmanians who seek employment in this rapidly growing energy sector. Additionally, job quality, industry diversity, career pathways and skills portability all have a role to play in ensuring the longer-term sustainability of the industry in Tasmania.

Factors which influence renewable energy employment[3]

- Technological advances and falling costs – lower costs = more deployments
- Industrial policies – access to credit, incentives, supplier capacity building
- Supply chains – changing geographic footprint and trade patterns
- New capacity – jobs in project planning, manufacturing, construction and installation
- Change in labour intensities – automation, economies of scale, learning effects
- Cumulative capacity – jobs in operations and maintenance
- Education and skill-training – mapping, monitoring, projecting, matching demand and supply

[3] Electricity Network Transformation Future Workforce Skilling Impacts, Energy Skills Queensland, 2017

The industry in Tasmania

The Tasmanian Government has a history of investing in infrastructure to boost the economy, and to drive employment in Tasmania. Extensive hydro and wind energy already exist, and more large-scale renewable energy expansion is pending, particularly with increasing private industry investment. Current projects under development and approval are being brought forward to support economic recovery in a post-COVID market.

As a part of the Tasmanian Renewable Energy Action Plan, the Tasmanian Government has set a target to deliver 100 per cent self-sufficiency in renewable energy generation by 2022 – with a 200 per cent target by 2040. It has also committed to delivering the lowest regulated electricity prices in the National Electricity Market by 2022.

According to the draft Tasmanian Renewable Energy Action Plan 2020, three priority areas are:

Priority 1 – Transforming Tasmania into a global renewable energy powerhouse

Priority 2 – Making energy work for the Tasmanian community

Priority 3 – Growing the economy and providing jobs.

The target of achieving 200 per cent renewable energy would position Tasmania as a global leader, doubling its output of renewable from around 10,500 GWh a year, to 21,000 GWh by 2040, with an interim target of 15,750 GWh per year, or 150 per cent renewables, by 2030.

Competitive advantage

Tasmania has an enviable renewable energy profile. 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 the renewable energy comes from wind, and the remainder from hydro-electric generation, which delivers base load and peaking electricity for Tasmania's major industrials, small businesses and households.

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. Tasmania can become a net exporter of electricity, which would support improved energy security and reliability, not only in Tasmania but also across the National Electricity Market (NEM). Tasmania's flexible hydro-electric generation may assist in balancing the intermittent nature of other renewable energy sources across the NEM.

The Interim Report released by the Tasmanian Energy Security Taskforce identifies a deficit of up to 1,000 gigawatt hours of average annual electricity generation for Tasmania to become a net exporter of electricity over the long term. Increasing the energy efficiency of our homes and businesses may reduce the draw-downs from Tasmania's hydro storages, further enhancing the potential for renewable energy generation to meet the State's electricity needs and improving our energy security.

The Council of Australian Governments (COAG) Energy Council has agreed to an independent review of national energy security and the reliability of the NEM, with advice on a coordinated, national reform blueprint.

Hydro Tasmania has hundreds of megawatts of latent capacity and ample opportunities to optimise their existing asset base and build highly cost competitive pumped hydro development. In particular, their existing and potential long duration (deep) storages allow them flexibility in optimising their assets and operations to best meet future market requirements.

Additional interconnection (across Bass Strait) would support expansion of Tasmania's existing hydropower system, through development of pumped hydro, providing the firming capacity that will be needed to support a future Australian energy market characterised by decreasing coal plant and increasing wind and solar[4]

Tasmania's location with prevailing westerly winds directly in the path of the 'roaring forties', as well as its 100 years of hydro development makes it a world class source of green energy.

[4] https://www.hydro.com.au/clean-energy/battery-of-the-nation/future-state

Access to an available workforce and well-established education and training systems provide a compelling support for investors.

Tasmania can take advantage of its' plentiful and low-cost electricity to contribute to the greening of Australia's energy, allowing it to power existing industries and attract new energy intensive ones looking for a competitive advantage.

New technologies and energy sources are available which enable Australian commodities to be produced without using fossil fuels, enabling Australia to address its' Paris climate commitments.

Renewable energy provides more reliable power supplies and energy diversification, which enhance energy security while reducing the need for imported fuels. Renewable energy also helps conserve the nation's natural resources, whilst Tasmania's current renewable energy sources of wind, solar, and hydro do not necessitate fuel costs or require transportation, and therefore offer greater price stability.

Additionally, opportunities to further expand on green-energy production through low-cost emission free hydrogen, powered by Tasmania's renewable energy, makes it attractive to countries looking to meet their own emission targets. Hydrogen has the potential to be a globally traded energy source, comparable to gas and oil.

Renewable energy projects

Tasmania is headed for unprecedented growth in the renewable energy industry. As a project of national significance, Marinus Link will provide a second 1,500 MW undersea interconnector to deliver renewable energy to the National Energy Market and help stabilise the grid.

Additionally, the Battery of the Nation, which seeks to utilise the state's advantage in pumped hydro storage, is intended to help free up the pipeline of energy transmission on the mainland.

Opportunities to develop a green hydrogen industry has led to the government's further investment of $50 million toward its green hydrogen goals over the next 10 years.

More renewable projects, predominantly wind, at various stages of planning, offer the potential to provide billions of dollars of regional investment, substantial construction, and ongoing employment. Projects that are likely to proceed within the timeframe of this Stage One report are described below.

Tasmanian energy project pipeline

Project Marinus

Marinus Link is a proposed 1,500 Megawatt capacity undersea electricity connection to link Tasmania and Victoria, as part of Australia's future electricity grid. The project, being undertaken by TasNetworks, is considering a new interconnector known as Marinus Link and its supporting transmission. Marinus Link will operate in addition to the existing privately-owned Basslink interconnector.

The project has received $20 Million in funding support from the Tasmanian Government through TasNetworks and $56 million from the Commonwealth Government through the Australian Renewable Energy Agency (ARENA)[5]

Changes to North West Tasmania's electricity network are proposed to unlock the State's renewable energy and storage resources and provide further connection with mainland Australia. These developments will deliver low-cost, reliable and clean energy for Tasmania and the broader National Electricity Market.

They are 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. [6]

The Marinus Link project is the enabler of the Tasmanian Renewable Energy Action Plan. It provides the infrastructure to achieve 200 per cent by 2040 Tasmanian Renewable Energy Target.

A 1500 MW Marinus Link will enable Tasmania to deliver:

1. At least 400 MW of latent hydro capacity
2. Up to 350 MW of repurposed hydro resources
3. At least 750 MW of pumped hydro development
4. Up to 2400 MW of world-class wind development.

In short it opens the path to market and has additional reported benefits:

- Unlocks renewable wind, solar and hydroelectric energy and storage
- Increases supply security and firms' renewables
- Harnesses diversity of load and generation
- Utilises modern, robust and flexible converter technology
- Complements other interconnection.

[5] Marinus Link, TasNetworks, 2018

[6] www.tasnetworks.com.au/poles-and-wires/planning-and-developments/marinus-link-and-north-west-transmission-upgrades (accessed 29/09/20)

There are broader economic benefits including[7]:

- An estimated $1.5 billion of direct economic stimulus to the Victorian economy and 1,400 direct and indirect jobs during peak construction[8]
- An estimated $1.4 billion of direct economic stimulus to the Tasmanian economy and 1,400 direct and indirect jobs during peak construction.[9]

The first 750 MW stage will be delivered in 2028, the second 750 MW stage in 2030 or 2032.

For the purposes of this report, the workforce modelling assumes that Project Marinus is delivered.

Marinus Link and Battery of the Nation will require the following jobs across all skill levels

TRADES

- Electrical
- Mechanical
- Builder
- Welder
- Carpenter
- Plumber
- Metal fabricator
- Fencing contractor
- Plant operator eg. Excavator driver
- Legal –construction specialists*

ENGINEERS

- Electrical -power systems and telecommunications
- Civil –road, foundations, trenching and buildings
- Geotechnical –siting and construction
- Mechanical –machine and equipment design, assembly and operation
- Chemical –soils analysis
- Hydropower specialists*
- Fluvial-geomorphologists
- Hydrologists and hydrographers
- Aquatic and terrestrial scientists
- Geologists
- Tunnelling*
- Dam engineers

OTHER PROJECT ROLES

- Project managers
- Procurement specialists
- Architects
- Surveyors
- Ecologists
- Land use planners
- Accountants
- Finance and asset managers
- Lawyers
- Safety and environment advisors
- Marine logistics & transport specialists
- Community engagement specialists
- Industrial relations specialists
- Commercial*
- Drafting/document control
- Mobilisation & industrial relations management
- HR recruitment specialists
- Detailed design/ constructability

SUPPORT SERVICES

- Education and training
- Accommodation
- Hospitality
- Food service
- Cleaning
- Medical services

[7] Project Marinus Overview, TasNetworks, 2020

[8] Job figures are estimated

[9] Job figures are estimated

The working timeline for Project Marinus is shown below[10]:

Figure 1: Current public version of timeline

Pumped hydro

Pumped-storage hydroelectricity (PSH), or pumped hydroelectric energy storage (PHES), is a type of hydroelectric energy storage used by electric power systems for load balancing. Pumped hydro energy involves storing water in an upper reservoir which has been pumped from a lower reservoir.

During periods of high electricity demand, power is generated by releasing the stored water through turbines. While during periods of low demand, the upper reservoir is recharged by using lower-cost electricity from the grid to pump the water back to the upper reservoir.

Although the losses of the pumping process make the plant a net consumer of energy overall, the system increases revenue by selling more electricity during periods of peak demand, when electricity prices are highest. If the upper lake collects significant rainfall or is fed by a river then the plant may be a net energy producer in the manner of a traditional hydroelectric plant.

Pumped-storage hydroelectricity allows energy from intermittent sources (such as wind) and other renewables to be saved for periods of higher demand.[11]

Under the Battery of the Nation initiative, Hydro Tasmania is currently undertaking feasibility on three potential pumped hydro sites - Lake Cethana, Lake Rowallan and Tribute power station on the West Coast.[12]

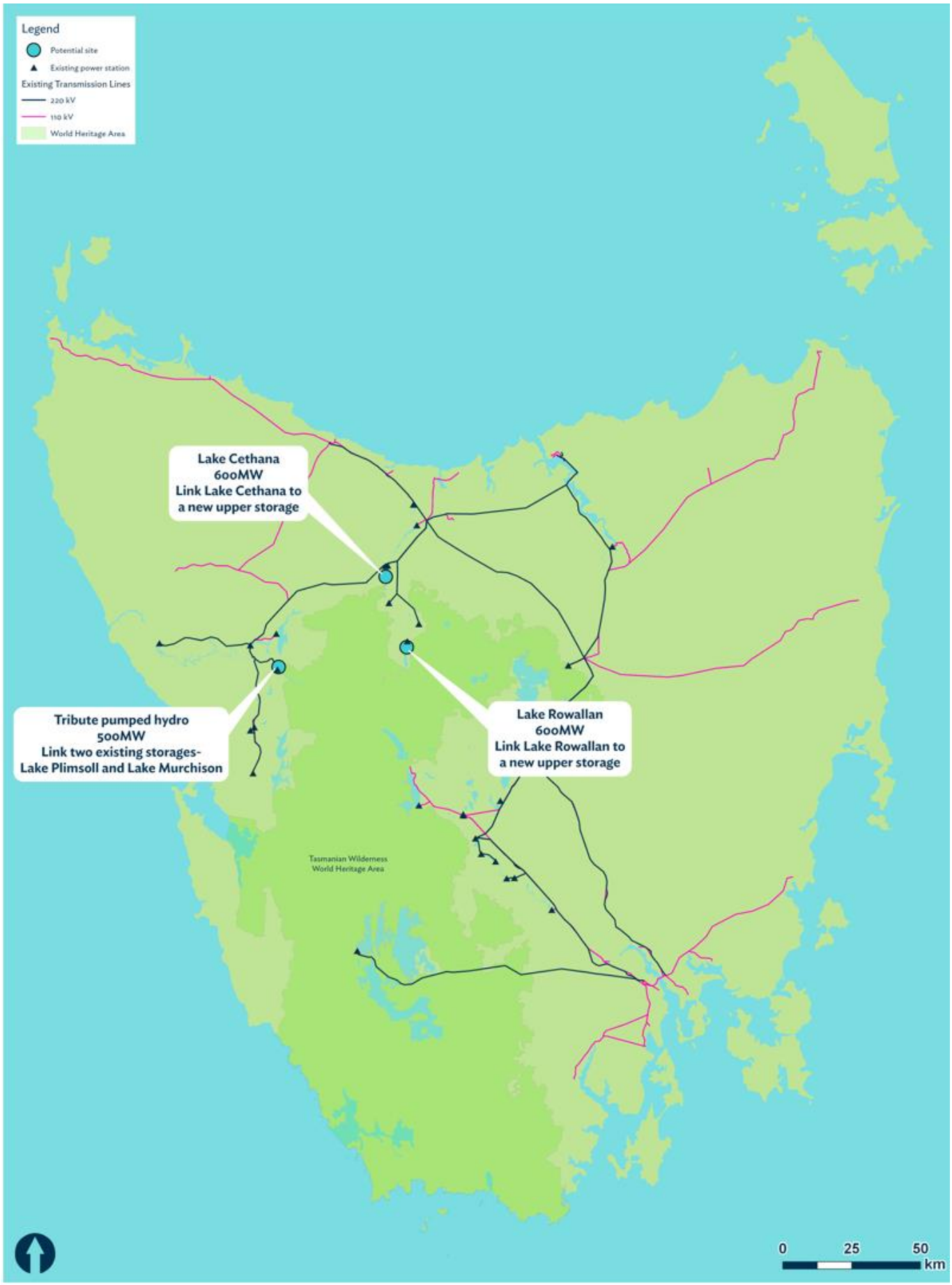
These feasibility studies will inform the selection of a preferred site to progress to full feasibility for consideration for development in line with the timing of the second Marinus cable.

[10] www.marinuslink.com.au/2019/02/project-timeline/

[11] www.energy.gov.au/government-priorities/energy-supply/pumped-hydro-and-snowy-20

[12] Battery of the Nation Analysis of the future national electricity market, Hydro Tasmania, 2018

Map of the three potential pumped hydro sites in Tasmania[13]



[13] www.hydro.com.au/clean-energy/battery-of-the-nation/pumped-hydro

Robbins Island Road to Hampshire transmission line overview

The transmission line component of this project is comprised of several different components, these being an underground cable from Robbins Island Bridge to the transmission station, and then from the transition station to the Robbins Island Renewable Energy Park connection.

The total transmission line network is comprised of the following:

- Approximately 10 km of 220 kV transmission line from the above transmission station to the Jim's Plain Renewable Energy Park substation
- Approximately 100 km of 220 kV transmission line from the Jim's Plain REP substation to a TasNetwork infrastructure at Hampshire
- The construction costs also include the associated telecommunications facilities, access tracks and ancillary infrastructure associated with the construction and operation of the transmission lines.[14]

Construction costs for the Robbins Passage to Hampshire Transmission Line have been made available by UPC\AC Renewables Australia and are estimated at $160 million. Construction is scheduled to commence in quarter 3 2022 and be completed by the end of 2024.

Breakdowns of these construction costs were not available, as such the following assumptions have been developed for the construction expenditure on the Robbins Passage to Hampshire Transmission Line:

- Transmission cabling costs (including cable, transformers etc.) – 20 per cent of capital expenditure
- Construction costs of the transmission lines – 80 per cent of capital expenditure.

Annually, total peak employment is estimated at 703 FTE employees within Tasmania during 2024, comprising of 266 direct FTE employees and 437 indirect FTE employees. Construction impacts are projected to result in an increase to Tasmania's employment by approximately 300 FTE employees in 2023 and approximately 700 FTE employees in 2024.

[14] EIA of Robbins Island and Jim's Plain Renewable Energy Parks, GHD Advisory, 2019

Wind: Robbins Island renewable energy park overview[15]

The Robbins Island Renewable Energy Park is a wind farm proposal that involves installing between 74 - 122 Wind Turbine Generators (WTG) on Robbins Island in north-west Tasmania, each with a generating capacity of between 4.5 MW – 12 MW, dependant on the final WTG model selected for the Project. The total power generating capacity of the Project will be up to 1,000 MW.

In addition to the WTGs, the Project includes the following major infrastructure components:

- Electrical infrastructure including multiple substations, a network of underground cables connecting the WTGs to the substations, overhead transmission lines from the substations to a transition station, and multiple transmission conduits through the bridge connecting the Project to mainland transmission infrastructure (forming a separate project)
- A network of roads across Robbins Island for construction and operational use. This will involve both the upgrade of existing tracks on the island and the construction of new roads. Roads will be of a width and grade suitable for accommodating large semi-trailers and oversized construction machinery. The project also includes the upgrade of Robbins Island Road on mainland Tasmania
- A bridge over Robbins Passage to enable vehicle access between Robbins Island and mainland Tasmania. This will be a piled structure with on ramps on either side of the passage to maintain the hydrodynamic regime and allow recreational boat access through the navigable sections of Robbins Passage
- A wharf with roll on/roll off facilities to avoid the use of the public road network for oversize WTG equipment and other materials and equipment delivery during the construction phase. The wharf will be located on the east coast of Robbins Island
- A maintenance and services facility, wash-down bays and meteorological masts.

Construction costs for the Robbins Island Renewable Energy Park have been made available by UPC\AC Renewables Australia. Construction is separated over two phases, with the first phase having capacity for 350MW's and then stage two bringing the total capacity of around 800MW's.

Construction costs estimates for these two stages are:

Stage 1 – total construction cost of $650 million

Stage 2 – total construction cost of $450 million

Construction of stage one is scheduled to commence mid to late 2022, with a construction period of three and a half years (construction completed by the end of 2025). Construction for stage two is subject to operations of Marinus Link and will need to align with this timing. Assuming the first stage of Marinus Link is operational by 2028, construction of Robbins Island could begin in 2027 with a total construction period of two years (construction completed by the end of 2028). A high-level breakdown of these construction costs by cost component have been provided by UPC\AC Renewables Australia.

The high-level breakdown of costs has been identified as:

- Wind turbine generator costs (including turbine components, shipping, port fees and handling, labour costs etc.) – 65 per cent of total capital expenditure
- Civil Balance of Plant (including roads, wharf, bridge, quarrying, cement, steel, fuel supply, labour etc.) – 20 per cent of total capital expenditure
- Electrical Balance of Plant (trenching, cable, transformers, labour etc.) – 15 per cent of capital expenditure.

[15] EIA of Robbins Island and Jim's Plain Renewable Energy Parks, GHD Advisory, 2019

Wind (and solar): Jim's Plain renewable energy park overview

The Jim's Plain Renewable Energy Park involves installing up to 31 WTGs capable of generating up to 200 MW and a solar array capable of generating up to 40 MW on Jim's Plain in north-west Tasmania. Each WTG would have a generating capacity of between 6 MW – 8 MW, dependent on the final model selected.

The WTGs and solar array will be micro-sited in the pre-construction phase. The total power generating capacity of the Project will be up to 240 MW.

In addition to the WTGs and solar array, the Project includes the following major ancillary infrastructure components:

- Electrical infrastructure, including a substation and network of underground cables connecting to the WTGs and solar array
- A network of roads across Jim's Plain for construction and operational use. This will involve upgrading existing tracks and constructing new roads. Roads will be of a width and grade suitable to accommodate semi-trailers and oversized construction machinery
- A maintenance and services facility, wash-down bay and meteorological masts.

Construction costs for the Jim's Plain Renewable Energy Park have been made available by UPC\AC Renewables Australia and are estimated at $300 million. Construction is scheduled to commence in quarter 4 2022, with a construction period of 24 months (construction completed by late - 2024).

A high-level breakdown of these construction costs by cost item have been provided by UPC\AC Renewables Australia, the high-level breakdown of costs was identified as being:

- Wind turbine generator costs (including turbine components, shipping, port fees and handling, labour costs etc.) – 75 per cent of total capital expenditure
- Civil balance of plant (including roads, cement, steel, fuel supply, labour etc.) – 10 per cent of total capital expenditure
- Electrical balance of plant (trenching, cable, transformers, labour etc.) – 15 per cent of capital expenditure.

Whilst the construction phase will occur between 2022 and 2024, the majority of the employment impacts is expected to occur in 2023, where 518 full time equivalent (FTE) employees will be supported.

Post construction, the total employment supported by the operational phase is estimated at a total of 38 FTE employees annually (15 directly and 23 indirectly) and for the remainder of the renewable energy park's life.

Hydrogen

Environmental concerns have led different industries to look for new energy sources. Hydrogen is a viable alternative as it is a very versatile and low emission fuel. Renewable or green hydrogen is produced through a process called electrolysis by splitting water molecules into hydrogen and oxygen. This process is powered by solar, wind, or hydro energy. Water electrolysis is an ideal method for energy production as it is powered by renewable energy to produce a zero-carbon source of hydrogen. Hydrogen production methods require proximity to different resources such as renewable energy resources, grid access and water for the process of electrolysis. Given the abundant land area and renewable resources, Australia is an ideal place for industrial scale production.

Proponents argue that Australia can establish itself as a key supplier of hydrogen as countries such as China, South Korea, Singapore, and Japan are relying on hydrogen as a cost-effective route to reducing emissions. Hydrogen can be mixed with natural gas as a way to lower greenhouse gas emissions for space heating, water heating and cooking. It can also be used as a biofuel in cars or stored in fuel cells as an alternative to batteries for electric cars which will require new skills in handling, storing, and using hydrogen.

Hydrogen can be safely added to the existing infrastructure and appliances at 10 per cent volume without making any changes to pipes or regulations. Some of the challenges regarding hydrogen include the transportation and storage of liquid hydrogen, hydrogen carriers, pipelines, and hydrogen terminals.

Tasmania is a highly attractive low-cost location for a large-scale renewable hydrogen production industry providing economic and environmental benefits.[16] The Tasmanian Office of the Coordinator General is actively working with a range of proponents to facilitate investment in renewable hydrogen production for both domestic use and export, with a focus on developing either the Bell Bay Advanced Manufacturing Zone or the port of Burnie as a hydrogen hub.

The potential scale and competitiveness of Tasmanian renewable hydrogen production, in industrial precincts with existing and adaptable deep-water ports, makes Tasmania ideally suited to be a significant exporter of renewable hydrogen to supply emerging global demand.

Tasmania has several key competitive advantages for the development of a renewable hydrogen sector:

- Highly cost-competitive and reliable hydropower and wind generation, reflecting the world-class nature of Tasmania's renewable energy resources, with close to three gigawatts of installed renewable energy capacity
- A very high renewable energy contribution (96 per cent in 2018), with Tasmania on track to meet its target to be self-sufficient in renewables by 2022, making it the first state or territory in Australia with 100 per cent renewable power generation. This is almost unique globally, and provides Tasmania with the capacity to develop a large-scale renewable hydrogen industry now
- Feasible and abundant further renewable energy development potential, including approximately eight gigawatts of wind and multi gigawatts of pumped hydro, which could support hydrogen production on a multi-gigawatt scale over the longer-term
- The combination of wind power and hydropower (and proposed future pumped-hydro schemes) that can provide a high electrolyser utilisation
- Tasmania has industrial precincts with available land and access to high quality infrastructure, notably the Bell Bay Advanced Manufacturing Zone which has existing and expandable port facilities, strong transmission infrastructure, and access to abundant fresh water

[16] Renewable Energy Country Attractiveness Index, Ernst Young, 2020

- Access to a highly skilled and innovative workforce, supporting Tasmania's renewable energy and major industries, and world-class educational and research institutions including the Blue Economy Cooperative Research Centre.
- The comparatively small geographic size of Tasmania (relative to mainland Australia) means hydrogen infrastructure investment can be minimised while reaching the majority of the population. For example, a relatively small number of hydrogen refuelling stations would be required as part of an initial roll-out.[17]

While supporting the development of a hydrogen export sector is a strategic priority for the Tasmanian Government, the creation of a domestic market for hydrogen in parallel is recognised to be equally important.

Tasmania is well placed to integrate renewable hydrogen into a range of domestic end-uses, including; blending of hydrogen into the existing hydrogen-compatible natural gas network, as a carbon-neutral feedstock in Tasmanian industries, and using hydrogen to support; fuel cell electric vehicles (e.g. light vehicles, buses and trucks), marine applications (e.g. passenger ferries), and remote power supplies (e.g. Bass Strait island power stations).[18]

A renewable hydrogen production facility in the range of around 10 to 100 MW could be a viable first-stage commercial scale facility at the Bell Bay Advanced Manufacturing Zone. This could be developed without transmission network augmentation and could be situated on a number of available industrial development sites in the Zone. It could be directly supplied with Tasmanian renewable energy (wind and hydro power), enabling high electrolyser utilisation and cost-competitive renewable hydrogen production.

A 100 MW renewable hydrogen production facility could contribute an estimated 100 to 150 jobs, mostly in regional areas. It could produce up to 14 000 tonnes of renewable hydrogen per year as either pure hydrogen or embedded within derivatives such as liquid hydrogen, ammonia or methanol. It would be likely to consume up to around 400 mega litres of water per year which could be sourced through existing infrastructure.

Such a facility could offer renewable hydrogen to the domestic market for end-uses such as transport (including road, rail and marine), injection to the local natural gas network, and industrial applications. Compressed hydrogen could be distributed from Bell Bay either by road or rail. The facility could also be scaled to meet emerging export demand.

Future expansion to a 1 000 MW renewable hydrogen production facility in the Bell Bay Advanced Manufacturing Zone is feasible with further infrastructure investment, and could produce up to 140,000 tonnes of hydrogen per year, representing nearly 15 per cent of the additional Australian hydrogen production estimated for 2030 in the "hydrogen: energy of the future" scenario analysis carried out under the National Hydrogen Strategy.

A 1000 MW facility could support around 2000 MW of renewable energy investment and contribute an estimated 1000 to 1200 jobs. Existing hydro power and planned pumped-hydro augmentation could back additional wind generation to continue to provide high electrolyser utilisation for competitively priced renewable hydrogen production.[19]

The COAG Hydrogen Council Working Group has recommended training and educational programs to both build the necessary skills for the hydrogen industry and build community understanding and support for hydrogen. With appropriate skills training and accreditation programs, the Australian Gas industry is poised to maximise growth opportunities in the hydrogen value chain. This enables an economically sustainable hydrogen sector, helping to address concerns around energy security and supply.[20]

Accredited training is not currently available in this area but is being proposed by the Gas and Construction Industry Reference Committees to the Australian Industry Skills Committee. The Master Plumbers ACT, Master Plumbers New Zealand and the National Electrical Contractors Association have also proposed the development of accredited courses to support the hydrogen workforce.

Given the nexus of water gas and electricity, a prerequisite upskilling course may be required for some trades. Potential exists to upskill gas fitters, plumbers and electricians with hydrogen specified skills. Current proposals include three levels of accreditation, together with an upskill course, for existing trades (see appendix).

It is recommended:

- That qualifications and skill sets be developed for hydrogen workers.

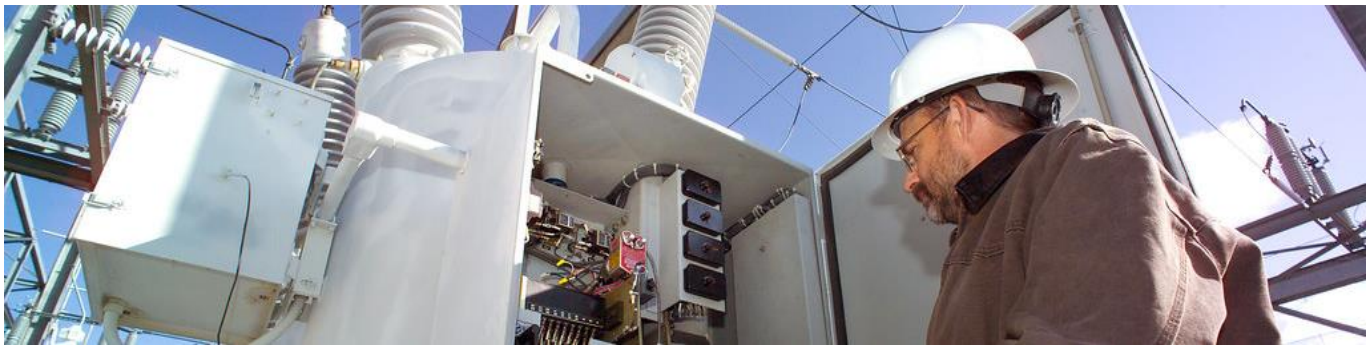
[17] Tasmania's Green Hydrogen Opportunity, Hydro Tasmania, 2019

[18] Tasmania Renewable Hydrogen Prospectus, Office of the Coordinator General, 2019

[19] Tasmania's Renewable Hydrogen Action Plan, Department of State Growth, 2020

[20] UEG Skills Forecast, Australian Industry Standards, 2020

The current workforce



Annual direct full time equivalent (FTE) employment in renewable energy activities in Australia was estimated at 26,850 jobs in 2018-19. This was an increase of 5,770 jobs in FTE employment (27 per cent) from the previous year (2017-18) and represents the highest level of FTE employment in renewable energy activities since 2011-12.

2018-19 overview[21]:

- 26,850 jobs
- 27 per cent increase from 2017-18
- 120 per cent increase over 10 years.

The increase of FTE employment in renewable energy activities between 2017-18 and 2018- 19 was driven by an increase in construction activity for roof-top solar photovoltaic (PV) systems (2,880 additional FTE jobs), large scale solar PV systems (1,600 additional FTE jobs) and wind farms (1,220 additional FTE jobs).

Solar energy accounted for over 75 per cent of this increase and the top three renewable energy types (roof-top solar, large scale solar and wind) contributed 99 per cent of the increase in FTE employment in renewable energy. The only renewable energy type to record a fall in employment between 2017-18 and 2018-19 was biomass (down by 70 FTE jobs, or 4 per cent).

The Australian Bureau of Statistics records 1,560 annual direct FTE positions in 2018-19[22] although it is recognised that the current workforce in Hydro and TasNetworks is larger than this (reported as a combined workforce of 2,241 at end of 2019). There is capacity for significantly growing this workforce in the period 2021 to 2027, specifically from the large blocks of activity scheduled via the pipeline renewable energy projects.

Much focus has been given to the number of jobs that renewable energy investment will create, however it is equally important to look at the quality of these jobs. Although information on this is limited, job quality is a critical aspect of any workforce.

“A well-paying job that requires well-honed skills and is performed in a safe, rewarding workplace is a greater multiplier of socio-economic benefits than one that pays little, carries few benefits, or is temporary.”[23]

Inclusivity and diversity also need to be considered, providing equal opportunities for people with different talents and skills and ensuring opportunities for pathways into and within the industry.

Additionally, because of its multi-disciplinary dimension, the renewable energy field appeals to women in ways that the fossil fuel industry does not. Globally, women currently represent 32 per cent of the renewable energy workforce, substantially higher than the 22 per cent average reported for the global oil and gas industry, and the 25 per cent currently experienced in the Australian renewable energy industry.

The global shift to renewables requires a broad range of skills – technical, business, administrative, financial and legal, among others. Access to a wider pool of talent, including women, will ensure a strong and energised workforce.

[21] Open NEM Tasmania, AEMO, 2020

[22] Employment in Renewable Energy Activities, Australia 2018-19, ABS Cat 4631.0 Table 8

[23] Renewable Energy Jobs and Skills in the Energy Transition June 2019

Supply chain

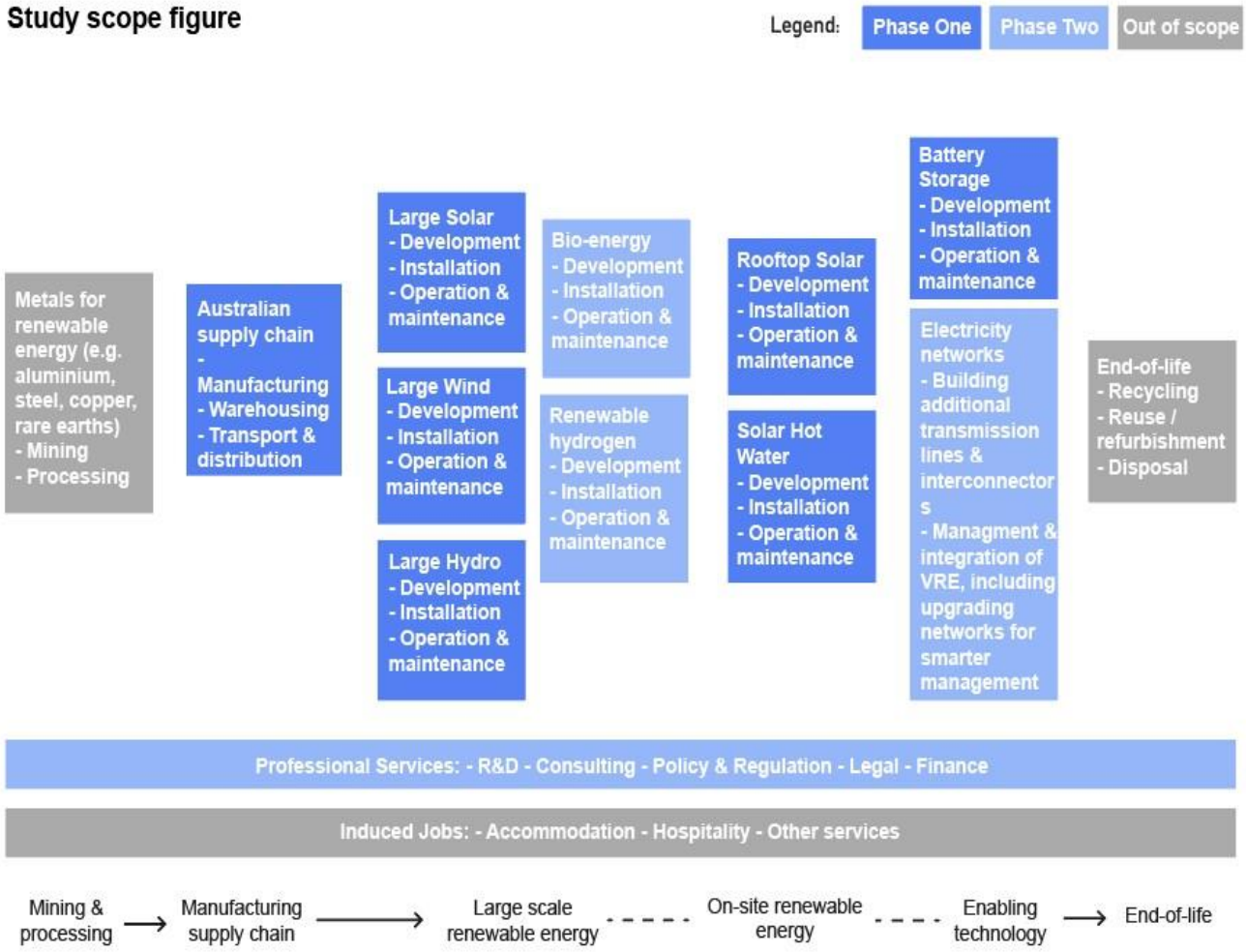
When considered in terms of its economic or workforce impact, renewable energy is often viewed within the context of its support chain which encompasses the manufacture of materials and components, construction, operations and maintenance through to decommissioning.

This supply chain approach is important to understanding and optimising the potential benefits of renewable energy to Tasmania. Quite simply, the greater the role Tasmanian industry has in the supply, manufacture, construction and operations of its renewable energy assets, the greater the workforce and economic impact.

To support the renewable energy industry and further embed supply chain benefits into the economy, it is recommended that:

- TEIWAC establish a business case for Tasmanian assembly of manufactured components for the renewable industry.

The Clean Energy Council has documented[24] this supply chain as follows:



The renewable energy sector has four major elements to its value chain: equipment manufacturing and distribution, project development, construction and installation, operations and maintenance. The occupations are varied and span different sectors of the supply chain.

[24] Renewal Energy Jobs Tasmania Profile, Clean Energy Council, 2020

This supply chain includes skills from the following Industry training packages:

- Agriculture, Horticulture and Conservation and Land Management
- Automotive Retail, Service and Repair
- Business Services
- Construction, Plumbing and Services
- Defence
- Chemical, Hydrocarbons and Refining
- Electro technology
- Electricity Supply Industry - Generation Sector
- Financial Services
- Forest and Wood Products
- Health
- Information and Communications Technology
- Local Government
- Manufacturing and Engineering
- Manufacturing
- Public Sector
- Public Safety
- Property Services
- Resources and Infrastructure Industry
- Retail Services
- Transport and Logistics
- Transmission, Distribution and Rail Sector

A further breakdown is included in the Appendix.

The occupations that make up the industry are widespread and require varied levels of skills. These are shown in the table below:

Table 2: Occupations in selected renewable energy sub-sectors by value chain[25]

Value chain	H = Highly Skilled M = Medium skilled (technical/ skilled crafts/supervisory) L = Lower skilled
Equipment Manufacture and Distribution (Wind energy)	• R&D Engineers (computer, electrical, environmental, mechanical, wind power design) (H) • Certifiers (H) • Manufacturing Engineers (H) • Logistics Professionals (H,M) • Manufacturing Quality Assurance Experts (H,M) • Sales Personnel (H,M) • Software Engineers (H,M) • Procurement Professionals (H,M) • Marketing Specialists (H,M) • Modellers (prototype testing) (H,M) • Industrial Mechanics (M) • Manufacturing Technicians (M) • Logistics Operators (L) • Equipment Transporters (L) • Manufacturing Operators (L)
Project Development (Solar energy)	• Project Designers (Engineers) (H) • Architects (H) (small projects) • Atmospheric Scientists and Meteorologists (H) • Environmental Consultant (H) • Resource Assessment Specialists and Site Evaluators (H) • Lawyers (H) • Debt Financier Representatives (H) • Public Relations Officer (H) • Land Development Advisor (H) • Land Use Negotiator (H) • Lobbyist (H) • Mediator (H) • Resource Assessment Specialists (H) • Environmental and Social NGO Representatives (H,M) • Developers/Facilitators (H,M) • Procurement Professionals (H,M)
Construction and Installation (Hydropower)	• Engineers (civil, mechanical, electrical) (H) • Project Managers (H) • Business Developers (H) • Commissioning Engineer (Electrical) (H) • Skilled Construction Workers (Heavy Machinery Operators, Welders, Pipefitters etc.), (M) • Construction Labourers (L) • Transportation Workers (L)
Biomass production (Bioenergy)	• Agricultural Scientists (H) • Biomass Production Managers (H,M) • Plant Breeders & Foresters (H,M) • Agricultural / Forestry Workers (L) • Transportation workers (L)
Cross-cutting/ Enabling Activities (all sub-sectors)	• Human Resources Professionals (H) • Other Financial Professionals (Accountants, Auditors and Financers) (H) • Educators & Trainers (H) • Health and Safety consultants (H,M) • Sales and Marketing Specialists (H,M) • Policy Makers and Government Office Workers (H,M) • Publishers and Science Writers (H,M) • Insurer Representatives (H,M) • IT Professionals (H,M) • Trade Association and Professional Society Staff (H,M,L) • Client relations (H,M,L) • Management (H,M,L) • Administration (H,M,L)

[25] www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/publication/wcms_168354.pdf

Current labour and skill supply in the state

The bulk of current workforce in Tasmania rests with two employers: Hydro Tasmania, the Government Business Enterprise responsible for hydro energy production; and TasNetworks the state-owned company responsible for electricity transmission and distribution throughout Tasmania.

Together with private sector developers, state education institutions, engineering bodies, and the construction industry, they form the primary stakeholders in the renewable energy industry. Their perspectives, experience and advice are noted below.

Hydro Tasmania

Hydro Tasmania is the largest producer of clean energy in Australia and at end of financial year 2019 employed 1,236 people (full time equivalent)[26]. As such their experience with renewable energy projects is vital. Their workforce focus remains on building talent and communities; using as much Tasmanian talent as possible to maximise local outcomes. This focus is not without risks as locals may not have the necessary skills, time to build the skills may be limited, costs may be higher, and data on local skills is not easily accessible. An audit on skills is required to ensure workforce decisions can be made that support projects at a regional level.

From a Hydro perspective, although materials and skills are different at each new facility, all the pipeline projects are inter-connected. Workforce mobility is becoming increasingly important, with business seeking to implement labour saving and collaboration enabling policies, as well as technological advances.

Although the pipeline projects will require predominantly field-based trade related skills, the leadership skills of the workforce are taking on greater focus. Agile leadership, balancing strategic and operational capability, new operating and technical challenges, growth mindset, critical thinking and problem solving have been identified as areas of future need.

TasNetworks

TasNetworks owns, operates and maintains the electricity transmission and distribution network in Tasmania and at end of financial year 2019 employed 1,005 people (full time equivalent)[27]. As such, their workforce demands remain focussed on electrical and trades skills. Comprehensive internal training already exists, with strong structures around recruitment and training. Current recruitment is done for specific numbers only and does not take into account attrition. New positions are made available to cover those who are retiring. Recruitment is an annual activity.

Training and recruitment are considered necessary but expensive activities and require adequate lead time. The current process of 'replace and renew' is based on meeting current workforce demand, and on-the-job training is the preferred model. The use of a traditional apprenticeships model ensures a strong and viable workforce, with huge interest in annual apprenticeship positions. From January 2021, TasNetworks will be training over 60 apprentices, mostly directly employed by TasNetworks and some externally employed within the industry. Government funding is necessary for meeting workforce needs and future funding remains vital to ensuring workforce inflow continues.

Concerns exist with the current electrical qualifications: the qualification is considered to be too long, with a high level of time and commitment required for completion. Additionally, it is reported that there is protectionism around the qualification and a requisite dated training model.

The qualification is seen as inflexible and does not meet local industry needs. Training needs to be customisable: there is potential to look at basic electrical skills, with potential cross-sector application, plus on the job training as a model to address real needs and to achieve better training outcomes and accelerating through training and/or upskilling basic electrical skills. The dis-satisfaction with the National Training Package qualifications is also noted in the Civil Construction Industry Workforce Plan.[28]

Finding and retaining suitable trainers remains a challenge and will take on greater emphasis if there is any further increase in workforce numbers. Quality of outsourced training also remains variable, with line-worker qualifications being a primary concern. Trainer capacity and capability will need to be monitored.

The confluence of a range of pipeline projects will likely create a bottleneck for key occupations such as electricians. TasNetworks is seeking cross sector collaboration, with consideration for working together on pooling resources and

[26] www.hydro.com.au/docs/default-source/about-us/our-governance/annual-reports/hydro-tasmania-annual-report-2019.pdf?sfvrsn=ca319a28_0

[27] www.tasnetworks.com.au/config/getattachment/339f8530-2a2b-454c-a535-26e8bb3b2c4c/TasNetworks-Annual-Report-2018-19.pdf

[28] Civil Construction Industry Workforce Plan, CCF Tasmania, 2019

developing specialist skills. An opportunity exists to look at core skills in renewable energy that cut across solar, wind and hydro to address the entire industry.

The industry recognises the importance of both Hydro and TasNetwork's role in providing the 'stock' for the sector's growth and it is therefore recommended that:

- Apprenticeship numbers be increased across all sectors to ensure that the industry is renewing, preparing for future demand, and providing adequate 'on the job' context for entrants into the industry.
- TEIWAC test the applicability of national training package pathways in civil infrastructure and electro technology – and if necessary, develop a state accredited solution.
- Skill sets required by the existing workforce be prioritised.

UPC\AC Renewables

UPC\AC Renewables develop utility scale renewable energy projects throughout Australia, with current projects underway in Tasmania's North West.

UPC\AC has a strong focus on building talent internally, with a commitment to local, community, and workforce engagement. Commercially, UPC\AC seeks to include as much local workforce as possible, however they will likely need to seek expertise externally for installation work planned in Tasmania.

With current and pipeline projects in mind, they are looking to maximise local outcomes, with possible inter-regional workforce exchanges being considered due to skills and knowledge similarities across projects. Skills portability is being explored particularly with more field-based work being generated with the pipeline projects.

Challenges to be considered for their projects exist around the time needed for upskilling any workforce. Pipeline project timelines will need to be solidified to allow planning for workforce skilling opportunities.

From UPC\ACs perspective, opportunities to value add to the UPC projects through local material and assembly arrangements could be explored, as they are open to expanding their local support.

It is therefore recommended that:

- TEIWAC establish a business case for Tasmanian assembly of manufactured components for the renewable industry.
- The Government provide business development and support activities for the renewable energy supply chain, particularly in advanced manufacturing. This includes support for local suppliers to engage with head contractors, particularly in regard to commercial and compliance obligations.
- Government and TEIWAC establish community engagement and support programs with a focus on local/regional opportunities provided by the industry.
- TEIWAC augment an existing or create a regional portal or communication hub with case studies/ stories / job opportunities / training information / industry benefits and attractiveness.

Education and training institutions

The Tasmanian Department of Education is developing a future focussed curriculum in Years 9 to 12. Work is being done on mapping and renewing curriculum with current economic priorities and developing packages of learning accordingly. The focus is on looking at jobs into the future, building on quality through industry and community connections and work placements, and ensuring actual demand for jobs to continue. Close tracking of demand and availability will be ongoing.

Attention is currently on school based apprenticeships and strengthening pathways and connection to new industries. The renewable energy industry and its associated sectors will be a priority.

The Department of Education is looking at pathways connected to the renewable energy industry, including Construction, Electrotechnology, Renewable Energy, and Engineering and Advanced Manufacturing, with several related programs underway around the state. Work-based opportunities are included in the programs.

It is therefore recommended that:

- Schools work with industry and TEIWAC to develop and promote pathways into renewables. Existing Department of Education programs around the state, aimed at attracting and supporting new entrants into the industry, should be reviewed and adjusted to ensure they meet industry needs and then promoted.
- Schools ensure a pre vocational pathways plan, with a focus on industry exposure in project connected communities, be created and shared via an education network or renewable energy industry portal.

A need has been identified for TAFE responsiveness to be ongoing, with TasTAFE currently developing qualifications for students to work in the hydrogen sector, with further support anticipated through the proposed Trades and Water Centre of Excellence facility.

A difficulty finding trainers for the industry has been identified by the Department, with a lack of willingness to move from current field roles into a training role, and challenges with the requirement for Training and Assessment qualifications identified as the main challenges. The Department has recognised the necessity of building the trainer workforce if the renewable energy workforce is to increase. Concerns have been raised that pipeline project work will mean trainers going back to tools.

Teamwork, communication, problem-solving, and technology skills have been identified as workforce skills in demand. Additionally, the Department is looking at project management as a vital skill set for the pipeline projects, however, much of this has an on- the-job experience element that is required.

Across all sectors of education, it is recommended that:

- A plan be developed for identifying new talent, particularly to identify new trainers and educators for the renewable energy industry for all sectors.
- A plan be developed to identify new and novel means to develop future talent. Taking into consideration the location of potential learners, their disbursement, travel and transit difficulties and more diverse modes of training facilitated within tertiary and vocational providers in partnership with enterprises.
- TEIWAC to consider an audit of trainer capacity to determine sectoral needs and address gaps as an industry-wide approach.

University of Tasmania (UTAS) and University College

It is acknowledged that specialist and management level skills are supported by a range of tertiary providers and international vendors. However, the focus of this report is Tasmanian and thus the narrative focuses on UTAS and the University College.

The University of Tasmania currently has a range of industry focussed programs. Current offerings include a course for upskilling existing engineers and a Masters in Renewable Energy, presently going through the approval process. UTAS is exploring increased opportunities for students with pathways into the current projects and targeting thematic areas around transport, mechanics, renewable energy, and electricity. UTAS is also focusing on training pathways, collaborating with industry to ensure jobs and training connections. It is keen to support the industry with specific education demand and have identified an opportunity to expand renewable energy subjects into humanities, finance, business, and management to create more pathways.

The university, through its' Centre for Renewable Energy and Power Systems, is simultaneously working on research opportunities and collaborating in areas around electrical power, specifically around engineering, as well as investing in small scale hydrogen areas, marine renewable energy, and tidal and wave technology.

UTAS, in conjunction with University College, is keen to assist the renewable energy industry with support in terms of either short form credentialed offerings (to upskill), or Diploma (AQF 5) pathways into further development. University College consider that it is important to develop people to ensure that they can 'pivot' across industries with transferable skills and capabilities to maximise work opportunity for individuals due to the nature of these type of projects.

The University College currently has offerings that would have direct industry relevance, including:

- Diploma of Construction Management (AQF5)
- Associate Degree Applied Technologies
- Undergraduate Certificate in Applied Technologies
- Associate Degree Equipment Design and Technology
- Undergraduate Certificate in Equipment Design and Project Management.

The above are 'technical' offerings in nature but University College also has a range of other Associate Degrees (with Diploma exits) that would be directly relevant to the sector, including business with specialisation streams into supply chain management as well as project management.

Potential capacity gaps at the professional and management level roles required for the projects may exist beyond what is offered at the VET level of education. Collaboration between UTAS and industry to monitor future higher education needs is suggested.

It is recommended that:

- Higher apprenticeship programs for para-professionals be supported, particularly for engineering, electrical, advanced manufacturing qualifications.
- That UTAS consider the applicability of its engineering programs to the multi stream engineering technicians required by the renewable energy sector.
- That UTAS consider subject 'modules' in renewables and sustainability for inclusion in humanities, finance, business and engineering.
- That industry and UTAS work together to ensure a pipeline of suitably qualified managers and professionals to meet the future needs of the sector.

Engineering in Tasmania

From an engineering perspective, the various sectors in renewable energy are already 'technically' integrated, however recognise that a collaborative approach to industry development through representative bodies and organisations working on commonalities and challenges would be beneficial for the future of the renewable energy industry.

At present, technicians and draftsmen are needed in engineering, with a practical training ground for engineers coming into the industry essential to ensuring quality in the workforce. There is an opportunity to use the pipeline projects for upskilling existing engineers and as training ground for new workers. Key shortfalls in paraprofessionals due to constant outsourcing, reduced investment in training, availability of pathway positions, and a need to invest in training at this level are central to workforce concerns.

Scholarships and apprenticeships to build the workforce, with trainee engineers are recommended. Sponsorship of newly trained individuals should be explored to allow work across the sectors, with collaboration from all the sectors required.

Civil construction

From a civil construction perspective, the workforce is based on current workload and infrastructure projects, the workforce responds to immediate need but has limited capacity to grow quickly should demand suddenly intensify. Infrastructure pipeline project information is required to allow time for planning of workforce and training needs. The stop-go nature of projects and delays in the release of work negatively impacts workforce planning. Additionally, issues arise when workforce capacity is limited by competition for construction and civil workers across multiple projects and building workforce requires lead time.

Skills gaps currently appear at the plant operator, paraprofessional and project management levels. There are gaps in experience which require significant on the job training. Current issues with training are around finding suitable mentors to support the upskilling of existing workers and the mentoring of new entrants.

In the short term, there may be need for short courses to address compliance related issues, and a need for funding to meet these needs.

This issue was identified across all stakeholders and it is therefore recommended:

- That leadership and mentor programs be implemented
- To develop and deliver a specific program of skills development for existing para-professionals. This program should cover digital technologies, quality assurance, onsite supervision, contract and project management.

Enrolment data

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.

Enrolment numbers may not show direct connections to employment pathways into the renewable energy industry, however, the numbers will indicate broad interest in related educational fields, as well as the potential for education to feed into the industry.

As previously noted, planned renewable energy projects will require an increase in apprentice, paraprofessional and managerial roles.

Matching the supply and demand of skills to the market will be essential to the industry. Tracking as well as sourcing relevant data directly from the various educational organisations will be important.

The UTAS enrolment data (see Table 3) reflect generally on the increasing demand in the domains of IT, Engineering, and Managerial and Commerce. Potential to increase enrolments for in demand renewable energy occupational areas around managerial roles and paraprofessionals with UTAS offerings, (as mentioned in the section on 'Current labour and skill supply in the State') – UTAS and University College will need to be monitored.

Table 3: Tertiary data for Tasmania by broad field of education, 2011-18[29]

Year	Institution	Natural and Physical Sciences	Information Technology	Engineering and Related Technologies	Architecture and Building	Agriculture, Environmental and Related Studies	Management and Commerce	Mixed Field Programs	Non-award courses	Total	All Student Enrolments
2011	University of Tasmania	1,786	1,649	1,528	511	415	4,531	647	104	11,171	23,944
2012	University of Tasmania	1,978	1,642	1,430	560	447	4,261	616	0	10,934	25,367
2013	University of Tasmania	1,976	1,485	1,498	529	470	4,660	844	0	11,462	26,783
2014	University of Tasmania	1,995	1,353	1,683	451	453	4,316	859	10	11,120	29,232
2015	University of Tasmania	1,943	1,341	1,736	409	478	5,898	602	57	12,464	32,149
2016	University of Tasmania	1,536	343	1,089	231	291	2,625	1,063	0	7,178	29,091
2017	University of Tasmania	1,533	360	987	192	392	1,852	827	0	6,143	31,161
2018	University of Tasmania	2,127	1,864	1,572	321	925	4,895	757	66	12,527	36,194
Total		**14,874**	**10,037**	**11,523**	**3,204**	**3,871**	**33,038**	**6,215**	**237**	**82,999**	**233,921**

* 2019 data not available.

[29] www.education.gov.au/higher-education-statistics

Workforce skills drivers affecting the wider workforce group around digital literacy, cyber security, data analysis, smart technology and automation are increasing, as well as desired skills in leadership and project management (see section on 'In demand skills and occupations'). Prioritising these skills and feeding enrolments, both at university and VET level, into these areas would be beneficial.

The currently available data lacks the required granularity to distinguish renewable energy jobs directly aligned with qualifications but enrolment data can be understood from broad fields of work. The data does provide indications of interests in fields related to renewable energy and provides the benchmark to develop skills required by the renewable and broader infrastructure industry (see Table 4).

The vocational sector supports the infrastructure industry more broadly through a range of offerings across the following areas of study:

Table 4: VET enrolment numbers in the major study areas relevant to the industry

Qualification Area	2017	2018	2019
Administration	431	323	277
Work health and safety	183	161	228
Project management practice	254	277	245
Leadership and management	1044	1122	1239
Diploma of human resources management	53	27	32
Construction pathways	13		141
Concreting	13	12	23
Building and construction (building)	73	50	63
Accounting	36	29	38
Trade engineering - mechanical trade	244	147	183
Trade engineering - fabrication trade	298	350	411
Plant operations	176	238	114
Driving operations	156	114	264
Total	2,974	2,850	3,258

A full breakdown of qualifications and their associated national codes is included in the appendix.

Nationally recognised training for electricians is delivered under the UEE – Electrotechnology Training Package. Australian Industry Standards (AIS), the Skills Service Organisation responsible for this training package recognises the increasing expectation that a digitally literate workforce has implications for electrotechnology skills. Updates to the electrotechnology training package reflect these emerging skills, with minor upgrades to the training package occurring regularly, however, the current training package was last endorsed in 2011/2012.

Current data shows that enrolments at Certificate III (trade) level in Tasmania are strong, with numbers in all other electrotechnology qualifications remaining negligible. This disparity needs attention given evidence of current skill shortages and forecast demand provided in this report.

Funding for the UEE30811 qualification has been available through the Skills Tasmania User Choice program for apprentices and trainees since 2016, hence the significantly larger number of enrolments in this qualification. Ongoing funding and apprentice enrolment numbers will remain a factor in continuing to support apprentices into the industry, particularly as these have been identified as an area of future demand.

The vocational sector also supports the energy sector specifically by direct enrolments in the electrical qualifications.

Table 5: VET enrolment numbers in the electricity qualifications relevant to the industry 2017-2019

Qualification Code	Qualification Title	2017	2018	2019
UEE30611	CERTIFICATE III IN ELECTRICAL MACHINE REPAIR	0	1	4
UEE30811	CERTIFICATE III IN ELECTROTECHNOLOGY ELECTRICIAN	585	592	587
UEE33011	CERTIFICATE III IN ELECTRICAL FITTING	0	0	3
UEE40411	CERTIFICATE IV IN ELECTRICAL - INSTRUMENTATION	0	1	2
UEE42011	CERTIFICATE IV IN ELECTRICAL - PHOTOVOLTAIC SYSTEMS	1	0	0
UEE42611	CERTIFICATE IV IN HAZARDOUS AREAS - ELECTRICAL	1	0	0
UEE50211	DIPLOMA OF ELECTRICAL AND INSTRUMENTATION	0	0	4
UEP30112	CERTIFICATE III IN ESI GENERATION - SYSTEMS OPERATIONS	11	0	0
UEP30212	CERTIFICATE III IN ESI GENERATION - OPERATIONS	0	4	6
UEP40212	CERTIFICATE IV IN ESI GENERATION - OPERATIONS	11	9	0
UET50212	DIPLOMA OF ESI - POWER SYSTEMS	9	8	0
UET60212	ADVANCED DIPLOMA OF ESI - POWER SYSTEMS	0	1	0
	Total	623	621	606

Funding and support

According to the Premiers Economic and Social Recovery Advisory Council (PESRAC), 'Young people have also been particularly hard hit by the job losses. While total employment in Tasmania fell by 7.4 per cent from March to May, nearly one-in-five Tasmanians aged 15-24 lost their employment. New apprenticeships have dropped dramatically in most sectors. Appropriate courses and training pathways will be critical in supporting young people to find jobs in a shrinking and competitive labour market'[30].

It is therefore recommended that:

- A training guarantee be considered, with a requirement for all major projects to provide a minimum threshold of apprenticeship pathways.

Training, funding, and work opportunities, particularly for young Tasmanians, will be a focus of any economic stimulus planned in Tasmania. In line with this, Skills Tasmania is preparing a rollout of the Energising Tasmania skills and training initiative, with plans to deliver $16.1 million skills and training to boost Tasmania's renewable energy sector. '*Energising Tasmania* will provide a Tasmanian workforce better equipped with the skills necessary to build Tasmania's capability in priority areas needed to support the continued growth of Tasmania's renewable energy sector.' [31]

[30] Premiers Economic and Social Recovery Advisory Council (PESRAC) Interim Report July 2020

[31] The Draft Tasmanian Renewable Energy Action Plan 2020 22

Managed by Skills Tasmania, Energising Tasmania will provide training in major energy development related priority skills needs areas such as engineering, project management, civil construction and trades.

Key elements of the program include[32]:

1. a new training grants fund to deliver up to 2500 fully subsidised training places in areas of identified skills need and provide up to $1000 per learner to assist with non-tuition fee costs, such as training materials
2. 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
3. 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
4. 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.[33]

Skills and occupations in demand

Key factors driving change in the energy industry are the automation and digitalisation of the industry, as well as grid decentralisation.

Automation and digitalisation are transforming the industry

The widespread implementation of digital and automatic systems has had a significant impact on the industry. The adoption of automated systems, data collection, and application of data analytics have enabled better energy availability, remote operation and monitoring, predictive maintenance, and reduced operational costs.

These smart technologies and systems are beneficial and will present both challenges and opportunities for the industry. They can enable the harmonious integration of different generation sources into the electricity grid. As these new technologies become more common, upskilling the current and future workforce will be essential to meet new skill demands.

The grid is being decentralised

Digitalisation and innovative technologies, such as home-based solar panels, have changed the electricity grid from its traditionally centralised structure to be more decentralised, which includes 'prosumers' (consumers of electricity who are producers as well).

These innovations will require the workforce to upskill to respond to changes. More workers will be required to work from remote operating centres to monitor and review demand in real-time and analyse and interpret data that is generated from home-based batteries and VPPs. Training in battery storage safety procedures is critical for current and future workforce skill needs.

[32] https://www.skills.tas.gov.au/about/current_projects/energising_tasmania (accessed 19/10/20)

[33] The Draft Tasmanian Renewable Energy Action Plan 2020 22

Digital literacy is essential

Digital transformation is completely revamping every aspect of life and the workforce. New technologies and devices are widely used in the workplace, creating digitally enabled environments that affect numerous occupations. Digital literacy and Information Communication Technology (ICT) skills are required to respond and adapt to the fast pace of implementation of these technologies. Digital literacy is defined as having practical skills in using technology to access, manage, manipulate, and create information as well as the skills to critically analyse, interpret and apply the information to relevant situations. Digital literacy also encompasses more technical skills in programming and coding, data analytics, technology design, system analysis, and presenting and managing content on the web to develop applications and manage networks.

Traditional technical roles such as engineering and electrical will be where the greatest change will appear, with skills gaps needing to be addressed. Further data and ICT specialist information will be critical to ensuring that the industry retains its' technical advantages.

Data is the driver of improved customer service which is offered through digital platforms. Data specialists can provide organisations with insights into consumer behaviour. Organisations can use the data and insights that have been sourced from digital services and platforms to tailor consumer relationship processes. Consumers are also increasingly demanding digitalised services, allowing them to directly communicate with service providers via smart devices and social media channels. The design and build of these digitalised service systems and their usability for consumers will be critical to attract and retain consumers.

Industry specific cyber security is required

The growing pace of new innovations and technologies is accompanied with increasing exposure to cyber security threats. Cyber-attacks are a common risk to many industries including the energy sector.

Awareness of the nature of cyber security threats and skills to detect, report and resolve the issues remain a challenge.

Cyber security specialists have been identified as one of the most critical roles for the future. The electricity grid has become more dependent on digitally connected information systems which require highly trained workers with the skills to protect not only consumers' personal information but also grid infrastructure. Investing in skills and capabilities through educational programs is key to understanding cyber security and being protected from cyber threats.

It is therefore recommended that:

- An industry specific skillset be created to meet the demands of the increased digital landscape. Include cyber security, digital literacy, data analysis, and smart technology and automation.

Leadership, mentoring and project management skills are in demand

With a need for greater technical experience also comes current industry-wide skills that should be addressed. Organisations need a structured approach to plan, organise, control and manage their resources and internal capabilities to deliver timely results. Project managers with sound project skills, are necessary to tackle both small and large projects. The inter-disciplinary nature of the work and the varying levels of complexity of projects necessitates careful planning to ensure future leaders are nurtured through the ranks.

Industry research has suggested mentoring as a key component of transfer of experience and knowledge and industry stakeholders have recognized the need for mentoring programs to develop leaders, as well as novice workers. Potential to use existing Skills Tasmania training funds, in particular the Energising Tasmania Training Fund could be explored.

It is therefore recommended that:

- Leadership and mentor programs should be implemented.

Core skills for flexibility

Opportunity exists to align the core skills around common work that will allow workers to move between sectors and projects. Exposure to various sectors would allow workers to develop a buildable knowledge and experience base, with skills development allowing workers to progress through novice roles to those requiring greater proficiency.

Transferrable skills, including digital literacy, creativity, communication, enthusiasm for learning and complex problem-solving skills, will become a requirement for all sector workforces and will become critical for workers to adopt, and organisations to encourage within the renewable energy sector and supporting industries. These skills have not traditionally been embedded within vocational and higher education pathways, and where suitable training does not exist, it is expected that organisations will develop in-house, non- accredited training to compensate.

In addition to these 'macro level' skill requirements, occupational shortages are presenting within the Tasmanian industry, with Cattle Hill and Granville Harbour Wind farms having noted difficulty in securing skills in the following areas over the past two years[34]:

- Project Managers (good experience)
- Grade A Electricians (for WTG technicians and Service technicians for service jobs)
- Quality, Health, Safety and Environment Professionals
- Installation Managers/Supervisors/Technicians
- Electricians and Supervisors with high voltage experience
- Trades in general with WTG experience
- Estimators
- Document Controllers.

It is therefore recommended that industry:

- Develop and deliver a program of skills development for existing paraprofessionals.

[34] Interview with UPC\AC Renewables July 2020

Forecast demand

The future growth of the renewable energy sector in Tasmania is contingent upon a set of interconnected political, economic, social and environmental factors. Project Marinus is the trigger that opens the market for Tasmanian energy to the national market. It is assumed, for the purposes of this report that this project proceeds and results in other known planned developments also coming to fruition.

These renewable energy projects sit within a broader infrastructure pipeline of activity[35] – much of which is substantially underway or complete and within the context of COVID-19 that has impacted many investments and commercial construction activity. Both these factors indicate that the current labour market has significant spare capacity.

This report is primarily desktop based and recognises that there are discrepancies in data. In order to model the effect of forecast work on occupation numbers and their associated qualifications and skills, the following approach was taken:

For all infrastructure work described in the Tasmanian Infrastructure Project Pipeline:

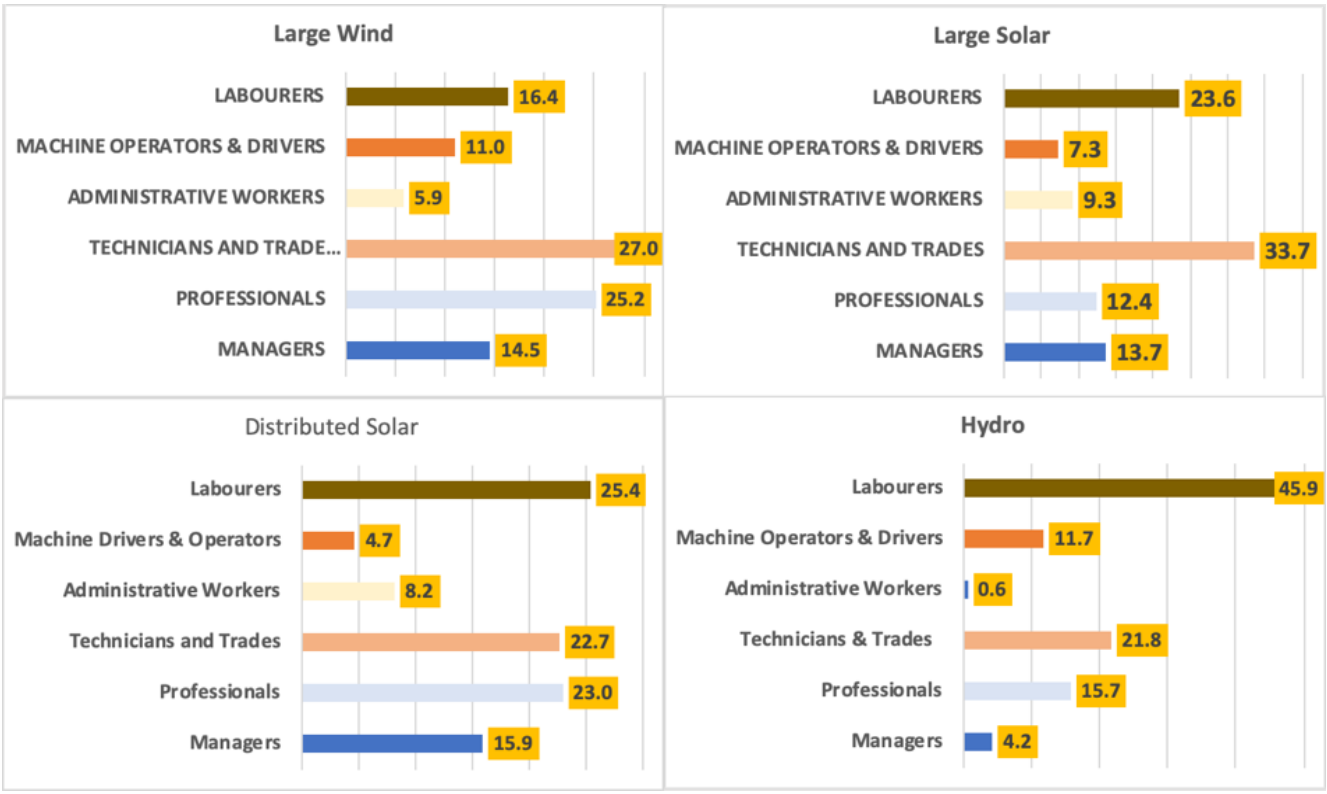
1. a map of occupations and their associated qualifications was developed through desktop research
2. a baseline of productivity for each occupation was established using census data and the value of work done by each sector in the corresponding period
3. the value of new work, year on year, described in the infrastructure plan was established (subtracting from the 2016 base)
4. attrition rates were established and built into the year on year occupation totals
5. forecast requirements were calculated for each occupation based on its productivity rate (1), the value of new work (2), subtracting attrition (3).

For renewable energy projects in this plan:

1. workforce projections for each project is based on information supplied at the time of writing
2. using a contribution methodology (see figure below) these have been mapped to occupations within the broader infrastructure industry
3. job creation projections were then apportioned in the general infrastructure model (step 5 above).

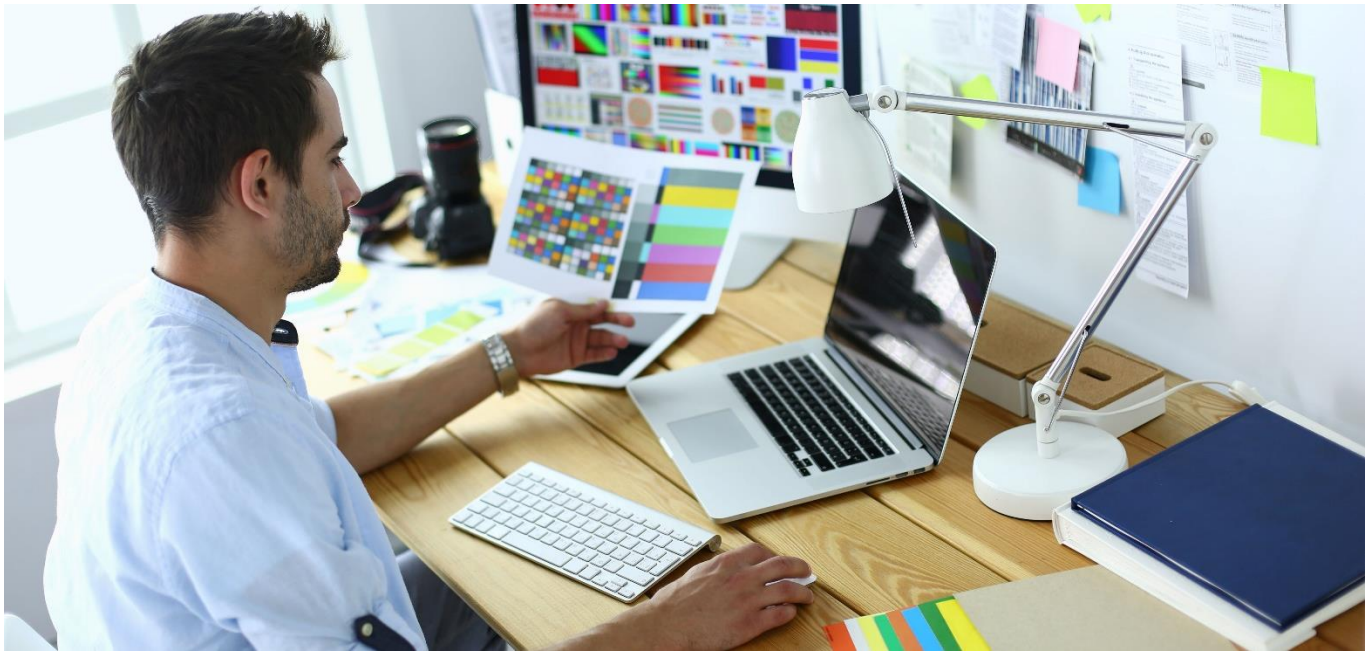
[35] Tasmanian Infrastructure Project Pipeline, Infrastructure Tasmania, July 2018

Figure 2: Occupational composition of renewables[36]



The above methodology combined has enabled the calculation of projected worker numbers for Project Marinus, renewable energy jobs and jobs required by the broader infrastructure industry.

However, it is noted that other workforce projections use alternative methodologies and comparing like with like is challenging. For example, Project Marinus notes 283 direct and 1,109 indirect at peak construction in Tasmania[37] (2025-27) and provides projections as 'job years'[38] (as opposed to new job openings) with 863 job years during this stage one report period and 4,904 indirect jobs. This Report's analysis models job creation and therefore assumes higher number at the commencement of projects and less 'new jobs' as activity tails or merges into a second tranche.



[36] Renewal Energy Jobs Tasmania Profile, Clean Energy Council, 2020

[37] www.marinuslink.com.au/wp-content/uploads/2019/12/The-Economic-Contribution-of-Marinus-Link-Supporting-Transmission.pdf

[38] A job year is one year of work for one person; a new construction job that lasts five years is five job years.

Table 6: Renewable energy and infrastructure project worker projections[39] 2021 - 2027

Year	Project Marinus	Renewable Energy projects	Infrastructure projects
	Jobs	Jobs	Jobs
2021	356	512	1680
2022	316	456	1723
2023	322	464	1721
2024	402	580	1688
2025	242	348	1700
2026	121	174	1695
2027	121	174	1696
Totals	1,880	2,708	11,903

This workforce development plan is Stage One and spans the period 2020 to 2027. Significant energy and infrastructure activity is likely to continue beyond this time frame as part of the Tasmanian Government Renewable Energy Action Plan, particularly to 2030 and beyond.

The increase in investment in renewable energy will have a significant positive impact across a range of other sectors, with increasing employment demand. For this reason, it is recommended that TEIWAC monitor progress with the workforce development plan and update relevant data or information as required, in particular as detailed project labour requirements are confirmed.

[39] Data based on multiple sources, includes worker replacement from attrition. Worker numbers for Marinus and Renewable Energy projects are calculated on the estimated proportion of the project total undertaken over its projected lifespan, year on year. Infrastructure requirements are based on year on year changes of value of work forecast.

Table 7: The skills and qualifications required by Infrastructure projects (including renewables) 2021-27

Managers	ANZSCO Code	VET Qualification	Projected Nos
Executive and General Manager	111111	BSB80215 Strategic Leadership	35
HR, Finance and Business administration managers	132111, 132211, 132311	BSB60215 Business BSB50615 Human Resources Management	82
Construction/project managers	133111	CPC60212 Building and Construction (Management)	26
Transport and logistics managers	133611	TLI50415 Logistics TLI50515 Deployment Logistics TLI50215 Materiel Logistics TLI60215 Deployment Logistics TLI60115 Materiel Logistics	49
Site managers (project builder)	133112	CPC50210 Building and Construction (Building) CPC50308 Building and Construction (Management)	44
Operations/asset managers	222312	FNS60615 Banking Services Management	61
Other managers	111211,139999, 133211, 133512,142111,149913, 139914,149212	BSB51918 Leadership and Management BSB61015 Leadership and Management MSM50316 Production Management PMA50116 Process Plant Technology PMA60116 Process Plant Technology PSP50116 Government PSP50316 Government Security	203
Professionals			
Legal and planning professionals (policy and planning prof.)	132411	PSP50116 Diploma of Government	69
Finance and accounting professionals	221111	PSP50504 Government (Financial Services) FNS50215 Accounting FNS60215 Accounting	12
Human resource professionals	223111	BSB41015 Certificate IV in Human Resources BSB50618 Diploma of Human Resources Management	9
Sales and marketing professionals	225113	BSB52415 Marketing and Communication BSB61315 Marketing and Communication	95
Community engagement (public relations prof.)	225311	LGA40104 Certificate IV in Local Government CHC52115 Diploma of Community Development	9
Surveyors	232212	CPP40216 Certificate IV in Surveying	46
Civil engineers	233211	RII60615 Advanced Diploma of Civil Construction	22
Electrical engineers	233311	UET50212 ESI - Power Systems UET60212 ESI - Power Systems	231
Grid engineers (industrial engineer)	233511	MEM31219 Certificate III in Engineering - Industrial Electrician	231
Mechanical engineers	233512	MEM30219 Engineering - Mechanical Trade	169
Solar PV designer (engineering prof.)	233999	UEE42011 Electrical - Photovoltaic systems	83
Environment assessment professionals	234399	LGA40308 Certificate IV in Local Government (Health and Environment) LGA50208 Diploma of Local Government (Health and Environment)	52
Scada/telecommunications engineers	263311	ICT51015 Diploma of Telecommunications Engineering	37
Geographic Information Systems	312116	CPP40216 Surveying CPP40316 Spatial Information Services CPP50116 Surveying CPP50216 Spatial Information Services	18
Health and safety professionals	312611	BSB41415 Work Health and Safety BSB51319 Work Health and Safety PSP60116 Government (Workplace inspection/ Investigations/Fraud control)	18
IT professionals	313199	ICT40120 Certificate IV in Information Technology ICT50120 Diploma of Information Technology	98

Transport and logistics	591211	TLI32416 Logistics TLI41515 Materiel Logistics TLI41616 International Freight Forwarding (Senior Operator) TLI42016 Logistics	83
Land developers	N/A		34
Trades and Technicians			
Site supervisors	312112	CPC40611 Building and Construction (Specialist Trades) CPC41013 Demolition RII40615 Civil Construction Operations RII40715 Civil Construction Supervision	0
Civil engineering technicians	312212	RII50415 Civil Construction Management RII60615 Civil Construction	14
Electricians	341111	UEE30611 Electrical Machine Repair UEE30711 Switchgear and Control gear UEE30811 Electro Technology Electrician UEE33011 Electrical Fitting UEE40311 Installation Inspection and Audits UEE40411 Electrical - Instrumentation UEE40611 Electro technology - Systems Electrician UEE42611 Hazardous areas - Electrical UEE43011 Electrical Equipment and Systems UEE50211 Electrical and Instrumentation UEE53011 Electrical Systems Engineering UEP40612 Large Scale Wind Generation	14
Electrical technician support	312312	UEP50212 ESI Generation (Operations) UEP50312 ESI Generation (Maintenance) UEP50412 ESI Generation Maintenance - Electrical Electronic UET50312 ESI - Power Systems Operations UET60312 ESI - Power Systems Operations	74
SCADA technician support	313199	ICT41219 Certificate IV in Telecommunications Engineering Technology	126
Other technicians	N/A		60
Metal trades	322211	MEM30305 Engineering - Fabrication Trade MSM30216 Surface Preparation and Coating Application	14
Mechanical trades (mechanical draftsperson)	312511	CPC50612 Hydraulic Services Design CPC50509 Fire Systems Design	200
Mechanical technicians	312512	MEM60112 Engineering	153
Carpenters	331212	CPC30211 Carpentry	42
Plumbers	334111	CPC32413 Plumbing	14
Telecommunications trades	342414	ICT30215 Telecommunications Digital Reception Technology	79
Power plant/control room operators	399213	UEP30112 ESI Generation - Systems Operations UEP30212 ESI Generation - Operations UEP40112 ESI Generation - Systems Operations UEP40212 ESI Generation - Operations UEP40312 ESI Generation Maintenance (Mechanical) UEP40412 ESI Generation Maintenance (Fabrication) UEP40512 ESI Generation Maintenance - Electrical Electronics UEP50112 ESI Generation - Systems Operations	19
Other trades	N/A		19

Administrative			
Contract, Program and Project Administrators nfd	511100	PSP50616 Diploma of Procurement and Contracting RII60615 - Advanced Diploma of Civil Construction	11
Contract Administrator	511111	CPC40208 Building and Construction (Contract Administration)	31
Program or Project Administrator	511112	BSB41515 Project Management Practice BSB51415 Project Management BSB61215 Program Management PSP50616 Procurement and Contracting PSP60616 Procurement and Contracting BSB61218 Program Management	62
Accounts Clerk	551111	FNS40615 Accounting FNS30315 Accounts Administration	58
Bookkeeper	551211	FNS40215 Bookkeeping	26
Data entry operator	532111	BSB30415 Certificate III in Business Administration	17
Payroll Clerk	551311	FNS50417 Diploma of Payroll Services	20
Personal assistant	521111	BSB40515 Certificate IV in Business Administration	20
Receptionist (General)	542111	BSB30415 Certificate III in Business Administration	15
Despatching and Receiving Clerk	591211	TLI32416 Logistics TLI42016 Logistics	9
Human Resources Clerk	599411	BSB41015 Human Resources	12
Inspectors and Regulatory Officers nfd	599500	LGA40504 Certificate IV in Local Government (Regulatory Services) LGA50604 Diploma of Local Government (Regulatory Services)	9
Inspectors and Regulatory Officers nec	599599	PSP41404 Government (Statutory Compliance)	12
Sales Representative (Building and Plumbing Supplies)	611311	UEE20811 Electrical Wholesaling FWP30616 Timber Merchandising	34
Sales Assistant (General)	621111	SIR30216 Retail	9
Machine Operators and Drivers			
Earthmoving, grader operators	721211	RII30815 Civil Construction Plant Operations	84
Truck Drivers (large solar and wind)	733111	TLI31216 Driving Operations	3
Drivers (distributed solar PV)	733111	TLI31216 Driving Operations	67
Other drivers & machine operators	N/A		
Labourers			
Concreters	821211	CPC30318 Concreting	256
Riggers	821711	CPC30711 Rigging	12
Dogman	821911	CPC32912 Certificate III in Construction Crane Operations	12
Scaffolders	821712	CPC30911 Scaffolding	0
Security guards	442299	CPP31318 Certificate III in Security Operations	0
Electrical trade assistants	899914	UEE21711 Certificate II in Technical Support	16
Mechanical trade assistants/labourers (mechanics assistant)	899916	MEM30219 Certificate III in Engineering - Mechanical Trade	176
Civil trade assistants/labourers (see other labourers) (civil technicians)	821111	CPC20211 Construction Pathways	49
Landscape gardeners	362213	AHC30916 Landscape Construction AHC42016 Landscape AHC50616 Landscape Design AHC52016 Landscape Project Management	16
Other labourers (minus mech./diesel mech. labourers)	N/A		496

It is acknowledged that the multiple methodologies have been used to project worker numbers, and there is also a lack of clarity on specific project requirements. Nevertheless, when these projected numbers are compared with enrolment numbers presented in tables 4 and 5, there is a discrepancy between what is being provided now compared with projections of requirements over the next seven years.

It is recommended that:

- TEIWAC monitor progress with the workforce development plan and update relevant data or information as required, in particular as detailed project labour requirements are confirmed.

Workforce development barriers and enablers

Infrastructure construction during this period (2020 - 2027) will vie with renewable energy project construction demands. The fluid nature of these projects works against a broad sector view required to address workforce needs. COVID-19 will have immediate productivity implications, with principles of disease control needing to be considered, border restrictions, and additional interstate project commitments taken into account.

Timelines from new civil construction projects will require tracking to address capacity and workflow pressures for renewable energy projects. Slowing or increasing workforce supply will create overlapping challenges in the civil construction, construction and renewable energy industries.

With potential moving targets and timelines, it will be essential to slow or increase the workforce flow according to demand. During the project construction phase, consideration needs to be given to a strategic approach for addressing workforce and skills demands, particularly where there are potential competing forces and overlaps with these projects.

Furthermore, capacity for the civil construction industry to support their own workforce demands, prior to the peak construction period for the renewable energy projects, will need to be monitored. No projects of note are tabled at present and the state-wide pipeline report is expected to be released by November 2020. This should provide a clearer indication of needs and potential intersections with renewable energy.

Renewable energy careers are emerging, and skill sets associated with energy technology cut across both traditional and new industries.

The regionality of the main renewable energy projects provides additional workforce challenges, particularly at a community and workforce level. All renewable energy projects slated to begin in the next 10-year period are located from the midlands through the north of the state, indicating a need for location specific support.

Regional support with a focus on local opportunities are required by industry to cultivate a strong, relevant workforce. Inclusiveness, local talent, on the job training as well as education and training offerings should be considered from a regional perspective.

The range of industries and stakeholders involved in the renewable energy economy makes collaboration tricky given that many workers and employers in the space may not see themselves as part of an integrated industry.

Demands will be made for Tasmanian resources, specifically with regard to funding and people. Post construction and project demand for domestic labour needs to be considered, and workforce optimisation should be deemed a priority.

There is an opportunity for all sectors within the industry for creating an attractive, sustainable, resilient and highly employable workforce to meet current and future industry demand, whether that be during development, construction, or the operations stages.

It is recommended to:

- Establish community engagement and support with a focus on local/regional opportunities provided by the industry
- Augment an existing or create a regional portal or communication hub with case studies/stories/job opportunities/training information/industry benefits and attractiveness.

It is important to prioritise flexible initiatives focusing on training and retraining the existing workforce, in particular for construction/ installation roles.

"Training targeted on the renewable energy sector should invest in skills that are portable. Even with efforts taken to adopt a smooth transition approach, employment in development, construction and installation may be volatile. In occupations linked to operations and maintenance, there may also be periods when scope to employ newly trained workers will be limited. Education and training courses should therefore be built around a core qualification that will be useful in a broader range of sectors".[40]

Demand for people to work in renewable energy is subject to change and there is often a need for education and training institutions to source the trainers and educators they need at short notice. Stakeholder feedback indicates that an existing shortage of suitable trainers and educators will need to be addressed if training is to be responsive to industry demand.

To mitigate many of these risks and challenges, there is an opportunity for industry to collaborate in the following ways:

1. Annual Reporting – continuous updating to provide a true reflection of the industry, assist in preventing gaps, and addressing risks
2. State Resources – provide a state skills resource to ensure a connection between industry, government and education facilities. There is a role to support industry bodies, oversee workforce reporting and report funding, communicating workforce findings, provide input into training development and initiatives
3. Skilling – investment in skills particularly to address needs around emerging technologies and ongoing skills development is required within the renewable energy sectors. This requires clear pathways and career benefits
4. Education and Training Package Design – needs to be industry driven with a focus on deliverable benefits to the industry and customers, with potential to share training resources and facilities
5. Diversity and Inclusion – embracing and promoting diversity and inclusion in future training, employment and workforce strategies, particularly when sourcing local talent
6. Industry Awareness – creating an awareness of the industry as a new, exciting, and attractive employer through hiring practices and connection to education and training. Identify and promote strengths of the industry with respect to employment and opportunities
7. Talent development – considerations made for sharing human resources, recruitment, apprentices, trainers and on the job training support
8. Industry can collaborate on recruitment, establishing talent pipelines, apprenticeships, and on the job training to address potential competition issues and work shortages.

According to an IRENA Report on Renewable Energy Jobs and Skills in the Energy Transition[41] well-coordinated education and skills-building programs are essential to building a suitable-trained, capable renewable energy workforce.

Governments must:

- Map skills requirements across the supply chains of different renewable energy technologies
- Closely monitor labour market dynamics
- Project / anticipate emerging skills needs
- Coordinate between the renewable energy sector and educational institutions, to match the demand and supply of skills as closely as possible
- Integrate gender perspectives in training and capacity building efforts.

[40] https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/publication/wcms_168354.pdf

[41] Renewable Energy Jobs and Skills, IRENA, 2019

It is recommended that:

- TEIWAC consider creating a collaboration mechanism that will allow all sectors within the renewable energy industry (hydro, wind, solar, hydrogen) and the broader infrastructure industry to potentially share workforce, training, and recruitment related resources
- TEIWAC consider the supply chain requirements in its program of activities.

Action plan

The Department of State Growth published the Tasmanian Renewable Energy Action Plan (TREAP) which outlines three priorities:

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

Each of these details actions and targets. This Workforce Development Plan fits within action 3.3: Skills Tasmania rollout of the Energising Tasmania skills and training initiative and supports priority three. The full set of actions is included in the appendix.

Table 8: Tasmanian renewable energy workforce development action plan:

Recommendation	*Priority*	*Timelines*
TEIWAC monitor progress with the workforce development plan and update relevant data or information as required	High	Ongoing
A plan be developed to identify new and novel means to develop future talent; taking into consideration the location of potential learners, their disbursement, travel and transit difficulties and more diverse modes of training facilitated within tertiary and vocational providers in partnership with enterprises.	Medium	Ongoing
TEIWAC to consider an audit of trainer capacity to determine sectoral needs and address gaps as an industry-wide approach	High	Immediate
Higher apprenticeship programs for para-professionals be developed through university/ TAFE partnerships, particularly for engineering and electrical qualifications.	High	Immediate
Develop and deliver a specific program of skills development for existing para-professionals. This program should cover digital technologies, quality assurance, onsite supervision, contract and project management.	High	Immediate
Establish a business case for Tasmanian assembly of manufactured components for the renewable industry.	High	Immediate
Leadership and mentor programs should be implemented	High	By 2021
A plan be developed for identifying new talent, particularly to identify new trainers and educators for the renewable energy industry for all sectors	High	By 2022
Qualifications and skill sets be developed for hydrogen workers	High	By 2022
Apprenticeship numbers be increased across all sectors to ensure that the industry is renewing, preparing for future demand, and providing adequate 'on the job' context for entrants into the industry	Medium	Immediate
Test the applicability of national training package pathways in civil infrastructure and electro technology – and if necessary, develop a state accredited solution	Medium	Immediate
Skill sets required by the existing workforce be prioritised	Medium	Immediate
Provide business development and support activities for the renewable energy supply chain, particularly in advanced manufacturing. This includes support for local suppliers to engage with head contractors, particularly commercial and compliance obligations.	Medium	Immediate
A training guarantee be considered, with a requirement for all major projects to provide a minimum threshold of apprenticeship pathways	Medium	By 2021
Create a regional portal or communication hub with case studies/ stories / job opportunities / training information / industry benefits and attractiveness etc.	Medium	By 2022
TEIWAC consider creating a collaboration mechanism that will allow all sectors within the renewable energy industry (hydro, wind, solar, hydrogen) to potentially share workforce, training, and recruitment related resources.	Medium	By 2022
Create an industry specific skillset to meet the demands of the increased digital landscape. Include Cyber security, Digital Literacy, Data analysis, and Smart technology and automation.	Medium	By 2022
TEIWAC consider the supply chain requirements in its program of activities	Medium	By 2023
Schools work with industry and TEIWAC to develop and promote pathways into renewables. Existing Department of Education pilot programs around the state, aimed at attracting and supporting new entrants into the industry, should be reviewed and adjusted to ensure they meet industry needs and then promoted	Medium	By 2024

Recommendation	*Priority*	*Timelines*
Schools ensure a pre-vocational pathways plan, with a focus on industry exposure in project connected communities, be created and shared via an education network or renewable energy industry portal	Medium	By 2024
That UTAS consider subject 'modules' in renewables and sustainability for inclusion in humanities, finance, business and engineering	Medium	By 2024
That UTAS review and validate their programs to support the managerial and professional level requirements required	Medium	By 2024
TEIWAC monitor progress with the workforce development plan and update relevant data or information as required	Medium	Ongoing
That UTAS consider the applicability of its engineering programs to the multi stream engineering technicians required by the renewable energy sector	Low	By 2021
Establish community engagement and support with a focus on local/regional opportunities provided by the industry	Low	By 2023

Credit, Vestas Granville Harbour Operations 2020

Appendix

Stakeholders consulted

In addition to all TEIWAC members the following stakeholders were consulted:

- Ben White – TasNetworks, Project Marinus
- Brian Hall – Project E
- Oriana Sanicola – H2H Energy
- Shane Bartel – Climate Capital
- Marc White – Goanna Energy
- Dr Anita Talberg – Clean Energy Council
- Mike Brindley – Regional Development Australia
- Damian Peirce – Industry Training Hubs
- Sophie Rowlands – Department of State Growth
- Robert Edwards – H2 Networks
- Sarah Jones – UTAS and University College

Tasmanian Renewable Energy Action Plan 2020

Priority 1: Transforming Tasmania into a global renewable energy powerhouse	Priority 2: Making energy work for the Tasmanian community	Priority 3: Growing the economy and providing jobs
Targets	**Targets**	**Targets**
By 2022 Tasmania will be 100 per cent self-sufficient in renewable electricity generation. By 2040 we will double our renewable generation with a target of 200 per cent of our current needs. From 2030 Tasmania is a producer and exporter of renewable hydrogen.	Ensure regulated electricity prices remain affordable with the target to achieve the lowest regulated electricity prices in the NEM by 2022. Maintain and further strengthen Tasmania's energy security framework. Ensure Tasmanian customers have the tools and information required to manage their electricity use, lower their electricity bills and access new products and services.	Grow Tasmania's renewable energy 'brand' nationally and globally. Attract new load and energy intensive industries to Tasmania. Create thousands of new jobs and realise up to $7 billion of new investment in the renewables sector by 2030.
Actions		
1		
Introduce a Tasmanian Renewable Energy Target to double our renewable energy production to meet 200 per cent of our current electricity needs.	Supporting Customers during COVID-19.	Establish 'Renewables Tasmania' to promote and develop Tasmania's renewable energy advantage.
2		
Continue to progress Project Marinus and Battery of the Nation.	Establish a pricing framework that results in affordable electricity prices for Tasmanian consumers.	Develop a new load growth attraction strategy for Tasmania.
3		
Implementation of Tasmanian Renewable Hydrogen Action Plan.	Manage Tasmania's Energy Security Risk Response Framework in response to COVID-19.	Continue to promote Tasmania as a premier investment destination for businesses wanting low cost, reliable and clean energy.
4		
Undertake community a consultation on an ambitious net zero emissions target.	Monitor, evaluate and ensure the progressive rollout of advanced meters to Tasmanian households.	Skills Tasmania rollout of Energising Tasmania skills and training initiative.
5		
Scoping study for the development of a Renewable Energy Centre of Excellence.	Continued rollout of on-farms energy initiatives.	Maximise renewable energy development opportunities for Antarctic nations under the Antarctic Gateway Strategy.
6		
Develop options to support bioenergy.	Continue support for energy efficiency programs.	
7		
Develop a Tasmanian policy framework to coordinate the renewable energy growth required to achieve the Tasmanian Renewable Energy Targets and to support Tasmanian major energy projects (the 'Renewable Energy Coordination Framework').	Empower consumers through influencing the National Energy Policy agenda.	
8		
Transport Industry Emissions Pathway.		

Proposed new wind farms

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

Proposed hydrogen worker qualification framework

Hydrogen - Proposal three levels of accreditation together with an upskill course for existing trades.

Example course, purpose outcomes and end use[42]

The Training Product	Skills Set (possibly both Cert-III & Post Trade) – H2Technology for Gas fitters	Skills Set (Post Trade) – H2 Fuel Cells and Electrolysis	Skills Set (Post Trade) – Advanced Hydrogen Technology
Risks to be mitigated	Low risk work	Moderate risk work	High risk work
Qualification	Level 1 H2 Worker	Level 2 H2 Worker	Level 3 Hydrogen Worker
Purpose of training product	Domestic and commercial H2 piping systems and H2 combustion.	Fuel cells and electrolysis below 200 kilowatts - storage, dispensing and piping systems up to 400 bar and temperatures above -50c	Fuel cells and electrolysis above 200kw - storage, dispensing and piping systems above 400 bar and temperatures below - 50c and LH storage and transport.
Recognised by	State and territory gas regulators and licencing authorities (Approved by ASQA)	State and territory gas and electrical regulators and licencing authorities (Approved by ASQA)	State and territory gas and electrical regulators and licencing authorities (Approved by ASQA)
Regulatory basis for training	Public Safety OH&S, Consumer Confidence	Public Safety OH&S, Consumer Confidence	Public Safety OH&S, Consumer Confidence
This training is for	Plumber, Gas fitters Gas fitters	• Plumber -gas fitter with Restricted Electrical Licence (REL). • Gas fitter with REL and has completed the UPSKILL COURSE • Electricians who have completed the UPSKILL COURSE.	• After completion of H2 Fuel Cells and Electrolysis course • Plumber - gas fitter with REL. • Gas fitter with REL and has completed the UPSKILL COURSE • Electricians who have completed the UPSKILL COURSE.

[42] With permission: The Master Plumbers ACT, Master Plumbers New Zealand and the National Electrical Contractors Association draft proposal to the Australian Industry Skills Committee, July 2020

Learners likely work **Gas fitter (no REL)**	Design, installation and commissioning of gas piping, flues and combustion appliances for domestic, commercial and industrial applications, downstream of the meter set and H2 Vapour phase up to x KPA and storage up to x Kg		
Learners likely work Plumber / Gas fitter (no REL)	Design, installation and commissioning of gas piping, flues and combustion appliances for domestic, commercial and industrial applications, downstream of the meter set and H2 Vapour phase up to x KPA and storage up to x Kg		
Learner's likely work. Plumber gas fitter (with REL)	Design, installation and commissioning of gas piping, flues and combustion appliances for domestic, commercial and industrial applications, downstream of the meter set and H2 Vapour phase up to x KPA and storage up to x Kg	Design, repairs, disconnect and reconnect of power gas and water, installations and commission of domestic and commercial fuel cells, electrolysers, piping, dispensing and storage systems up to 400 bar and above minus 50C	Previous cell plus the design, repair and installation of high-pressure pipework, storage and dispensing systems exceeding 400 bar and temperatures below minus 50C. Storage transportation and LH.
Learner's likely work **Electrician**		Design, repairs, disconnect and reconnect of power gas and water, installations and commission of domestic and commercial fuel cells, electrolysers, piping, dispensing and storage systems up to 400 bar and above minus 50C	Previous cell plus the design, repair and installation of high-pressure pipework, storage and dispensing systems exceeding 400 bar and temperatures below minus 50C. Storage transportation and LH
For which end user	Residential, commercial, and light industrial (As per Natural gas and LPG)	Residential, commercial, light industrial and mobility - excluding high pressure systems for HRS for small passenger vehicles	Heavy industry, power generation, transportation, and storage, including HRS for small passenger vehicles, export.

Example of upskilling course - gas fitters, electricians & plumbers- purpose & outcomes

The Training Product	Skills Set (Post Trade) Upskilling for Gas Fitters, Plumbers (With REL) and Electricians
Risks to be mitigated	Moderate to high
Qualification	NIL
Purpose of training product	Prerequisite to H2 Fuel Cells and Water Electrolysis Course & Advanced H Technology Course. To provide additional skills for gas fitters (with an REL but without plumbing qualifications), plumbers (with an REL but without gas fitting qualifications) and electricians so they can safely Isolate and purge H2 Fuel Cells and Electrolysers and disconnect and reconnect water supplies to electrolysers.
Course modification	Gas fitters not required to undertake gas elements of this course. Plumbers not required to undertake water elements of this course.
Recognised by	State and territory gas regulators and licencing authorities (Approved by ASQA)
Regulatory basis for training	Public Safety OH&S, Consumer Confidence
This training is for	Gas fitters (with REL but without plumbing qualifications) plumbers with REL but without gas fitting qualifications) and electricians
Learners existing training	Post Trade Gas Fitting and REL Post Trade Plumbing and REL Electro technology CERT III
Learners likely work	Disconnect and reconnect H2 from fuel cells and electrolysers. Disconnect and reconnect water supplies to electrolysers. Test service and replace components.

A national perspective

It is estimated that in net terms over 33,980 new jobs will be created in the Australia electricity sector by 2030, including 7,619 permanent ongoing jobs, close to 20,700 construction jobs and 5,650 manufacturing jobs[43].

Renewable energy sources have diversified significantly in the past few years. Recent government policies promote the adoption of renewable electricity generation, including sources from wind, solar, hydro, and bioenergy. The share of Australia's total electricity generation that comes from renewable sources is currently around 16 per cent and is expected to grow to 30. This diversification improves security of energy supply and can offer many opportunities. The growing popularity and affordability of renewables requires the industry to ensure the workforce has the required skills and can adapt to new processes.

Pumped hydro is the most widely deployed large-scale energy storage technology. It involves pumping water from a storage reservoir at a lower elevation to a storage reservoir at a higher elevation, and later releasing it through turbines to generate electricity. There are 22,000 potential pumped hydro sites identified across Australia. Back in 2000-2001, hydro power accounted for 95 per cent of renewable energy production, but due to the wider adoption of other renewable technologies, hydro power currently makes up 40 per cent of renewable energy generation.

Wind and solar power made up 5.7 and 3.4 per cent of the national total electricity generation in 2016-17 respectively.[44]

[43] www.phillipriley.com.au/renewable-energy-employment-in-australia-shows-promising-future/

[44] ESI Generation Industry Skills Forecast, Commonwealth of Australia, 2020

National occupation demand

The industry is reported[45] as having a range of skills in demand, nationally:

- Power systems engineers
- Grid connection engineers and managers
- Origination specialists
- Field based protection and control technicians and engineers
- Project managers (with Renewable Energy experience)
- Project development managers
- Schedulers and planners
- Civil project engineers, excavator operators, mechanical fitters.

[45] ibid

Training package to occupational role mapping

Training package		Occupation/s
Code	Name	
AHC	Agriculture, Horticulture and Conservation and Land Management	- Landscape gardener
AUR	Automotive Retail, Service and Repair	- Forklift operators
BSB	Business Services	- Data entry operator - Executive and General Manager - Health and Safety Professionals - HR, Finance & Business administration managers - Human Resources Clerk - Human resource professionals - Other managers - Personal assistant - Program or Project Administrator - Receptionist (General) - Sales & marketing professionals
CPC	Construction, Plumbing and Services	- Carpenters - Civil trade assistants/labourers - Crane and hoist operators - Concreters - Construction/project managers - Contract Administrator - Dogmen - Mechanical trades (mechanical draftsperson) - Plumbers - Riggers - Scaffolders - Site managers (project builder) - Site supervisors
CPP	Property Services	- GIS - Security guards - Surveyors
DEF	Defence	Control Room Operators
FNS	Financial Services	- Accounts Clerk - Bookkeeper - Finance & accounting professionals - Operations/asset managers - Payroll Clerk
FWP	Forest and Wood Products	- Sales Representative (Building and Plumbing Supplies)
ICT	Information and Communications Technology	- IT professionals - SCADA technician support - Telecommunications engineers - Telecommunications trades
LGA04	Local Government	- Community engagement - Environment assessment professionals - Inspectors and Regulatory Officers nfd
MEM	Manufacturing and Engineering	- Grid engineers - Mechanical engineers - Mechanical technicians - Mechanical trade assistants/labourers - Metal trades
MSM	Manufacturing	- Metal trades - Other managers
PMA	Chemical, Hydrocarbons and Refining	- Other managers

PSP	Public Sector	- Contract, Program and Project - Administrators nfd - Finance & accounting professionals - Health and Safety Professionals - Inspectors and Regulatory Officers nec - Legal and planning professionals - Other managers - Program or Project Administrator
PUA	Public Safety	- Control Room Operators
RII	Resources and Infrastructure Industry	- Civil engineers - Civil engineering technicians - Contract, Program and Project Administrators nfd - Earthmoving, grader operators - Site supervisors
SIR	Retail Services	- Sales Assistant (General)
TLI	Transport and Logistics	- Control Room Operators - Despatching and Receiving Clerk - Drivers (distributed solar PV) - Transport & logistics - Transport & logistics managers - Truck Drivers (large solar and wind)
UEE	Electrotechnology	- Electricians - Electrical trade assistants - Sales Representative (Building and Plumbing Supplies) - Solar PV Designer
UEP	Electricity Supply Industry – Generation Sector	- Electricians - Electrical technician support - Power plant/control room operators
UET	Transmission, Distribution and Rail Sector	- Electrical engineers - Electrical technician support

VET enrolment numbers in qualifications relevant to the industry 2017-2019

Qualification Code	Qualification Name	2017	2018	2019
BSB30412	CERTIFICATE III IN BUSINESS ADMINISTRATION	31		0
BSB30415	CERTIFICATE III IN BUSINESS ADMINISTRATION	242	207	263
BSB41415	CERTIFICATE IV IN WORK HEALTH AND SAFETY	183	161	228
BSB41513	CERTIFICATE IV IN PROJECT MANAGEMENT PRACTICE	31		0
BSB41515	CERTIFICATE IV IN PROJECT MANAGEMENT PRACTICE	223	277	245
BSB41715	CERTIFICATE IV IN RECORDKEEPING	1		0
BSB42015	CERTIFICATE IV IN LEADERSHIP AND MANAGEMENT	369	485	730
BSB50615	DIPLOMA OF HUMAN RESOURCES MANAGEMENT	53	27	32
BSB51915	DIPLOMA OF LEADERSHIP AND MANAGEMENT	675	636	227
BSB51918	DIPLOMA OF LEADERSHIP AND MANAGEMENT		1	282
CPC20211	CERTIFICATE II IN CONSTRUCTION PATHWAYS	13		141
CPC30313	CERTIFICATE III IN CONCRETING	13	12	23
CPC50210	DIPLOMA OF BUILDING AND CONSTRUCTION (BUILDING)	73	50	63
FNS30315	CERTIFICATE III IN ACCOUNTS ADMINISTRATION	157	116	14
FNS50215	DIPLOMA OF ACCOUNTING	36	29	38
MEM30205	CERTIFICATE III IN ENGINEERING - MECHANICAL TRADE	244	147	183
MEM30305	CERTIFICATE III IN ENGINEERING - FABRICATION TRADE	298	350	411
RII30813	CERTIFICATE III IN CIVIL CONSTRUCTION PLANT OPERATIONS	1,202[46]		0
RII30815	CERTIFICATE III IN CIVIL CONSTRUCTION PLANT OPERATIONS	176	238	114
TLI31210	CERTIFICATE III IN DRIVING OPERATIONS	156		0
TLI31216	CERTIFICATE III IN DRIVING OPERATIONS		114	264
	Total	4,514	3,330	3,258

[46] Further detail on this figure is not available

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Estimating renewable energy employment under the integrated system plan	Australia Institute	Nov	2018
Future state NEM analysis full report	Hydro Tasmania	April	2018
Global Energy Talent Report	Airswift		2020
Hays Recruiting – energy industry report	Hays Energy	June	2020
Infrastructure Project Pipeline	DSG		2018-19
Marinus Link	TasNetworks		2018
Open NEM: Tasmania		June	2020
Renewable Energy Jobs Tas profile	Clean Energy Council	June	2020
Renewable Energy Jobs Future Growth in Australia	Climate Council		2016
Renewable Energy States Report	Climate Council		2018
Renewable Export Covid recovery package	WWF	June	2020
Renewable Stimulus Programs	WWF	June	2020
Renewable Energy Jobs in Australia Stage One	Clean Energy Council	June	2020
Premiers Economic and Social Recovery Advisory Council Interim Report	PESRAC	July	2020
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The future of hydrogen	International Energy Agency	June	2019
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Tasmania sets world leading target of 200% renewables by 2020	Sophie Vorrath	March	2020
Vision for vocational learning and VET in Tasmanian schools to 2030	Education Consortium	October	2018
Course selection guides - building and construction pathways	TBCITB	February	2019
Packages of Learning 2019 pilot program	DoE		2019
Project Marinus Overview	TasNetworks	March	2020
Proposal for Hydrogen Training Accredited course outline	MPA ACT	August	2020
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